THE JOURNAL

OF THE

Society of Chemical Industry.

A MONTHLY RECORD

FOR ALL INTERESTED IN CHEMICAL MANUFACTURES.

No. 5.—Vol. XIX.] **MAY 31, 1900.** [Non-Members 30/- per annum; Members 21/- per Set of extra or back numbers; Single Copies (Members only) 2/6.

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Monday, June 11th:—

Messrs. W. J. Dibdin and G. Thudichum. "The Maintenance of Aeration as a Standard of Purity of Sewage Effluents."

Dr. F. B. Power and Mr. F. Shedden. "The Composition and Determination of Cerium Oxalate."

Mr. F. G. Welch. "The Production of Nitrate of Soda in Chili."

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NOTE.—The names in *italics* are those of Members of Committee who retire at the end of the current session.

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NOTICES.

Annual General Meeting.

The Annual General Meeting will be held in London on July 18th, 19th, and 20th next. A draft programme will be found in the April number of the Journal, with particulars of the Paris Excursion on July 21st.

In accordance with the provisions of Rule 18 of the Bye-laws, notice is hereby given that those Members whose names are placed in *italics* in the list of Council will retire from their respective offices at the forthcoming Annual Meeting.

Mr. Joseph W. Swan has been nominated to the office of President; Prof. C. F. Chandler has been nominated a Vice-President under Rule 11; and Prof. G. G. Henderson, Mr. Walter F. Reid, and Mr. Boverton Redwood have been nominated Vice-Presidents under Rule 8.

Mr. A. Gordon Salamon has been nominated a Vice-President, and Mr. Thos. Tyrer an Ordinary Member of Council, under Rule 24.

The Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices.

Members are hereby invited to nominate fit and proper persons to fill four vacancies among the Ordinary Members of Council. Forms for this purpose can be obtained, on application, from the General Secretary, or from the Hon. Local Secretary of the New York Section.

Extract from Rule 18:—"No such nomination shall be valid unless it be signed by at least ten Members of the Society who are not in arrear with their subscriptions, nor unless it be received by the General Secretary, at the Society's Office, at least one month before the date of the Annual General Meeting, to the election to take place at which it refers. Nor shall any such nomination be valid if the person nominated be ineligible for election under Rules 12 or 15. No member shall sign more than one nomination form."

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

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Belden, Arthur W., c/o Birmingham Cement Co., Ensley, Ala., U.S.A., Chemist.

Crosskey, Alex. N., c/o Alloys Syndicate, Ltd., New Dock, Llanelly, South Wales, Chemist.

Dodge Dr. Francis D., c/o Dodge and Olcott, 137, Water Street, Brooklyn, N.Y., U.S.A., Chemist.

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French, Thos., 1, Kelvinside Terrace West, Glasgow, Chemist.

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Wiener, August F., c/o Alloys Syndicate, 31, Lombard Street, London, E.C., General Manager.

Yamaoka, S., c/o Kyushu Cement Co., Wakatsu, Chikugo, Japan, Chief Engineer.

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London Section.

Meeting held on Monday, May 7th, 1900.

MR. BOVERTON REDWOOD IN THE CHAIR.

THE NITRATE OF SODA INDUSTRY IN CHILI.

BY WM. NEWTON, PH.D., F.I.C.

THE production of nitrate of soda in large quantities is a comparatively modern industry. Exportations from Chili may be said to have commenced in 1830, and the following table shows the growth of the manufacture up to the present date.

Year.	Tons Exported.	Price in March.
		£ s. d.
1830	8,348	28 0 0 (1832)
1835	..	21 0 0
1840	10,500	20 10 0
1850	22,870	15 0 0
1860	61,171	15 10 0
1870	131,402	16 10 0
1880	111,420	*19 0 0
1885	482,030	9 10 0
1890	1,003,340	8 5 0
1895	..	9 0 0
1899	1,355,360	8 5 0

* War between Chili and Peru.

The total number of tons for the last ten years from 1890 to the end of 1899 have been 10,523,000. At the present price of 8*l.* 5*s.* this would amount to the enormous sum of 89,445,500*l.*

Of these large shipments of nitrate of soda by far the largest proportion is used direct in agriculture. Part is used in the production of gunpowder, for which it is first converted into nitrate of potash by dissolving in water with potassium chloride and re-crystallising. When double decomposition ensues with the production of sodium chloride and potassium nitrate another quantity is used in the production of nitric acid for ordinary chemical purposes and in the production of high explosives such as gun-cotton, nitro-glycerin, picrates, &c.

Nitrate of soda is produced nowhere else in the world outside the Northern Provinces of Chili. The only other natural product of a similar kind is the nitrate of potash which is obtained by washing certain surface soils in India and Burmah. The importations into England amount to about 20,000 tons per annum. This is an insignificant source of nitrate compared with the Chilian produce, the production being perhaps 70,000 tons per annum.

The first question about nitrate therefore arises. Why should it occur in Northern Chili in such quantities and nowhere else in the world? To answer this question we must first consider the peculiar topographical and climatic conditions of the nitrate province. The nitrate district lies at right angles across the 20th degree south of the equator, extending about 30 miles north of this degree and about 50 miles south, and is 15 to 20 miles inland from the Pacific Coast. It starts in the north at Hazpampa, 15 miles east of Pisagua, and runs south almost parallel with the coast to Lagunas, a line of 85 miles. There is then a break of 60 miles where no nitrate has yet been declared till we come to the district of Tocopilla and then to Taltal.

Except the most southern portion, all the nitrate field is within the tropic of Capricorn. Now, the peculiarity of this nitrate district is, that it is practically rainless, that is rain does not occur for years, and when it does it is usually hardly sufficient to wet the surface of the ground. It is the absence of rain which allows the accumulation of the deposits. The absence of rain is due to the fact that the nitrate district is bounded on the west by a cold south polar ocean current, and on the east by the high Andes, the result is, that all winds coming in are colder than the atmosphere and surface of the district, consequently in passing over this narrow strip the winds become warmer, and therefore are in a condition to absorb moisture not to deposit it.

The nitrate beds of the Province of Tarapaca are the most important, and it is to them I wish to especially draw your attention this evening.

Perhaps the best way of describing the country is to follow the nitrate railway from Iquique, which is the principal nitrate port and stands west of the centre of the line of nitrate deposits of Tarapaca. The cliffs recede round Iquique; the railway runs out of the town three miles up the slope to the foot of the cliffs; there is then the rinconada or reverse, and the train commences the journey up the incline along the face of the cliff at a gradient of over 4 per cent. till it reaches the top Molle, ten miles, 2,000 feet above the sea. It then turns inland and eastward, passing between high hills of plutonic rock absolutely bare of vegetation. In about 20 miles there is a gradual rise of another 1,000 feet, and then the rail comes out on to the plain of Tamarugal, extending north and south 150 miles, and varying in width east and west from 30 to 45 miles to the foot hills of the Andes. The vast plain appears perfectly level but really gradually slopes up from the coast range of hills, which completely wall the plain off from the sea, from Pisagua on the north to Lagunas on the south, a distance of some 80 miles. The lowest part of this irregular wall of plutonic rock is 150 feet above the plain. The plain has the aspect of the ancient bed of an arm of the sea, or of an enormous lake. Darwin, in "A Naturalist's Voyage," gives it as his opinion that it was an ancient sea bed. The line of the nitrate deposits lies at the junction of this plain and the coast line of hills, extending in width sometimes to three miles.

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One of the theories accepted accounting for the formation of these deposits is, that in past ages these nitrate pampas were sea beaches, and that an enormous quantity of seaweed was piled on them. In course of time these beaches were elevated above sea level, and the seaweed decomposed leaving its nitrogen as nitrate, and its small quantity of iodine as iodate (see Watts's Dictionary). The origin of the seaweed theory is chiefly due to the fact tnat previous to the extraction of iodine from nitrate liquors, the only source of iodine was "kelp," the ash of burnt seaweed. The existence of large deposits of common salt, called salares, in conjunction with the nitrate beds, also induces the popular notion of evaporated sea water. But one must bear in mind that even the salt of the sea is derived originally from the washings of the land. There is no more reason to suppose the salares are evaporated sea water than that any of the inland salt lakes of the world were originally connected with the sea. Inland salt lakes derive their salt from the washings of the soil surrounding them. The water running into the lakes may not be very salt, but if there is no outlet from the lake, the constant evaporation, especially in hot climates, gradually concentrates the salt in them, sometimes all the water being evaporated and only a salar left. Salars are also formed by the water below the surface of the soil being drawn up by capillary attraction and constantly evaporated, giving place to fresh supplies and evaporation.

It is true the decomposition of seaweed, as also all organic matter containing nitrogen, does under circumstances produce nitrate. But to the seaweed theory of the production of the nitrate deposits of Chili there are several objections.

Firstly: Where is the bromine which would accompany the iodine if it had come from seaweed? I have never found bromine in caliche; I have examined samples from all parts of the nitrate district. I have heard it talked about as existing in some places; in fact, at one of the oficinas, "Tres Marias," I believe, there was great talk of producing bromine, but as far as I could ascertain, the existence of bromine even in that part of the pampa was based more on imagination than chemical research.

Secondly: There are never sea shells or other sea *débris* in or near the nitrate deposits except where the nitrate line passes over a much older chalk formation.

Thirdly: The stones in the caliche and its neighbourhood are sharp and jagged, showing no signs of being water worn as they would have done if they had existed on a sea beach.

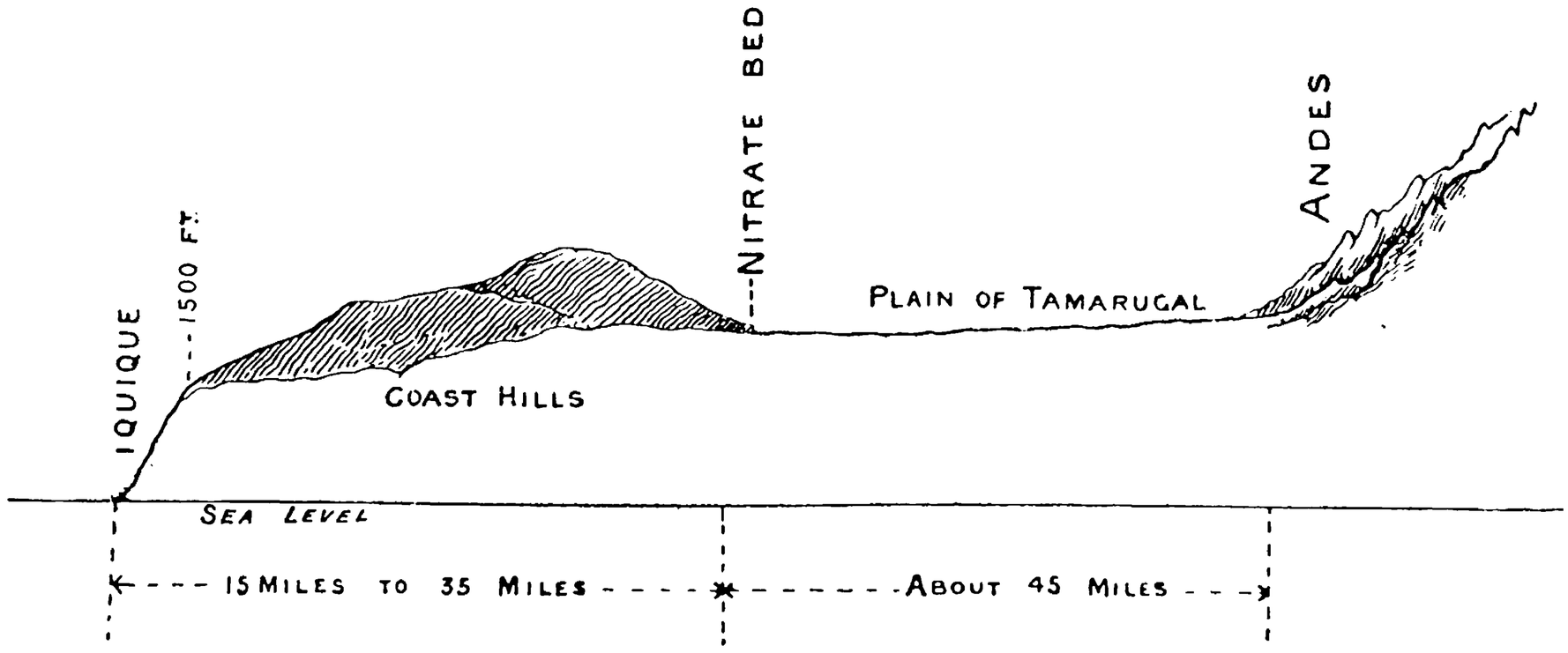
There is another favoured theory that the nitrate has been derived from the decomposition of ancient guano deposits. As one evidence in favour of this, is put forward the presence of birds and their remains in the caliche. These birds have, however, apparently been always insignificant in numbers. The same birds exist at the present day, having their nest in crevices in the ground, and they have sometimes been blown up alive in the calicheras. Their guano, although in a few spots on the pampa rather conspicuous, is in reality little more than a colour, and the amount of nitrate which could be produced from it must be more insignificant than that of the village sewage. The great disproof of the guano theory, however, is that we find no accumulation of phosphate which would necessarily occur in a corresponding amount to the nitrate if this idea were true.

There is one objection which applies to both these theories, and that is that if the nitrate is derived from seaweed or guano, the guano of low-flying sea birds, it must have taken ages and ages, even geologically speaking, for the nitrate pampa to be lifted over 3,000 feet. During these ages the district must have been subjected from age to age to varying climatic conditions, including heavy tropical rains. Geologically speaking, nitrate must be a very recent deposit, and therefore at that height it cannot be a sea deposit. Darwin himself, who, I believe, was only two or three days in the La Noria district, apparently was not informed of the mountain floods from the Andes, which periodically occur, and about every seven or eight years swamp the plain of Tamarugal. The present surface of the plain and for some considerable depth as shown by the well sinkings is evidently alluvial washed down from the Andes.

May not the explanation of the formation of nitrate which goes on in every agricultural soil in England and throughout the world lead us to the explanation of the formation of nitrate beds in Chili. In agricultural soils throughout the world nitrate originates from the oxidation of the organic materials and ammonia in the soil. This oxidation is brought about by the action of microscopic organisms, "nitrifying germs." Professor Warrington has shown that the most favourable conditions, for the active life and work of these nitrifying organisms, is a porous soil containing plenty of vegetable or animal organic matter, together with sulphate of lime and an alkaline base such as carbonates of potash, soda, or lime. Given a soil of this character, the amount of nitrate produced by the action of these organisms will vary with the temperature. The rate of manufacture of nitrate being more rapid in a high summer temperature and diminishing as the weather gets colder. In ordinary agricultural soils, unless they are lying fallow, this nitrate is greedily absorbed by the plant almost as fast as it is produced. In fact, except in the case of leguminous crops (clover, beans, peas, &c.), it is almost certain that the plant can only live by absorbing the nitrogenous food necessary for its growth when it is in the form of nitrate.

Now in the enormous plain of Tamarugal we have a porous alluvial soil containing organic matter, chiefly of ancient vegetable origin. The soil contains also sulphate of lime and is basic in its nature, the water percolating through it containing carbonate of soda. The temperature is high, and, in fact, we have all the conditions which Professor Warrington has pointed out as favourable to the rapid conversion of the nitrogen of organic matter into nitrate. On account of the absence of rain in this district, there is now no growing vegetation to absorb the nitrate, and therefore it must accumulate.

Now let us look at the conformation and situation of the plain of Tamarugal. On one side we have the high



GENERAL EAST AND WEST SECTION OF THE NITRATE DISTRICT OF CHILI.
VERTICAL SCALE EXAGGERATED.

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Cordilleras (or Andes) running north and south, then we have this alluvial plain about 30 to 45 miles wide, with a very gradual downward slope to the west, where it is again shut in by the coast line of hills running practically parallel to the Cordilleras. The waters of the western side of the Cordilleras have no escape except by passing through the soil of the plain. At the western side of the plain the waters are stopped by the coast line of hills, forming a complete wall from north to south. At the foot of the eastern or landward side of this wall of hills, some 30 miles from the sea, and at the lowest about 2,500 feet above sea level, these drainage waters of the plain gather and evaporate, giving up all the salts they have dissolved in their long passage through the soil. The mountain floods which swamp the plain of Tamarugal, at intervals of seven or eight years, being chiefly responsible for the transportation of nitrate from the superficial layers of the pampa soil. It is along the line at the foot of these hills that all the nitrate grounds are situated. Their situation, always on the landward side, is an indication that the caliche is derived from the land, and in itself almost an absolute disproof of the guano or seaweed theories.

Nitrate then may be the concentrated fertility of the thousands of square miles of land between the watershed of the Cordilleras and the coast line of hills. The alluvial of this belt of country is on an enormous scale, the same thing as the heaps of mud, organic refuse, and lime, French farmers were by law compelled to create in the time of Napoleon I., in order that these heaps should ferment and on washing yield nitrate for gunpowder. To this cause may perhaps be added the extreme amount of electrical activity of the atmosphere in the volcanic chain of the Andes producing nitric oxides by the direct combination of the nitrogen and oxygen of the air. Last year, in the Andes, I had experience of the high electrical energy in those mountains, and the effects must have been much greater when the volcanoes were in an active state of eruption.

We will now leave the region of theories and come to the facts of the actual state of the nitrate beds.

The nitrate strata is covered with a few inches of loose blown dust, called locally "chuca," under which is a hard rock, called "costra," containing some nitrate, much common salt, sulphate of soda and magnesia, &c., and pebbles. This may extend from 1 to 20 feet or more in depth, then we find the caliche, from a few inches to several feet in thickness. The layer of caliche is, in appearance, hard to distinguish from salt. Under this is a loose gravelly layer called "cova," below which nitrate is not found. Between the cova and caliche often occurs a hard layer difficult to separate from caliche, containing sulphate of lime, clay, &c. This layer is called "banco" or "congelo."

The following figures give the analyses of some representative samples of costra and caliche:—

Description of Samples.

	Caliche.			Costra.	
	1.	2.	3.	1.	2.
Water	2·322	1·983	2·547	4·122	3·653
*Nitrate of soda	50·046	39·322	28·503	13·626	12·260
*Nitrate of potash	0·454	4·800	4·512	3·017	2·963
Chloride of sodium	25·272	26·912	21·993	18·952	20·820
Sulphate of sodium	5·204	2·540	2·786	4·990	5·504
Sulphate of lime	2·720	3·064	5·032	7·203	7·682
Sulphate of magnesia	0·326	5·022	4·544	6·606	4·593
Phosphate of lime	None	Trace	0·312	0·223	0·262
†Iodate of potash	0·022	0·101	0·073	0·076	0·096
Fe and Al	3·200	1·853	2·270	3·836	3·920
SiO_2	10·434	14·403	27·428	37·349	38·247
	100·000	100·000	100·000	100·000	100·000
*Total nitrates	50·500	44·122	33·015	16·643	15·223
†Containing iodine	0·017	0·078	0·057	0·059	0·071

All samples contain slight traces of chromate of potash.

The caliche or raw nitrate material is chiefly a mixture of nitrate of soda, very often with a proportion of nitrate of potash and a large amount of common salt, or in some places sulphate of soda and magnesia, the common salt and nitrate increasing in an inverse ratio. There are also sulphates of soda, lime, &c., and siliceous rock in the form of sand and pebbles. The caliche varies very much, not only in the thickness of the seam but in the quality, from 20 per cent. up to 80 per cent. of nitrate of soda. A good ground would contain a bed 3 or 4 feet thick, and containing 40—45 per cent. nitrate. The upper over layer or costra varies from 4—20 per cent. of nitrate; at 20 per cent. in the poorer grounds it would be called "caliche."

The manner of opening up the ground is as follows: A skilled labourer called a "barretero," because he uses a "barreta" or long steel chisel-edged crowbar, clears away first of all the blown dust "chuca," then he proceeds to cut vertically a round hole of about 9 ins. in diameter through the costra and caliche. He removes the *débris* as he gets deeper with a disc or spoon attached to a long wooden handle. When he gets below the caliche to the "cova" or "congelo" the hole is enlarged into what is called a "taza," in English "cup," in which he is aided by sending down a small boy to scoop out the hole. This taza or cup is then filled with gunpowder to which is connected a slow match to the surface. The hole is then well filled in or tamped with *débris*. A light is applied to the slow match or fuse and all retire, and any stranger approaching is warned by the cry of "fuego" or "fire" to keep clear. In a minute or two the ignition reaches the powder in the taza or cup and the explosion takes place. If the "tiro" or shot has been well made the ground for yards round is heaved, split, and broken up, and a dense cloud of smoke emerges above the cracks. If the "tiro" is badly made the tamping blows out and a high fountain of smoke and stones rises for 50 feet or more and the surrounding ground is little broken.

After the explosion other workmen known as "particulares" loosen the blocks with crowbars and break the bigger lumps up, separating the "costra" over layer from the "caliche," and making two separate piles behind them. The trench is then worked forward by another "tiro" or "shot." On good grounds hundreds of men, "barreteros" and "particulares," can work in line. I have seen a line or "raga," as it is called, half a mile long being worked forward across Lagunas grounds showing 3 or 4 feet of costra and 3 feet of caliche of 45—50 per cent. caliche. As the trench is worked forward it is filled in behind with the costra, which makes the road for the carts to come up to fetch the piles of "caliche."

The powder used is made on the oficina of a mixture: nitrate, 70 per cent.; charcoal, 18 per cent.; and sulphur, 12 per cent. The mixture has to be well ground and dried. Although a poor powder in one sense, it is good for the use to which it is put, as it gives more of a slow and steady heave than a more explosive powder. A good deal of dynamite is now used in helping to sink the tiros, and in breaking up very hard boulders. The workmen are inclined to be too lavish with the dynamite, as it saves them trouble at the expense of the company.

The present pay of the "barreteros" is about 50 cents per foot; the particulares get about 4·50 dols. per cartload of 45 quintals. The dollar is 16*d*. A quintal is 100 lbs.

As the tiros have to be sunk every few yards at the cost of say 8*s*. for each tiro of 12 feet, it will be seen that this is a considerable item in the cost of extraction. Attempts have been made to substitute a mechanical drill, but as the holes were made vertically, it was necessary to heavily weight the drill, and the apparatus was too cumbrous, especially as it would have to be removed well out of range every time the tiros were fired. A drill, however, might be used with great effect driving horizontally from the trench through the bottom soft bed of cova.

The price paid by cartload is not a fixed sum where the thickness of the costra and caliche varies. If the costra is deep, and the seam of caliche thin, the price to the workman is higher per cartload than when the proportion of costra to caliche is the reverse. The measurements for the payment per tiro, and the number of cartloads, are usually left to a native "corrector" or foreman. Any collusion between the corrector and the workmen, or any attempt of the "particulares" to leave a thin piece and

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cover it up so as to get a fat piece at easier work, is of course a serious loss. For caliche once passed over may never be extracted, or, as in the case of grounds that have been worked over for a second time, the cost of the extraction is very high, on account of the irregularity of the workings, and the searches that have to be made. If, also, the caliche is not being immediately carted to the maquina, it is stocked in heaps on which the cartloads are estimated by the corrector and paid for accordingly. It is also not unknown for these heaps to be paid for twice over. The workmen too have a habit of adding to their gains by putting blocks of costra in with their caliche piles.

It can easily be seen that the manager must keep a watchful and skilful eye on this work, or it will make all the difference between a profit and loss in working the oficina. I have known a good manager, by seeing that his carts are well loaded, get over 50 quintals, or 2 tons 10 cwts. per cartload, which makes a good difference in the cost. If the workmen are not watched, they will make a good show with under 45 quintals in a cart, building up quite a wall of caliche in the front of the cart, and tapering off very quickly behind.

The carts to stand the usage have to be very strong, the body is usually made of $\frac{3}{8}$-inch iron plate, and the carts weigh over 30 cwt. A loaded cart is therefore a heavy pull for three mules over the heavy dusty roads. A quatiador or pull-up man fastens on another mule or two to pull up the heavier inclines. The cartmen or "carreteros" are paid by the day, the number of journeys depending on the distance of the rejas or caliche furrows from the maquina. In oficina with large grounds a light railway is usually used for carrying the caliche. The carts in this case would be used mostly in carrying to the loading station on the railway or going to and fro to the acopios or reserve stocks of the raw material, which may be formed either near the extraction trenches or close to the maquina. These acopios or reserve stocks of raw material are a little extra expense in transport and loading, but are very useful in regulating the labour and the working of the maquina, accumulating when the maquina is working slowly, and being used up when the maquina is working faster.

To come now to the maquina itself, or the machinery by which the nitrate of soda is produced from the raw material.

The boiling tanks are built on a hill as near the centre of the grounds as possible. They are placed on an elevation in order to allow the liquid caldo or solution of nitrate in water to run down into the crystallising tanks, also to give a good shoot for the ripio or refuse of the raw material after the nitrate has been extracted. The boiling tanks are constructed high, also, that there should be sufficient fall for the condensed steam of the coils to run back to the steam boilers. In some of the maquinas, however, the elevation is unnecessarily great, causing considerable extra work in raising the raw material and giving a long steam pipe connection with consequent great loss of heat. For good working purposes, the bottom of the boiling tanks should not be more than 12 feet above the top of the steam generators. This gives sufficient fall also for the liquid running into the "bateas" or crystallising tanks while allowing them, the bateas, sufficient height to unload above the "canchas" or draining floors.

As the raw material is carted in in big lumps of a foot or so in diameter it is necessary first to crush it. In all the older oficinas, except the Liverpool Nitrate Company, "Ramirez," the crushers were placed above the boiling tanks, the trunks containing the broken caliche being run from under the crushers on a level along the top of the boiling tanks. This necessitated in nearly all cases from the level of the nitrate grounds a heavy pull up for the mules, or a difficult incline for the locomotives. In the newer oficinas this is altered by having the crushers placed low and the ground material brought up to the top of the boiling tanks by a bucket chain elevator or in trucks by a hydraulic lift, or wound up an inclined plain by a winding engine and steel rope. Of these three methods I believe the bucket chain has been a failure, and I should say the wire-rope winder is cheaper and more simple than the hydraulic lift. The engine for the wire rope could also be used for winding up the ripio trucks.

Above the boiling tanks it is necessary to have at least three large tanks, usually cylindrical shaped, of riveted iron plates. One of these for the pure water, one for the "relaves" or last washings of the spent caliche, and one for "aqua vieja" or mother liquor, the liquor from which the nitrate has crystallised out, but which still contains nearly 40 lbs. of nitrate per cubic foot.

As typical examples of boiling tanks, I may mention those of the Lagunas companies. These tanks are 32 ft. long, 9 ft. deep, and 6 ft. wide. There are other shapes, squarer and larger, but they do not show to any advantage in quick boiling or rapid emptying of ripio or refuse. In the interior of these tanks is a steam coil 9 inches from sides, the diameter of the steam pipes being 5 inches. This steam coil makes a circuit of the tanks five times. The tanks are constructed of $\frac{1}{5}$-inch iron plate, strengthened at the bottom angles with $\frac{1}{2}$-inch angle iron. About one foot from the real bottom is the false bottom of or grid of iron plates on which the caliche is supported. There are two doors at the bottom which are opened from the outside when the ripiodores are clearing out the ripio or spent caliche. Full of caliche and hot liquor, the expansion of the sides is considerable, and they are strengthened by cross-bars from side to side. Nine inches from the sides is a steam coil 5 inches diameter of four or five tiers. The steam for these coils is let in by a cock at the top, and as the steam is condensed into water it flows out at the bottom. Each tank is also furnished with two openings, one to allow the caldo or hot nitrate liquor to run out into the curved iron troughs and down to the crystallising tanks, and another lower one to allow the "relave," or last washing, to run out to the "relave" tanks or reservoir. Both these pipes take from below the false bottom, one reason being that they would otherwise be choked by the caliche. They both have an upward bend at first, so that as little solid as possible flows out. These tanks each take a charge of 60 tons of caliche. The tanks are built in series of six, communicating by a 9-inch pipe, which opens below the grid through which the liquid rises, and pours through an arm into the adjoining tank.

The caliche is first broken up in Blake's crushers to pieces of two or three inches in diameter. Finer crushing is not advisable as the caliche in the boiling tanks would then lie too close to allow the water to circulate thoroughly through the mass.

The working of the series of six boiling tanks may be described as follows:—One tank is being emptied of the exhausted caliche through the bottom doors by the ripiodores, who first, by means of an iron rod, work down the ripio immediately above the hole. They then jump in and shovel the ripio out through the doors into the truck below. This is extremely trying work as the ripio is still hot, and very often the steam cannot be completely shut off from the coils. The men, generally Bolivians, work stripped to the waist, and the perspiration pours off them. The ripio, as it comes out into the trucks, is in the shape of liquid mud; the first truck-loads being, naturally, the most watery. The trucks carry it away from under the maquina and shoot it, when, after some hours, it sets hard like cement. The age of a maquina can be gauged by the size of the embankment. In the construction of a maquina, plenty of space has to be left for these ripio heaps, and, in this regard, the higher the boiling tanks are put the shorter would be the embankment, and, consequently, there is a saving in time and labour in transport of this refuse. The next tank to the one being described contains caliche, having its last washing with plain water. This water, after standing some hours, is run off by the relave vent and carried down to one of the "relave" reservoirs which stands below the boiling tank, and usually as close to them as the road for the refuse cars will permit. When this water is completely run off this tank comes to the stage of the previously mentioned tank.

The third tank contains partially extracted caliche, on which relave water is allowed to run. After this relave water has been allowed to stand a few hours commences the "traspasso" or transpassing of the liquids from one tank to the next. This is effected by running in from the top plain water. As this comes in it forms a gradually increasing

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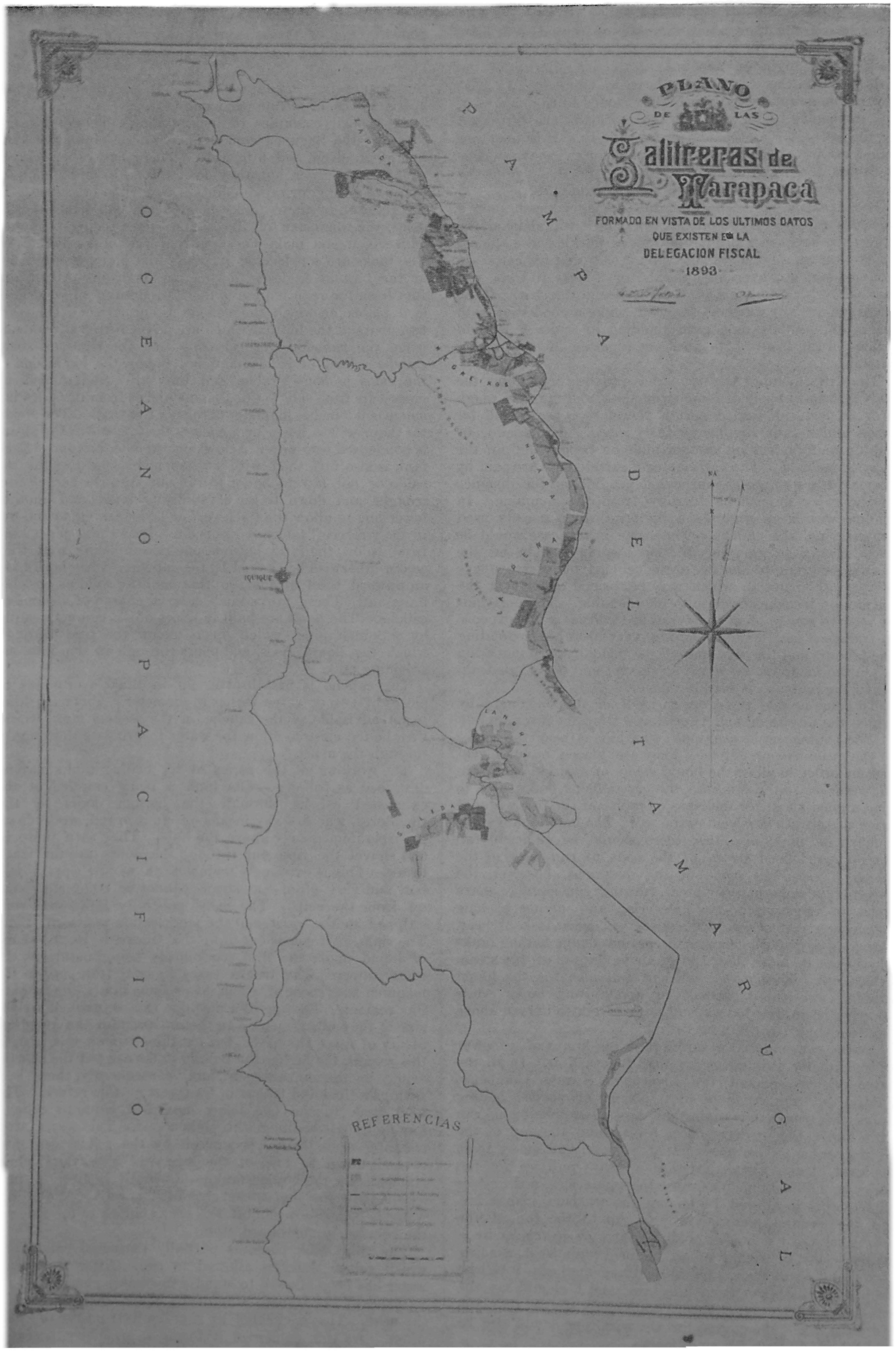

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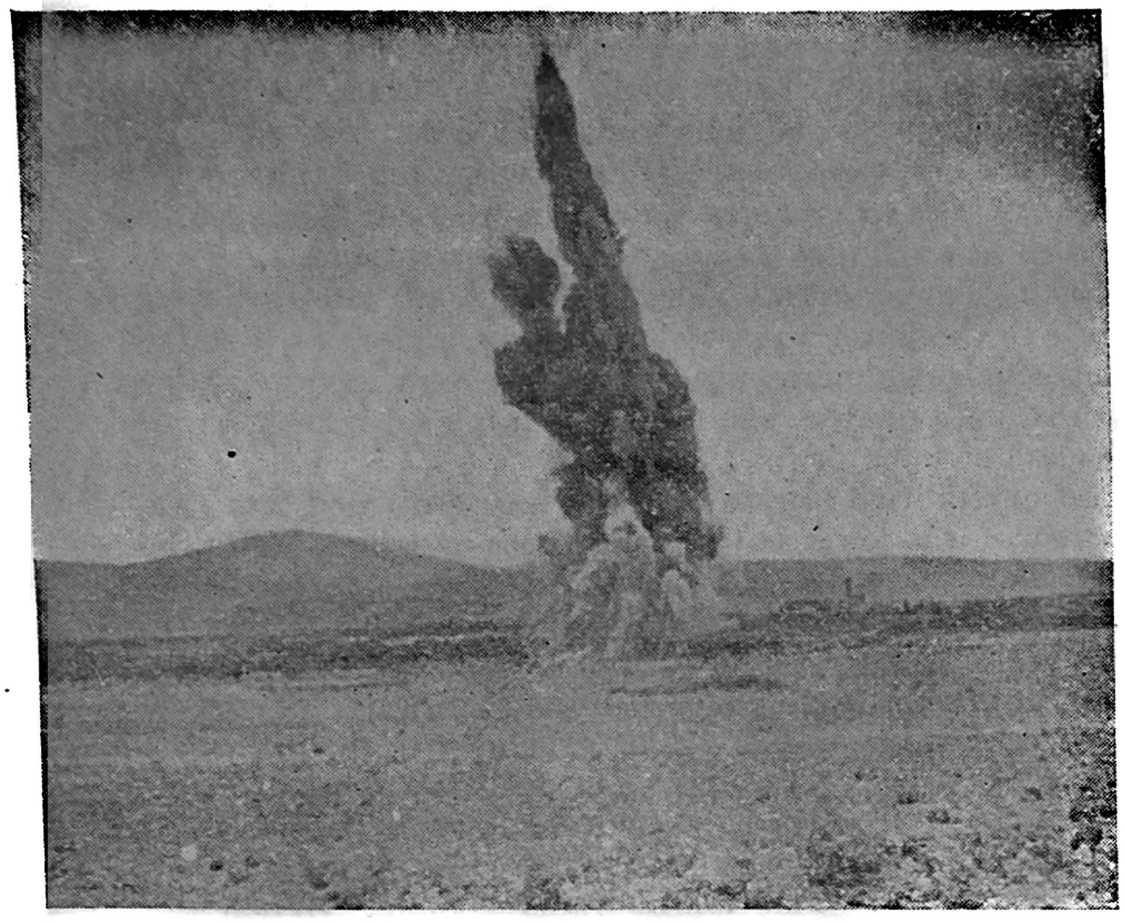
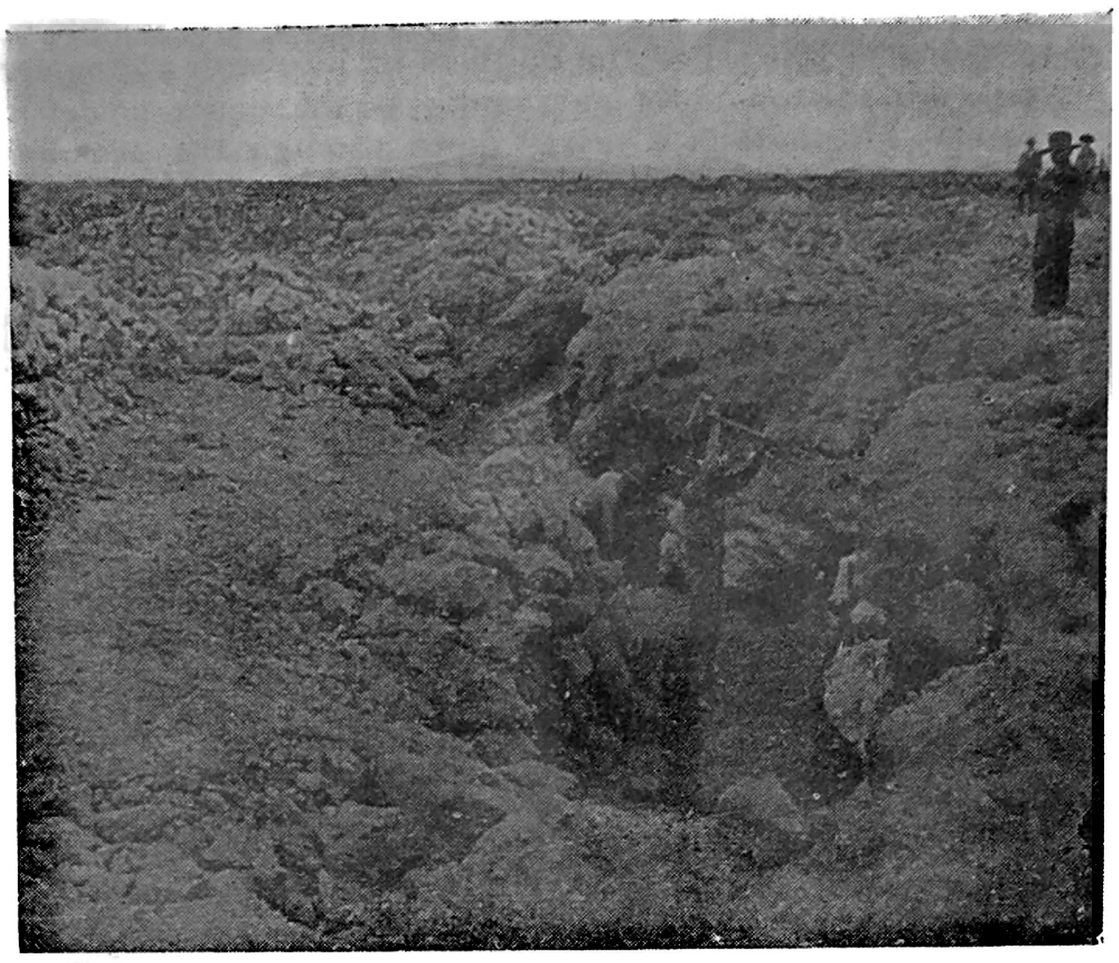
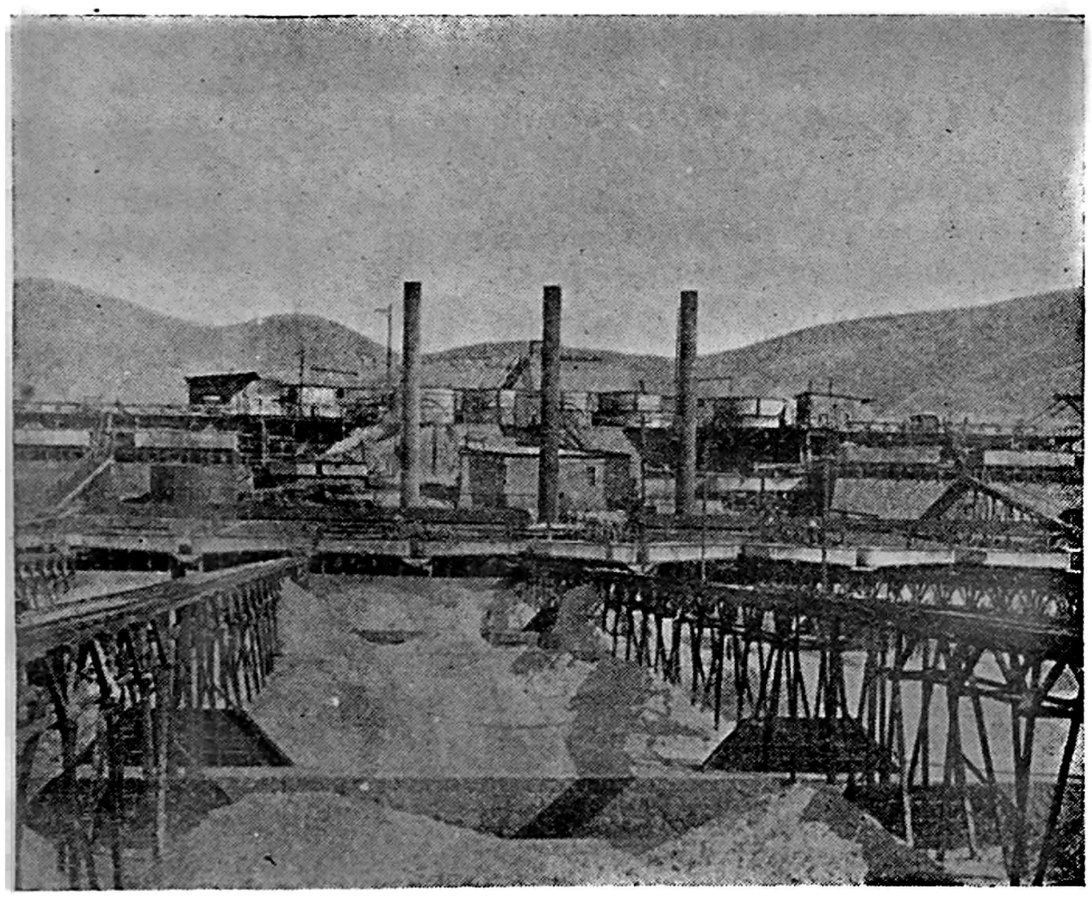


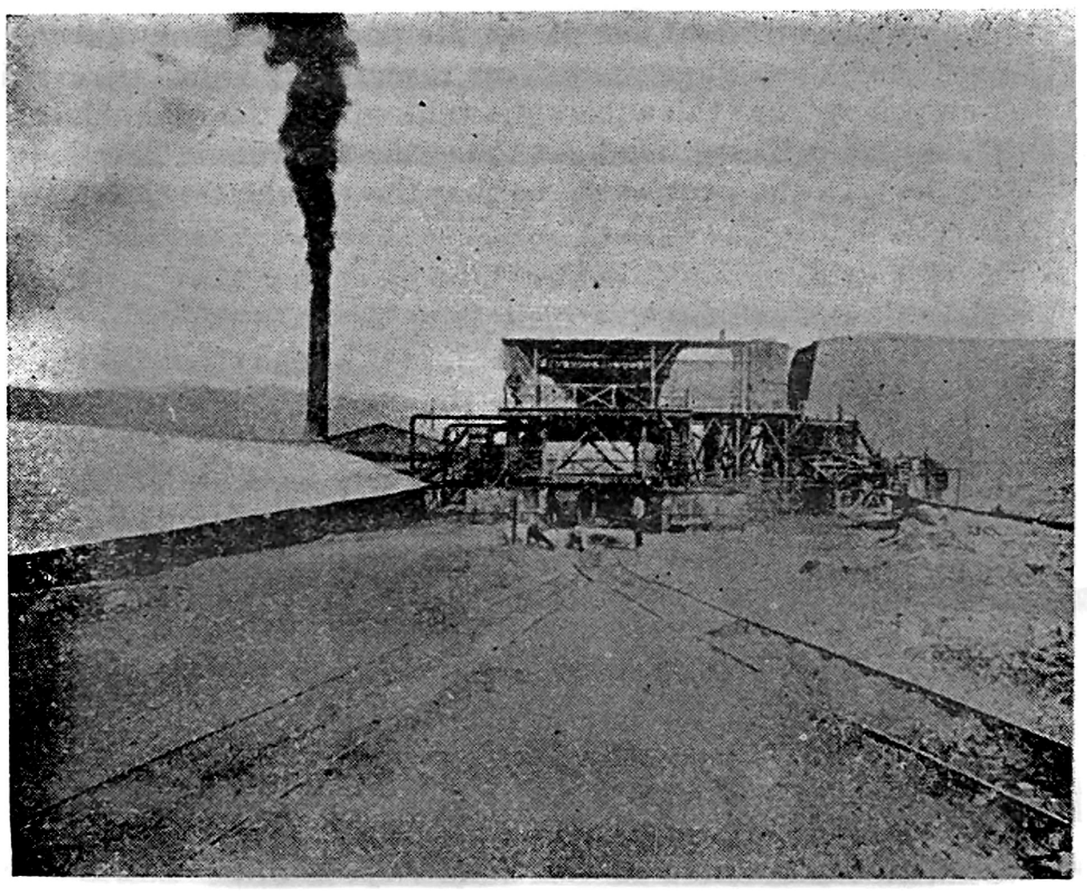
BLOWING UP CALICHE.



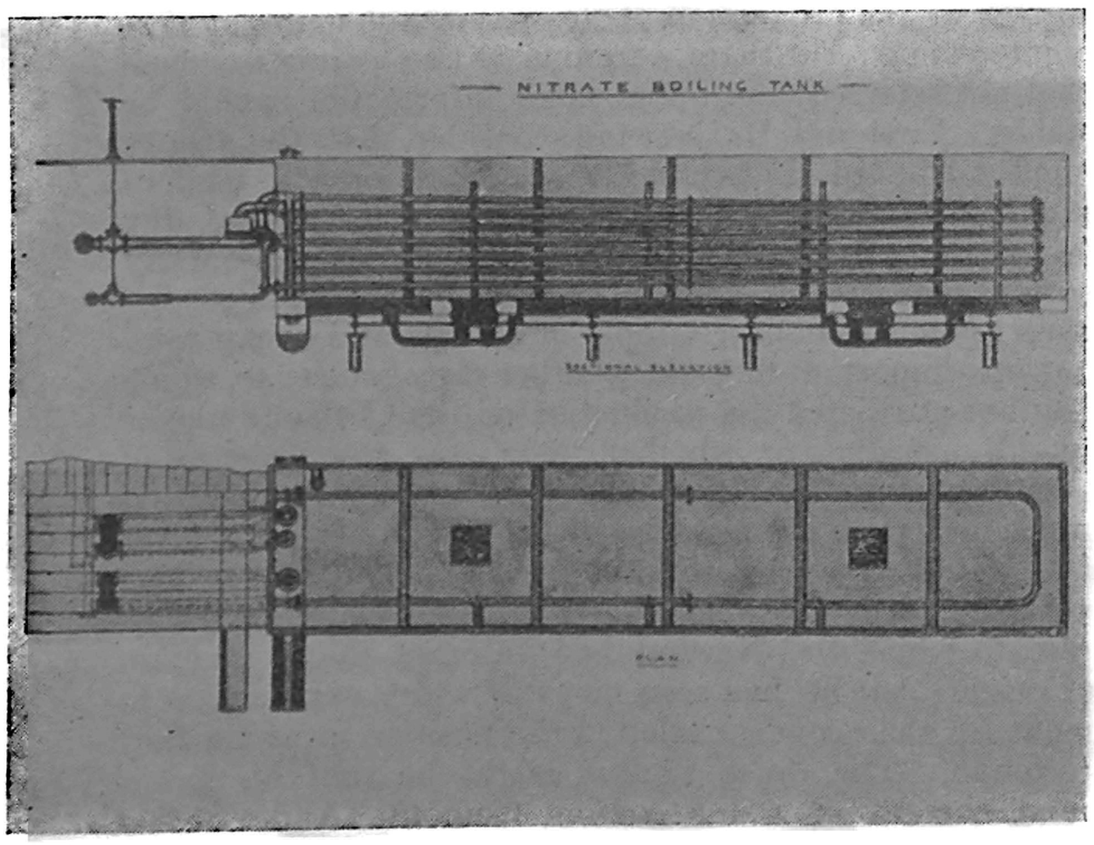
GETTING THE RAW MATERIAL.



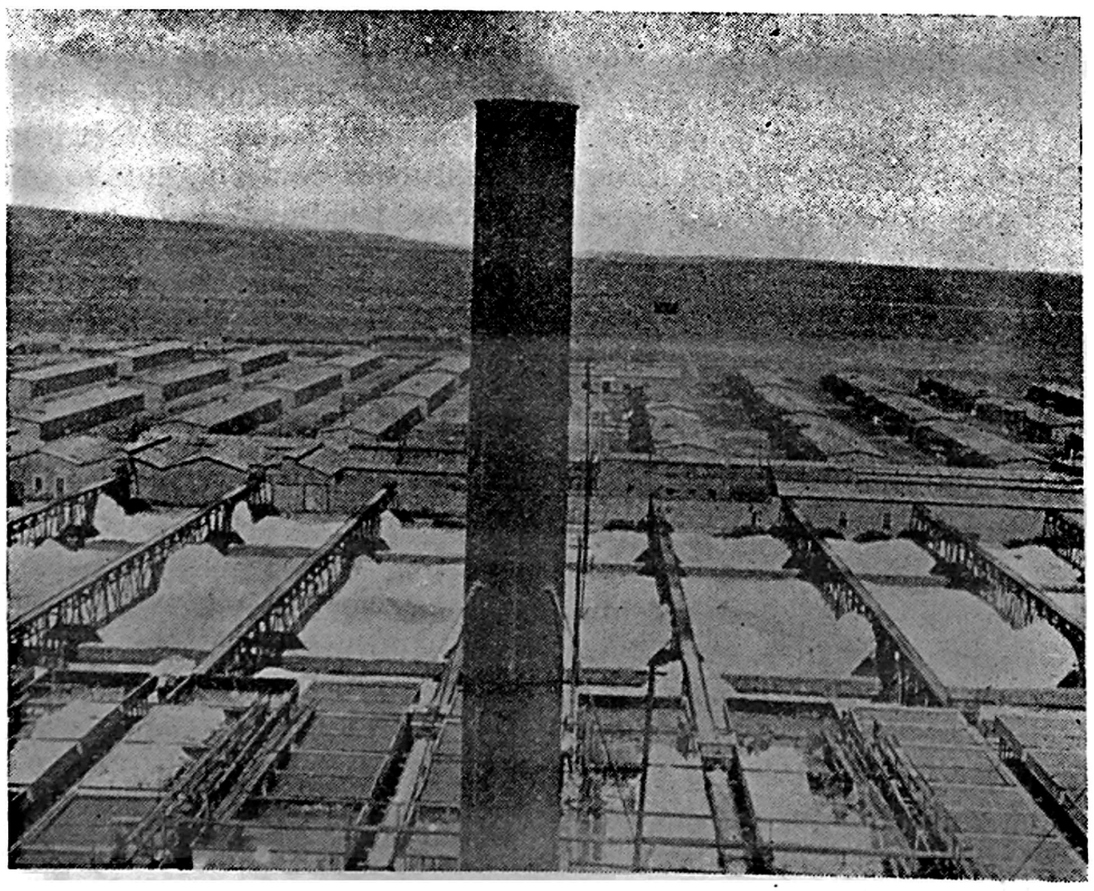
FRONT OF LAGUNAS CENTRAL WORKS.



SIDE VIEW OF BOILING TANKS.



SECTION OF PLAN AND ELEVATION OF BOILING TANKS.



VIEW OF CRYSTALLISING TANKS

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layer on top of the specifically heavier enriched relave water, which is gradually forced down through the false bottom or crinoline as it is called and up the 9-in. pipe with a shoulder pipe into the top of the next tank; as the liquor comes in to this fourth tank it drives down through the crinoline and up through a similar shoulder pipe the still more enriched liquor. After standing three or four hours on the less exhausted caliche, it is pushed forward by the liquor from the previous tanks following in its stages. It comes then into the fifth tank, or caliche very partially extracted, where it takes up more nitrate, and after three or four hours is pushed forward in the same way by the liquor in the tank behind it into the sixth tank, where it comes on to untouched caliche. Here it receives a thorough boiling till its temperature reaches 112° C. and the liquor has a gravity of 112° to 114°. The steam should then be turned off for some time to allow suspended matters to settle. The liquor or caldo is run off to the bateas or crystallising tanks till the hydrometer registers about 160°. In making high quality nitrate, that is over 90 per cent. nitrate and 1 per cent. or under of common salt, the caldo is run first into tanks called chulladores, just below the level of the cachuchos or boiling tanks. Here most of the suspended matters settle and the clear liquor is then run off to the bateas, where it is allowed to cool and crystallise for four or five days.

The caldo as it is run off contains up to 80 lbs. of nitrate per cubic foot. After cooling during the four or five days the mother liquor called "aqua vieja" is drained away, containing up to 40 lbs. of nitrate per cubic foot, and runs into the aqua vieja tanks or reservoirs; from here it is pumped up into the aqua vieja tank above the cachuchos, or if iodine is being made, it goes first through the iodine house. In the process of boiling the caliche this aqua vieja is returned to the boiling tanks.

If it were possible, it would be good to run on only aqua vieja to the caliche, and heat it so as to dissolve only the nitrate, and so use the same liquor already containing as much nitrate as it can hold in the cold over and over again. But owing to evaporation in the boiling tanks and in the crystallising tanks, and leakages, there is considerable loss of water. Also the water which has to be continually added is necessary for final washings, for it would never do to allow the liquor in the ripio mud to consist of a liquor containing 40 lbs. of nitrate per cubic foot. With the quantity of water used in the corral and among the inhabitants concerned in the manufacture, it is reckoned that it requires a water supply for each oficina in proportion up to six gallons for every cwt. of nitrate made.

In the description of the traspasso system I purposely omitted the addition of this aqua vieja in order not to complicate matters. In passing the liquor from one tank to another the aqua vieja is added while the flow from the adjoining tank is coming in. It is no use adding it to a cold tank, for then it cannot dissolve more nitrate, nor to one where the liquor is weaker than itself, so it is best to add it in the last two tanks where the tanks are hot and the caliche rich. The steam for the coils is at 50 to 60 lb. pressure, and is generated in three large Galloway boilers, 28 feet long by 7 feet diameter. The expenditure of coal amounts to one ton to about seven tons of nitrate produced, but the proportion varies according to the economy of manufacture and class of coal used.

Besides the heat needed to bring the water to the boiling point, nitrate in dissolving takes up a large amount of heat, for this reason the liquor should become saturated in the cold in the first tanks of the series before steam is turned on to the coils. The cold water dissolves a large quantity of common salt, and other salts, such as sulphate of soda and magnesia; as the temperature of the liquor rises in the presence of caliche more nitrate is absorbed, and the common salt is turned out of the solution. This fine salt is slow in precipitation in a boiling solution, but gradually sinks down, and with the fine mud from the caliche is the most liquid portion of the ripio called bora.

The caldo, or hot liquor, runs by the canals as I have previously mentioned, either first into the chulladores or settling tanks, and stands for an hour, where it deposits very salty nitrate, or it runs direct into the bateas or crystallising tanks. A good form of crystallising tank is one of 6-in. iron plate, 25 ft. × 18, and 2 ft. 9 ins. to 3 ft. 3 ins. deep; thus giving a slope on the bottom of half a foot in 18 feet, to allow for draining off the aqua vieja, when the crystallisation is complete. Five to six days are allowed for crystallisation. When the boiling tanks are in full work the six require 44 of these crystallising tanks. The fifth or sixth day the plugs are removed from the lower side of the batea and the aqua vieja runs off into the canal leading to the lower aqua vieja reservoir. Here as it stands it deposits some more nitrate, not of very good quality, which is used on the oficina for making sal natron, crude carbonate of soda, or for gunpowder.

The crystallised nitrate in the bateas is divided into two, and that of the lower half of the batea is piled on to the higher half, so as to get better draining. Also in some oficinas for this purpose falqueas are used, that is, iron plates sloping steeply down to the side of the batea, on which the workmen throw out the nitrate and let it drain. The bateas, although below the level of the cachuchos (it requires a 1 per cent. grade to run the liquor down, although generally a much steeper one is given), are usually 10 or 12 feet above the ground, supported on wood posts and cross pieces. This allows rapid cooling. When the nitrate is drained as above mentioned, it is put into cars and run out along moles or bridges and then shot down on the canchas or drying floors. These drying floors are on a level with the floor of the railway trucks, on to which the nitrate is subsequently loaded.

As the nitrate comes on to the cancha floors it contains still about 10 per cent. of water. The nitrate stands on these floors five days or more to drain and dry. It is much more draining than drying as if the aqua vieja is dried out it adds to the percentage of salt. The aqua vieja which drains through the canchas, containing up to 40 lbs. of nitrate per cubic foot, is entirely lost.

After about five days the analysis of the crystals is:—

—	First Quality.	Second Quality.
Nitrate of soda	96·50	95·20
Sodium chloride	0·75	2·50
Sulphate of sodium	0·45	0·60
Moisture.....	2·30	1·70

The quality depends on the liquor having passed through the chulladores, also on the quality of the caliche worked. When the nitrate arrives at this state, it has only to be put in bags and on the cars to be carried down to the port.

To the actual cost of nitrate on the oficina must be added carriage to port, 8*s.* 3*d.* per ton; export tax, 2*l.* 8*s.* per ton; and freight to Europe, which varies.

Discussion.

Mr. W. F. Reid said that the particulars which Dr. Newton had given of the production of this important material were very interesting; but there were one or two points to which he had not referred, and upon which information would be valuable. First, did Dr. Newton consider that the theory he had advanced respecting the production of Chilian nitrate by the action of nitrifying organisms held out any hope for the production of nitrate in the future? Many important industries besides agriculture were dependent for success upon a plentiful supply of nitrate at a cheap rate, and it was important to know whether the agencies to which the author attributed the production of the Chilian deposits were still operative, or whether there was any prospect of the development of any process for the artificial production of nitric acid from the nitrogen of the atmosphere at a price which would compete with the natural product. The theories as to the production of these natural supplies of nitrate to which Dr. Newton had referred might explain their origin; but he had seen no satisfactory explanation to account for their concentration in the position in which they were found. The cause of this might be that an underground current of water coming from the Andes would dissolve the more soluble salts in the soil; the solutions would then rise to the surface, where, owing to the heat

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and dryness of the climate, they would concentrate. The occasional supplies of moisture that occurred, however, would redissolve and drive them underground again, where they would concentrate in the upper layers of the soil to form the caliche. He would remind the author that in Argentina, especially in the territory of Santiago del Estero, there were valleys called salinas which in summer time were encrusted with salt; but in the middle of these lagoons there was found a mother-liquor containing much nitrate of soda from which, by natural evaporation in the summer, solid nitrate was obtained. Lastly, in view of the investigation which had been made of recent years on the injurious action of chlorates and perchlorates upon crops manured with sodium nitrate, he would like to ask Dr. Newton whether he could give any information as to the distribution of chlorates throughout the mass of nitrate.

Mr. A. Robottom could confirm most of the statements of the author from his own personal experiences of forty years ago, when he had visited all the fields from which it was produced in quest of borate of lime for the manufacture of boracic acid. The first importations of nitrate of soda were made by Mr. Shorthouse under the impression that it was nitrate of potash, and its real character was only discovered when the Government, regarding it as saltpetre, attempted to use it for the manufacture of gunpowder. When its real nature was known, he himself travelled all over England introducing it for use in the manufacture of nitric acid.

M. J. H. M. Fallon, having seen a great deal of the nitrate industry in the course of his own labours in Chili, had often wondered that this important subject had not been brought before this section of the Society earlier. It would, he thought, have added to the interest of the paper if Dr. Newton had said something about the development of the method of separating the nitrate from the caliche from the engineer's point of view. The latest improvement, he understood, had been introduced by a Chilian engineer (a Mr. Prieto), who, by forced currents, had reduced the time of boiling from about 24 hours to something like eight hours. He would have liked also to have heard something about methods for increasing the returns of the nitrate companies. Formerly, when everybody was making money out of the business, a few pence more or less per quintal did not make much difference; but now, when it was understood that many of the companies could barely pay their debenture interest, it was surprising that research work had not been started with a view to utilising the caliche to the fullest extent. When he was in Iquique, three years ago, everybody was talking about perchlorates and their possibilities. Dr. Newton had said very little about perchlorates in his paper, and he did not know whether the perchlorates talked about were only of potash or of potash and soda; it was reported that no potash was to be found in the caliches of Antofagasta. A commission had been appointed at Iquique to report on the occurrence of perchlorates, and they found that these were precipitated from the mother-liquors to the extent to which the latter were exposed to the atmosphere. He did not know if any researches had been made as to whether the oxidation could be restricted so as to form chlorates instead of perchlorates. The nitrate manufacturers did not find an easy market for perchlorates, whereas chlorates had a recognised market and price. In some of Dr. Newton's analyses of caliches and costras which he (Mr. Fallon) had seen, there always appeared a certain proportion of nitrate of potash. In 1876–7, there were exported from Tarapacá some 6,000 to 7,000 tons of nitrate of potash, and according to Dr. Newton's analyses there was always an inverse proportion between the percentages of nitrate of soda and nitrate of potash. If the same conditions applied to nitrate of potash as to iodine, *viz.*, the lower the percentage of nitrate of soda, the higher that of nitrate of potash, there might be quite a valuable store of the latter body remaining to be worked in the costras at the various oficinas.

Mr. A. Marshall wished to know whether the iodine that occurred was recovered, and also in what form the iodine occurred, whether as iodide or iodate.

Dr. Newton replied that it was always as iodate.

Mr. Oscar Guttmann considered the paper to be a very interesting one, if for no other reason because it gave a clear description of the state of the nitrate industry, and because it was illustrated by some excellent photographs, that had not been seen in this country before. The author had, however, omitted two important points—the production of iodine and perchlorate. It was known that by far the largest quantity of iodine in the market came from the nitrate factories in Chili, but that, owing to the over production there and to the desire to keep up the prices, the nitrate companies often discontinue recovering it, and let the vapours of iodine pass in dense masses into the open air. The paper had certainly confirmed the impression he had formed about the nitrate industry of Chili, namely, that it was one of the most wasteful industries he had ever known. Every part of the process was crude and wasteful. The blasting was done in a rough and ready way, with admittedly bad powder, simply blasting trenches, and filling them up with costra, a material containing 40 per cent. of nitrate, probably for future generations to mine again. The extraction of the nitrate was done in such a way, that, as was said by a previous speaker, the simple expedient of circulating the liquor could result in doubling the efficiency. The iodine was frequently totally wasted, and the mother-liquor, containing 40 per cent. of nitrate, was run to waste in a country, where, from all accounts, water was so precious. Finally there was the waste of fuel on account of the very low thermal efficiency of the boiling plant. The author stated that six gallons of water were wanted for every cwt. of nitrate, and 1 ton of coal was required for 7 tons of nitrate, keeping the liquid in the boiling tank at 112° C. This meant that 1 lb. of coal was wanted for $3\frac{3}{4}$ lb. of water used in the process, which could only be considered as ineconomic. Evidently there was plenty of room for improvements, and opportunities for the making of fortunes by capable engineers.

Mr. Henry Shield said that the statement of the last speaker, that a pound of coal was consumed to evaporate half a pound of water, arose from a misconception of Dr. Newton's statements with regard to recovering the nitrate of soda from the raw caliche. The process they were discussing, which was practically the process adopted in the entire Tarapacá district, was not one of concentration of weak nitrate solutions by evaporation, but was a process based on the facts that, while the solubility of common salt (one of the constituent parts of caliche) was almost the same in cold as in hot water, matters were quite different in this respect with nitrate of soda. A reference to a table of chemical solubilities would show that the rise in solubility of nitrate of soda was nearly 3 to 1 as the temperature of water rose from 16° C. to 120° C. The process described by Dr. Newton was one of heating and lixiviation, settling, and subsequent cooling. During lixiviation the heated waters took up more and more nitrate, throwing down salt into the refuse or repio; and during cooling the settled clear heated liquors deposited crystals of sodium nitrate in the cooling tanks from which they were fished, and, after draining, were bagged and forwarded to the port of shipment. The mother-liquor remaining in the cooling tanks, which was in effect a cold saturated solution of nitrate of soda, was utilised in the lixiviation of subsequent charges of caliche in the boiling tanks. The only real, or as he might say, intentional, evaporation about the process was that required to generate the steam which served, by its condensation in coils placed in the boiling tanks, to raise to the required temperature of greatest saturation, or as near thereto as found in practice most advantageous, the mixture of water, mother-liquor, and caliche in the boiling tanks. A certain amount of evaporation did take place on the surface of the liquid in the boiling tanks, and, though efforts had been made to check it, it could not be avoided in open vessels heated to practically boiling point without bringing in complications of plant and of charging to which it would take too long to refer. Amongst these efforts he might perhaps allude to covering the boiling tanks, and to dividing the coil into sections, each capable of being supplied with steam independently of the other sections; the steam supply being cut off in the upper section first, would, it was anticipated, possibly aid in diminishing the surface evaporation. This evaporation in the boiling tanks was accidental, and *pro tanto* wasteful, every pound of water so evaporated representing so much heat lost.

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The steam used for the heating coils of the boiling tanks was generated in double-flued Lancashire boilers, set in the best matter and placed at such a level below the boiling tanks as permitted of the condensed water in the coils being returned direct to the boilers. Thus the whole of the latent heat was given up on condensation of the steam in the coils to the liquors to be heated, as well as a part of the sensible heat of the condensed water, the remainder returning to the boilers. No more rational or economical mode of producing steam for heating purposes could be devised. The amount of water evaporated per pound of coal under such a system would vary from, say, 6 lb. to 9 lb., according to the quality of coal and care in firing. In order to allow the crystals to deposit, it was necessary to let the liquor cool, and it was this cooling that was mainly responsible for using up the heat primarily imparted to the steam, and, so far, it had not been considered feasible, from a manufacturing point of view, to utilise the heat so given off in the cooling, which was carried out in simple tanks in the open air.

The members of this Society must not consider that, so far at any rate as regarded those technically connected with the nitrate industry, the process described was thought perfect.

A great many efforts had been and were being made to improve a state of affairs which permitted the loss of, on the whole nitrate contents of the caliche, about, say, a fourth to a third, which was unrecovered and lost in the refuse, or ripio and borras, as they were called. Forced circulation, by the use of centrifugal pumps, of the mother-liquors (*aquas viejas*) and rewashings (*relavés*) chiefly have been for many years in use in some oficinas. Many years ago the heater pipes were placed round the sides of the tank inside, mainly with a view to prevent their getting injured by caliche falling on them, or getting clogged or coated outside, and thus having their efficiency as heating surfaces reduced.

A few years ago Mr. Prieto introduced an improved system, a combination of forced circulation of the hot liquor, or "calde," of the boiling tanks, as well as of the poorer liquors, along with the location of the heating pipes in a separate compartment inside and round the sides of the tank, which enabled a more rapid lixiviation and a quicker discharge of refuse to be made.

Then the question of fine crushing had not escaped notice. It had been recognised that the "Blake" crusher, as generally in use for crushing the caliche, did not crush sufficiently fine, and if the jaws were set much closer it produced too much dust. Thus, especially in certain hard caliches, much nitrate went into the boiling tanks surrounded by a coating that prevented access of the lixiviation waters to it, and passed away in the repio. To meet this difficulty, rolls had been used in some oficinas for a long time, through which rolls the caliche passed after leaving the Blake crusher and before going into the boiling tanks.

Mr. Welch had of late years been, so to speak, the apostle of a system combining fine crushing of caliche with forced circulation of caldos and other liquors and complete isolation of the heater coils from the tanks containing caliche. He placed the heater coils in a separate tank altogether, which was entirely devoted to heating the liquors. It would be of interest if Mr. Welch could at some time give an account of the experiments he had carried out in the direction of his patents, and of the actual results achieved.

From what he had said, the members would see that their experience of cognate matters might perhaps help them to suggestions as to how the waste incurred in nitrate thrown away in the refuse might best be prevented, in a practical way and consistently with the carrying on of the industry under the general conditions, fiscal and other, at present obtaining, and without too much interruption of manufacture.

They must, however, remember that in the case of caliche they were dealing with an article of great mass and of little intrinsic value comparatively speaking.

From the selling price in Liverpool of, say, 8*s.* per cent. or 7*s.* 3*d.* per quintal, less $2\frac{1}{2}$ per cent., had to be deducted the cost of bagging, transport by rail to port of shipment, shipping charges and freights to Europe and the heavy export duty on nitrate charged by the Chilian Government before they got at the value to the nitrate maker of this nitrate, ready for delivery at the oficina, or as it was called "in caucha." This value represented the cost of manufacture plus his profit, or it might be minus his loss. The cost of manufacture varied with the quality of nitrate within very wide ranges. If, for the sake of illustration, they took it in round numbers at a medium cost of, say, 1 dollar or 1*s.* 5*d.* per quintal of $101\frac{1}{2}$ lb. English, that would represent roughly about 30*s.* a ton of nitrate. If the nitrate recovered only represented two thirds of the total nitrate contained in the caliche, and if the caliche itself was poor and only contained on assay (as was not unfrequently the case), from 30 per cent. to 35 per cent. of nitrate, it was obvious how comparatively low money value the caliche or material which had to be handled represented per ton, at the existing market value of the finished product. All these considerations explained to a great extent the reluctance of nitrate makers to embark an outlay on untried processes; even where theory and, to some extent, experiment pointed to a saving in cost, either by reducing the coal used per ton of nitrate made, or increasing the tons of nitrate recovered from a given quantity of caliche. The two gains must be combined and there must not be any serious increase in the quantity of water used, nor above all in the amount of labour which was at times very scarce before any promised improvement could appeal to the nitrate maker. The question of coal consumption and its cost would illustrate what he meant if we assumed that a weight of coal equal to one-seventh of the out-turn in nitrate was consumed (and he might say this was not an extravagant figure to take, it sometimes ran to a fourth), and if that coal cost 42*s.* per ton at boiler house, that meant coal of a value of 6*s.* was used per ton of nitrate made or $3\frac{1}{4}$*d.* per quintal of nitrate made. If an improved process saved a third of this coal, or, say, 1*d.* a quintal, that was not a very serious percentage on the selling price, though it did represent a material percentage on the 1*s.* 5*d.* a quintal cost of manufacture. To make it of real value it must be accompanied with, above all, a saving in cost of labour, and, if possible, the amount of water required should be decreased, and, at any rate, not very materially increased.

Mr. W. F. Reid said that he would like to correct one error. He had not referred to the process as a wasteful one. He knew the conditions under which it was carried on, and he felt great respect for those of his countrymen who expatriated themselves to one of the most hateful spots on the face of the earth in order to produce a most valuable body and sell it to us at something like cost price. He thought that the utilisation of the waste products of this industry offered a suitable opportunity for offering a prize through the medium of the Society, and that there was plenty of technical skill among the young members of the Society to work out such a problem if they only knew the conditions.

The Chairman considered it evident that Dr. Newton's object in bringing his paper before the Society had been achieved. There had been but little previously published on the subject, which was one of considerable industrial importance; and if the author's criticisms had no other effect than that of calling general attention to the defects in the manner in which the industry was conducted, they would serve a useful purpose. It was admitted that the processes employed were open to improvement; and he cordially endorsed the suggestion made by Mr. Reid that an inducement should be held out to members of the Society to devote their energies to suggestions tending to such improvement. There need be no fear of interference with the continuity of manufacture. It would be easy to arrange for experiments to be conducted, even on a considerable scale, without interrupting the regular output of the factories.

Dr. Newton, in reply, said that, with regard to the shortness of the paper and to the omission of references to the iodine industry, it was really only with the object of starting the discussion that he had read this paper, it being his intention to continue the subject and deal with those points in a later paper. He would therefore not go into the

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matter at that late hour further than to say that he thought that, when the improvement of the method of production came about, the costras, up to 15 per cent. of nitrate, would be the great source of the nitrate industry, and that there would be no fear of a failure of the supply for many years to come.

Manchester Section.

Meeting held on Friday, May 4th, 1900.

DR. J. GROSSMANN IN THE CHAIR.

SOME ELECTROLYTIC PROCESSES FOR THE DECOMPOSITION OF ALKALI CHLORIDES.

BY JOHN G. A. RHODIN, F.I.C.

The apparatus used for electrolysis of solutions of alkali chlorides can be divided in two great classes. The first contains the apparatus which separates the products at the positive and negative poles by means of a diaphragm, and the second class contains the apparatus which utilises mercury as a cathode without the intervention of a diaphragm. We are less concerned with the inventions referring to electrolysers with fused electrolyte. In the following we shall endeavour to adhere to this classification.

The process, which involves the use of a porous diaphragm, depends upon the fact that a solution of an alkaline chloride, when subjected to electrolysis with two insoluble poles, will yield caustic alkali at the negative pole, and chlorine at the positive pole, the separation of which is effected by means of a porous diaphragm. Many inventors have tried to improve this process. William Cook in 1851 applied for a patent as a communication from abroad for a process of a similar nature, and we come down as far as Messrs. Hargreaves and Bird without finding anything materially new in principle. The whole process is simply the development of an old lecture experiment used by Berzelius and his pupil Kolbe.* It consisted in dividing a tank into two halves by means of a porous diaphragm and immersing one pole in each half, and showing that when current was passed through the electrolyte of chloride of sodium a litmus solution was reddened and afterwards bleached at the positive pole, whereas a deep blue colouration was caused at the negative pole. The scientific explanation of the phenomenon holds good in all cases. It is, however, next to impossible to produce strong solutions of alkalies by this means, as the alkali solution forming round the negative pole is in itself an electrolyte of lower heat of combination or, as I prefer to call it, decomposition value than the salt solution itself with which it becomes mixed. An attempt to concentrate the alkali solution by continued electrolysis would, therefore, result in the formation of hydrogen mainly at the negative pole. This fact caused a great deal of ingenuity to be employed in order to abstract the sodium hydrate at the same rate as it was formed, and one of the inventors, who worked on the diaphragm process, Mr. Greenwood in his patent of 1891 (this Journal, 1893, 525) arranged to circulate mercury through his cathode chamber in order to carry the sodium off as an amalgam before allowing it to be decomposed by water for the formation of caustic soda. This invention is very remarkable, looked upon as an anticipation of more modern patents, because the diaphragm was absolutely unnecessary, and a little thought would have shown him a way to construct one of the more modern appliances for electrolysis with a mercury cathode. Messrs. Atkins and Applegarth, in their earlier patent of 1890 (this Journal, 1892, 43), did practically the same as Mr. Greenwood. None of these gentlemen realised fully that the diaphragm itself was useless and served no purpose. Messrs. Hargreaves and Bird, however, abstract the sodium hydrate from the solution by other means (this Journal, 1895, 1011). They make the cathode itself porous and cause it, by their mode of construction, to form the wall of the apparatus in such a way as to allow the caustic soda formed to trickle through and combine with carbon di-oxide on the outside in order to form carbonate of soda. In principle this cathode action is beautiful and original. They further claim that this saturation with carbon dioxide will lower the decomposition voltage utilised in the process (see this Journal, 1894, 250, 256; 1895, 166). Such neither is nor can be the case. The decomposition voltage in all electrolytic processes for decomposing common salt is the same, the efficiency of the apparatus depending upon its electrolytic resistance. No *secondary* reaction adopted can be utilised as an energy producer in the first cell, even if this reaction develops energy. When we try to cause depolarisation as a general rule we have to deal with hydrogen, and the oxygen supplied must occur either in the solution or else in combination with the positive pole. If it is supplied by mechanical means depolarisation is only incomplete, and, in fact, only possible when the depolarising gas is soluble in the electrolyte. In the case of sodium and carbon di-oxide we might say that the carbon di-oxide is soluble in water, but at the same time we have to remember that in the Hargreaves-Bird process the carbon di-oxide is not dissolved in water, but in a solution of caustic soda, and hence it does not enter into the electrolytic action before it is chemically combined with the caustic and thus requires energy for being made electrolytically available. The decomposition voltage is $3\frac{1}{2}$ volts in a simple cell with a mercury cathode without any diaphragm and without any depolarising agent, and I have no doubt that a still smaller voltage can be employed. The main thing remains. We do not know accurately what the decomposition voltage of an electrolyte ought to be, and its laws are not absolutely defined for measurable current. The old law given by Sir W. Thomson * had to be considerably altered by Nernst in order to give it flexibility, and, to my mind, flexibility only means indefiniteness. The mere fact of the dissolution of the electrolyte in water causes a partial decomposition of the same, and we can hence understand that the slightest application of electrolysis will further increase this decomposition and cause a migration of the ions. To begin with this decomposition will be counteracted by diffusion, and the so-called decomposition voltage is only arrived at when the electrolytic dissociation is so great as to make the natural diffusion insignificant. At the present moment the theory of electrolysis with low voltages is not over well understood, but a large amount of work is being done on the subject. Hence the differences of voltage observed in the different electrolytic processes are ascribed to imaginary effects of depolarisation and other obscure causes. In the future we shall no doubt be able to handle these subjects mathematically, showing that the energy employed is not altogether dependent upon the strictly defined formula which was delineated by Lord Kelvin for the first time.

The first attempt in this country to utilise the diaphragm process for production of caustic soda and bleach, was made by Messrs. Richardson and Holland in Kent, about the year 1893. I believe the diaphragm process to be quite as promising as the mercury processes, if the statements made as to the lasting power of the diaphragm can be borne out by actual practice. The only drawback will be a comparatively larger plant for the same output, but at the same time it is easy to understand that this plant might be cheaper.

We shall now turn our attention to mercury cathode processes, to which I have paid a greater amount of attention that I have done to the other. We shall discuss the following patents:—

André Leopold Nolf, 1882, No. 4,349.

Atkins and Applegarth, 1890, No. 20,768 (this Journal, 1892, 43).

Eugene Hermite and André Dubosc, 1891, No. 21,959 (*ibid.* 1892, 1015).

Hamilton Young Castner, 1892, No. 16,046 (*ibid.* 1893, 768).

* Kolbe's Lehrbuch der Chemie.

* The formula in question is as follows:—
$$\pi = \frac{C}{\epsilon . \text{const.}};$$ C = Molecular heat of combination. ϵ = Valency.

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Carl Kellner, 1894, No. 20,259 (*ibid.* 1895, 1047).
Rhodin, 1896, No. 21,509 (*ibid.* 1897, 745).

These patents represent the types of cells constructed without the interposition of a useful diaphragm, and can be put down as the most important ones leading up to the present state of manufacture. The specification by André Nolf is a mixture of gross ignorance coupled with remarkable ingenuity. It contains a large amount of interesting subject matter. The apparatus described is a circular tank, holding brine, and having a bottom of iron on which the mercurial cathode rests. The anodes are fixed on a horizontal cross which can be brought into rotation for the purpose of stirring the electrolyte, and at the top of the tank there are tubes arranged for filling in salt for concentrating the brine. The idea was to saturate the mercurial cathode with sodium, and afterwards to take the liquid amalgam out, and by some means utilise the sodium therein, and finally to pour the mercury back into the cell. The arrangements shown in Nolf's drawings are highly ingenious and contain, in an embryonic state, the elements of what was afterwards developed into a continuous process. The patent was only provisionally protected, and the description is badly translated French of small interest. The drawings, however, are exceedingly interesting, although the error has been made of showing the carbon anodes dipping down into the mercury. What would have been the case if electric current could at that time have been produced cheaply is hard to say, but there is certainly enough in this invention to enable a modern engineer and chemist to deduce a practicable apparatus. In the specification by Atkins and Applegarth (this Journal, 1892, 43), we find one retrograde movement, namely, the introduction of a diaphragm, but at the same time one distinctly novel feature, namely, the introduction of continuous movement applied to the mercury. The apparatus described is highly impracticable, but shows at the same time traces of practical trial, and I have ascertained by experiment that an apparatus such as described can be made to work with a fair amount of efficiency. This apparatus consists of a metallic tube amalgamated on the inside, over which the mercury is made to flow, and there is a syphon trap outlet at the bottom of the machine for letting the amalgam out. The anode is inserted in the centre of this tube and consists of a hollow carbon rod through the centre of which there is a pipe for filling in the brine. The anode is surrounded by a hose which acts as the diaphragm, and there are the several outlet pipes for gases, &c. I cannot see the use of the diaphragm in this apparatus, except for preventing the mercury from coming in contact with the anode. The vertical form of the apparatus is naturally a mistaken one, but we can easily see that if the apparatus were laid flat and slightly slanting, we should arrive at the decomposition cell in the later and double constructions. The next patent is one by Messrs. Eugene Hermite and André Dubosc (this Journal, 1892, 1015). These gentlemen applied the same principles as Messrs. Atkins and Applegarth, namely, the flowing mercurial cathode, and employed an outside tank for the decomposition of the sodium amalgam, placed in such a way as to necessitate the interposition of a mechanical arrangement for conveying the mercury back into the decomposition chamber. There is no doubt that this patent formed, both in this country and in other countries, the mother patent of all the subsequent ones, and that if the specification had been drawn with foresight, and with the application of more knowledge as to the different ways in which the mercury might be moved backwards and forwards, this specification would have invalidated all subsequent ones. The form of apparatus described is not a very practicable one, but it can be made to work after a fashion. Historically, this patent is highly interesting. We are now only dealing with England and English patents, otherwise it might be shown that an invention made by Sinding Lasen, in Norway, somewhat earlier than the one described by Castner, showed the elements of the correctly formed cell. We shall, however, go straight to the invention described by Castner, which from a technical point of view, is the most important one as being worked on a large scale in this country (this Journal, 1893, 768). Hamilton Young Castner designed a double cell of such a nature that the mercurial cathode could be run from the decomposition cell, where it was saturated with sodium by the electrolytic action, into the so-called cathode chamber, where the sodium was extracted as caustic soda by means of water, the movement in his first patent being caused by means of a pump or a fan, and according to a later patent, by means of rocking the tank. The peculiarity of Castner's construction is this. The main current is not coupled to the mercury at all, and the mercury acts by means of polarisation, and all the claims of the inventor are of such a nature as to be confined to this principle. Electrically the principle was not new except as applied to Castner's process of manufacture, and there is no doubt that we must give Mr. Castner every credit for devising a new "process patent" on this subject. The objection in my mind to the design is the necessity for an exceedingly slow movement particularly in the rocking form of apparatus. The large surface tension of mercury amalgam no doubt causes a continuous concentration of the sodium amalgam in the decomposition chamber, with its accompanying disadvantage of forming hydrogen which mixes with the chlorine. Besides this, the dipping seal between the two chambers, which is so advantageous for the purpose of saving mercury, will no doubt tend to increase the difficulty of hydrogen in the chlorine. I have made experiments with similar tanks for other electrolytic processes, and I have found a great difficulty in using a quickly rocking apparatus, the result being a wave motion of the mercury, and for certain periods of oscillation you can make the mercury lie absolutely still with reference to the bottom of the vessel. This may have something to do with the rather limited current density used in the Castner apparatus.

Dr. Kellner's apparatus, described in his English specification, No. 20,259, 1894 (this Journal, 1895, 1047), is a reversal of the Castner apparatus and differs from the latter also with reference to its electrical coupling. Kellner makes the electrolyte move bodily backwards and forward over the mercury, the same being the case with the water containing tanks. Kellner also limits his speed to something very inconsiderable in order to realise what he calls a "stationary mercurial cathode." There is also a rotary construction described, about which there is a litigation with the owners of the writer's patent. I shall therefore have to leave the question of entering into the details about this. The patent by the writer utilises the same process as Hermite and Dubosc, as well as the principle involved in most of the other patents, but the diffusion of sodium through the mercurial cathode is utilised in order to keep the concentration of sodium practically constant in all parts of the same both in the outside decomposition vessel and in the inside electrolysing vessel. The construction is simplified by the shape of the electrolyser vessel, which allows the whole machine to be built in two self-contained parts of which one contains the other. The electrolyser vessel itself has tubular projections from its lower wall and acts as a kind of propeller, stirring up the mercury when the cell is rotating. The bottom surface of the outside iron vessel containing the mercury is also provided with turbine guide ribs for increasing this circulation. The main idea is to make the sodium remain as short a time as possible in the mercury, and to utilise high current densities in order to diminish the effect of secondary reactions. The electrolyte is also heated in order to facilitate the passage of the current, and the exhaustion of the mercury amalgam.

Electrolysers with mercurial cathodes enable us to employ very simple forms of apparatus and high current densities, thus enabling a fairly small plant to be utilised for a large output. The drawbacks are the demands for an exceedingly pure raw material: the slightest traces of impurities accumulate into large percentages when the process has been working for some time, and then if great care is not taken mercury will soon take up several other metals except sodium, such as, for instance, magnesium. The fluidity of the mercury becomes impaired by the accumulation of sodium and other metals and large percentages of hydrogen accumulate with the chlorine. These difficulties can be overcome fairly easily, but I know that in my case there has been more work to do in solving these small questions than in improving the

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general design of the apparatus. I fully believe these processes above described and discussed to be promising for the future. I might give some figures as to output and costs, &c., but I presume that it will all be well known to all present, from the various journals now published. It is to be hoped that the work done, which as can be seen from the above has been very considerable, will be rewarded in the near future by the firm establishment of electrolysers as a manufacturing agent in the heavy chemical industry.

Before closing my paper I might refer to Vautin's and Hulin's processes. These gentlemen decompose molten chloride of sodium and take up the sodium in molten lead. It is claimed for the Hulin process that it will give a great efficiency. I have no doubt that this is the case, but I have never seen any material as yet that will hold molten chloride of sodium for any length of time. The problem of utilising the chlorine for the production of current under similar circumstances was worked on by Mr. Joseph Wilson Swan (Royal Society Proceedings, Vol. 56), and the writer had the honour of carrying out the experiments in connection therewith. We tried nearly every possible material for the purpose of holding the molten chlorides, but nothing would stand. It can, however, be understood that the cost of the renewal of the vessels might be counteracted by the comparatively larger output of such cells as these.

Faraday, who also laid the foundation of the perfect dynamo, prophesied the possibility of an electro-chemical industry. In his Experimental Research on page 307 he says: "The capability of decomposing fused chlorides, iodides and other compounds according to the law before established, and the opportunity of collecting certain of the products without any loss by the use of apparatus of the nature of those already described render it probable that the voltaic battery may become a useful and even economical manufacturing instrument." Substituting the dynamo-electric machine for the voltaic battery we have seen that Faraday's prediction was fulfilled before the close of his own century.

New York Section.

Meeting held on Friday, April 20th, 1900.

MR. THOS. J. PARKER IN THE CHAIR.

ON THE ANALYSIS OF TITANIFEROUS IRON ORES.

BY CHARLES BASKERVILLE, PH.D., F.C.S.

A recent article in this Journal (Vol. XVIII., No. 12) by Mr. Jas. Brakes on the "Determination of Titanic Acid in Iron Ores" prompts the author in presenting this paper to the New York Section. The method detailed below is taken directly from notes given to students in the University of North Carolina. Fragments of the method have been published (Baskerville, Journ. Anal. and Appl. Chem., VII., No. 4; *Idem*, Journ. Am. Chem Soc., XVI., No. 6) from time to time, hence may possess no new features to some. Thus brought together it has been used successfully in a large number of analyses for several years. The unusually long and somewhat complicated analysis of titaniferous iron ores as given by Blair and others is much simplified, and very great economy in time is secured. We have made determinations of phosphorus in ores varying in their content of titanium within the hour; and of titanium within forty minutes.

The method is as follows:—

Silica.—1 grm. of the finely divided ore is intimately mixed with 5 grms. c.p. dry sodium carbonate and 1 grm. potassium nitrate in a platinum crucible of about 25 c.c. capacity. The whole is then heated with the blowpipe for at least half an hour, or until the turbulent effervescence of the decomposing carbonate ceases and the fusion is calm.

The crucible is now clasped with the tongs and from time to time dipped into about 50 c.c. of water in a 300 c.c. beaker until it is cool enough to be completely immersed. Much of the fusion can be removed in this manner; the crucible is cleaned by being placed in a small beaker in which there is diluted hydrochloric acid (1:1). The fused particles having thus been removed from the crucible, it is lifted out of the beaker and well rinsed with distilled water. This solution is now carefully added to that in the casserole and the whole brought to a boil. Many small particles will be seen floating around in the liquid; if these are not dissolved on a further addition of acid, and any other particles which may be in the bottom of the beaker do not "feel" gritty with the end of the stirring rod, the whole should be transferred to a casserole, if the solution has been made in a beaker, and evaporated to a dryness on a water-bath. In case the particles in the bottom of the beaker are gritty, the solution should be filtered, the washed filter paper transferred again to the crucible and ignited. This sandy feel gave evidence that the ore had not been completely decomposed by the fusion. This residue after ignition is placed in an agate mortar, about 6 cm. in diameter and again pulverised. It is now fused with five times its weight, approximately, of the "fusing mixture" as before. Finally the hydrochloric acid solution of this fusion is added to that of the first fusion, and the whole evaporated to dryness on a water bath. The casserole is then placed in an air bath and heated not above 110° C. until the odour of the hydrochloric acid can no longer be detected.

The substance in the casserole is moistened while still hot with 10 c.c. of water and 15 c.c. concentrated hydrochloric acid, 50 c.c. more hot water added to the solution, boiled and filtered hot. When all the solution has passed through the filter paper, the residue is transferred and washed with a hot 2 per cent. hydrochloric acid solution. If the washing is done with water alone titanium passes through and the filtrate becomes cloudy. The *iron* is reduced and determined in the filtrate by the bichromate method.

The precipitate is burned in a platinum crucible and weighed. The precipitate is moistened with concentrated sulphuric acid, an excess of hydrofluoric acid slowly and carefully added, and the liquid evaporated to dryness on a sand bath. The crucible should be ignited, cooled, and weighed. Difference in the weights gives the amount of silica present.

Titanium.—Two methods are given, one gravimetric and one colorimetric. If only a few analyses are to be made the former is preferable, but if a large number are to be made, then much time can be saved by the use of the latter.

Gravimetric.—One-half gramme of the finely divided ore is mixed with an equal amount of pure sodium fluoride and ten times as much potassium bisulphate in a large platinum crucible, and the whole fused carefully over a Bunsen burner until not only all of the silicon fluoride has been driven off, but the "melt" is perfectly clear. The crucible is then heated for 15 minutes up to low redness. The crucible and contents are cooled as rapidly as possible and quickly dipped into a beaker of about 200 c.c. capacity, containing 50 c.c. of distilled water. The "melt" dissolves slowly, usually requiring 12 hours for complete solution; this time may be very much abbreviated by heating. The solution is, therefore, boiled until the solid is dissolved. During this solution 3 c.c. of concentrated nitric acid should be added, then neutralised with ammonium hydroxide, the excess of which is boiled away, filtered, washed five or six times with boiling water. The precipitate is now dissolved in dilute hydrochloric acid. This is best done by first removing most of the precipitate from the filter paper by means of a spatula and placing it in the beaker in which the original precipitation occurred. 15 c.c. dilute hydrochloric acid are added; the solution boiled and then decanted through the filter paper. Hot water is used to wash the filter paper and the solutions are united. Very dilute ammonium hydroxide is now added slowly to neutralise the acid. When a slight permanent precipitate is obtained 1 per cent. hydrochloric acid is

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added drop by drop boiling after each addition until the solution just belomes clear; the total amount of liquid now should not be more than 100 c.c. Sulphur dioxide is now passed through the solution for several minutes to saturation, then the solution is boiled from three to five minutes, the precipitate allowed to settle, then filtered. The precipitate is washed with hot water until the wash water gives no curdiness when treated with silver nitrate; the precipitate in the filter paper is placed in a platinum crucible and ignited and weighed. The precipitate after ignition should appear perfectly white, being pure TiO_2. If this does not happen to be the case, the precipitate must be mixed with ten times its weight of potassium bisulphate and fused as at first and the whole process repeated.

Colorimetric.—(Weller's method, Ber. d. Chem. Ges. **15**, 2592.) Exactly the same method for obtaining the ore in solution as noted above is made use of in this process. Particular care, however, must be taken to drive off all the fluoride, as hydrofluoric acid interferes with the colour reaction (Hillebrand, J. Am. Chem. Soc., **17**, 718; Chem. News, **72**, 158). There is one essential difference, however, which must be observed in obtaining the solution of the ore, and that is, at least 5 per cent. of sulphuric acid must be present (Dunnington, J. Anal. and Appl. Chem. **5**, 39) when the "melt" is dissolved in the water. This is obtained by substituting a 10 per cent. sulphuric acid solution for the distilled water.

The solution is made up to 500 c.c. and 100 c.c. taken out and placed in one of the comparison tubes, 5 cc. of hydrogen dioxide are added and stirred in. This is then compared to the standards, from which it can be learned how much titanic oxide is contained in one-tenth of a gramme. A fresh ferrous sulphate, if necessary, may be added to the standard to match the colour of one solution before adding the hydrogen dioxide.

Standard Titanium Solution.—One grm. of pure titanium oxide, which may be purchased, as a fine powder, is fused with 10 grms. potassium bisulphate in a platinum crucible. When all of the oxide is nearly dissolved in the melted bisulphate, the crucible is cooled, digested in a cold 10 per cent. sulphuric acid solution, until nearly all of the "melt" is dissolved, filtered. If the filtrate passes through turbid, it must be re-passed through the same paper until it is perfectly clear, The clear solution is now made up to 500 c.c., and this is used as the standard. In order to learn accurately the strength of this solution, 10 c.c. of the solution are run from a burette into a weighed platinum crucible and evaporated to dryness on a sand bath; a little dry ammonium carbonate is added to take off the last traces of sulphuric acid; it is then ignited over the blowpipe. The difference in the weight of the crucible is the amount of titanic oxide in 10 c.c. of the standard.

The Comparison.—Six tubes of the same dimensions marked at the point for 100 c.c. are placed in a box in which there are holes cut to fit with a white paper arranged at the proper angle to reflect the light up through the tubes to the observer. Into each one in succession measure accurately 0·1, 0·2, 0·5, 1·0, 2, and 5 c.c. of the standard, then pour in 5 c.c. hydrogen dioxide and fill the tubes up to 10 c.c. mark with 5 per cent. sulphuric acid. By comparison of the depth of the tints, the tube containing the unknown amount of titanium oxide can be mated.

Sulphur and Phosphorus.—This method is the shortest and most rapid known for the determination of phosphorus and sulphur in titaniferous iron ores. 2 grms. of the finely pulverised ore, which has been dried at 100° C. by heating for two hours in an air bath, are thoroughly mixed with about 20 grms. fusing mixture, as used in the determination of silicon above, and brought to a quiet fusion in a platinum crucible of about 40 c.c. capacity. After five minutes' more heating the fusion is run well up on the sides of the crucible, which is then rapidly cooled by alternate dipping and removing from the water in a beaker. The crucible is finally plunged into the water, inverted, and allowed to stand overnight. To avoid this delay the crucible may be filled with distilled water, held over the beaker and boiled hard. Repeating this ten times will answer as well as standing over night.

The solution, which now should amount to about 300 c.c., is filtered, and the residue washed with hot water four or five times; 25 c.c. of ferric chloride, free from phosphorus, and containing about 0·1 grm. of metallic iron, is then added. The solution is acidified with hydrochloric acid, brought to a boil, and precipitated with ammonia, and the precipitate is washed twice with hot water after filtering. The filtrate contains the sulphur, which may be determined according to the directions given in the method for ordinary iron ores.

The precipitate of hydrate and phosphate of iron contains all the phosphorus. This precipitate is dissolved in 40 c.c. of hot concentrated nitric acid (1·43 sp. gr.); 25 c.c. strong ammonia (0·92 sp. gr.) are then added, and the whole thoroughly mixed. Ammonium molybdate is now added and the phosphorus is determined as in an ordinary iron ore.

As we use gasolene in this laboratory for heating purposes there is no danger of absorption of sulphur from the gas used. Where coal gas is used an annular hole in asbestos board serves admirably for holding the crucible during the ignition.

Nottingham Section.

Meeting held at Leicester, on Wednesday, April 25th, 1900.

MR. L. ARCHBUTT IN THE CHAIR.

THE NEED FOR UNIFORMITY IN CERTAIN LABORATORY PROCESSES.

BY S. F. BURFORD, F.C.S.

The variation in results caused by the influence of mass, temperature, time, and other factors, in chemical operations is a matter of daily observation, and where it is necessary to express the results arithmetically, for comparison with a given standard, uniformity in method is essential, *e.g.*, in estimating the constituents of milk, or the percentage of volatile fatty acids in butter, or of alcohol in a spirituous liquid, the details of the process must exactly correspond if the results obtained by different analysts are to be compared.

Two attempts to induce uniformity in analyses have been made by the Society of Public Analysts. So far as regards milk, the result has been admirable, and fully justifies the action of the society; but in the case of water, the recommendations of the society have not been adopted to the extent desirable, or indeed anticipated. This has arisen partly because analyses of water are made by many persons who are not members of the society, but chiefly from the fact that authors of text books, especially those connected with medicine and sanitation, with the view of obtaining the simplest and quickest indications from which to draw conclusions, have usually recommended processes characterised by ease and rapidity in execution.

The various methods employed in making analyses for the purpose of reporting on the quality of a sewage effluent, may be instanced as showing the urgent necessity for an agreement among professional chemists; the absence of such an agreement at present causes a good deal of inconvenience and is increasingly likely to become a source of trouble.

The importance of sufficient information regarding the chemical constituents of an effluent is obvious, yet published reports are often very defective as regards data.

The amount of the sample taken for analysis is of prime importance, yet different authorities recommend that 10 c.c., 20 c.c., 50 c.c., 70 c.c., be taken respectively. Such variations give rise to very considerable differences when the amounts obtained are calculated out to grains per gallon.

The slight difference in the amounts of free ammonia is probably due to its being in solution.

The matters in suspension may affect results in albuminoid NH_3, though care was taken to get as far as possible uniform samples, and D was same sample of sewage as A after having been previously passed through filter paper to remove suspended matters.

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Results obtained by working on Different Quantities of Materials.

	Free Ammonia.				Albuminoid Ammonia.			
	10 c.c.	20 c.c.	50 c.c.	100 c.c.	10 c.c.	20 c.c.	50 c.c.	100 c.c.
Crude sewage :—								
A	3·122	2·838	3·120	..	0·9660	1·354	1·064	..
B	..	2·891	2·842	2·754	..	0·9170	0·9058	0·9905
C	..	1·0080	1·302	..	..	0·6615	0·4438	..
Effluents and filter effluents, &c. :—								
D	2·842	2·1140	2·8154	..	0·5110	0·3745	0·2422	..
E	2·645	2·912	..	..	0·567	0·602	..	..
F	2·562	2·310	..	..	0·294	0·273	..	..
G	..	1·1480	1·3412	1·1931	..	..	0·1970	0·1939
H	..	1·0590	1·1508	1·0241	..	0·322	0·1988	0·1337
I	..	1·267	1·0136	1·0269	..	0·385	0·2548	0·1659
J	..	0·2380	0·2800	0·2366	..	0·2205	0·1750	0·1275

The differences are more clearly seen by taking the totals of several examples :—

Free NH_3.		Albuminoid NH_3.	
Examples, A, D, E, F.		Examples, A, D, E, F.	
10 c.c.	11·172	10 c.c.	2·338
20 c.c.	10·174	20 c.c.	2·6035
Totals of A, B, C, D, H, I, J.		Totals of A, B, C, D, H, I, J.	
20 c.c.	11·406	20 c.c.	4·2345
50 c.c.	12·5238	50 c.c.	3·2844
Totals of B, H, I, J.		Totals of B, H, I, J.	
20 c.c.	5·446	20 c.c.	1·3445
50 c.c.	5·2864	50 c.c.	1·5344
100 c.c	5·0416	100 c.c.	1·4126

I am inclined to think that free ammonia is underrated as a factor in estimating the amount of polluting matter in an effluent. The expansive figures render it a more sensitive indicator than the albuminoid ammonia, besides which it does not much matter whether 20 c.c. or 100 c.c. be taken for analysis, whereas in the case of albuminoid ammonia it would usually be necessary to add a fourth to the results obtained from 20 c.c. to compare them with those obtained from 50 c.c. of the sample.

In dealing with a strong crude sewage 50 c.c. is too much to employ, and when it is required to estimate the percentage of purification effected by any process, it is desirable that the same amount of crude sewage and of effluents should be taken for analysis.

The amount of albuminoid ammonia obtained partly depends on the volume of the alkaline fluid in the retort, and also whether the analyst stops the process when he has drawn off 150 c.c. of distillate, or distils over as much as is practically possible. In this matter there is a variance in the custom of chemists. It would often be advantageous if, in reports, the designation "Wanklyn," or "total distillate," were inserted, as the case might be.

In waters containing much organic matter, and in sewages, I have found that the ratio between the amount of albuminoid ammonia obtained in the first 150 c.c. is fairly constant to that obtained in the total distillate, and where the percentage of purification only is required there is no preference to be given to either method.

This is shown by the following examples of the percentage of purification effected, as compared with crude sewage :—

No. of Samples.	Percentage of Purification calculated on total Distillate.	Percentage of Purification calculated on 1st 150 c.c. of Distillate.
5	54·42	50·66
11	7·62	6·00
10	27·18	27·53
6	37·36	40·23
5	75·71	70·97
4	84·02	83·95
28	24·47	21·26
28	70·98	70·41
28	86·76	87·33

In estimating the amount of oxygen consumed by an effluent, the modifications of the process (*see* C. Bell, this Journal, Vol. XVII., p. 11) are unusually varied. 7 c.c., 50 c.c., 70 c.c. are taken and kept at temperature of the air, or 60° F., or 80° F., or at boiling point, for 3 min., 15 min., 1 hr., 2 hrs., 3 hrs., or 4 hrs., as the operator pleases, without indicating such in his report.

The following experiments indicate some possible variations :—

	A. Q.S. $K_2Mn_2O_8$, 0·395 grm. per litre. 10 c.c. H_2SO_4, 1 in 4. 4 hrs. at 80° F.		B. 50 c.c. $K_2Mn_2O_8$, 0·395 grm. per litre. 10 c.c. H_2SO_4, 1 in 4, 4 hrs. temp. of air 70 c.c. Sample.	C. 10 c.c. $K_2Mn_2O_8$ = 3·95 grms. per litre, 10 c.c. H_2SO_4 1 in 4, 4 hrs. 80° F.	
	50 c.c. Sample 200 c.c. Aq. dist.	250 c.c. Sample.		7 c.c. Sample, made up to 70 c.c. Aq. dist.	70 c.c. Sample.
	Grains per Gallon.				
Crude ...	5·7299	..	..	9·059	6·683
	..	4·1170	4·525	11·20	6·324
	4·5476	4·5248	..	..	6·327
Effluents.	1·2028	..	1·522	..	1·905
	1·2495	..	1·368	4·83	1·824
	1·1162	1·0614	1·327	..	1·994
	0·9436	0·9592	1·243	..	1·089

Although theoretically it may seem advisable to make the estimation at 80° F. for 4 hours, yet I have never been able to see the advantage of the lengthy period, or to derive information which could not as well be obtained by a temperature of 80° F. for 15 min. only, together with testing for nitrites; whilst in the practical work of a laboratory it is sometimes extremely inconvenient to wait for the four hours' process.

The analysis of sewage effluents furnishes a conspicuous illustration of the necessity for a general agreement among chemists, in regard to the precise methods of procedure in analysis. Doubtless in other departments of chemical industry similar instances are likely to be met with, it therefore seems highly expedient that either this society or some similar body should, as the necessity arises, in connection with special departments of chemical industry, appoint committees to investigate, and recommend for adoption, methods of analysis and manner of reporting (similar to that of the German Association of Makers of Portland Cement), also that annually a recommendation be made to the members generally, to adopt such methods of procedure, or such alterations therein as may from time to time be agreed on.

The Society of Chemical Industry with its large membership of technical chemists seems well adapted to initiate such a desirable procedure—a procedure which would not interfere with the freedom of action of individual analysts, except in so far that whenever any method had been recommended for adoption by a representative or official chemical authority, any departure from the process (likely to affect results to any material extent) should be indicated

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on any certificate in which arithmetical details of analysis were given.

An annual resolution confirming the adoption of, or alteration in, any authorised method would conduce to uniformity in procedure, and the advancement of applied chemistry.

Scottish Section.

Meeting held at Glasgow on Tuesday, March 27th, 1900.

PROF. E. J. MILLS, F.R.S., IN THE CHAIR.

NOTES ON THE USE OF FORMALDEHYDE IN CALICO PRINTING.

BY WILLIAM E. KAY.

THE main applications of formaldehyde (formalin) in calico printing depend upon its peculiar action on gelatin, glue, caseine, and like albuminoids, which substances it coagulates or renders insoluble. Gegner was the first, in 1893, to observe this action of formaldehyde on gelatin solutions, and Hauser found later that the gelatin so coagulated cannot be liquefied again at any temperature. One explanation that has been given of this curious effect is that it is due to molecular condensation; another, that it is due to a reduction in the water absorbing power of the gelatin. The minute quantity of formaldehyde required to produce the result, and the inability to find a ponderable amount of this body in the converted gelatin, render it very unlikely that a compound body is formed. We therefore simply accept and utilise the fact whilst admitting that we cannot explain it.

The first proposal for the commercial application of this reaction is contained in the patent of Reissner and Hauser, Eng. Pat. 18,237, 1893 (this Journal, 1894, 973); and this was closely followed by the numerous patents of the Chem. Fab. vorm. E. Schering, Eng. Pat. 2036, 4276, 4696, 4697, and 23,585, all of 1894 (*ibid.* 1895, 65, 386, 285, and 1061). These patents, though chiefly concerned with the application of the reaction to photographic purposes, are also valuable as containing many useful observations on the general reaction.

At an earlier date than that of Gegner's observation, however, the antiseptic and preservative properties of formaldehyde had begun to attract attention, and from 1892 onwards many papers were published pointing out its value as an antiseptic and disinfectant. This power is doubtless associated with its specific hardening action on albuminous matters and tissues generally. Thus a paper in the *Pharmaceutische Zeitung* for 1894 describes a rather curious experiment:—"The tip of a rabbit's ear was treated three times daily for four days with a 40 per cent. formaldehyde solution to the extent of about half an inch. After 10 days the top of the ear, about three-quarters of an inch, dropped off spontaneously without the least loss of blood, and clean cut off as done by a knife." The observer quaintly adds: "The rabbit did not seem to suffer in any way, no change being observed in its appetite for food."

A suggestion made by Ed. Knecht in 1896 (Journ. Soc. Dyers and Colourists, XII., 90) for the animalising of vegetable tissues by impregnating them with lanuginic acid, and rendering this insoluble by formaldehyde, constitutes, I believe, the first proposal for the application of this specific action of formaldehyde in the dyeing industry (this Journal, 1896, 449).

The first suggestion of the work done at Thornliebank (where the whole of the matter described in this paper has been worked out) for the utilisation of formaldehyde for the fixation of metals and pigments in calico-printing arose from the use of this reagent for photographic purposes, and so may be considered the lineal descendant of Schering's observations. In the year 1897 a trade demand arose for metal prints, and the unsuitability of albumen for the fixation of metallic powders led to the attempt being made to utilise the coagulating power of formaldehyde on gelatin for the desired purpose. The extension of the process to other like coagulable bodies in addition to gelatin, and to pigment and powders as well as to metals, was but a natural step when the experiments were initiated. The first experiment made was to print a soluble barium salt admixed with gelatin solution, and then pad with a solution of an alkaline sulphate admixed with formaldehyde, and dry. This was fairly successful in producing the fixation on the fibre of a precipitate of barium sulphate attached to the cloth by the insoluble gelatin formed. This indirect method was, however, at a very early stage abandoned for the simpler and far more satisfactory direct fixation of a prepared pigment by a similar reaction. The pigment was admixed with the dissolved gelatin, printed, dried, and the cloth then padded in formaldehyde solution. The results proved in every way satisfactory. Attempts were then made to effect the fixation by the vapour of formaldehyde, acting in the cold and in the presence of air, but these did not give a sufficient fastness.

After these preliminary trials, the first systematic experiments in the development of the process were directed to the fixation of metallic powders, the need of a process for effecting such fixation being immediate and urgent. At the same time this was the most difficult form the problem could assume, for the physical form of the metallic powder, viz., that of a thin plate or leaf, though in itself absolutely but small, is yet relatively large when compared with the fine grains of a chemical precipitate or pigment. This difference in dimension renders the thorough fixation of the metal much more difficult than that of the pigment, for in the former case the particles of the larger metallic leaflet cause a wider separation of the constituent parts of the binding coagulated medium.

After many trials, the method adopted in practice (and still followed) was to mix the metallic powder with a printing paste containing gelatin at about 2 lb. to the gallon, print the admixture heated to 110° to 120° F., dry, and pad at the nip only through formaldehyde solution containing 1 per cent. of formaldehyde, that is the commercial 40 per cent. formalin reduced 40 times. In some cases the solution was used at $\frac{1}{2}$ per cent., the cloth padded and allowed to lie a little time, then repadded and dried off. Precaution had to be taken to have the drying cans well closed in, and provided with a good exhaust, as the vapours of formaldehyde are very irritating.

The results obtained by this fixation were, on the whole, satisfactory, and met the trade requirements. The fixed metals stood boiling with soap without substantial loss, but they possessed the fault common to every ordinary method of fixation by coagulation, viz., that the coagulated body, though it may be absolutely insoluble in water, is still capable of taking up some water by absorption, and so becomes softened somewhat, and in consequence the metal so fixed may be removed by a combination of soaping and friction. The crowning point of success, so far as I know still to be achieved, is some method of preventing this water absorption; that is, a method of rendering the precipitated gelatin water repellent or waterproof. Some facts may be found in Classen's English patent 25,942, 1897 (this Journal, 1898, 1177), which offer suggestions for work on this problem. Despite this fact of water absorption, the fixation of the metal by the insoluble gelatin is so thorough that it is quite practicable to apply the process to the production of metallic crépons by the action of caustic soda on the unprinted portion of the fabric. When the fixation is properly carried out, the cloth printed with the metal and gelatin and subjected to the action of formaldehyde may be passed through caustic soda at 70° Tw.; washed and soured and washed again to remove the acid, and then dried, without the fixation of the metal being in the slightest degree affected. A style based on this process has now been practised for some years at Thornliebank with complete success.

A second style in which the use of formaldehyde for the fixation of a pigment has been largely and successfully used is that known as the opal or paste style, in which a white pigment such as oxide of zinc is printed, either on to a thin and transparent cloth, or most effectively on to a mercerised sateen cloth, for the production of a species of woven or brocade effect, the contrast in the latter case of

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the opaque print against the lustrous background being especially effective. The zinc oxide may be mixed with coloured pigment for tinting purposes, or soluble colours of the substantive class may be added to it.

It was when working on this style that two modifications of some importance were introduced into the working process. The first consisted in a substitution of a soluble caseine (in our case caseine-borax) in lieu of the gelatin. The fixation is quite as effective as with gelatin, and the print has the advantage of being free from the stiffness that a gelatin print possesses. In the case of a metal print, such stiffness is not objectionable, and with the metal crépon it is rather advantageous than otherwise, but with the opal print a soft cloth-like or woven feel is essential to the complete success of the style, and this is furnished when caseine is used. The second modification has a wider interest. I have said earlier that the coagulation of gelatin by formaldehyde vapour in the cold is not sufficient to satisfy the practical requirements of the case. When, however, the formaldehyde is applied in an atmosphere of steam, a very rapid, efficient, and economical fixation is effected. This we carry out by introducing formaldehyde vapour into an ordinary short steamer, such as the Mather and Platt. In our own case the steaming has five minutes' duration. It has been simply a matter of works' convenience that the particular machine which gives this duration to the steaming process has been chosen. I have no reason to doubt but that a shorter steaming of one minute in the Mather-Platt would be equally effective.

The amount of formaldehyde required, when so applied, for the thorough transformation of the caseine used is very small indeed, amounting to not more than about 4 per cent. of actual formaldehyde. In practice we feed $\frac{1}{4}$ oz. of formalin of 40 per cent. to each piece of 30 yards run through the box. The formalin is supplied from an earthenware jar with tap, and drops into a funnel connected with a block tin pipe passing through the side of the box. This pipe is bent at right angles a little above the hot plate at the bottom of the box, and its horizontal arm is pierced with a number of small holes, the formaldehyde being vaporised as the formalin drops on to the hot plate. We introduce the formalin at a point furthest removed from the steam exit, so that the steam laden with the formaldehyde vapour has to traverse the whole length of the box. As this quantity of formaldehyde per piece is sufficient to thoroughly fix a pigment print containing about $1\frac{1}{4}$lb. caseine-borax and 5 lb. of zinc oxide to the gallon, such print taking, on an average say one-tenth of a gallon of the printing colour per piece, the amount of formaldehyde, 40 per cent., amounts, roughly, to 10 per cent. of the caseine-borax contained in the printing colour. We have reduced the amount of formaldehyde supplied to three-fourths of the above without diminishing the efficiency of the fixation, but as at the amount stated the total quantity used is very small indeed, and as a margin of safety is always desirable, we have made no attempt to find the lowest possible limit of effective formaldehyde. I may add that the resulting white print is so fast that it will stand boiling with soap for a quarter of an hour without appreciable loss.

These two styles, the metal style and the opal or paste style, represent the main applications up to the present in our own practice of the use of formaldehyde for purposes of fixation. There is, however, I imagine, a wide field of usefulness open in the application of gelatin and caseine (preferably the latter) as substitutes for albumen in general pigment styles. This is rendered practicable by the steam fixation just referred to, and by a modified fixation by means of formalin compounds, to which I shall refer later. We have, experimentally, determined the relative fastness of prints made with albumen, as compared with caseine fixed by steam-formalin, and we find that substantially, and for practical purposes, it may be taken that caseine will replace albumen weight for weight with, at any rate, equal effectiveness of fixation. Omitting the cost of the formaldehyde, which is small, caseine-borax at $4\frac{1}{2}d.$ per lb. is as effective as egg albumen at, say, 2*s.* per lb., or blood albumen at, say, 6*d.* per lb., whilst for purity of result the shade produced with caseine is quite equal to that got when the best egg albumen is used.

Next in order of time to the Thornliebank patent covering the above processes (Eng. Pat. 6112, 1897; this Journal, 1898, 152), and bearing indirectly on the subject, is the American patent of Hall (Eng. Pat. 12,208, 1897; *ibid.* 1898, 597), which is applied mainly to the surfacing of paper, and which consists essentially in adding free formaldehyde to a mixture of caseine and china clay, the claim being that in the presence of the china clay the precipitating action of the formaldehyde is retarded.

That a considerable quantity of mineral matter in such an admixture has a retarding effect on the precipitation is undoubted, but we had in Thornliebank made many trials in this direction before the date of Hall's patent and had not found the direct addition of formaldehyde to strong gelatin or caseine mixtures to be suitable for practical purposes, the points of effective fixation and premature precipitation lying too near to one another. My assistant, Mr. John Neilson, (who has given me valuable help in this and many other matters) has, however, recently made the interesting observation that the precipitation of caseine solutions by free formaldehyde is very much influenced by the state of dilution of the former; the more dilute the solution, the greater being the proportion of free formaldehyde that may be added to it without causing premature coagulation, and this in the entire absence of pigment. Thus, a solution containing 20 per cent. of caseine coagulated in a few hours after an addition of 0·25 per cent. of formalin (40 per cent.) reckoned on the amount of caseine present; whilst a solution containing only 5 per cent. of caseine stood an addition of 25 per cent. of formalin, also reckoned to the caseine present, and showed no sign of coagulation after keeping several weeks. A caseine intermediate in strength between these, namely, 10 per cent., stood an addition of 2 per cent. of formalin, but coagulated with 4 per cent. of formalin after a few hours, whilst the same strength of caseine solution, containing also 50 per cent. of zinc oxide, stood an addition of 4 per cent. of formalin, but coagulated (after a day or two) on an addition of 6 per cent. of formalin. These observations suggest a very simple process of applying the reaction to the fixation of pigments (in those cases where the amount of pigment is not large) by direct addition of the formalin to the printing colour.

The next step, and a very important and highly interesting one, in the application of formaldehyde to the uses of the calico printer is contained in the patent of M. Camille Schoen, of Mulhouse (Eng. Pat. 13,916, 1897; this Journal, 1898, 761). He overcomes in a very ingenious manner the difficulties attendant on the addition of free formaldehyde to gelatin and caseine solutions. In lieu of using free formaldehyde, he uses a formaldehyde compound which is inactive towards gelatin or caseine, and he then brings about the reaction by steaming, the compound being broken up and free formaldehyde regenerated. The compounds he uses are the ammonia compound of formaldehyde (hexamethyleneamine) and the bisulphite compound. The one or the other of these is added to the printing colour in an amount corresponding to 4 per cent. of free formaldehyde (100 per cent.) of the gelatin or caseine used. To facilitate the decomposition a little sodium carbonate or other alkali may with advantage be added to the printing colour. M. Schoen has shown me ordinary pigment prints, and pigment discharge prints on aniline black grounds, produced by his process, and they yield in no respect either in purity of shade or fastness to similar prints produced by the use of egg albumen.

This exhausts the subject on its practical side, so far as present progress goes and my knowledge carries me. There is one point which is worth a reference in view of future development. Up to the present I know no practical method of applying the reaction to indigo blue discharge or other like work, in which an oxidising reaction constitutes one step of the process. There is, however, one characteristic of the use of caseine that is worth bearing in mind in working out this or an analogous application. Caseine possesses the property of resisting fairly well a treatment with acid or hot water, and so a temporary fixation by its means is possible without using formalin, this fixation being sufficient to withstand such works' processes as do not include

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a soaping or alkaline treatment, and from this property it is feasible to suppose that a process might be worked out which should have for its distinguishing characteristic the permanent fixation of the caseine by steam-formalin as the final step of the operation. For the present I put this out as a suggestion only.

Among more recent work, a process which includes the steam-formation fixation of caseine or gelatin has been published by Baruch (French Pat. 287,431, 1899). This consists in preparing the vapour of formaldehyde by the passage of the vapour of methyl alcohol and air over a platinum radiator heated by electricity, and then subjecting the fabric to the action of the resulting mixture of gases in conjunction with steam (Rev. Gén. Mat. Col., Vol. IV., p. 40). This is therefore only a detail modification of the process earlier described, from which it is differentiated only by the fact that the formaldehyde is manufactured on the spot. I do not know how it would compare as regards economical work, but it seems to me to introduce a complication inadvisable in an average print works.

Another modification, of the practicability of which I cannot speak, is that published in the *Revue Generale* for August 1899, and giving the contents of a sealed packet of M. E. Kopp, dated December 1897. This consists in printing a soluble gelatin mixture containing formaldehyde (prepared by a rather complicated formula) in conjunction with a white pigment, and rendering the gelatin insoluble by steaming for one hour. I may say that in a somewhat similar manner, in our earlier work at Thornliebank, we made use of a gelatin rendered soluble by long boiling, but we were always doubtful of the efficiency of this procedure, and in practice we used the soluble gelatin only in conjunction with a certain proportion of ordinary unconverted gelatin.

Before closing I wish to refer briefly to two other processes in which formaldehyde is proposed for utilisation by the calico printer in a manner entirely removed from those already described.

The one example is the patent of Geigy (Journ. Soc. Dyers and Colourists, February 1900, p. 32) for the fixation of certain colours which of themselves have insufficient fastness, but which are rendered either absolutely fast or very much faster (according to the particular colour) by an after treatment with formaldehyde. The inventors explain the increased fastness as being due to a condensation of the colouring matter on the fibre. I believe this process has up to the present no commercial application, but it is nevertheless very suggestive.

The second example is contained in the patent just published of the Compagnie Parisienne de Couleurs d'Aniline (French Pat. 287,984, April 1899), in which indigo white is precipitated from a solution containing formaldehyde, and it is claimed that by this procedure it is much more stable, possibly from the formation of an aldehydic compound.

These tentative attempts at the extension of the use of formaldehyde for the purposes of the calico printer other than that of pigment fixation, are interesting as showing that this body, which not very many years ago was only a laboratory product, a sort of chemical curiosity possessing only theoretical interest, is now exciting general attention as an agent for effecting industrial advance.

Discussion.

Mr. W. W. Wilson said that Mr. Kay had referred briefly to the fact that he had not used the process for the fixation of indigo-blue discharge prints. Indigo-blue discharge prints could be fixed in a very satisfactory manner by formaldehyde if they were treated with formaldehyde after passage through a weak glue solution. Their fastness was thus greatly increased, and altogether the print was superior.

Dr. D. S. Jerdan said that Mr. Kay expressed the opinion that formaldehyde did not form a definite compound with gelatin, basing this opinion on the very small quantity of formaldehyde required to render the gelatin insoluble. The molecular weight of gelatin, which was unknown, was probably very large, larger even than that of starch, and as the molecular weight of formaldehyde was only 30, it would be evident that a relatively small percentage of the latter substance would be necessary for the reaction.

Prof. E. J. Mills said that formaldehyde resembled tannin in one respect; penetration could not be had if a strong bath (or vapour) were used in the first treatment. He was very glad to hear that this difficulty had been so neatly got over by introducing the formaldehyde into a Mather and Platt steamer. He would like to know if Mr. Kay had made any use of the fact that formaldehyde gelatin was soluble in acetic acid, and dried up again to a varnish insoluble in water; this solution might be suitable for some pigment and other styles. As to the formula of gelatin, he had published one a number of years ago in the Society's Journal, which would correspond, unit for unit, to 1·54 per cent. of formaldehyde. Much smaller quantities were, however, used in practice.

Mr. Miller said there was only one question he would like to ask Mr. Kay. By the process of injecting the aldehyde into the steamer, did he not find a large amount of para-aldehyde on the plate?

Mr. Kay, in reply, said that it was possible that some slight decomposition of the formaldehyde took place in steaming, though no para-aldehyde was observed on the plate. In both the padding and steam processes, however, there was a very large margin of formaldehyde that was not utilised in determining the fixation. As to the question of the coagulated gelatin being a formaldehyde compound, Elsner and Classen had found that the presence of formaldehyde could not be analytically detected in the insoluble gelatin; and he believed, with Classen (who had in other ways obtained true compounds of gelatin and formaldehyde in both soluble and insoluble forms), that the ordinary insoluble gelatin did not contain this body in chemical combination. Prof. Mills had suggested dissolving the insoluble gelatin in acetic acid. It was worth trying, but the use of such a solution would be limited by the consideration that a considerable number of pigments were acted upon by acetic acid.

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Electric Furnaces [*Resistance Furnace*]. La Compagnie Electro-Metallurgique des Procédés Gin et Leleux, Paris, France. First application in France, Jan. 27, 1899. Eng. Pat. 12,956, June 21, 1899.

THE electrodes are formed by one or more cores of carbon of high conductivity, surrounded by an agglomerated mass of carbon "roasted in a muffle furnace at a temperature not exceeding 1000° C.," so as to avoid superficial combustion and to reduce the wear of the electrodes. The bed plate of the furnace is formed of two superposed parts, separated by an insulating layer of refractory material, and communicating by carbon blocks placed near the discharge holes so as to concentrate the heat at that part. The crucible has perforations which divide the generated gases into streams, which enter channels in the walls of the furnace, where they mix with air, and so maintain around the crucible a regulated temperature and restrict calorific emission. An arrangement of wedges and keys connects the adjustable electrode to the conducting plates in connection with the source of electricity, and the bed plate has a wedge arranged to enter between spring contacts so as to complete the electric circuit when the bed is in working position.—G. H. R.

Furnaces, Impts. in ——. J. B. Howard, Columbus, U.S.A. Eng. Pat. 2343, Feb. 6, 1900.

A SMOKE-CONSUMING furnace is formed with a series of independent air-heating ducts having contracted openings at their outlet ends, and arranged alternately side by side on each side of the fire chamber, and forming a part of the inner vertical walls thereof at the fire chamber. The ducts are provided with hinged covers for the air-inlet ends. Every alternate duct is connected to an air-heating chamber, which bulges or projects inwardly over the fire bed, and has air outlets or openings at its under side only. The other ducts are connected together by tubular arches spanning the fire bed, and also provided with air-openings at their under sides only, the openings increasing in size as they approach the centre. Other air-heating chambers, similar to those above, are arranged across the bridge wall of the furnace, having air ducts with movable covers at their inlet ends.—R. S.

Ovens and Furnaces; Appliances for Drying, Baking, and Burning Goods in ——. H. Herzfeld, Berlin. Eng. Pat. 2996, Feb. 14, 1900.

THE oven or furnace is provided with extending corbels or brackets for carrying side supporting plates or rails. The articles to be treated are placed upon a loose plate, which is carried into the oven or furnace on a vehicle, the loose plate extending over the side supporting plates or rails. The loose plate is then lowered so as to rest upon these supporting plates, and the vehicle withdrawn from the furnace. —R. S.

Finely Divided or Finely Divided and Dissolved Substances of Different Specific Weights; Method of Separating ——. F. H. A. Wielgolaski, Christiania, Norway. Eng. Pat. 17,505, Jan. 30, 1899. (Under International Convention.)

THE liquid containing the suspended materials, and another liquid (water), are introduced into a centrifugal apparatus in two separate currents, where they are brought together in such a manner that the centrifugal action and the inwardly flowing water current will cause the separation of the suspended substances according to their specific gravities, and then eject them thus separated from the apparatus. —R. A.

Drying Wet or Humid Materials; Impts. in ——. A. B. Lennox, Newcastle-on-Tyne. Eng. Pat. 6097, March 21, 1899.

THE materials are dried by subjecting them to the combined effects of heat and vacuum. The invention is described as applied to drying peat. The peat is carried on trucks, which are pushed into a chamber or series of communicating chambers. Each chamber, which is preferably inclined, is heated by hot air, waste furnace gas, or live or exhaust steam passing through a jacket or coil, or by a furnace; and is put in connection with a condenser and an air pump or other equivalent apparatus.—R. S.

Evaporating Substances and Reducing them to an Anhydrous Condition; Improved Means for ——. W. Mather, Salford Iron Works, Manchester. Eng. Pat. 10,404, May 17, 1899.

THIS invention relates to concentrating apparatus of the kind described in Eng. Pat. 26,981 of 1898, which is now made applicable for dehydrating borax, cyanide of potassium, or other substances which can be reduced by heat to a liquid or semi-liquid condition. The apparatus comprises a feeding vessel, or a combined melting and feeding vessel, adapted to supply a regulated quantity of the liquid or semi-liquid substance in the form of a film, a heated cylinder for receiving such film, and a stripping doctor for removing the anhydrous material from the cylinder. A spreading roller, provided with a second doctor or scraper, may be employed for distributing and compressing the film on the cylinder.—R. A.

Solutions; Apparatus for Making ——. F. A. Anderson, Middlesex. Eng. Pat. 10,964, May 25, 1899.

THE apparatus is for automatically making solutions of definite strength, and has an overflow pipe from the solvent supply connected to the solution delivery, so that if the column of solution in the delivery be heavier than the column of solvent in the supply, the solvent overflows into the delivery and dilutes the solution until the columns again balance.—R. A.

Steam Boilers; Method and Means for Preventing Incrustations in ——. J. L. M. A. Reis, Antwerp. Eng. Pat. 11,367, May 31, 1899.

THIS process consists in maintaining the salts contained in the boiler water in a state of solution, until the water is completely saturated, by the addition to the water of a preparation of molasses, or preferably sugar, with extract of tannin, silicate of soda or of potash, and boric acid. An alkali sulphate and glycerin may, in some cases, be added to the preparation. When the water is completely saturated it is discharged from the boiler.—R. A.

II.—FUEL, GAS, AND LIGHT.

Combustible Materials [*Lignite Briquettes*]; *Relative Value of* ——. F. Isaac. Bull. Assoc. Belges des Chim. **14**, [1], 19—23.

THE author reports on the quality of certain lignite briquettes of German origin offered for sale in Belgium. They are said to be easy to handle, and without dust, to burn easily and well, with a long bright flame at first, afterwards decreasing and turning blue, and without crepitation or smoke. The lignite does not cake when burning, and requires only a slight draught; it burns out completely, and leaves no cinders, but only a heavy red ash.

The lignite briquettes examined, contained 15 per cent. of water and 5 per cent. of ash (inert matter, 20 per cent.), with 55 per cent. of volatile substances and 25 per cent. of fixed carbon (total combustible matter, 80 per cent.) In a dry state the total carbon amounted to 73 per cent. (42 per cent. volatile and 31 per cent. fixed), and the calorific value = 7,000 cal. The calorific value of the crude material = 5,600 cal., but, as part of this heat is consumed in evaporating the moisture, the nett value may be taken as 5,500 cal. Now the nett calorific value of ordinary coal, containing 2 per cent. of moisture and 6 per cent. of ash, averages 7,000 cal.; hence the ratio of coal to lignite is 1 : 0·8, which very nearly corresponds to their respective market quotations.

The author concludes that carbon is the chief element, and that the proportion of hydrogen decreases in proportion to

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the age of the fuel, but less rapidly than the oxygen does; thus, the OH ratio diminishes with age, one result of which is an increase in the calorific value.—C. S.

Coking Properties of Coal; Improving ——. H. Schild. Glückauf, **36**, 205; Chem. Zeit. Rep. **24**, [11], 94.

If good coking coal be extracted with water or dilute magnesium chloride, the residue obtained on evaporating the extract will improve poor coal. The same results are obtained by using lignin in the form of waste lye from the sulphite cellulose process, after having removed the gypsum by concentration. The hydrocarbons in this lye increase the gas-producing power of the coal, and the moisture develops CH_2 and C_2H_4 in the coking process. This reaction occurs at the same stage as the formation of ammonium cyanide; and as the latter reaction also facilitates coking, the lye is treated with ammonium sulphate, which at the same time precipitates the lime present. The addition of this lye is said to have no unfavourable influence on the recovery of the by-products of coking.—C. S.

Calcium Carbide; Reducing Action of ——. Geelmuyden. Comptes Rend. **130**, [15], 1026.

See under XXIV., *page* 475.

PATENTS.

Peat Briquettes; Process and Apparatus for the Manufacture of ——. H. Kerrinnes, Tilsit, Germany. Eng. Pat. 5974, March 20, 1899.

Claim 1:—"The manufacture of peat briquettes which have a woody structure and do not crumble in the fire, by a process in which the peat from the bog is comminuted by mechanical treatment and converted into a pulp, which, after partial removal of the water, is formed into briquettes by pressing, at the same time utilising the natural binding material and water contained in the peat, the briquettes being afterwards dried." 2. "A machine for carrying into practice the process referred to, wherein the peat material is converted into pulp by a comminuting machine or mill, and has the water removed from it by continuous pressure by a filtering apparatus with a large pressure surface, and then passes as a continuous strip into the moulds of the press, in order to be there pressed into separate blocks." The comminution is effected by pressing the peat through a cylinder provided with grooved or toothed rotary and fixed cutting arms and a conical mill. The removal of the water is effected by filter tubes lined on the inside with smooth filtering material, such as stout silk fabric with a backing of felt, and provided with rotating curved perforated blades. The moulds are provided with plates entering simultaneously into slits in the moulds, and are shut off by a movable frame. The pressed blocks are discharged in layers by a stamp and brought on to a rising and falling support. The stacking-up ready for securing the blocks together is effected by turning the support, after the discharge of each layer of pressed blocks, through an angle of 90°.—R. S.

Composite Fuel; Impts. in ——. H. R. Romney, London, J. Thame, Isleworth, and The Fibrous Materials Syndicate, Ltd., London. Eng. Pat. 6340, March 23, 1899.

Claims:— 1. "A composite fuel consisting of an outer envelope of porous, slowly combustible material and a hollow inner core of absorbent material which is impregnated with a rapidly combustible liquid adapted so that the said liquid is evaporated and issues as gas from the central core and through the pores of the outer envelope, and burns at the exterior thereof, the central hollow core being adapted to mix air with the gas." 2. "A fuel block consisting of a mass of slowly combustible material having one or more central passages there-through, the mass being treated in its central portion with an inflammable liquid so as to produce a central zone of highly inflammable material surrounded by an outer envelope of slowly combustible material, forming a retort for the distillation of the inflammable liquid."—R. S.

Fuel, Artificial; Manufacture of ——. H. M. Van Etten and H. Greenfield, both of Moravia, U.S.A. Eng. Pat. 2555, Feb. 8, 1900.

The fuel is formed of the following ingredients mixed in about the following proportions:— Coal-dust, 947½ lb.; slack, 947½ lb.; alkali makers' waste, 100 lb.; and alum, 5 lb. Sufficient water is added to make a wet mass.—R. S.

Liquid Combustible; Lighting and Heating Apparatus using ——. W. Glitsch, Zürich. Eng. Pat. 6333, March 23, 1899.

The invention deals with "the use and the construction of a system of distribution of liquid hydrocarbons by means of a set of capillary tubes, the number of which is made to correspond to the number of levels on which the said hydrocarbons are to be made use of." Also with a distributing vessel subdivided into as many compartments as there are capillary tubes to be supplied, each compartment being fitted with a screw peg or similar device for regulating the supply to the tubes.—C. S.

Spraying Liquid Fuel into Furnaces; Apparatus for ——. H. F. Swan, Newcastle-on-Tyne. From J. D. Swensson, St. Petersburg. Eng. Pat. 9329, May 3, 1899.

The features of this invention are: a feed pump fitted with a steam jacket and delivering the oil into a cylinder which is provided with a union nozzle piece, cylindrical drum, and perforated diaphragms, the latter supporting and guiding a throttling spindle regulated by an adjustable spindle, whilst the walls of the nozzle chamber are so formed as to impart a vortex motion to the oil in its passage. Finally, the issuing jet of oil is completely atomised by impinging on a tongue placed in line with the current of spray.—C. S.

Coke Ovens, with Recovery of the Bye-Products. R. Brunck, Dortmund, Germany. Eng. Pat. 7984, April 15, 1899.

To prevent the annoyance and loss due to gas escaping into the atmosphere during the period of charging and discharging coke ovens, the ascension pipes are provided with a branch or valve leading to an auxiliary collector or main, which is used during charging and discharging. The gas thus collected may be used for any desired purpose.—R. S.

Coke Ovens, Regenerative; Impts. in ——. F. W. C. Schniewind, Everett, U.S.A. Eng. Pat. 3335, Feb. 20, 1900.

The inventor claims: "In combination with a bank of coke ovens having regenerators for preheating the air and to support combustion by the waste heat of the furnaces used for heating the ovens," two air-supply conduits leading to each regenerator, a system of cooling flues situated in the masonry beneath the ovens and furnaces, a collecting fan for drawing air through said flues, a supplementary air inlet to the fan independent of the cooling flues, a discharge conduit from said fan connecting with the air-supply pipes leading to the regenerators, a conduit connecting the cooling flues and having conduits and a valve "whereby the connection to either conduit can be closed at will," and an air passage, which can be regulated, independent of the cooling flues opening into the pipes or conduits connecting said flues with the regenerators.

—R. S.

Oil Burners or Heating Apparatus. C. and A. Musker and W. G. Hay, Bootle, Lancs. Eng. Pat. 9627, May 8, 1899.

The principle claimed by the inventors is the employment of heated air for vaporising the liquid fuel, and then mixing the said hot air with the oil vapour on the way to the burner. The means by which this object is effected consists of an annular vaporising chamber, having an inclined heated surface down which the oil is allowed to flow, and provided with an inlet aperture for the hot air and an outlet leading the mixed air and vapour to the burner by way of an inner chamber with a perforated end wall, through which the mixture is discharged against a perforated block for dispersing the flame.—C. S.

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Vapour Burners. L. E. Main, Cerdon, France. Eng. Pat. 10,193, May 15, 1899.

THE burner for petroleum, &c., stored under pressure, comprises a truncated cone-shaped funnel, open at both ends and surrounded by a metal casing, so as to form a closed chamber, into which the liquid to be vaporised is introduced through a tube. Into the said chamber there also extends a suitably bent jet tube, which draws off the vapour, and is provided with a hole in the central vertical axis of the apparatus, the parts being so arranged that the escaping vapour, passing through the funnel, draws in sufficient air for its own combustion, and that the heat from the burner flame is transmitted, by conduction, to the closed chamber, in order to maintain the production of vapour. A more thorough mixture of air and vapour is obtained by providing an enlarged extension on the funnel, and the supply of air is increased by means of an outer casing. The lower end of the jet tube is fitted with a movable cover for removing accumulated impurities from the tube; a rose or perforated device may be set above the burner, to spread the flame, for heating, &c., and a cup is suspended below the vapour tube, to heat the burner until the latter begins to work automatically.—C. S.

Burner for Vaporised Liquid Fuel for Incandescence Lighting or Heating Purposes. W. Glitsch, Zürich. Eng. Pat. 13,748, July 3, 1899.

IN connection with direct-gasification burners, the inventor claims: the adaptation of two open concentric sleeves perforated with apertures for admitting air, and mounted vertically above the jet in such a manner that the section of the openings corresponds with the cone resulting from the spread of gas issuing from the jet. Also the use of a hood in the centre of the distributing gauze, which hood is provided with lateral openings for directing flame against the wall of an external metal cylinder, which conveys the heat thus received and utilises the same for vaporising the liquid fuel. Several appliances are supplied for fitting to the burner when the same is to be used for heating purposes. —C. S.

Petroleum Vapour Stoves. P. Glud, Frederiksberg, Copenhagen. Eng. Pat. 3622, Feb. 23, 1900.

THIS wickless hydrocarbon vapour heating stove is characterised by two concentric tubes passing through the centre and nearly to the bottom of the container, the outer tube communicating with the vaporising chamber, whilst the inner tube, closed at the top, terminates below this chamber, so that the air, enclosed above the fluid within the inner tube and the container, is heated by the lamp-flame, and by its expansion forces up the liquid fuel from the container into the vaporiser by way of the outer tube. Provision is made for removing the concentric tubes through a capped opening in the bottom of the container, when the tubes need to be cleaned.—C. S.

Gas for Lighting and Heating; Manufacture of ——. A. E. Hodder and J. B. G. Lester, London. Eng. Pat. 10,439, May 17, 1899.

THE inventors claim, in connection with the manufacture of gas, the combination with an air supply under pressure, controlled by a relief valve or otherwise, of a generator, comprising two or more annular chambers, one within another, fitted with spiral vanes, a different hydrocarbon in each chamber, separate conduits and valves for supplying air to each hydrocarbon, with or without a central mixing chamber containing an enriching agent, together with the complete generating apparatus relating to the method. —C. S.

Furnaces and Fire-Boxes for effecting Smokeless Combustion. E. Morterud, Konga, Sweden. Eng. Pat. 3724, Feb. 26, 1900.

IN furnaces for steam generators and for other purposes, in which the draught is so arranged as to cause the flame to pass through the grate from above downwards, there are hollow grate-bars communicating with the outer air and provided with lateral perforations and passages in the side or rear walls of the furnace, depending on the position of the grate-bars communicating with and forming extensions of the hollow bars, said passages terminating in the furnace above the grate, for the purpose of admitting heated air both between the grate-bars and into the space above the same. The passage in the rear wall forming the bridge is provided with outlets in the shape of several small passages at the lower portion of the bridge where the flame passes.—R. S.

Gases; Process and Apparatus for Separating and Extracting —— from a Gaseous Mixture; Purifying, Exhausting, and Compressing Gas, and Increasing its Illuminating Power. E. N. Mazza, Turin, Italy. Eng. Pat. 20,494, Oct. 12, 1899.

THE lighter constituents of a gaseous mixture are separated from the heavier by the rapid rotation of a vertical drum, divided by vertical partitions, at the base of which the gaseous mixture enters. The light constituents—for instance, hydrogen—pass out by a central passage in the top of the drum, while the heavier constituents pass out by exits near the periphery of the drum.—J. A. B.

Gas-purifying Apparatus. E. Mayrisch, Dudelange, Luxembourg. Eng. Pat. 179, Jan. 3, 1900.

THE claim is for the employment, in a gas-purifying apparatus, of means for preventing the latter drawing in or sucking air through a blast furnace when employed in connection therewith, when there is a lack of gas coming therefrom, and for preventing a back pressure on the furnace or mouth of same when an excess of gas is being developed,—by employing a pair of compensating chambers connected by a pipe, and also connected respectively with the inlet and outlet of the purifying apparatus.—C. S.

Gas and Water Vapour Burners, for Heating. J. P. B. Sadtler, Baltimore (Md.), U.S.A. Eng. Pat. 2308, Feb. 6, 1900.

THE inventor claims the method of applying a body of water to a gas or vapour burner by projecting the flame downwards from the point of combustion and directing the heat from such combustion upward, so that the surface of the water is brought into such close proximity to the gas and air combustion point that the water vapour will form an equal or material element of such combustion.—C. S.

Acetylene Gas; Apparatus used for Generating and Storing ——. H. Kinsey, Swansea. Eng. Pat. 7374, April 8, 1899.

THE descent of the bell gasholder which stores the gas causes water to flow from the tank of the holder into a receptacle, from which it passes to a divided trough, so pivoted that according to its position the water flows to one or other of two generators in which carbide is arranged in superimposed boxes. The gas passes through a washer to the gasholder.—J. A. B.

Acetylene Gas Lamps. G. A. Moore, Bromborough, Cheshire. Eng. Pat. 7539, April 11, 1899.

CAPSULES or cartridges, impervious to moisture, and containing carbide, are delivered as required into water. The capsules are cut or perforated as they pass into the water chamber.—J. A. B.

Acetylene Gas; Apparatus for the Production of ——. E. Pianet, Grenoble, France. Eng. Pat. 8402, April 21, 1899.

A BELL gasholder operates by its movements two slides at the base of a carbide receptacle in such a manner, that measured portions of carbide are discharged into water. The pressure on the bell varies according to its position, owing to the tilting of pivoted troughs, in which balls travel, by the bell.—J. A. B.

Acetylene Gas Lighting Torch. R. MacDonald, Perth. Eng. Pat. 8599, April 25, 1899.

AN acetylene generator is connected by a swivel joint to a gas pipe traversing a lamp-lighting torch, which it supplies with acetylene.—J. A. B.

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Acetylene Gas Generators. W. Ellen, Knighton, Radnorshire, and W. Davies, Bucknell, Salop. Eng. Pat. 9322, May 3, 1899.

THE inlet pipe to the gasholder terminates in a flexible tube to which is attached a hollow vessel, so weighted, that it remains a short distance below the level of the water in the gasholder tank. The gas escapes through perforations in this vessel, and is washed by the water, but gas cannot return from the holder through the inlet pipe to the generator.—J. A. B.

Acetylene Gas; Apparatus for the Production of ——. A. J. Boult, London. From A. Molet, Buenos Ayres. Eng. Pat. 9909, May 10, 1899.

A FLOAT on the water in a generating tank operates levers connected with a swinging distributing plate, in such a manner that carbide is discharged from a hopper into the water according to the level of the water in the tank. A pressure regulator is attached to the pipe by which the gas leaves the generating tank.—J. A. B.

Acetylene Gas; Apparatus for Generating and Storing ——. J. W. Powers, North Minneapolis, U.S.A. Eng. Pat. 10,748, May 23, 1899.

A BELL gasholder receives gas from a generator with water-sealed lid, in which is sealed an adjustable gas-exit pipe, which leads to the gasholder. Water is supplied intermittently through a pivoted pipe to a looped pipe leading to the generator, according to the movements of the bell. Several modifications are described.—J. A. B.

Acetylene Gas; Apparatus for Use in the Production of ——. C. Schröder, Arendsee, Altmark, Germany. Eng. Pat. 10,786, May 23, 1899.

A WEIGHT attached to the bell of a gasholder acts on a pivoted lever when the bell descends, and thereby releases clockwork mechanism, which then rotates a shaft to such an extent that a charge of carbide is dropped into water.
—J. A. B.

Acetylene Gas; Apparatus for Generating and Storing ——. F. S. Thorn and C. Hoddle, both of Westminster. Eng. Pat. 12,053, June 9, 1899.

IN generators such as that described under Eng. Pat. 15,962 of 1896 (this Journal, 1897, 604), the gas space of the floating bell is reduced by means of a horizontal partition. An escape pipe also is provided.—J. A. B.

Acetylene Gas Generators. S. W. Allen and L. J. Davies, both of Cardiff. Eng. Pat. 1495, Jan. 23, 1900.

CARBIDE is discharged from a receptacle on a gasholder bell into the tank, whenever the bell descends to a given point, by means of a counterweighted bucket, which receives the carbide from the receptacle, and is tilted by a stop-piece within the tank.—J. A. B.

Incandescence Bodies for Gas Lighting. J. H. H. Duncan, London, The New Incandescent (Sunlight Patent) Gas Lighting Company, Limited, London, and H. T. Barnett, Teddington. Eng. Pat. 6919, March 30, 1899.

MANTLES are to be made from two or more kinds of threads or filaments, containing different incandescing materials, spun, knitted, cabled, or otherwise mechanically connected together, for the purpose of modifying the tint of the light or for strengthening the mantle. For example, one length of cotton thread is impregnated with the usual thorium-cerium mixture; another length is impregnated with a thorium-aluminium-chromium mixture; and the two threads are intertwisted to form a mantle, the light from which will have a "golden white" tint. The collodion process of manufacturing the filaments may also be used.
—H. B.

Electric Incandescent Lamps and their Manufacture. F. M. F. Cazin, Hoboken, U.S.A. Eng. Pat. 7863, April 14, 1899.

THE bulb of the lamp is enclosed in an outer globe to prevent loss of heat; but a small portion of the bulb protrudes through the outer globe, the idea being that as the projecting part will be cooler than the rest of the bulb, the carbon which is volatilised from the filament will all be induced to deposit in the projecting part, thus minimising the "smoking" of the bulb. The filaments consist of a conducting core, such as carbon, covered with a refractory substance which is not chemically affected by carbon, or the carbon core may be surrounded first by a chemically inactive substance and then with a refractory oxide. The filaments and coatings may either be continuous or their continuity may be broken at various points. The base of the lamp, carrying the leading wires, is of glass, and is attached to the bulb by fusing powdered glass round the joint.—H. B.

Incandescence [Gas or Vapour] Lamps. L. Denayrouze, Neuilly, France. Eng. Pat. 9690, May 8, 1899. (Under Internat. Conv.)

WATER is forced, by air pressure, from a reservoir in the lower part of the burner up a pipe to a small vaporising coil situated above the mantle; the steam produced is dissociated more or less into hydrogen and oxygen by being passed through a coil placed within the burner flame; and the gases are then led to and mixed with the combustible gas entering the Bunsen tube of the burner. The combustion of the dissociated gases is said to produce a considerably increased luminosity of the mantle. The combination of such a water supply with an incandescence lamp is claimed.—H. B.

Incandescent Gas Lamps. H. Tee, Liverpool. Eng. Pat. 10,845, May 24, 1899.

THE mantle is suspended over the burner by an incombustible, flexible cord of considerable length, such as a thread of asbestos, which acts as an "anti-vibrator." The drawing shows the burner provided with a long mantle support consisting of a wire which is bent over to a hook in the upper part of the chimney. From the hook depends an asbestos thread of about the same length as the mantle, and the mantle hangs from a loop at the end of the thread.—H. B.

Incandescence Mantles; Method of Marking ——. W. MacKean, London. Eng. Pat. 12,077, June 9, 1899.

AFTER the mantle has been burnt off and stiffened, a narrow strip of paper bearing the desired marks is cemented to it by means of collodion, &c.—H. B.

Incandescence Lamps for Liquid Combustibles. A. Poeffel, Vienna. Eng. Pat. 12,078, June 9, 1899.

THIS relates to lamps of the circular-wick type, provided with a central air passage, and having one or more collars surrounding the outer wick-tube for the purpose of leading external air supplies to the flame. According to the claims "two or more of the external air supplies that influence the form of the flame are made adjustable, whilst the inner supply is so regulated by raising or lowering the flame spreader that, while maintaining the same volume of air supply, the direction of the air currents can be varied."
—H. B.

Igniters for Gas; Improved Process of Manufacturing ——. L. Friedeberger and The "Vulkan" Gesellschaft, &c., Berlin. Eng. Pat. 16,056, Aug. 5, 1899.

THE igniting material is manufactured by calcining an intimate mixture of a salt of a refractory earth, such as nitrate of thorium, a chloride of a metal of the platinum group, a cyanide of the same group (or a double cyanide, such as barium platinum cyanide) and a "chlorine-expelling agent, that is to say, a refractory acid, or a salt leaving behind such acid" (such as silicic acid or an alkali silicate, boric acid, or borates, &c.). In the example given, a fabric is impregnated with a soluble silicate, treated with hydrochloric acid to produce gelatinous silicic acid, impregnated with a solution of platinum chloride, barium platinum cyanide and nitrate of thorium, dried and ignited.—H. B.

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Incandescent Gas Lighting; Manufacture of Mantles to be used in ——. A. J. Boult, London. From F. Isitt, Leichhardt, N.S.W. Eng. Pat. 16,166, Aug. 8, 1899.

THERE are claimed (1) mantles composed of oxides of aluminium and beryllium, or other refractory earths of low illuminating power, with 0·03 to 0·07 per cent. of a metal of the platinum group; and (2) mantles composed mainly of oxides of aluminium and beryllium, or other refractory earths of low illuminating power, with a small proportion of a "semi-developer" (consisting of a mixture of such substances as indium, gallium, vanadium, cerium, chromium, &c.), and with 0·03 to 0·07 per cent. of a metal of the platinum group.—H. B.

Lighting Torches for Incandescent and other Gas Lamps. G. F. L. Foulger and J. G. Glover, London. Eng. Pat. 22,625, Nov. 13, 1899.

THIS describes a lamplighter's torch up the hollow stem of which a sliding rod passes, by means of which the head of the torch, in which the burner is situated, and which is pivoted at its lower part to the top of the stem, may be canted over at a convenient angle for lighting incandescent and other burners.—H. B.

Incandescent Lighting Mantles; Machines and Apparatus for Manufacturing ——. J. H. Abercrombie and R. B. Symington, Newark, N.J. Eng. Pat. 25,171, Dec. 19, 1899.

THIS fully illustrated description specifies machinery, whereby mantles, after being impregnated and dried by hand as usual, are burned off, shaped, hardened, dipped into toughening material, and trimmed, with the employment of but little hand labour.—H. B.

Incandescent Bodies for Illuminating Purposes. J. Janz, Berlin. Eng. Pat. 3530, Feb. 22, 1900.

WEAVING the cotton fabric with a novel form of loop-stitch, which provides a larger quantity of threads over a given surface of its circumference than the material usually employed has.—H. B.

Incandescent Gas Burners. P. Heinroth and G. Tresenreuter, Berlin. Eng. Pat. 3735, Feb. 26, 1900.

ABOVE the usual Bunsen tube of a gas burner is superposed a second mixing tube of greater diameter, at the base of which a second air supply, under very slight pressure, enters and mingles with the mixture of gas and air. The air-compressing apparatus may be of any convenient form.
—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM.

Aromatic Hydrocarbons; Action of Nitric Acid on the Vapour of —— at the Ordinary Temperature. B. Znatowicz. Anz. Akad. Wissensch. Krakau. 1900, 45; Chem. Zeit. Rep. **24**, [10], 84.

THE vapours of aromatic hydrocarbons were aspirated through a 60 cm. column of nitric acid, the current being regulated to vaporise 10 grms. of substance in 2½—3 hours. No trace of nitro products or aromatic acids could be detected in the case of ordinary nitric acid or such as had been freed from nitrogen oxides. With benzene, red fuming nitric acid (sp. gr. 1·52) furnished a substance crystallising in white needles (m. pt. 89·7° C.),—giving the reactions of *m*-dinitrobenzene; whilst with toluene crystalline needles of m. pt. 69° C. (probably 1.2.4-dinitrotoluene) were formed. Acid of similar strength, deprived of lower oxides of nitrogen by carbamide, gave a nearly colourless liquid, which frothed up and disengaged red fumes when heated, distilling at about 210° C.

A mixture of 40 parts of nitric acid (1·52) and 60 parts of fuming sulphuric acid furnished, with benzene, about 90 per cent. of the theoretical quantity of *m*-dinitrobenzene. In the case of *o*-dimethylbenzene the product contained a liquid and a sparingly crystallisable portion (m. pt. 60° C.); *m*-dimethylbenzene gave white acicular crystals of m. pt. 176·5° C. (2.4.6-trinitro-1.3-dimethylbenzene); and *p*-dimethylbenzene furnished rhombic tables melting at 92° C. ($CH_3 : NO_2 : NO_2 : CH_3 = 1 : 2 : 3 : 4$), and needles of m. pt. 121° C.—

($CH_3 : NO_2 : CH_3 : NO_2 = 1 : 2 : 4 : 6$).
—C. S.

Petroleum, Grosny; Behaviour of —— under the Acid Test. K. W. Charitschkow. Trudy bak. otd. imp. russk. techn. obschtsch. **14**, 256; Chem. Zeit. Rep. **24**, [11], 91.

IN applying to Grosny oil the official test with sulphuric acid of sp. gr. 1·53, and using the Baku colorimetric standard solution for comparison, the author found that temperature had little influence on the colour of the extract, and that the coloration imparted to the acid bore no relation to the colour of the oil. Whereas the paler burning oils from Baku petroleum yield lighter acid extracts, the case is different with Grosny burning oils. Again, whilst resinous agglomerations are often found after the acid treatment in the case of the pale acid extracts, they are occasionally absent in the dark extracts. The author is of opinion that petroleum oils that have been imperfectly refined with alkali furnish larger amounts of resinous matters, the origin of which he ascribes to the presence of oxygen compounds in the oil; whereas the coloration of the acid is probably caused by unsaturated hydrocarbons of the naphthene and terpene series.—C. S.

Petroleum, Baku; Organic Bases in ——. G. W. Chlopin. Chem. Zeit. Rep. **24**, [10], 88.

To isolate the basic nitrogen compound described by Schestakow the author agitated about 600 lb. of Baku "masut" with 20 litres of 15 per cent. sulphuric acid for several weeks, and obtained therefrom, by supersaturation with alkali and extraction with ether, 0·005 per cent. of a thick, oily, dark brown liquid, with a greenish fluorescence and an odour of pyridine. The (basic) product is sparingly soluble in water, but readily so in ether, benzene, alcohol, cold hydrochloric or sulphuric acid, though concentrated nitric acid dissolves it with difficulty. It furnishes non-crystalline precipitates with the chlorides of platinum, palladium, and cadmium, as well as with potassium ferrocyanide or bichromate, whilst alcoholic iodine gives a brownish precipitate. Ultimate analysis indicates a composition analogous to that of pyridine or quinoline, with 15—18 carbon atoms in the molecule. The examination of the platinum double salts revealed a series behaving like homologous members of a chemical group. Five members have been isolated, with mol. wts. ranging from 104 to 309.

Experiments on the toxic effects of the basic product on mammals, fish, and bacteria lead the author to conclude that the poisonous action of crude petroleum is due to the hydrocarbons and allied derivatives rather than to the nitrogen bases present.—C. S.

Petroleum Residuum; Detection of Adulterants in ——. K. W. Charitschkow. Trudy bak. otd. imp. russk. techn. obschtsch. **14**, 251; Chem. Zeit. Rep. **24**, [11], 94.

CONSIDERING that the usual fractional distillation for this purpose is inapplicable in small laboratories and in testing

Oil.	Sp. Gr.	Soluble.
		Per Cent.
Petroleum spirit ("benzine"), b.pt. 50° C.....	0·659	42
„ „ „ b.pt. 50°—60° C.	0·666	38
„ „ „ b.pt. up to 90°C.	0·6966	8
Grosny crude oil.....	0·908	4
Baku crude oil	0·867	2
„ petroleum	0·8236	6
Grosny petroleum	0·8176	9
Petroleum distillate	0·8222	8
Heavy petroleum spirit ("benzine").....	0·7513	16
Grosny residuum.....	0·9185	10
„ „	0·9355	6
Baku „	0·9445	1
„ „	0·914	1
„ distillation residue.....	..	about 0·5

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cargoes, owing to lack of the necessary apparatus, the author proposes to employ extraction with cold solvents, and finds agitation with an equal volume of 91·5 per cent. ethyl alcohol for 40 minutes the most suitable. The results obtained are shown in the foregoing table.

In all the cases tabulated, a subsequent separation of alcohol and hydrocarbons occurred; but with a mixture of 1 part heavy petroleum spirit and 1—2 parts "goudron" (residue from lubricating oil distilled *in vacuo*) of sp. gr. 0·992, the alcohol refused to separate on standing, a considerable deposit of asphaltum particles being, however, observed. This last mixture forms the principal adulterant of residuum, and the method appears suitable for its detection. The author regards the adulteration of petroleum and residuum with waste from acid-refining as highly improbable, since the constituents are insoluble in petroleum and all other hydrocarbons.—C. S.

PATENT.

Mineral and Petroleum Oils, Refining ——. T. Macalpine, Chiswick. Eng. Pat. 10,391, May 17, 1899.

The refining material consists of the inventor's "acetylene preparation of manganese" (Eng. Pat. 3381 of 1899), made by the action of acetylene on alkali or alkaline earth oxides or carbonates in water, and the subsequent action of solution of a permanganate or manganate of an alkali or alkaline earth. The manganese acetylene compound is precipitated, and collected on a filter. This preparation is agitated with the oil, and assisted, if desired, by an addition of mineral acid and alkali, the proportions used being about 5 per cent. of the manganese preparation and 2—2½ per cent. of acid or alkali. After leaving to settle and removing any excess of acid or alkali in the usual manner, the oil is distilled, preferably under a partial vacuum, either with or without previous separation from the deposited sediment. —C. S.

IV.—COLOURING MATTERS AND DYESTUFFS.

Indigo; The Cultivation, Manufacture, and Uses of ——. C. Rawson. J. Soc. Arts, 1900, **48**, [2472], 413—434.

The Indigo plant thrives only in tropical climates. By far the greatest amount of Indigo is obtained from India, and more especially from Bengal, Oudh, and Madras. It is also produced in Java, Manila, China, Japan, Central America, Brazil, and certain parts of Africa.

The principal plants cultivated for the production of the dyestuff are the *Indigofera tinctoria*, *I. anil*, *I. disperma*, and *I. argentea*. There are numerous other varieties of lesser importance. Indigo is also obtained, to a comparatively small extent, from other plants besides the species *Indigofera*. Among these may be mentioned the *Wrightia tinctoria* (cultivated to some extent in Madras), the *Strobilanthes flaccidifolius* (Assam), *Tephrosia toxicaria* (Bombay and Rajputana), the *Polygonum tinctorium* (China and Russia), *Lonchocarpus cyanescens* (West Coast of Africa), and *Isatis tinctoria* (China, Afghanistan, &c.).

The *Isatis tinctoria*, or Woad plant, was formerly largely cultivated in Europe, and was used almost exclusively up to the 16th century. It is still grown in Lincolnshire and on the Continent (south of France, Hungary, &c.), but is now never used alone in dyeing. It is used in the fermentation vats, hence known as Woad vats, in dyeing woollen goods. An account of the cultivation and manufacture of Woad has been given by Darwin and Meldola (*Nature*, 1896).

Cultivation and Manufacture of Indigo.—(See this Journal, 1899, 467.)

Constituents of Indigo.—Good Bengal indigo contains, on an average, from 60 to 66 per cent. Madras Indigo, on the whole, is of inferior quality: much of it contains, on an average, about 30 per cent., but the variations are greater than in the case of Bengal Indigo. Some qualities contain upwards of 50 per cent. Broadly stated, the Indigo made in the North-West Provinces (Oudh, &c.) is of a quality intermediate between those of Bengal and Madras. Java Indigo contains, as a rule, the largest percentage of Indigotin, but the general opinion of woollen dyers in England is that it does not give such good results as a high-class Bengal Indigo of a corresponding quality. Indigo also contains another colouring matter of considerable tinctorial value, namely, Indirubin or Indigo Red.

In addition to Indigotin and Indirubin, natural Indigo contains a variety of other substances, which are usually regarded as impurities, though in some cases the organic matters undoubtedly have an appreciable effect in dyeing. They comprise indigo-gluten and various brown substances, and amount in all to 20—30 per cent. Natural Indigo always contains more or less mineral matter. This is partly derived from the leaves of the plant and partly from suspended matter (clay and sand) present in the water used in steeping. The amount varies greatly, from 2—3 per cent. to more than 60 per cent. Good Bengal Indigo usually contains 3—6 per cent.

Dyeing of Wool with Indigo.—In England the Woad vat and the "hydrosulphite" vat are most largely employed. The former, which is the more important, is used principally in the dyeing of heavy cloth, and the latter chiefly for loose wool, slubbing, yarn, and lighter fabrics.

The substances used in the preparation of a Woad vat are, besides Woad and Indigo, bran or sharps, madder and lime. In fermenting, the starch of the bran is changed into glucose, which in turn passes into lactic acid, and then into butyric acid. During the last transformation, there are formed carbonic acid and hydrogen, the latter of which combines with the Indigo, forming Indigo White.

Before going into the Indigo vat, piece goods are frequently dyed a pale shade of red with barwood, cudbear, or alizarin. This "bottoming" is necessary with cloth made from shoddy, in order to counteract the grey or brown colour of the material. The application of the red colour also prepares the cloth for the reception of the Indigo, and makes the dye faster to rubbing. In some cases a deep red bottom is put on the cloth for the sake of economy, as less Indigo is then required.

After dyeing, the goods have to be well washed in water and cleansed with soap and fuller's earth, in order to remove the Indigo, which loosely adheres to the outside of the fibres. This operation is of great importance; if imperfectly performed, the goods have the objectionable property of "rubbing." If the pieces, however, should not have been thoroughly cleansed before dyeing, or if the vat should have been out of condition, no amount of fulling will overcome the liability of the dye to rub.

The experiences of the woollen dyers with the "hydrosulphite" vat have been varied. It is much more easily managed than a Woad vat. A much greater amount of work can be done, since it is not necessary to wait for a voluminous sediment to subside, as in the Woad vats. The goods dyed are usually cleaner than those dyed in Woad vats. Since there is less Indigo mechanically attached to the outside of the fibres, there is not so much loss in washing and milling. It is the opinion of heavy cloth dyers, nevertheless, that the Indigo does not penetrate into the interior of the cloth, and that more red dyestuff is required to give a certain shade.

Dyeing of Cotton with Indigo.—In the East, cotton is still largely dyed in fermentation vats; raisins, dates, and honey being used in place of treacle, Woad, and bran.

Fastness of Indigo.—A sample of cloth dyed with Indigo, after being exposed to brilliant sunshine in India for 90 days, retained its richness and bloom perfectly, and in depth of shade was but very slightly affected. At the same time, a piece of cloth dyed with logwood lost its colour entirely, and the colour of another dyed with Alizarin Blue faded to a dull reddish-slate shade.—E. B.

Cochineal; Amount of Ash in Commercial ——. G. F. Merson. Pharm. J. 1900, **64**, [1552], 309.

The author states that the prices of cochineal appear to be based upon the appearance of the insect rather than upon its tinctorial value; also, a considerable proportion of ordinary commercial specimens are adulterated.

The B.P. allows 6 per cent. of ash, but the author found that the average normal amount of ash in genuine cochineal does not exceed 2·5 per cent. 31 commercial

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samples of cochineal, including both dark grain and silver grain insects, were examined as to their percentage of ash, which was found to vary from 2·4 per cent. up to as much as 43·6 per cent. The dark grain insects form much the better variety so far as freedom from adulteration is concerned, although a considerable amount of sand and grit was adherent to the insects, and could be readily noted on rubbing down in a mortar. Genuine silver grain cochineal has the ridges well defined, or grooves or crinkles only have a white appearance, whilst the adulterated article looks in many instances like "a bad sample of a badly coated pill."

—A. S.

Monomethylaniline; Action of Formaldehyde on ——. C. Goldschmidt. Chem. Zeit. 1900, **24**, [27], 284.

Manasse and Lederer were the first to observe that formaldehyde acts upon phenols with the formation of benzyl alcohols. According to the patent of Kalle and Co. (Ger. Pat. 87,972), anhydro-*p*-hydroxylamine benzyl alcohol is obtained from phenyl-hydroxylamine and formaldehyde. The same phenomenon has also been observed in the case of aromatic amido compounds (Ger. Pat. 96,851 of Kalle and Co.).

The author has found that similar compounds are produced when a hydrogen atom of the amido group is replaced by an alkyl or acid radicle, and in this way has prepared *p*-anhydromonomethylamidobenzyl alcohol from monomethylaniline. When the latter substance is acted upon by an excess of formaldehyde in the presence of dilute hydrochloric acid, white crystals are, in the cold, deposited after about 30 minutes. These are separated and washed with water acidified with hydrochloric acid. They are soluble in water, and are reprecipitated on adding hydrochloric acid. From the aqueous solution, *p*-anhydromethylamidobenzyl alcohol is precipitated by alkalis as an amorphous white substance, which is purified by being dissolved in chloroform and precipitated by ether. It melts at 196° C. with decomposition, and is $C_6H_4:(CH_2):NCH_3(1:4)$. It is probably a derivative of the compound—

$$C_6H_4(NHCH_3)CH_2Cl.$$

—C. A. M.

Paranitraniline; Electrolytic Reduction of ——. H. Sonneborn. Zeits. f. Elektrochem. 1900, **6**, [41], 509—510.

The author has electrolysed *p*-nitracetanilide in alcoholic solution in presence of sodium acetate, the solution being kept neutral by adding acetic acid. About 30—40 per cent. of the theoretical amount of diacetyl-*p*-diamidoazoxybenzene (m. pt. 275° C.) separates out, the mother-liquor containing 50—60 per cent. of acetyl-*p*-phenylenediamine. The diacetyl compound, on account of its insolubility, could not be further reduced. It was therefore hydrolysed, and the *p*-diamidoazoxybenzene converted in alcoholic solution, with sodium acetate as electrolyte, into *p*-diamidoazobenzene and the corresponding hydrazo compound. When the reduction is complete, the solution is evaporated to dryness, extracted with benzene, evaporated again with ammonium sulphide, and again extracted with benzene. The method thus affords an easier means of obtaining *p*-diamidohydrazobenzene than that heretofore employed.—T. A. L.

Colour Bases, Precipitation of ——, by Ammonium Persulphate. F. Pröscher. Chem. Zeit. 1900, **24**, [25], 262.

Ehrlich when examining vital organs stained with Methylene Blue, observed that this dyestuff was completely precipitated by ammonium persulphate. This immunity from oxidation is not shared by Methyl Green. The author finds that the following colour bases are completely precipitated by ammonium persulphate:—Resorcinol Orange, Diethyltoluthionine chloride, Succinicin-Rhodamine, Nitropentamethyl Violet, Acridine Orange, and Induline Scarlet. The following are precipitated all but traces:—Tetra-ethylsafranine, Nile Blue, Diethylsafranine, Thioflavin, Rosinduline sulphate, Phenosafranine, Chrysaniline, Naphthol Blue, and Thionine. Out of a number of alkaloids tested, only apomorphine was precipitated by ammonium persulphate; the precipitate had a cheese-like appearance, but soon became oxidised.—W. G. M.

Azo-Dyestuffs; Dynamical Investigations on the Formation of ——. IV. H. Goldschmidt and G. Keppeler. Ber. **33**, [6], 893—905.

It has already been shown in previous papers (this Journal, 1899, 263 *et ante*) that in the action of alkaline solutions of diazo compounds on alkaline phenol solutions, only those quantities of diazohydroxide and of phenol set free from the alkali salts by hydrolysis, react with one another. The rate at which this takes place, which depends upon the concentration, is given by a differential, and in the present paper further examples are given in support of the theory. The authors find that the rate at which the reaction between sodium diazobenzolate and sodium β-naphtholate proceeds, can be determined mathematically according to a given equation, which also shows that the greater the concentration of the components, the longer the time required for the formation of the dyestuff. In the case of hydroxyazo dyestuffs soluble in alkali, such as those from sodium diazobenzolate and sodium *m*-cresolate, or from sodium syndiazobenzene sulphonate and sodium *m*-cresolate, a different mathematical expression is required. Experiments are also described with isodiazobenzene, for which purpose the reaction between sodium *p*-nitro-isodiazobenzolate and sodium β-naphtholate was investigated. On the whole, relations exist here similar to those in the preceding cases.

—T. A. L.

Formazyl Series; Dyestuffs of the ——. F. Fichter and E. Schiess. Ber. **33**, [5], 747—752.

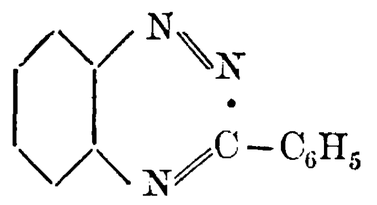
Formazyl compounds have been investigated by v. Pechmann and Bamberger (Ber. **25**, 3175 and 3201), but, with the exception of a short note by W. Wislicenus (Ber. **25**, 3458), no sulphonic acids of these compounds have been described, although, on account of their dyestuff nature, they are of interest. The nomenclature employed by the authors is that given by Wedekind (Ber. **31**, 474) according to the following scheme:—

$$C_6H_5(I.)C\begin{cases}N.NH.C_6H_5(II.)\\ N:N.C_6H_5(III.)\end{cases}$$

Formazylbenzene-II-p-sulphonic Acid—

$$C_6H_5.C\begin{cases}N.NHC_6H_4.SO_3H\\ N:N.C_6H_5\end{cases}$$

The sodium salt is obtained by combining sodium benzylidenephenylhydrazone-*p*-sulphonate with diazobenzene in presence of sodium carbonate. It forms reddish needles from alcohol, which decompose at about 135° C., and dissolve in concentrated sulphuric acid with a bluish-green colour, rapidly becoming brown. In a bath faintly acid with acetic acid, the dyestuff gives dark red shades on silk and wool. On warming with sulphuric acid diluted with glacial acetic acid, the compound undergoes the "triazine decomposition," yielding phenphenyltriazine—



melting at 123° C., together with aniline, but no sulphanilic acid. On treatment with zinc dust and sulphuric acid, the only products were phenylhydrazine and *s*-benzoylphenylhydrazine sulphonic acid, the latter crystallising from water in thin colourless plates.

Formazylbenzene-III-p-sulphonic Acid—

$$C_6H_5.C\begin{cases}N.NHC_6H_5\\ N:N.C_6H_4.SO_3H\end{cases}$$

The sodium salt is formed by dissolving diazobenzene-*p*-sulphonic acid in an excess of caustic soda lye, diluting with alcohol, and adding an alcoholic solution of benzylidenephenylhydrazone. The product forms reddish needles, decomposing at about 165° C., and dissolving in sulphuric acid with a greenish colour, which rapidly turns brownish-

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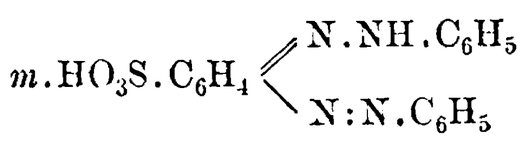
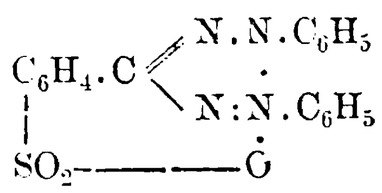
yellow. Like the previous compound, it dyes wool and silk red from a bath acid with acetic acid, and the same products are also obtained by decomposition with sulphuric acid, and with sulphuric acid and zinc dust.

Formazylbenzene-I-m-sulphonic Acid—



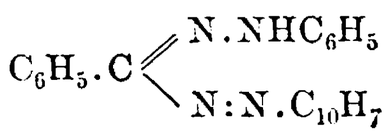
The sodium salt of this acid is produced by running simultaneously into cold sodium carbonate solution, diazobenzene and an alcoholic aqueous solution of the condensation product from phenylhydrazine and sodium benzaldehyde-*m*-sulphonate. The compound forms lighter red needles than the second isomeride above, and the shades produced are also brighter. Oxidation with nitrous acid yields the inner anhydride of triphenyltetrazoliumhydroxide-I-*m*-sulphonic acid—



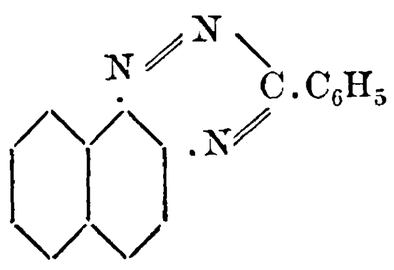
which crystallises from dilute hydrochloric acid in small quadratic plates, melting above 250° C. The substance is not attacked by acids, but turns red and decomposes with alkalis.

The authors have also prepared two naphthylphenylformazylbenzenes.

II-Phenyl-III-α-naphthylformazylbenzene—

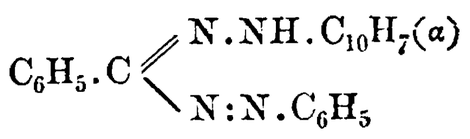


Solutions of α-diazonaphthalene chloride and benzylidenephenylhydrazone are allowed to drop simultaneously into an excess of cooled alcoholic potash lye with constant agitation. The product crystallises from benzene in dark violet needles, melting at 173° C. The "triazine decomposition" yields *naphthophenyltriazine*—



which crystallises from alcohol in yellowish-green needles, melting at 145° C.

II-Naphthyl-III-Phenylformazylbenzene—

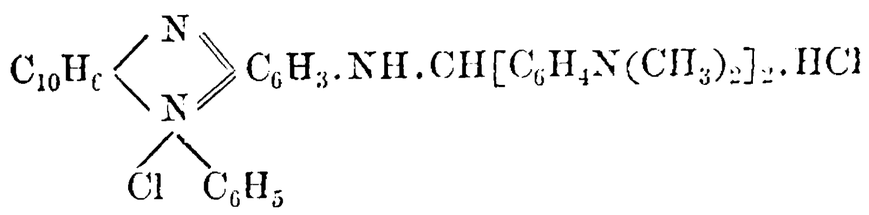


is formed by running solutions of diazobenzene chloride and benzylidene-α-naphthylhydrazone (plates melting at 145° C. obtained by condensing α-naphthylhydrazine and benzaldehyde in alcoholic solution) into alcoholic potash lye. The product crystallises in dark violet, almost black, needles, and differs from its isomeride by its greater solubility in benzene and chloroform, whilst on warming it with sulphuric acid diluted with glacial acetic acid, it gives the same naphthophenyltriazine melting at 145° C.—T. A. L.

Tetramethyldiamidodiphenylcarbinol on Rosinduline and Isorosinduline; Action of ——. R. Möhlau and W. Schaposchnikoff. Ber. **33**, [5], 799—803.

It has already been shown (Ber. **32**, 2146; this Journal, 1899, 1010) that the condensation of diphenylcarbinols with quinones and quinonoid compounds only takes place when the latter belong to the para series; and, with a view of testing this further, the authors have investigated certain *o*-quinonoid compounds with regard to their reacting as *p*-quinonoid compounds. The chlorides of Rosinduline and of Isorosinduline have been tested in this way, and it is found that the former does not react, whilst Isorosinduline yields a substituted leucauramine, and is not itself substituted in the ring.

Isorosinduline chloride leucauramine—



is obtained by dissolving Isorosinduline chloride in absolute alcohol and cohobating for three hours with tetramethyldiamidodiphenylcarbinol. On cooling, long greenish needles of the salt crystallise out. The product is readily soluble in alcohol, but less so in water, giving reddish-violet non-fluorescent solutions. The base precipitated by ammonium or alkali carbonates forms a violet precipitate. The solution in concentrated sulphuric acid is pure blue, turning violet and then pink on dilution. On hydrolysis (water, acids), the product decomposes into Isorosinduline and tetramethyldiamidodiphenylcarbinol. Attempts to oxidise it to the corresponding Auramine were fruitless, owing to the instability of the compound, but it was observed that the reddish-violet colour of its solution in dilute acetic acid turned reddish-yellow on adding lead peroxide, and that the dyestuff formed, gave yellowish-red shades on cotton mordanted with tannin.—T. A. L.

Triphenylmethane Dyestuffs; Salts and Bases of ——. A. Hantzsch. Ber. **33**, [5], 752—760.

In continuation of a previous paper (Ber. **33**, 278; this Journal, 1900, 236) several points have arisen with regard to triphenylmethane dyestuffs. One of these relates to the polyacid dyestuff or carbinol salts. It is usually assumed that the dyestuffs derived from triamidotriphenylmethane yield, in addition to the simple true acid dyestuff salts, diacid salts (generally green), and triacid salts (generally yellow). The two latter have, however, hitherto not been isolated, and their formation has been assumed from the change in colour into green and then into yellow, which takes place on adding a mineral acid. The same is also true of the colourless carbinol salts, as made evident by the experiment with Malachite Green leucohydrate (tetramethyldiamidotriphenyl carbinol), which gives an almost colourless solution with cold hydrochloric acid, turning green slowly on standing or more rapidly on warming. The author has, however, succeeded in separating triacid dyestuff and carbinol salts in the Hexamethyl Violet series, and finds that the hydrobromide salts are sufficiently stable.

Crystal Violet Leucohydrate Trihydrobromide—

$$HO.C[C_6H_4.N(CH_3)_2HBr]_3,$$

is obtained by passing dry hydrobromic acid at − 15° C. into the carbinol base dissolved in a mixture of ether and acetone. The flocculent precipitate, which is at first bluish, then greenish, and finally white, is filtered off and washed with ether. It dissolves to a colourless transparent solution in water, which on standing, or more quickly on warming, turns deep violet.

Crystal Violet Trihydrobromide—

$$BrN(CH_3)_2:C_6H_4:C:[C_6H_4.N(CH_3)_2HBr]_2,$$

is formed by passing hydrobromic acid into the hot chloroform solution of the carbinol base, and forms a yellowish to a bright red powder. It dissolves in water at 0° C. to a deep violet solution, showing that considerable decomposition into the monacid salt and free acid has taken place. This accords with the behaviour of Hexamethyl Violet salts, which only give greenish-yellow solutions with a large excess of concentrated acids. The amount of decomposition of both salts was determined by the electrical conductivity of the solutions, the triacid dyestuff salt giving at once a constant value, whilst the carbinol salt, with a smaller initial value, gradually almost reaches that of the dyestuff. The carbinol trihydrobromide is easily soluble, whilst the monohydrobromide, obtained by hydrolysing the dyestuff trihydrobromide, is sparingly soluble, and separates from the carbinol

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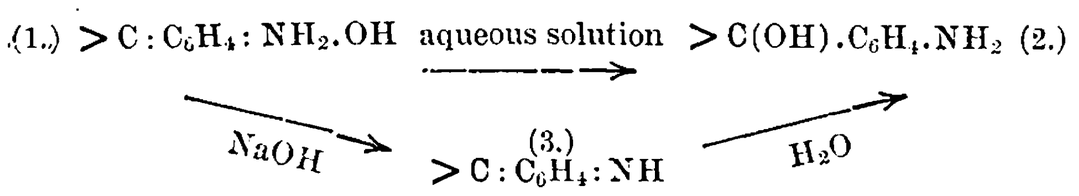
salt solution when not too dilute. The electrical measurements further show that the carbinol trihydrobromide behaves as a triple aniline salt. Each aniline radicle takes up one molecular proportion of acid, and the ammonium group so formed, like aniline hydrochloride itself, only undergoes partial hydrolysis. On the other hand, the dyestuff trihydrobromide is almost completely decomposed by water into monohydrobromide and two molecular proportions of hydrobromic acid, and therefore can only be present in very small quantities in aqueous solution, in the absence of an excess of acid. The normal triamido bases are, to a certain extent, comparable with aluminium hydrate, and the colour bases with potash, in their behaviour towards hydrochloric acid. It is, however, remarkable that the change from an aluminium base to a potash base in their organic analogues, is only due empirically to removal of water.

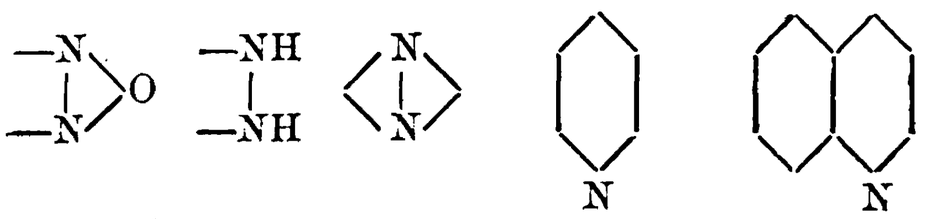
In the second place, with regard to triphenylmethane dyestuffs, the bases are dealt with. It has already been pointed out by Homolka (Nietzki, Chemie d. org. Farbstoffe, p. 119) that Pararosaniline or New Magenta, when decomposed with potash, yields a coloured base before the final product the carbinol, which differs from the latter by its greater solubility in ether, in which it dissolves with a red colour, and from which it can be precipitated by carbonic acid as a colourless carbonate, whilst the carbinol under these circumstances is not attacked. The author considers that this compound is most probably the imido base $(H_2N.C_6H_4)_2:C:C_6H_4:NH$, that is the anhydride of the true rosaniline hydrate $(H_2N.C_6H_4)_2:C:C_6H_4:NH_2OH$. There are thus three different bases obtainable from Rosaniline dyestuffs. 1. True colour ammonium bases; these are coloured and insoluble in ether; they exist only in aqueous solution, and are strong, generally monacid bases. 2. Pseudo-ammonium bases: the well known carbinols, colourless and soluble in ether, triacid bases yielding colourless salts which are slowly converted into the dyestuff salts; they do not yield carbonates. 3. Imido or anhydride bases; coloured and soluble in ether. They at once yield the dyestuff salts with acids, even with carbonic acid. The formation of these bases takes place as follows. The dyestuff salt gives with one molecular proportion of caustic soda primarily the true colour ammonium base (1); this slowly isomerises in aqueous solution to the pseudo-ammonium base (2), and is quickly converted by an excess of alkali into the imido base (3), which again slowly becomes hydrated, forming the pseudo-ammonium base.

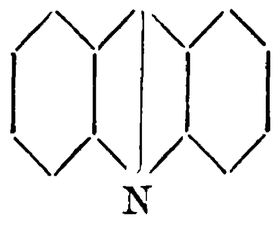


—T. A. L.

Dyestuffs; Compounds of Basic with Acid ——. A. Seyewetz. Comptes Rend. **130**, [13], 842—844.

Having found that in many cases dyestuffs of marked acid character gave precipitates with basic dyestuffs, though not with basic substances that were not dyes, and conversely, the author investigated the behaviour of various aromatic compounds, containing acid-forming groups, with Auramine as a typical basic dye, and of others, containing base-forming groups, with picric acid as a typical acid dyestuff. He found that aromatic compounds containing one of the groups COOH, OH, SO_3H, NO_2, CO.CO, one or more times, do not precipitate Auramine, but that those containing two or more of those groups do so. Similarly, those compounds, not dyestuffs, containing one of the groups NH_2, NH, N⋮, .N:N., do not precipitate picric acid, while those containing one or more NH_2 groups in the aromatic nucleus combined with the residue .N:N. (in which case, however, we have an amido-azo-compound—a dye) do so. Moreover, aromatic compounds, not dyestuffs, containing only one of the residues—





do not precipitate picric acid.

In the case of bodies of mixed function, the author's conclusions are as follows: 1. If into an aromatic compound not containing a chromophor we introduce both OH and NH_2 groups, the resulting substance will not precipitate either auramine or picric acid. 2. The same is the case if with the NH_2 groups there be present COOH groups, either alone or with OH groups. 3. If with the NH_2 groups there be one or more SO_3H groups, the compound will precipitate Auramine, like an acid dyestuff.—J. T. D.

Substantive Sulphur Dyestuffs; Note on ——. Dr. Chapuis. J. Soc. Dyers and Colourists, **16**, [4], 83—84.

In 1873, Croissant and Bretonnière obtained dyestuffs which dyed unmordanted cotton, by treating organic compounds of widely different character with alkali sulphides or polysulphides.

Recent investigations by the St. Denis Co. have shown that of the various organic substances, those substituted in the para position, either by two amido groups or by one hydroxyl and one amido group, were the most suitable for the manufacture of sulphur dyestuffs.

Such organic substances include phenylene diamine, amidophenol, amidonaphthol, diamidonaphthalene, Indamine, &c., or compounds capable of yielding these substances, and hydrochlorides of the para-amido-phenylamido derivatives of the spirit-soluble Indulines.

The use of sulphonated amidohydroxyl compounds, or diamidocompounds, as well as diphenylamines having two substituted groups in the para position, and containing besides sulphonic-, nitro- or carboxyl groups, have not met with much success.

A curious point in the manufucture of sulphur dyestuffs is that the temperature of 250° C. is best for the production of a black dyestuff, whereas a higher temperature (350° C.) yields a brown dyestuff which is more or less grey or greenish in shade.—J. E. H.

Picric Acid and its Solutions; Colour of ——. W. Marckwald. Ber. **33**, [7], 1128.

Although picric acid is usually more or less yellow, it can be obtained almost colourless on crystallisation from concentrated hydrochloric acid. On washing these crystals with water they again turn yellow, and the almost colourless mother-liquor also becomes much more yellow on dilution. If pure yellow picric acid be dried over sulphuric acid in a vacuum desiccator it gradually becomes lighter in colour, although never quite colourless.

These phenomena can be sufficiently explained by the electrolytic dissociation theory, if it be assumed that picric acid itself is colourless, or almost so, but that the ions $C_6H_2(NO_2)_3O$ are yellow. As a strong acid, picric acid in aqueous solution is to a large extent electrolytically dissociated. On the addition of hydrochloric or other strong acid, the $C_6H_2(NO_2)_3O$ ions disappear as such, and the yellow colour of the solution becomes paler. Moist picric acid shows the colour of the ions, and the same is also true of the fused acid, and hence the colourless acid always gives an intensely yellow melt. The phenomena can also be demonstrated as a lecture experiment by shaking commercial picric acid with petroleum ether, when, the medium being a non-dissociating one, a colourless solution is obtained, containing, however, only a small quantity of picric acid. On decanting the solution, and shaking with several times its volume of water, the latter turns deep yellow. Petroleum ether also serves for obtaining nearly colourless picric acid. The acid separates on cooling a hot saturated solution in almost white crystals.—T. A. L.

A New Indigo: its Analysis, and that of Indigo Pure of the Badische Anilin u. Soda Fabrik. J. J. Hazewinkel. Chem. Zeit. 1900, **24**, [32], 339—340.

By extracting plants of the genus Indigofera by a new continuous process said to involve chemical and technical

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questions of which no details are given, the author claims to have produced an indigo containing 91 per cent. of indigotin. Comparative volumetric or colorimetric tests were made with Indigo pure (B.A.S.F.), which from Brylinski's test (Bull. Soc. Ind. Mulhouse, **68**, 39; this Journal, 1898, 609) was assumed to contain 98·5 per cent. of indigotin, but, according to the author, contained considerably less, and also with a commercial pure indigo, which after extraction with glacial acetic acid, contained about 94 per cent. The purified Indigos were sulphonated by Koppeschaar's method (this Journal, 1899, 302), omitting the asbestos plug; the solutions of the disulphonic acids were titrated with permanganate. The results obtained were compared with those given by a colorimetric estimation of the sodium salts precipitated by salt, and were found to be tolerably concordant. An approximate analysis of the new Indigo, which will probably come into the market at the beginning of next year, is as follows:—Ash = 1·5, water = 0·75, glacial acetic acid extract = 6·0, indigotin = 91·0, other substances 0·75 per cent.—T. A. L.

Cochineal and Carmine; Simple Method for the Valuation of ——. G. F. Merson. Pharm. J. 1900, **64**, [1552], 309.

See under XXIII., *page* 473.

PATENTS.

Diamido Dioxynaphthalene, and Dyeings therefrom; Production of ——. R. B. Ransford, Upper Norwood. From L. Cassella and Co., Frankfort-on-the-Maine, Germany. Eng. Pat. 9502, May 5, 1899.

The disazo compound from 2.2′-dihydroxynaphthalene and naphthionic acid is reduced with zinc dust and hydrochloric acid, yielding probably 1.1′.2.2′-diamidodihydroxynaphthalene. This product has the property of giving deep black shades on wool, fast to washing and milling, when boiled with it in a bath containing sodium bisulphate and bichromate. For example, 160 kilos. of 2.2′-dihydroxynaphthalene and 80 kilos. of caustic soda are dissolved in water, 400 kilos. of sodium carbonate are then added, and after cooling to 0° C. the diazo compound from 450 kilos. of naphthionic acid is added. At the end of 24 hours the temperature is gradually raised to 50° C., and the resulting dyestuff is salted out. The dyestuff so formed is dissolved in 2,000 litres of boiling water, and reduced with 150 kilos. of zinc dust and 500 kilos. of hydrochloric acid with constant agitation. When the solution is decolorised, naphthionic acid separates out and is filtered off. The filtrate is treated with sulphuric acid, when the sparingly soluble diamidodihydroxynaphthalene separates in yellowish-white needles, soluble to a blue solution in alkalis. For dyeing purposes 100 kilos. of wool are boiled in a bath containing 10 kilos. of sodium bisulphate, 5 kilos. of sodium bichromate, and 3 kilos. of diamidodihydroxynaphthalene. The bath is exhausted in about one hour, and gives a black shade on the wool.—T. A. L.

Rhodamine Dyestuff; Manufacture of a New ——. O. Imray, London. From The Farbwerke vorm. Meister, Lucius und Brüning, Hoechst a/M., Germany. Eng. Pat. 10,054, May 12, 1899.

Dichlorodiethylrhodamine manufactured according to Eng. Pat. 9600 of 1888 (this Journal, 1889, 537) is insoluble in water. According to the present specification it may be made soluble in water by treatment with sulphonating agents. A solution of 25 kilos. of the dyestuff in 150 kilos. of sulphuric acid monohydrate is treated at 35°—40° C. with 150 kilos. of fuming sulphuric acid (20 per cent. SO_3). When, in about three hours, a sample is soluble in sodium carbonate solution, the melt is poured into water, the sulphonic acid filtered off, dissolved in sodium carbonate, and the filtered solution of the sodium salt is evaporated to dryness. The dyestuff so formed gives a dark red powder easily soluble in water to a red solution having a green fluorescence. Mineral acids precipitate the free sulphonic acid from this solution as a bluish-red flocculent precipitate. Concentrated sulphuric acid dissolves the dyestuff to a light yellow solution, which on dilution becomes yellowish-red, and finally bluish-pink. The new rhodamine gives very pure and bright bluish-red shades on wool.—T. A. L.

Chlorindigo, Manufacture of ——. O. Imray, London. From Die Farbwerke vorm. Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 12,762, June 19, 1899.

Chlorindigo is obtained by the action of acetone and alkalis on *o*-chloro-*o*-nitrobenzaldehyde. The product gives much purer and stronger shades on wool and cotton than can be obtained either with natural or with ordinary synthetic Indigo. The product resembles Indigo, but is readily soluble in alcohol and ether. It dissolves in cold concentrated sulphuric acid to a blue solution, whilst ordinary Indigo gives a yellowish-green solution, which only becomes blue on standing or on heating.

Ortho-chloro-ortho-nitrobenzaldehyde melting at 71° C., is obtained by the successive chlorination, bromination, and oxidation of *o*-nitrotoluene. On chlorinating this latter product, *o*-chloro-*o*-nitrotoluene melting at 37° C. is obtained, and this on bromination yields *o*-chloro-*o*-nitrobenzylbromide melting at 52° C. This product, when hydrolysed with water and chalk, is converted into *o*-chloro-*o*-nitrobenzyl alcohol melting at 59° C., which on oxidation readily yields the aldehyde. In order to convert it into Chlorindigo, 1 kilo. of *o*-chloro-*o*-nitrobenzaldehyde is dissolved in 6 kilos. of acetone, and a 1 per cent. solution of caustic soda is added drop by drop, with constant agitation. The appearance of a blue coloration indicates the formation of Indigo when the addition of caustic soda is stopped, the stirring being continued for another 10 hours. The condensation product separates in crystals melting at 134° C., and, after filtering off, is dissolved in a small quantity of pure acetone. This solution is run into 100 litres of water containing 1·2 litres of caustic soda lye of 40° B. The formation of Chlorindigo begins at once, and when no more is formed it is filtered off. It reduces more easily in the hydrosulphite vat than ordinary indigo, and Chlorindigo white appears to possess a greater affinity for the fibre than ordinary indigo white.—T. A. L.

Naphthophenazonium Compounds; Manufacture of ——. C. D. Abel, London. From The Actiengesellschaft für Anilinfabrikation, Berlin, Germany. Eng. Pat. 11,168, May 29, 1899.

Witt (Ber. **20**, 571) showed that the azo compounds derived from secondary β-naphthylamine derivatives, such as phenyl-, tolyl-, or xylyl-β-naphthylamine, when boiled with dilute mineral acids, are decomposed, yielding the original amine and azines, which, however, have not found any technical employment. If, however, certain tertiary β-naphthylamine derivatives be employed, the resulting azonium compounds form valuable parent substances for the manufacture of Safranine or Rosinduline dyestuffs. The derivatives suitable for this process are, methyl-phenyl-β-naphthylamine, methyltolyl-β-naphthylamine, ethylphenyl-β-naphthylamine, ethyltolyl-β-naphthylamine, and the sulphonic acids of these compounds. They can be obtained according to the method described in Ger. Pat. 96,402, the following compounds being characteristic:—

Methyl-p-tolyl-β-naphthylamine melts at 75° C., is readily soluble in ether, benzene, chloroform, and hot alcohol; it separates in plates from the last-named solvent.

Ethylphenyl-β-naphthylamine melts at 58° C., and crystallises in thick prisms from alcohol.

The dyestuff from diazotised sulphanilic acid and phenylmethyl-β-naphthylamine is digested with 10 times its weight of water and with its own weight of concentrated hydrochloric acid. The methylnaphthophenazonium chloride formed, dissolves to a yellow solution, which is filtered, the new dyestuff being precipitated by adding salt or zinc chloride, when it forms orange-coloured needles which dye tannin-mordanted cotton orange-yellow tints. The formation of the azo compound and its decomposition may also be effected in one operation. For instance, 4·8 kilos. of methyl-*p*-tolyl-β-naphthylamine are dissolved in 100 kilos. of alcohol and 3·5 kilos. of sulphuric acid. To this

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is added a concentrated solution of diazobenzene sulphonic acid obtained from 3·5 kilos. of sulphanilic acid. The azo compound produced, is slowly decomposed, and when the operation is complete the liquid is diluted with 2—3 litres of water, and the dyestuff is salted out with zinc chloride or salt. For the production of an orange-yellow wool dye, the dyestuff from diazotised *p*-nitraniline and methyl-*p*-tolyl β-naphthylamine sulphonic acid is digested for 12 hours at 80° C. with 2 parts of sulphuric acid and 20 parts of water. After filtering, the sulphonic acid of the azonium compound is precipitated in the form of brown crystals.—T. A. L.

Methyl-ω-Sulphonic Acids of Primary Aromatic Amines, and of Mixed Amido-azo Compounds resulting therefrom; Manufacture of ——. C. D. Abel, London. From The Actiengesellschaft für Anilinfabrikation, Berlin, Germany. Eng. Pat. 11,343, May 31, 1899.

By treating anhydroformaldehyde compounds of aromatic amines having the typical formula $R.N:CH_2$ with sulphurous acid or bisulphites, acids are obtained having the typical constitution $R.NH.CH_2SO_3H$, which are well-characterised substances, and readily soluble in sodium carbonate solution and in caustic alkalis. On combining them with suitable diazo compounds and replacing the group CH_2SO_3H by hydrogen, by treating the azo compounds with alkalis, alkaline carbonates, or mineral acids, mixed amido-azo compounds may be obtained, the production of which has hitherto been a matter of some difficulty.

A mixture of 11·9 kilos. of anhydroformaldehyde-*o*-toluidine and 60 kilos. of sodium bisulphite solution (32° B.) is rapidly agitated until the whole solidifies to a mass of white crystals of methyl-*o*-toluidine-ω-sulphonic acid. As an instance of the production of a mixed amido-azo compound, the solution of *p*-nitrodiazobenzene chloride from 6·9 kilos. of *p*-nitraniline is added to a cold solution of 10·5 kilos. of sodium methylaniline-ω-sulphonate and 13·6 kilos. of sodium acetate in 50 litres of water. The dyestuff, after filtering, is mixed to a paste with water, and heated with 6 kilos. of sodium hydroxide in 200 litres of water. Formaldehyde is given off, and, on acidulating, sulphurous acid is evolved. The reaction is complete after boiling half an hour, when the colouring matter is filtered off and washed with hot water. It forms a reddish-brown powder, which, after crystallisation from benzene, melts at 212° C. The hydrochloride forms steely-blue plates resembling those of amido-azobenzene.—T. A. L.

Brown Colouring Matters directly dyeing Cotton; Manufacture of ——. C. D. Abel, London. From The Actiengesellschaft für Anilinfabrikation, Berlin, Germany. Eng. Pat. 11,656, June 5, 1899.

On heating together the sodium salt of *p*- or *o*-nitrochlorobenzene sulphonic acid (26 kilos.) with *m*-tolylenediamine (12·2 kilos.) in presence of calcium carbonate (5 kilos.) and about 300 litres of water until carbonic acid is no longer evolved, a product is obtained which, when heated with sodium sulphide and sulphur, gives a brown dyestuff for cotton. A mixture of 20 kilos. of the condensation product, 60 kilos. of sodium sulphide, and 20 kilos. of sulphur, is heated to 180° C. until the melt becomes solid. The product thus obtained is powdered, and dissolves in water with a brown colour, which turns somewhat redder on adding sodium sulphide. The solution in concentrated sulphuric acid is violet-brown. The product gives dark brown shades on unmordanted cotton, which, by subsequent treatment with a mixture of copper sulphate and potassium chromate, are turned bronze.—T. A. L.

Black Colouring Matters directly dyeing Cotton, Manufacture of ——. C. D. Abel, London. From The Actiengesellschaft für Anilinfabrikation, Berlin, Germany. Eng. Pat. 12,076, June 9, 1899.

By treating quinonechlorimide with sodium "hyposulphite" (thiosulphate) and mineral acids (Eng. Pat. 10,775 of 1899; this Journal, 1900, 343) a black cotton dyestuff is obtained. The present specification is supplementary to this, the patentees now replacing the quinonechlorimide by certain of its derivatives, such as the halogen, carboxyl, sulphonic, nitro and amido compounds, or employing quinonedichlorimide or its derivatives. For example, the chloroquinonechlorimide obtained from 6 kilos. of chloro-*p*-amidophenol ($OH : Cl : NH_2 = 1 : 2 : 4$) is suspended in a concentrated solution of 20 kilos. of sodium thiosulphate. To this is then added 200 kilos. of dilute sulphuric acid (33 per cent. H_2SO_4), and the mixture is slowly heated to boiling. The black dyestuff which separates is purified by dissolving in sodium carbonate solution, filtering, and salting out. It gives deep black shades on unmordanted cotton.
—T. A. L.

Black Colouring Matters directly dyeing Cotton, Manufacture of ——. C. D. Abel, London. From The Actiengesellschaft für Anilinfabrikation, Berlin, Germany. Eng. Pat. 12,763, June 19, 1899.

According to Eng. Pat. 23,578 of 1893 (this Journal, 1894, 725), by treating *p*-amidophenol with sulphur and alkali sulphides, the so-called Vidal Black of commerce is produced. This dyestuff produces dark greenish shades on cotton, which by subsequent oxidation turn deep black. It has been further shown that on heating with sulphur and alkali sulphides, certain nitro-oxy derivatives of diphenylamine dyestuffs are produced, which give directly black shades on the fibre without requiring a subsequent oxidation (*cf.* Eng. Pat. 25,234 of 1897; this Journal, 1898, 1339). The patentees now find that if the quantities of sulphur and alkali sulphides are decreased below those given in the last-mentioned specification, a dyestuff is obtained, which, like Vidal Black, requires to be oxidised in order to fully develop the shade. The following example illustrates the invention:—10 kilos. of dinitro-oxydiphenylamine sulphonic acid obtained by the action of dinitrochlorobenzene on *p*-amidophenol-*o*-sulphonic acid, are stirred into 25 kilos. of sodium sulphide and 5 kilos. of sulphur heated to 110° C. The melt is gradually raised to 160° C. and kept at this temperature for one hour. The resulting product is dissolved in about 10 times its weight of water, and a current of air is passed through the solution until the separation of the black precipitate is complete, when it is filtered off and dried. It dissolves with a violet-black colour in hot water, and in presence of sodium sulphide with a bluish-black colour. It dyes cotton blue-black shades. The colour of the solution in concentrated sulphuric acid is violet.
—T. A. L.

Coloring Matters [Blue, Brown, Black], from β-Naphthoquinone and its Derivatives, Manufacture of New ——. G. B. Ellis, London. From The Chemische Fabrik von Heyden, Radebeul, Dresden, Saxony. Eng. Pat. 3265, Feb. 19, 1900.

The patentees heat β-naphthoquinone and its derivatives 1·2-dihydroxynaphthalene and dinaphthylquinhydrone with concentrated sulphuric acid preferably together with boric acid at 120°—230° C. The resulting melt is poured into water and the new dyestuffs obtained as neutral pastes or sodium salts give greenish-blue to brown shades on unmordanted wool and dark shades ranging to black on chromed wool or on fibres mordanted with aluminium, iron, or tin. For instance, 30 kilos. of β-naphthoquinone are stirred into 300 kilos. of sulphuric acid containing 5 per cent. of free SO_3. When completely dissolved, the solution is heated to 100° C. and 20 kilos. of boric acid are added, the temperature being raised to 130° C. The melt which is at first dark green, turns bluish and finally reddish-black, at the same time a copious evolution of sulphurous acid takes place. The process is complete in about 1 hour, when a sample, supersaturated with soda lye gives a clear bluish-green solution. The melt is then poured into water, filtered, and the separated dyestuff washed with cold water, dilute sodium carbonate solution, and finally with water until the wash liquors react neutral. The black colouring matter so obtained is slightly soluble in water, giving a brown solution. It differs from Naphthazarin in its colour reactions with sodium bicarbonate, sodium carbonate, soda lye and concentrated sulphuric acid, Naphthazarin giving respectively with these reagents violet-red, pure blue, pure blue and magenta red, whilst naphthoquinone black gives blue-black, greenish-blue, dark green, and blue-black solutions respectively.—T. A. L.

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Indigo and Substituted Indigos, Impts. in the Production of ——. G. B. Ellis, London. From The Chemische Fabrik von Heyden, Radebeul, Dresden, Saxony. Eng. Pat. 3730, Feb. 26, 1900.

ACCORDING to a statement in Eng. Pat. 6211 of 1898 (this Journal, 1899, 362) Indigo is obtained by heating the "ethers" of phenylglycin-*o*-carboxylic acid with acetic anhydride and subsequent treatment with alkalis and oxidising agents. This the patentees find is incorrect, and they have discovered that Indigo may be obtained by heating salts of the monethers of anthranilglycin having the formulæ $ROCOC_6H_4NHCH_2CO_2H$ and—

$$HOCO.C_6H_4NH.CH_2.CO_2R$$

with acetic anhydride and subsequent treatment of the product with alkalis and oxidising agents. For instance, 1 kilo. of the salt having the formula—

$$C_2H_5OCOC_6H_4NHCH_2CO_2Na \text{ or}$$
$$NaOCOC_6H_4NHCH_2CO_2C_2H_5$$

is cohobated with 5 kilos. of acetic anhydride until the evolution of carbonic acid has ceased. The acetic anhydride is distilled off *in vacuo* and the residue is dissolved in dilute soda lye (1:10). On passing air through the solution, Indigo separates out.—T. A. L.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Water absorbed by Textile Fibres in Steaming. A. Scheurer. Bull. Soc. Ind. de Mulhouse, 1900, 89—91.

THE method adopted by the author was as follows:—100 grms. of the textile fabric were suspended from the beam of a Dorian hygrometric balance in an ordinary steaming apparatus. After steaming for 15 minutes (and upwards) at 100° C., the sample was taken from the balance, dried at 100° C. and weighed. A special device for drying the material consisted in wrapping it around a copper drum, and covering it with two or three folds of any fabric to prevent cooling. After passing steam at ½ kilo. pressure through the drum for 15 minutes, the external covering was removed and the pattern wrapped upon itself, whilst still in contact with the hot metal surface, and placed in a weighed metal box.

The author found that, for each textile fibre, there was a fixed capacity of saturation, which remained rigidly constant under the same conditions for each fibre, as soon as equilibrium was once established.

The results are recorded below:—

	Per Cent. of Moisture.
White cotton absorbs	23·0
Raw linen absorbs	27·7
Raw jute absorbs	28·4
Bleached silk absorbs	36·5
Bleached and mordanted wool absorbs	50·0

—J. E. H.

The Conditioning of Wool. J. Persoz. Rev. Gén. des Mat. Col. 1900, **4**, [39], 81—82.

THE proportion of moisture in wool, which is legally adopted in France as the standard amount, namely, 18·25 per cent., is too high, the average amount being only about 13 per cent. This has brought about in France the practice of moistening wool before it is sold to the spinners. In consequence of the uneven distribution of the moisture thus introduced, and the rapid disappearance of a portion of it under ordinary conditions of storing, samples taken from the same bale of wool, and sent to different conditioning establishments, are frequently found to give discordant results. The remedy proposed is to adopt the old standard of about 13 per cent., as representing the average amount of moisture in wool fibre, adding 15 per cent. to the dry weight to give the weight of wool fibre with its normal amount of moisture.—E. B.

Artificial Silk Industry; Impts. in the ——. C. Süvern. Färber-Zeit. **11**, [7], 97—98.

C. H. STEARN states in his patent that the treatment of cellulose xanthogenate with alcohol or sodium chloride is not practicable, since the resulting threads remain sticky for a long time. This stickiness is avoided by a rapid passage first through a cold solution, and then through a boiling solution of ammonium chloride. By this after-treatment with ammonium chloride, the threads can be twisted and reeled off at once. The lustre of this so-called viscose silk is increased by treatment with a strong hot solution of sodium carbonate (or soap).

Pauly employs a 4·5 per cent. solution of cellulose, obtained by allowing cellulose to dissolve in an ammoniacal solution of copper oxide for eight days.

E. Bronnert obtains a stronger solution containing 12 per cent. of cellulose, in a shorter time, by grinding together sodium cellulose with the requisite amount of a copper salt, and dissolving in ammonia. Any increase of temperature must be avoided when grinding together the sodium cellulose and the copper salt. The same process is also patented by the Mulhouse Company.

Fremery and Urban facilitate the solution of cellulose in ammoniacal solution of copper oxide, by bleaching the cellulose for 12—18 hours in a 1·5 per cent. solution of bleaching powder. However, if the bleaching be carried too far, the solution of cellulose is no longer gelatinous, and no threads can be obtained from it. Also, it is to be noted that the conversion of cellulose into parchment by means of sulphuric acid or zinc chloride facilitates its solution in ammoniacal copper oxide.—J. E. H.

Sulphur [in Vulcanising]; Prevention of the Action of ——, *upon Textile Fabrics.* Gummi Zeit. **14**, [22], 410.

See under XIII. C., *page* 452.

PATENTS.

Proofing of Fabrics; Coating Mixtures for the ——, *and Machines used in their Application.* A. Camille, London. Eng. Pat. 7237, April 6, 1899.

THE waterproofing composition consists of 2 parts of coal tar, 1 part of rosin, and 1 part of plaster of Paris, with a small proportion of tallow to render the whole elastic and pliable; this is mixed together and used at about 130° C. After treatment, the fabric may be rendered fireproof by immersion in a bath containing 12 to 30 per cent. of ordinary sodium silicate solution and 4 to 12 per cent. of sodium tungstate. The apparatus employed in both cases consists of a jacketed rectangular box, fitted with adjustable tension rollers, guide rollers, and a scraper, &c., wherein the material under preparation is made to travel continuously through either coating mixture.—F. H. L.

Wool and Woollen Goods; A Process for Obtaining Soft and Unshrinkable ——. J. A. J. Florin and H. L. Lagache, Roubaix. Eng. Pat. 9044, April 29, 1899.

WOOL treated with chlorine becomes unshrinkable, but it also loses its elasticity, suppleness, and softness to the touch. The authors find that if such wool be treated with mineral salts of weak acids, all the properties are restored except the "unshrinkability," which remains unchanged. As an example, a bath containing 125 parts by weight of aluminium acetate 10° B., 2,500 parts of water and 100 parts wool, is employed.

After digesting for a short interval and washing, the wool at first retains its rough touch, but on exposure to the air its softness completely returns. Chlorinated wool has a great affinity for acids, which latter cannot be removed by washing; it is therefore advisable to digest the wool in a weak alkaline bath after chlorination.—C. M.

Mercerising Warp Yarns; Machinery for ——. J. F. Copley, Huddersfield. Eng. Pat. 9937, May 11, 1899.

A MACHINE in which the yarn is stretched either (1) before, (2) during, (3) after mercerisation, by passing it over nearly the whole circumference of "assisting rollers." These rollers are of larger diameter than the entering

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squeeze rollers, and revolve at the same speed, hence the fabric is stretched. It is finally passed through squeeze rollers of the same diameter as the assisting rollers.

—C. M.

Mercerising and otherwise Treating Hanks or Skeins under Tension; Machines for ——. L. Schreiner, Barmen-Ritterhausen. Eng. Pat. 6315, March 23, 1899.

THE various operations of mercerising and washing with several liquids are, in this machine, performed in one tank, the yarn being under tension between two rollers.

The tank is automatically filled and emptied of the various liquids by means of entrance and exit valves opening into the bottom. These are opened and closed automatically at the proper time by means of a driving shaft and cam-discs.—C. M.

Mercerising Hanks of Yarns; Machines for——. J. F. Copley, P. S. Marshall, and R. Heaton, Huddersfield. Eng. Pat. 10,936, May 25, 1899.

A MACHINE in which the hanks of yarn are automatically delivered on to the rollers, passed through a mercerising tank and one or more washing tanks, as may be necessary. Arrangements are also made whereby the yarn is stretched after mercerisation. (See also this Journal, 1898, 149, 240, 345, 452, 573, 756, 840, and 1141; 1899, 36, 136, 267, 490, 680, 911, and 1122; 1900, 43, 144, and 240).—C. M.

Dyeing, Drying, or otherwise Treating Yarns in the Hank; Apparatus for ——. J. H. Bolton, Colne, Lancashire. Eng. Pat. 11,278, May 30, 1899.

IN this machine the hanks of yarn are placed over removable transverse bars, situated between two parallel pairs of endless chains, which carry the yarn through dye-baths and washing tanks, and thence through squeeze rollers to the drying chambers heated with steam pipes.—C. M.

Wool; Apparatus for Degreasing and Scouring ——. M. A. Jacques, Salomé, France. Eng. Pat. 2847, Feb. 15, 1900.

THE wool is fed in the form of flocks on to a series of endless belts placed one above the other in a tank and revolving in opposite directions. The wool is carried through the solvent (sulphuric ether or petroleum spirit) in the opposite direction to which the latter is flowing.

The wool is collected in another vessel, and the excess of solvent driven out in a vacuum or by passing a current of hot water followed by hot air.—C. M.

Felted Materials; Manufacture and Production of New ——. J. T. Johnson, London. From A. Balada, Biella, Italy. Eng. Pat. 3119, Feb. 16, 1900.

THE vegetable fibres are prepared by the method given in Eng. Pat. 3118, 1900. These are mixed with "kemps" and refuse of hair, fur, or shavings of felted goods. These latter materials are improved by being first treated in a strong nitric and sulphuric acid bath, and then in a strong alkaline bath. They are mixed with vegetable fibres in the proportion of from 5 to 50 per cent.

In most preparations it is preferable to have the outer layers of pure felt made from animal fibres, and the mixture between them.—C. M.

Ramie or China Grass; Treatment of ——. B. H. Saillant, Paris. Eng. Pat. 9051, April 29, 1899.

THE ramie stalks are first scoured by treatment at 130° C. in a digester containing the following:—1 part by weight of sodium carbonate (90—92 per cent.); 1 part of caustic soda (70°—72° B.); 1 part by weight of sodium bisulphite (38° B.); 100 parts of water.

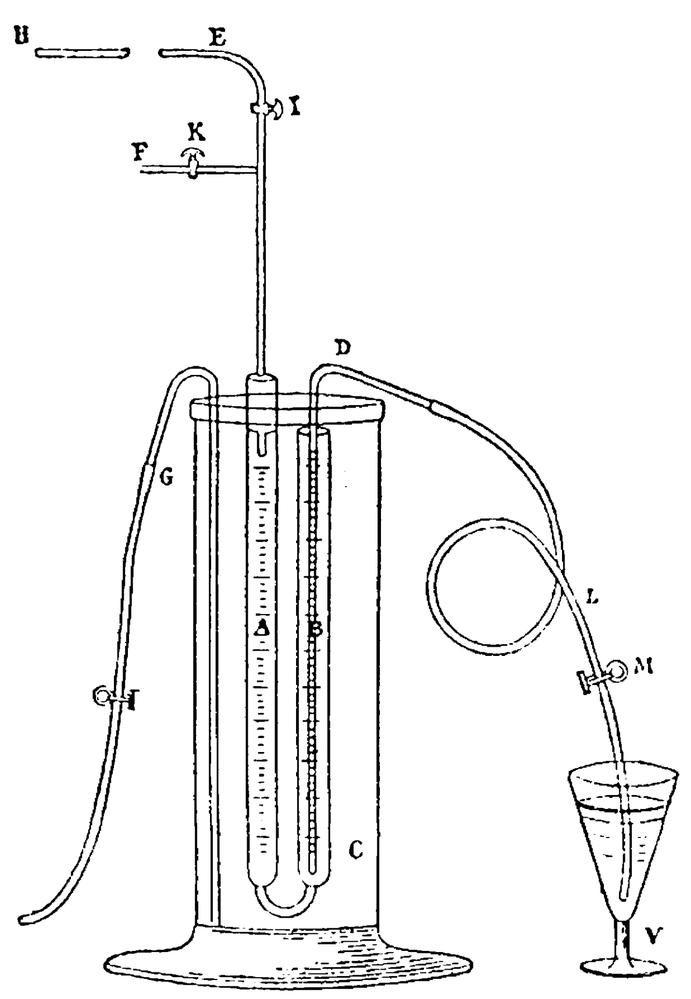
They are then heated in a second bath containing 1 per cent. of sodium bisulphite. The stalks are then stripped. For the ungumming, the following baths are employed:—Sulphuric acid (53° B.), 8 kilos.; hydrochloric acid (22° B.), 2 kilos.; water, 1,000 kilos. The strips are macerated in this bath for five hours and then digested at 144° C. in a bath containing: caustic soda (70°—72° B.), 12 kilos.; sodium carbonate (90°—90° B.), 12 kilos.; sodium bisulphite (38° B.), 6 kilos.; water, 1,000 kilos.

These operations are repeated until the grass is thoroughly ungummed. The latter bath is made from the former strong bath by suitable dilution. By using two vats as described in the patent, it is claimed that there is a reduction of from 50 to 60 per cent. in the consumption of chemicals and fuel.—C. M.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

Steaming Machines; Apparatus for Determining Air in ——. A. Scheurer. Rev. Gén. des Mat. Col. 1900, 4, [39], 83—85.

THE apparatus in question consists essentially of a U-tube into which a mixed atmosphere of steam and air is drawn, the former being condensed and the water produced being measured, along with the residual air.



APPARATUS FOR DETERMINING AIR IN STEAMING MACHINES.

A U-tube, 20 mm. in diameter, with graduated arms, is connected on one side A by means of a copper tube E, 1 mm. in internal diameter, with the steaming chamber, and on the other side B, through a siphon D L, with a graduated glass V. The apparatus is used in the following manner:—The arm A, which is stoppered, is filled with water, and the tap I being closed, the extremity H of the capillary tube is introduced into the steaming chamber through a small hole, fitted with a perforated cork. The tap K is opened while the arms A and B are filled to the zero marks, the siphon D L being also filled. M is next opened and the water in B is partly withdrawn into the graduated glass. On now opening I, the mixture of steam and air is aspirated into the capillary tube, which is surrounded by a condenser. In this the steam condenses, the water thus formed collecting in the U-tube, and from time to time being siphoned into V. The air drawn into the tube remains at the top of A, along with that which was present originally in the space between the zero mark and the stopper. After the aspiration has been continued until about 50 c.c. of water have been received, the tap I is closed, and the water in both arms is brought to the same level by opening the tap M and raising the graduated glass. The temperature of the water in C and the barometric pressure are taken and the volume of air obtained is observed. Finally the tap K is opened, the water is raised to the zero marks in the two arms by again moving the graduated glass, and the water left in the latter, when this has been done, is measured.

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As an example of the results obtained, 51 c.c. of water and 11 c.c. of air were collected, at a temperature of 20° C. and a pressure of 744 mm. These quantities correspond with 89 litres of steam and 14 c.c. of air at 99·6° C. The latter volume is calculated from the formula—

$$V^1 = V(1 + 0{\cdot}00367)\,(T - t)\,\frac{H}{H'}$$

where V^1 is the volume required at the temperature T and pressure H^1 in the steaming chamber (the steam in continuous steaming machines is under a slight pressure), V being the volume of air found at the temperature *t* and pressure H.

It is suggested that the expulsion of air from bleaching kiers may be controlled, and the best conditions of working ascertained, by the use of this apparatus.—E. B.

Indigo, fixation upon Tissues by means of Zinc Dust and the Acetone Bisulphite Compound. A. Pellizza. Bull. Soc. Ind. Mulhouse, 1900, 8 and 48—49.

THE bisulphite compound of acetone is readily decomposed in the presence of alkalis or acids on heating. A mixture of the bisulphite compound and zinc dust rapidly reduces indigo at high temperatures. The following is the constitution of the printing colour :—Artificial indigo 20, zinc dust 8 or 12; acetone bisulphite compound 40; thickening 32 or 28. After printing, steam until completely reduced, allow to oxidise in air or in running water and soap. Brighten by 0·5 per cent. caustic soda solution. An addition of 4 per cent. of sodium aluminate to the dyestuff accelerates the reduction. Small quantities of glue or gelatin deepen the shade.—A. C. W.

Tannic Acid; Caustic Soda as Discharge for ——. F. Binder. Bull. Soc. Ind. de Mulhouse, 1900, 93.

THE author introduced the method of discharging tannic acid by means of caustic soda in 1887.

He had easily obtained good results on a small scale in 1886 by using the chlorate and prussiate discharge originated by Jeanmaire. However, in practical working, the material was turned brown, owing to the effect of chlorine and gaseous chlorine compounds liberated on steaming, which latter also destroyed the brightness of the ultimate dyeing. Hence, the introduction of the caustic soda process, which offered no inconveniences of this kind.

Priority of this process is also claimed by Jeanmaire and Jaquet.—J. E. H.

Aniline Black with Lactic Acid. Goldovsky. Bull. Soc. Ind. de Mulhouse, Jan. 1900, 9.

THE author replaces tartaric acid with lactic acid and claims to produce blacks which are cheaper and do not weaken the fibre to such an extent.—J. E. H.

PATENTS.

Chromium Compounds; Development of Colours on Wool Fibre by ——. O. Imray, London. From Farbwerke vormals Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 12,614, June 16, 1899.

THE fastness to milling of azo colours developed on wool by chroming (Eng. Pat. 9371 of 1893; this Journal, 1894, 633) is greatly increased by performing the operation of chroming in the presence of reducing agents, such as lactic, tartaric, citric, and oxalic acids, tartar, bisulphites. To dye, for instance, a dark brown upon 50 kilos. of loose wool, a bath is prepared with about 150 litres of water, 7·5 kilos. of Glauber's salt, 1·5 kilos. of sulphuric acid, and 2 kilos. of Chrome Brown R O. The bath is heated to 40° C. before the wool is introduced and is then brought within half an hour to the boil, and boiled for an hour. It is then cooled a little, a solution of 2·5 kilos. of potassium bichromate, 1 kilo. of sulphuric acid, and 1·25 kilos. of lactic acid, is added, and the boiling is resumed and continued for an hour.

In some instances, it is preferable to prepare the dyebath with the dyestuff, acid, Glauber's salt, and potassium bichromate, and to add the reducing agent, along with an excess of a mineral acid, after dyeing at the boil for half an hour, that is when the lake-formation is nearly completed.

In other cases, for example with yarns, greater uniformity of dye is secured, when developing, by adding first the requisite quantity of alkali bichromate, and then, about 15 minutes later, the reducing agent and sulphuric acid. —E. B.

Paranitraniline Red; White Discharge of ——. Pellizza and Zuber. Bull. Soc. Ind. de Mulhouse, Jan. Meeting 1900, 8—9.

THE printing colour is made up with 44 parts of acetone bisulphite, 17 parts of zinc powder, and 39 parts of tragacanth water.

The fabric, previously dyed with Paranitraniline Red, is printed with the above paste, steamed for three minutes in moist steam, passed through hydrochloric acid (25 grms. per litre), and washed.

The discharge paste may be coloured with suitable dyestuffs; *e.g.*, a yellow discharge is obtained with Old Fustic extract and aluminium acetate.—J. E. H.

Paranitraniline Red and other Azo Compounds; White Discharge upon ——, by Means of Ketone or Aldehyde Bisulphite Compounds and Zinc Dust. A. Pellizza and L. Zuber. Bull. Soc. Ind. Mulhouse, 1900, 49—50.

THE use of zinc dust and sodium bisulphite as a discharge has many inconveniences. Long steaming is required; the zinc dust adheres to the roller; coloured discharges cannot be obtained. These defects are eliminated by the use of the bisulphite compounds of ketones and zinc dust. The reduction takes place only on steaming; there is no loss by oxidation in the air. The following proportions have given good results :—Dry acetone bisulphite compound, 44; zinc dust, 17; gum tragacanth thickening (60 grms. per litre), 39. Steam for two minutes in moist steam, wash in water, pass through hydrochloric acid (25 c.c. at 34° Tw., per litre), and wash thoroughly.

As an example of a coloured discharge, the following is given :—Acetone bisulphite compound, 43·5; zinc dust, 17·5; Fustic extract (55° Tw.), 13; aluminium acetate (21° Tw.), 13; gum tragacanth (60 grms. per litre), 13. Print, treat as before, without the acid bath.—A. C. W.

Paranitraniline Red and other Diazo Colours, Tin Salt Reserve under ——. The Brothers Koechlin. Bull. Soc. Ind. Mulhouse, 1900, 45.

THE fabric is prepared with an alkaline solution of a phenol; the design is printed upon this with a thickened mixture of tin salt and stannous oxide. The material is partially dried, then passed into the diazo solution, and cleared by weak acid and warm alkali, or soap, with or without sodium stannate.—A. C. W.

Paranitraniline Red: Tannic Acid as Resist for ——. Bull. Soc. Ind. Mulhouse, 1900, 94—102.

THIS article is a discussion concerning Rolffs' German patent, applied for March 17, 1898; completed Jan. 26, 1899; and opposed Feb. 14, 1899. Romann (Dec. 8, 1897) published a method whereby the property possessed by tannic acid, alone or in combination with basic dyestuffs, to resist Paranitraniline Red was specified. His process consists in printing unprepared cloth with tannic acid, alone or combined with basic dyestuffs, steaming, padding face of fabric with naphthol, and finally dyeing in diazo solution.

Langer, in a sealed packet deposited with the Soc. Ind. de Rouen and opened Jan. 1898, prepares the fabric with naphthol, prints on tannic acid, alone or combined with basic dyestuffs, steams, diazotises, and fixes with tartar emetic. J. Koechlin, in a sealed note, opened by the Soc. Ind. de Mulhouse, Jan. 1898, describes a process which is similar to Romann's, except that he pads both sides of the fabric with naphthol.

Rolff and Co. applied for a patent on March 17, 1898, for a process which it is affirmed is essentially the same as that of Langer.

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The chief points of Rolffs' patent are (i) that basic dyestuffs can be printed on naphthol-prepared cloth without the aid of a stannous salt; (ii) that very short steaming, or no steaming, is required to fix the dyestuffs combined with tannic acid; (iii) that a full padding with naphthol is necessary before printing; (iv) that the fixation with tartar emetic is performed last of all.

Opposition has been taken towards Rolffs' patent on the basis of Romann's method both by Schlieper and Baum, and the Soc. Ind. de Mulhouse, since the processes of Langer and Koechlin were published after the date of the application.

Schlieper and Baum state that the action of tannic acid (without stannous oxide) to produce resists on azo-ground, and the fixation with tartar emetic, are both well known.

Nevertheless, this opposition has been rejected by the Patent Office, because it considers Rolff and Co. were the first to demonstrate the possibility of printing basic dyestuffs on a naphthol ground, and to obtain coloured discharges without the aid of a reducing agent; further, since the succession of operations is especially insisted upon, the Patent Office declines to admit that the employment of tartar emetic as a fixing agent for basic dyestuffs combined with tannic acid is a fatal objection.

The opposition of the Soc. Ind. de Mulhouse rests on their contention that Rolffs' process is almost exactly a repetition of the old process for producing coloured discharges upon an azo-ground. The following are the operations as carried out in the old method :—

(i) Preparation of the fabric with β-naphthol.

(ii) Printing of basic dyestuffs along with tannic acid and stannous chloride.

(iii) Diazotising (with or without previous drying at raised temperature).

(iv) Finishing, *i.e.* washing, soaping (may be omitted), drying.

The serious defects inherent in this method are well known. The premature formation of stannous stannate in the printing colour itself, causes bad fixation of the dyestuff on the fabric, and hence the material does not resist soaping. Romann avoided these defects by the employment of tannic acid instead of stannous chloride, before the date of application for Rolffs' patent.

Indeed, except that Rolff and Co. have replaced stannous chloride in the old process by tannic acid, they have not changed the manipulation and the order of the operations.

Moreover, in the old method, the fixation with tartar emetic was quite superfluous, since the tannic acid lake was already saturated with a metal, *viz.* tin.

Consequently, with the substitution of tannic acid for stannous chloride, the treatment with tartar emetic was self-evident. Hence, the Soc. Ind. de Mulhouse ask that Rolffs' patent be entirely annulled.—J. E. H.

Sulphur Dyestuffs; Note on the Tendering of Cotton by ——. Dr. Chapius. J. Soc. Dyers and Colourists, **16**, [4], 84—88.

The tendering of cotton dyed by sulphur dyestuffs is due to several causes :—

(i.) The presence of sulphur in the free state or partially oxidised, which is deposited on the fibre during the dyeing or fixing process.

The tendering in this case depends on the rapidity of oxidation of the sulphur (into sulphuric acid), on the agencies, *e.g.* heat and moisture, which favour such oxidation, and on the amount of deleterious products formed in the fibre.

(ii.) The drying and calendering at too high a temperature, which should not exceed 104° C.

(iii.) The insufficient washing after fixation of the dyestuff with potassium bichromate and sulphuric acid, or with copper sulphate.

(iv.) Too energetic oxidation in the fixing process with potassium bichromate and sulphuric acid.

The following remedies are suggested :—

(i.) After fixing the dyestuff, wash the goods thoroughly, and for greater safety pass through a weak solution of soda or Turkey-red oil which is strong enough to neutralise the acid used in fixing, but insufficient to modify the shade.

(ii.) Wash the goods well immediately after dyeing, adding a little soda or sodium sulphide so as to keep the goods slightly alkaline.

(iii.) Avoid the use of sulphuric acid, or acid metallic salts containing sulphuric acid, in the dyeing or fixing process. Instead of the usual fixing agents, employ cupric chloride. The great drawback to the use of copper salts is that the shades are too green.

However, St. Denis Black does not exhibit this drawback with cupric chloride.

In conclusion, the author recommends St. Denis Black as being safer to use than Vidal Black, since it contains no free sulphur.

St. Denis Black can be fixed with cupric chloride or a mixture of copper sulphate and potassium bichromate, so that it will not bleed even white mercerised yarn when boiled with a strong soap solution.

St. Denis Black is clean to use, and does not form a thick scum on the surface of the dye liquor.

It has also the great advantage that it does not acquire a bronze lustre when dried.—J. E. H.

Azo Dyestuffs; Stannous Chloride Resist for ——. F. Binder. Bull. Soc. Ind. Mulhouse, 1900, 92.

As a consequence of the decision of the chemical committee of the above Society to publish the sealed packet deposited by Koechlin Brothers in October 17, 1888, the author deems it convenient to review the question of the origin of the resist process with stannous chloride.

The reaction appears to have originated with V. Meyer and T. Lecco (Ber. 1883, **16**, 2976) in a note on the preparation of phenylhydrazine. It was further developed by E. Fischer (Ber. 1884, **17**, 575; this Journal, 1884, 331), who found that stannous chloride gave good results every time that hydrazines were formed the hydrochlorides of which were slightly soluble.

The author applied the above reaction on July 24, 1888, in the case of the α- and β-diazo compounds of naphthalene.

—J. E. H.

Blood Albumin; A Method for Decolorising ——. F. Oswald. Bull. Soc. Ind. Mulhouse, 1900, 8; 45—47.

Blood albumin is always more or less coloured by foreign matters derived from the blood itself. This coloration, if dark, is a disadvantage, since it considerably dulls the shades. The coloured matters of the blood do not offer much resistance to chemical reagents, but the use of the latter is difficult, because most of them coagulate the albumin. On this account, too, heat must be avoided in any chemical action utilised. A method is described by which an oxidising agent is added to the printing colour, which has no action in the cold, but only acts on steaming. By this means the darkest albumins retain only a slight yellowish tinge after steaming. A mixture of potassium or sodium chlorate and red prussiate appears to give the best results; this mixture, in the necessary proportion, is without action upon the ordinary pigment colours, such as ultramarine, chrome yellow and orange, Guignet's green, ochre, Prussian blue, or lampblack. About 1 kilo. of potassium chlorate and 100 grms. of potassium ferricyanide are required for 4—5 kilos. of very dark albumin; these quantities may be diminished for paler samples. The decolorisation is not complete. The products of decomposition of the colouring matters are yellow, and alter injuriously the shades of colours into which yellow does not enter; *e.g.*, ultramarine acquires a greenish shade. But for other pigment colours, blood albumin may be used. Thus, no difference could be detected between two chrome yellows, one fixed with egg albumin and the other with blood albumin. In the case of chrome yellow and orange, the oxidising agent has the advantage of preventing the blackening which occurs on steaming. For practical purposes an addition of 50 grms. of chlorate and 5 grms. of prussiate per litre of colour is sufficient to give the finest yellows. Generally speaking, the colours containing chlorate and prussiate do not keep long, the chlorate decomposing. But the chlorate can be replaced by a fresh quantity, say one half of the original, after the colour has stood for two or three days.

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Chromic acid also destroys the albumin colouring matters, and thus dark-coloured albumins may be used for Indigo discharge work.—A. C. W.

Arsenical Wall-Papers and Mould Fungi. H. A. Schmidt. Zeits. für angew. Mikroskopie, 1899, 176.

The current opinion that the effect of moulds on hangings, or papers coloured by an arsenical pigment is to reduce the arsenic compound, and to set free arseniuretted hydrogen, is experimentally confirmed.

This reducing power is especially strong in four of the commonest mould-fungi, *viz.*, *Penicillium glaucum*, *Aspergillus flavus*, *Mucor mucedo*, and *Dematium pullulans*, but is possessed also to a lesser degree by nearly everyone of 24 species examined.

Formaldehyde in Calico Printing; Notes on Use of ——. W. E. Kay.

See page 422.

PATENT.

Mercerising, Dyeing, Warping, Beaming, and similarly Treating Yarns. G. Kershaw and A. Seeley, Rochdale. Eng. Pat. 6769, March 29, 1899.

The object of this invention is to mercerise under tension (and, if desired, to dye and dry) and to warp yarns at one continuous operation and in one combined machine.

A number of threads are passed simultaneously in a stretched condition over a system of rollers in a tank containing a concentrated solution of caustic soda, the stretching being produced by increasing the speed of revolution of the draw rollers, between which the threads successively pass. The threads are then drawn through water, dilute acid, &c., to a sectional warping machine.

A combination with the apparatus employed in mercerising, &c., and warping, of mechanism for stopping the operation when a thread breaks, is claimed.—E. B.

Printing Yarns such as are used in the Manufacture of Carpets; Apparatus for ——. A. F. Firth and A. O. Shaw, Brighouse, Yorks. Eng. Pat. 9174, May 2, 1899.

This invention applies to apparatus employed in the printing of carpet yarns by a method which consists in winding the yarns upon a drum and causing a disc revolving in a trough of colour to travel to and fro across the drum, and thus to print the yarns in transverse stripes. To avoid the formation of ridges of colour at the edges of the stripes, and to force the colours more evenly into the yarns, two rollers, supported by springs, are mounted at opposite ends of the trough-carriage in such a position that one of them follows the disc across the drum, and presses upon the printed parts.—E. B.

Indigo; Printing with ——, *and the Production of Indigo on the Fibre.* G. W. Johnson, London. From Kalle and Co., Biebrich-on-Rhine, Germany. Eng. Pat. 9250, May 2, 1899.

In connection with the process of producing Indigo on the fibre from "Indigo Salt," described in Eng. Pat. 7779 of 1899 (this Journal, 1900, 243), it is found that "clearer and more vigorous" impressions are obtained when the fabric is kept dry during the steaming process. This can be accomplished by heating the fabric before it comes into contact with the steam, using dry steam, and enclosing the steaming apparatus in a double jacket or employing an internal heater. The duration of the steaming is from 5 to 30 minutes, according to the depth of shade required; but a prolonged steaming, such as is necessary to fix alizarin and basic coal-tar colours, is not injurious to the Indigo. Uniform results are obtained.

The method also gives good results, in the case of medium and dark shades, with natural and artificial Indigo. A mixture of finely-ground Indigo, caustic soda-lye, and a thickening agent is printed. For example, 30 kilos. of Indigo are ground for two days with 50 litres of water. The paste is made up to 100 kilos. with water, and mixed with 50 kilos. of caustic soda-lye at 45° B. 500 grms. of this mixture are gradually stirred into 2,500 grms. of British gum thickening (1 : 1), then 1,600 grms. of water and 5,400 grms. of caustic soda-lye at 45° B. are added, while the mixture is cooled. The fabric is printed with this colour, dried, and steamed without access of air, as described, and is then washed, soured, and washed again. —E. B.

Decorative Fabrics for Use as Wall-hangings and the like, Manufacture of ——. L. Preaubert, Nantes, France. Eng. Pat. 11,279, May 30, 1899.

Canvas of coarse texture, after being coated with paint or a very thin layer of tinfoil, attached by means of cement or varnish, is block-printed with size, cement, or varnish, upon which woollen flocks are then blown. Another portion of the design is then similarly printed with a second block and covered with flocks of another colour or shade.—E. B.

Dyeing Cotton; New Process for ——. H. E. Newton, London. From The Farbenfabriken vormals F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 13,578, June 30, 1899.

Cotton fabrics are prepared for dyeing with direct cotton dyestuffs by passing them through a solution of caustic alkali, of a concentration insufficient to mercerise them, the excess of alkali being removed by rinsing. The fabrics thus treated become dyed deep shades during a single passage through a dye-bath in the continuous manner. As an example, the fabrics are passed successively through four tanks fitted with rollers. The first of these contains a solution of caustic soda at 12° B., the second contains apparatus for rinsing, the third the boiling dye-bath, for instance, 8 kilos. of Direct Deep Black G and 35 kilos. of Glauber's salt, dissolved in 900 litres of water, the fourth tank serving for rinsing. A deep black is obtained.—E. B.

Dyeing or Colouring, Impregnation, and like Treatment of Paper; Apparatus for Use in the ——. L. Holub, Freiheit, Bohemia. Eng. Pat. 20,344, Oct. 10, 1899.

Two doctors are placed a little distance apart above the upper cylinder of a two-cylinder mangle, one doctor with its edge in contact with the cylinder, the other adjustable in regard to its distance from the latter. Colour is supplied from an overhead receptacle to the space between the doctors, and is allowed to flow in regulated amount over the cylinder below, which conveys it to the sheet of paper as it passes in the wet state upon an endless felt band between the cylinders.

The apparatus may also be adapted for use in connection with "dry cylinders," that is, three-cylinder machines, through which the paper is passed in an almost dry condition, and for the colouring of finished and dried paper.—E. B.

Bleaching, Dyeing, Mercerising, Steaming, and like Treatment of the Material Wound in Slubbing and Roving Machines, and the Subsequent Spinning of the Same; Impts. in ——. R. Brandts, München-Gladbach, Germany. Eng. Pat. 459, Jan. 8, 1900.

Textile materials in the form of slubbing or roving are wound upon separable casings placed over the bobbin bodies in a slubbing or roving machine, in a manner similar to that adopted in the case of cross-spooling machines, and are then bleached, mercerised, &c. The casings, with the materials still upon them, are afterwards replaced upon the bobbin bodies and the manufacture of the yarn continued. —E. B.

VII.—ACIDS, ALKALIS, AND SALTS.

Seleniferous Sulphuric Acid. Schlagdenhauffen and Pagel. J. Pharm. Chim. 1900, **11**, [6], 261—262.

In preparing pure hydrochloric acid from common salt and pure sulphuric acid, the authors noticed a red coloration in the wash water. After a time, a precipitate appeared, which redissolved; a current of sulphurous acid then gave a brick-red precipitate. Many samples of so-called pure sulphuric acid were found to give this precipitate of selenium. As a test for selenium in sulphuric acid, the

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coloration with codeïne is recommended: 4—5 drops of acid are poured over a fragment of the alkaloid; a green coloration appears in a few minutes in the cold, changing to bluish-green on the water-bath. The reaction is of the same order of delicacy as that for nitric acid with brucine. —A. C. W.

Boric Acid; Preparation of ——. Ger. Pat. 110,421, Sept. 22, 1899. Chenal Douilhet and Co. Zeits. angew. Chem. 1900, [13], 326.

The method is based on the reaction that occurs when ammonium chloride is boiled with the borate of an alkali or alkaline earth, ammonia and boric acid being liberated, which reaction is complete provided the solution be sufficiently dilute. The extreme dilution necessary being, however, impracticable, the same object is attained by drawing off portions of the liquor from time to time, freeing them from boric acid by crystallisation, and then returning them to the bulk; thus keeping the amount of boric acid in the main liquor always below the critical point at which a reversal of the said reaction would occur. In this manner it is claimed that 98—99 per cent. of the total boric acid present in combination can be recovered, in place of the 60—70 per cent. obtainable in the ordinary manner. The reaction is facilitated by using calcined borates.—C. S.

Nitric Acid Process; Lyte and Lunge's ——. J. L. F. Vogel. Eng. and Mining J., April 7, 1900, 408—410.

G. Lunge and F. Maxwell Lyte have devised a process which consists in heating together sodium nitrate and oxide of iron in a mixed current of steam and air. The nitric acid was thus expelled in the form of oxides of nitrogen, which, by contact with water, could be converted into nitric acid, a compound being left behind, termed ferrite of soda, which on treatment with boiling water, yields a solution of caustic soda, and leaves undissolved ferric oxide, which can be used again. The various forms of experimental plant and apparatus employed are described. Chili nitrate of soda and highly calcined "blue billy" were the forms of raw material employed. The latter, of course, contained a small percentage of sulphur, and this ultimately appeared as sodium sulphate among the sodium salts yielded. In the latest and most improved form of experimental plant tried, the sodium salts obtained, expressed in percentages, were 92·0 per cent. of NaOH, 1·7 per cent. of $NaNO_3$, and 6·3 per cent. of Na_2SO_4. The author is of opinion that it is as yet too soon to arrive at a definite decision as to the real merits of the process, since the rate of wear and tear of machinery and plant needs as yet to be determined. Also, the success of the recovery of the nitric acid, as an economic process, has not yet been placed beyond doubt. The author concludes: "It seems probable, however, that the difficulties can be overcome."

Chlorine; Reactions occurring in the Production of —— by means of Manganese Peroxide. L. Wacker. Chem. Zeit. 1900, **24**, [27], 285.

The following facts are brought forward as evidence of the correctness of the view that manganese tetrachloride is formed as an intermediate product, which on raising the temperature is decomposed into chlorine and manganese dichloride: When crystalline manganese dichloride is dissolved in concentrated hydrochloric acid, the solution cooled in ice, and a current of chlorine passed through, the liquid becomes continually darker with the absorption of the gas; and when the dark brown solution, obtained after several hours' treatment, is poured into a large volume of hot water, brown flakes of manganese peroxide (hydroxide) are immediately deposited.—C. A. M.

Silicates; Action of Calcium Chloride upon ——. A. Tixier. Monit. Scient. 1900, April, 218—221.

If a silicate be heated to redness with calcium chloride in a current of air, a disengagement of chlorine takes place, or if water vapour be present, hydrochloric acid is produced. The author has made a series of experiments upon the reaction with pure alumina, lepidolite, kaolin, petalite, artificially prepared silicate of alumina, and various descriptions of sand. The extent of the reaction depends essentially upon the composition of the silicate and the proportion of calcium chloride used. Other conditions being the same, the quantity of chlorine liberated is greater when the silicate is rich in silica and poor in alkalis and alumina. The maximum result was obtained by the use of pure silica, when 96 per cent. of the chlorine was disengaged, 90 per cent. of which was liberated in the free state and 10 per cent. in the form of hydrochloric acid. From the point of view of the production of chlorine, the use of silicate of alumina is not advantageous. The reaction furnishes a most economical method for the extraction of alkalis from silicates containing them. The conditions necessary vary with the composition of the silicate, but these can be easily determined by a few preliminary laboratory experiments. The alkali chlorides, together with the slight excess of calcium chloride, can be dissolved out by water, and the residue, which consists of aluminium and calcium silicate, is then easily attacked by hydrochloric acid, with separation of gelatinous silica. On evaporating the solution, drying the residue at 300° C. in a current of air and washing with water, a very pure alumina is left, which is very suitable for the manufacture of aluminium and its compounds. Finally, the calcium chloride can be used over again for the treatment of a fresh quantity of silicate, or can be utilised in conjunction with the silica obtained, for the preparation of chlorine gas.—H. H. B. S.

Chromium; New Method of Preparation of Double Sulphates of——. C. Pagel. Comptes Rend. **130**, [15], 1030—1032.

In using a mixture of sulphuric acid with common salt and potassium bichromate for the destruction of certain organic matters, the author found that the residue, red when hot and green when cold, yielded two sets of microscopic crystals when broken up by water, one consisting of hexagonal plates, the other of prisms. When instead of common salt, potassium chloride was used, the hexagonal plates only were obtained; and when with common salt sodium bichromate was used, the prisms only were obtained. By their optical characters these prisms were shown to belong to the hexagonal system; and their analysis agreed with the formula $Cr_2(SO_4)_3.3Na_2SO_4$. The same salt was prepared by Klobb's process of melting together sodium hydrogen sulphate, ammonium sulphate, and chromium sulphate; this yielded it in fine needles, having, however, the same optical properties as the hexagonal prisms obtained by the other method.—J. T. D.

Chlorates, Decomposition of ——. *Part II. Lead Chlorate.* W. H. Sodeau. Proc. Chem. Soc. **16**, [222], 88.

The slow decomposition of lead chlorate consists of two independent reactions: (1) $Pb(ClO_3)_2 = PbCl_2 + 3O_2$; (2) $Pb(ClO_3)_2 = PbO_2 + Cl_2 + 2O_2$, the latter having about seven times the velocity of the former. At the same time, the reaction $PbO_2 + Cl_2 + PbCl_2 + O_2$ proceeds to a greater or less extent according to the conditions, and may result in much of the chlorine being reabsorbed. The mechanism in rapid decomposition is probably similar, except that the higher temperature decomposes much of the peroxide giving oxychloride.

Alkali Chlorides; Some Electrolytic Processes for the Decomposition of ——. J. G. A. Rhodin.

See page 417.

Liquid Ammonia Solutions; Electrical Conductivity of—— E. C. Franklin and C. A. Kraus. Amer. Chem. J. 1900, **23**, [4], 277.

See under XXIV., *page* 474.

Chromates; Estimation of —— by Mercurous Nitrate. L. L. de Koninck. Bull. Assoc. Belge des Chim. **14**, [1], 23.

See under XXIII., *page* 470.

Sulphate and Chromate of Lead; Electrolytic Determination of ——. C. Marie. Comptes Rend. **130**, [15], 1032.

See under XXIII., *page* 470.

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Nitrate of Soda Industry in Chili. W. Newton.
See page 408.

PATENTS.

Caustic Alkalis and Alkaline Earths, and of Aluminates; Production of ——. F. Projahn, Duisburg, Prussia. Eng. Pat. 6790, March 29, 1899.

Sodium sulphate and powdered iron are heated together in about the proportions indicated by the following equation—$Na_2SO_4 + 3Fe = Na_2O + FeS + Fe_2O_3$. The fused product is lixiviated to obtain caustic soda, and the residue is treated according to known processes. The alkali sulphate may be mixed with alumina or with argillaceous earth, in which case an alkali aluminate is obtained. The first claim is "for the production of caustic alkalis, alkaline earths, and aluminates, in which sulphates are transformed into the caustic state by metals, without the employment of carbon for reduction, the sulphur of the sulphate combining (without necessitating the presence of a third substance, such, for instance, as lime) with the metal, to form a sulphide, and in the event of argillaceous substances being added, aluminates being formed."—E. S.

Sulphuretted Hydrogen; Desulphurisation of ——. H. W. Hemingway, Walthamstow, Essex. Eng. Pat. 9432, May 4, 1899.

One portion of the crude hydrogen sulphide evolved in the manufacture of ammonium sulphate from gas liquor or the like, is led into a furnace, and the sulphurous acid produced is scrubbed in a coke tower to the upper part of which ammonia is admitted. The surplus SO_2 passes on to a second tower, whilst the solution of ammonium sulphite is received in a tank to which a regulated stream of solution of ferrous sulphate is admitted. Ferrous sulphite and ammonium sulphate are thus formed, and the mixture is pumped up to an elevated tank, whence it is delivered into a third and higher coke tower, near the bottom of which the other reserved portion of hydrogen sulphide is admitted, after it has first traversed the second tower already referred to as receiving the excess sulphurous acid. In this third tower ferrous sulphide and free sulphur are deposited as solids, and solution of ammonium sulphate is run off from the bottom. In the second tower referred to some thionic acids are formed, which are drained into a receptacle charged with scrap iron, whereby ferrous sulphide and hydrogen sulphide are formed, and the gas is passed into circulation.
—E. S.

Copper Sulphate or other Metallic Sulphate [Electrolytic]; Process of Manufacturing ——. H. Palas and F. Cotta, both of Marseilles, France. Eng. Pat. 9806, May 9, 1899. (Under Internat. Convent.)

A solution of sodium or potassium sulphate, of about 25° B. and at a temperature of 70° C., is placed in one compartment of an electrolysing apparatus, in which is arranged a plate of iron or other metal, not attackable by caustic alkali, as cathode. In the other compartment a solution of cupric sulphate, for instance, is introduced, at "a density and temperature corresponding with the greatest electrical conductivity," and a plate of the metal "to be transformed" (in this case copper), is arranged as anode. "If there be set up between the two electrodes a difference in potential of 2·5 to 3 volts, according to the resistance of the bath," caustic alkali is formed in the cathode compartment, and the copper sulphate solution is enriched at the expense of the copper anode. If the anode be of other metal than copper, the solution in that compartment is the sulphate of the metal used as anode. The fourth claim is for "the extraction of copper directly in the state of sulphate from the residues of copper pyrites, with the obtaining of an alkali as a sub-product" by the means described.—E. S.

Sulphuric Acid; Means to be employed in the Manufacture of ——. A. Clemm, Mannheim, Germany. Eng. Pat. 15,151, July 22, 1899.

Dry sulphurous acid, mixed with oxygen or air, is passed over red-hot copper sulphate, as contact material, to obtain sulphuric acid. It is preferred to mix crystallised cupric sulphate with moist, unbaked clay to form a stiff paste, which is moulded into convenient forms and heated, whereby a very porous material is produced, suitable for the purpose of the invention. Gypsum may be substituted for clay in the preparation of the contact material.—E. S.

Sulphates and Chlorine; Manufacture of ——. A. Clemm, Mannheim, Germany. Eng. Pat. 15,152, July 22, 1899.

Anhydrous sulphurous acid with dried oxygen or air are passed over a heated chloride or chlorides to obtain chlorine and a sulphate. Sulphuric anhydride may be substituted for the sulphurous acid. The chloride may be mixed with clay or the like, and then dried before subjecting it to the process; or metallic oxides, such as copper oxide, ferric oxide, or the like, or sulphates, as blue or green vitriol, may be used with the clay to diminish fusibility and act as contact material.—E. S.

Volatile Liquids; Apparatus for the Manufacture of ——, and the Production of Mechanical Energy. C. Joly, London. Eng. Pat. 17,692, Sept. 1, 1899.

A system and apparatus for the manufacture of volatile liquids (liquefied gases), in which "the heat produced by the compression of gases is absorbed by the atmosphere, or any cooling medium, so that the expansion of a part of the compressed gas in an unfreezable brine, contained in an insulated vessel and surrounding the rest of the compressed gas, will produce enough cold to force the rest of the compressed gas to liquefy, this liquefaction being automatic and self-effected through a pressure-maintenance valve." Mention is also made of the adaptation of the system to "perpetual motors."—R. A.

Hydrogen Gas; Decomposition and Formation of Metallic Chlorides in the Manufacture of ——. H. K. Hess, Philadelphia, U.S.A. Eng. Pat. 3514, Feb. 22, 1900.

The process, as described in the sixth claim, consists in heating a metallic chloride (zinc chloride for instance) "by a body of carbon in contact therewith and in a state of combustion, introducing steam into the carbon, subjecting the heated metallic chloride to the action of hydrogen liberated from the steam for forming hydrochloric acid, and releasing the metal of the chloride, and finally uniting said acid and released metal, and forming a metallic chloride and hydrogen." The furnace has supported in its upper part, over the fuel, so as to be axially movable, a graphite pot into which is discharged zinc chloride solution, forced up from a vessel below by a force-pump. As the liquid is heated, the steam is taken through a cooling pipe to a receptacle or condenser, having an opening above, to the chimney, and a valved opening below leading to the lower vessel. When the chloride is dried and fused, the pot is inverted so that the chloride streams into the ignited coke below, while, lower in the furnace, steam and air are admitted. The hydrochloric acid gas formed, passes, like the steam before it, into the receptacle referred to, where it is condensed, and flows into the lower vessel, which also receives the metallic zinc set free in the furnace. This metal flows through the fuel into a pipe leading to that lower vessel, wherein the acid acting upon it re-forms zinc chloride, hydrogen being liberated, which is taken off for storage. The zinc chloride solution, thus recovered, is then ready to be forced into the furnace for a renewal of the process.—E. S.

VIII.—GLASS, POTTERY, ENAMELS.

Glass and Allied Products; Constitution of ——. K. Zulkowski. Chem. Ind. **23**, [6], 108—114.

In a previous communication (this Journal, 1899, 760) the author dealt with the constitution of certain silicates and aluminates. He now carries the inquiry into the domain of the analogous compounds of boric, stannic, and phosphoric acids. On fusion with excess of potassium carbonate, boric acid shows a decided tendency to form metaborate, thus:—

$$B_2O_3 + nK_2CO_3 = KO.B.O.O.B.OK + (n-1)K_2CO_3,$$

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which supports the view that in simple boric acid glasses only polymeta-boric acid compounds exist. In the case of silicate glasses containing boric acid, it is, however, quite uncertain whether each acid forms a compound for itself or not. Stannic acid fused with potassium carbonate produces insoluble potassium dimetastannate:—

$$2SnO_2 + K_2CO_3 = KO.SnO.O.SnO.OK + CO_2.$$

With sodium carbonate it produces ordinary sodium meta-stannate, $SnO(ONa)_2$ soluble in water, and a simple meta-stannate is also produced on fusion with a mixture of sodium and potassium carbonates. The author considers it probable that the relative proportion of the acid to the base is governed largely by the temperature at which fusion takes place. Referring to the production of phosphate milk-glass, the author ascribes the cause of the opalescence to the difficult solubility of phosphate glasses in molten silicate glass, especially when the temperature of fusion is comparatively low. This view is opposed to that of Inwald, who considers that the calcium phosphate dissolves as such in molten glass and separates out unchanged on cooling. The author further discusses the nature of the "fining" process in glass manufacture and expresses the opinion that a chemical as well as a mechanical action occurs, that, in fact, the formation of the glass takes place in two stages, the first resulting in the production of simple silicates, and the second or "fining" stage, at the higher temperature, in the formation of a double compound.—H. H. B. S.

Bottle-Glass; Composition of. C. Dralle. Chem. Zeit. 1900, **24**, [30], 323—328.

It has been assumed by Zulkowski (Chem. Ind. 1899, **22**, 280; this Journal, 1899, **18**, 760) that the production of good serviceable glass depends upon the relation of the acids to the bases being such as to form approximately a trimeta-silicate, and he has proposed, as a convenient means of expressing this relation, to divide the quantity of the bases in molecules by that of the acids (including as such the alumina) also in molecules, and to call the quotient thus obtained the "degree of saturation." Assuming normal glass to be a trimeta-silicate, its degree of saturation found in this way would be 0·333. The author sought to verify Zulkowski's assumption by applying the test to the analyses of a large number of bottle glasses. The results, however, were not confirmatory, it being found that the degree of saturation of glass of good quality varies between 0·333 and 0·5. The author also points out that in a number of cases glass of good quality was found to contain magnesia, which is opposed to one of the principles laid down by Zulkowski, *viz.*, that besides alkalis, only an alkaline earth is permissible.

—H. H. B. S.

Lead; Solubility of the ——, contained in the Glaze of Stoneware. F. Garelli. Giorn. Farm. Trieste. 1899, **4**, 331.

The author examined a number of earthenware cooking vessels, and found that the majority of them had a glaze from which lead could be extracted by 15 minutes' boiling with 4 per cent. acetic acid. The quantity of lead dissolved varied from 1 to 106 mgrms. per square decimetre.—J. F. B.

PATENTS.

Ceramic Material. H. Werner. Stadtlengsfeld (Thuringia), Germany. Eng. Pat. 1931, Jan. 30, 1900.

A ceramic material of great strength, low specific gravity, low conductivity as to sound and heat, and possessing a natural glaze when fired, is prepared by the inventor by incorporating 0.5 to 45 per cent. of ground basalt—with or without an addition of quartz—along with refractory earth, and firing the mixture in a kiln, the lustre and colour of the glaze-like surface of the material varying with the proportion of basalt and the kiln temperature employed.

—C. S.

Glass from Tanks to Moulds; Measuring and Delivering Molten ——. C. E. Blue, Wheeling, U.S.A. Eng. Pat. 3547, Feb. 22, 1900.

The inventor claims a method of dipping and delivering a predetermined quantity of glass and forming the measured glass into a finished article, by chilling the surface of the glass so as to produce a non-adhering film surrounding the compact mass of glass, cutting off this portion from the bulk, separating it, and forming it into a finished article whilst still in a plastic state.—C. S.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

PATENTS.

Artificial Stone; Process and Apparatus for the Manufacture of ——. E. Coulon, Blaton, Belgium. Eng. Pat. 5603, March 15, 1899.

The raw materials used are lime and sand, or the like, which are reduced to an impalpable powder, well mixed, and filled in the dry state into moulds. The moulds are constructed in the form of trucks, so that they can be run into a digester. In this they are submerged in water at a temperature of 140°—150° C. for six hours, whilst at the same time an electric current is passed through the mixture with the object of promoting chemical action. Owing to the expansion of the mixture during setting, there is a tendency for the blocks to adhere to the walls of the mould, and to obviate this and facilitate their removal, the moulds are constructed with an outer and an inner casing, the latter with movable walls, the space between the two being packed with sand.—H. H. B. S.

Marble; Manufacture of Artificial or Cast ——. J. Gernaert, Brussels. Eng. Pat. 9360, May 3, 1899.

In the manufacture of artificial marble, the veining is effected during casting by a regulation of the fusion of the different substances brought together, so that the fluidity of some of the substances may be complete, whilst that of others of them is incomplete.—H. H. B. S.

Bricks, Artificial Stone, and the like; Improved Drying Chamber for the Hardening of ——. H. Alexander, Leeds. Eng. Pat. 9441, May 4, 1899.

The chamber is constructed so as to be capable of withstanding a pressure of 100—200 lb. per sq. in., and is of such a size that loaded trolleys can be run into it. Within it are (*a*) a series of pipes for the circulation of hot water, steam, or hot air, and (*b*) a perforated pipe or series of pipes for the supply of high pressure steam. In using the apparatus, the blocks are first submitted to a gentle heat, which is afterwards gradually increased, and as soon as the drying action has proceeded far enough, they are subjected to the action of high pressure steam.—H. H. B. S.

Concrete and Artificial Stone for Building, Paving, and other purposes; Manufacture of ——. T. Rouse, Middlesex. Eng. Pat. 11,805, June 7, 1899.

The novelty consists in accelerating the hardening of concrete blocks by submitting them whilst still in the moulds and under pressure to the action of moist heat for several days.—H. H. B. S.

Slaking Lime and Drying Artificial Stones and the like Devices for ——. W. Olschewsky, Berlin. Eng. Pat. 1705, Jan. 26, 1900.

This invention relates to a special form of truck upon which the blocks of artificial stone are introduced into the drying oven. The body of the truck consists of a chamber into which steam can be admitted, and the cover of the chamber, which is in two halves movable upon hinges, constitutes the platform upon which the blocks are piled. The platform being heated by the steam, the blocks placed immediately upon it become sufficiently dry to enable them to bear the weight of the succeeding layers. The steam chamber is also

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utilised for slaking lime and for this purpose is provided with a stirring arrangement.—H. H. B. S.

Cements ; Manufacture of ——. J. Maloney, London. Eng. Pat. 8128, April 18, 1899.

DRIED chalk is saturated with a solution of alum, pearlash, and borax, after which it is burnt in an ordinary muffle kiln.—H. H. B. S.

Portland Cement ; Manufacture of ——. W. E. Hopps, Hull. Eng. Pat. 8210, April 19, 1899.

THE cement is manufactured from the following raw materials: 123 parts of dry chalk, 26 parts of sand, flint, or sandy clay, or mud; five parts of carbonate of soda, and four parts of gypsum, all ground to the condition of fine powder. The mixed ingredients are made up into bricks, and burnt and ground in the usual way. The use of these ingredients (*a*) gives the manufacturer a better control over the proportions of the chemical constituents, and (*b*) results in the production of a cement of better quality than that made from chalk and clay.—H. H. B. S.

Cement ; Manufacture of ——. W. A. O. Wuth, Pittsburgh, U.S.A. Eng. Pat. 2886, Feb. 13, 1900.

IN the manufacture of cement from basic slag, the slag is mixed with lime which has been slaked with water containing nitrate of soda, or other salt capable of acting as an oxidising agent at a high temperature. The deleterious sulphide of calcium present in the slag is thus oxidised and rendered harmless during the burning operation.

—H. H. B. S.

Mortars ; Manufacture of ——, *applicable also as Fireproof, Soundproof, or Non-conducting Compositions.* W. J. Chrystal, Rutherglen, county of Lanark. Eng. Pat. 11,078, May 27, 1899.

THE mortar is composed of equal parts of lime waste, vat or soap waste, and sand, ashes, or similar material. For boiler or pipe covering, any fibrous material may be added.

—H. H. B. S.

Fire-resisting and Heat Non-conducting Materials ; Manufacture of ——. H. R. Romney, Crouch End; J. Thame, Isleworth; and The Fibrous Materials Syndicate, Ltd., London. Eng. Pat. 6944, March 30, 1899.

THE composition consists of cocoa-nut husk refuse, materials of a fibrous character, such as paper, wood or rag pulp, or asbestos fibre, mica or similar material, magnesium silicate or carbonate, and in certain cases, sodium silicate. The sodium silicate may be used either as an ingredient of the composition itself, or it may be applied superficially to harden it. In the former case, hydrochloric or sulphuric acid is added to precipitate silica in the mass. The material may either be made in a moist state, moulded and dried, or it may be produced as a dry powder for making up as required.—H. H. B. S.

Wood ; Process for the Treatment of ——, for the Purpose of Hardening and Rendering the same Fire and Water Proof. S. Willner, London. Eng. Pat. 10,618, May 19, 1899.

THE wood is placed in an impregnating vessel, heated by steam or hot air, and gradually heated up to the boiling point of water, at which temperature it is maintained until thoroughly dry. The vessel is then hermetically closed, the air exhausted, and a boiling solution of tungstate of soda and gelatin injected in the form of spray, after which a pressure of 5—10 atmospheres is applied and maintained for some hours. The solution is then run off, the air again exhausted, and a spray of formic aldehyde injected, pressure being again applied and maintained for some hours as before. Finally the wood is allowed to slowly dry. Though tungstate of soda solution is preferred, it may be replaced by a solution of ammonia and soluble glass or mica.

—H. H. B. S.

Wood ; Treatment of ——, *with Solutions for Rendering it Non-flammable, and for other Purposes.* H. V. Simpson, London. Eng. Pat. 11,333, May 31, 1899.

THE wood is placed in a cylinder, the impregnating solution run in, and pressure applied for, say, 20 hours. In cases where this treatment is insufficient to effect complete impregnation, steam is blown through the solution in the cylinder, whilst at the same time an exhaust pump connected with the cylinder is put in operation. Either of the following three impregnating solutions may be used: (1) a solution of ammonium phosphate, ammonium sulphate and zinc sulphate; (2) a solution of ammonium sulphate, zinc sulphate, or of magnesia and boric acid; (3) a solution of ammonium phosphate, ammonium sulphate and magnesium sulphate. The effect of either of these solutions is to leave an insoluble salt in the wood on evaporation.—H. H. B. S.

Mineral Wool, also called "Slag Wool" and "Silicate Cotton" ; Manufacturing ——. A. D. Elbers, New Jersey, U.S.A. Under Internat. Conven. Eng. Pat. 11,544, June 2, 1899.

THIS invention relates to the production of "slag wool" free from sulphides, and consists in the addition of gypsum, or other sulphates of the alkaline earths, to the cupola charges, where the method of re-melting the hardened slag and then blowing it into wool is followed. The desulphurisation is due to the following reaction:—

$Ca(Mg, Fe)S + 3CaSO_4 = Ca(Mg, Fe)O + 3CaO + 4SO_2$.

The process can also be used to get rid of the sulphur introduced in the coke used as fuel in cases where the raw materials employed are of themselves free from sulphur.

—H. H. B. S.

Cork Waste and other Disintegrated or Fibrous Materials ; Manufacture of Sheets, Blocks and other Articles from ——. S. F. Ridley and G. and W. R. Whitley, London. Eng. Pat. 112, Jan. 2, 1900.

CORK waste (3,600 parts) is mixed with casein (190 parts), lime (15 parts), and water (500 parts), the mixture is subjected to hydraulic pressure of 6 kilos. per sq. cm., and afterwards heated to 100°—150° C. in order to harden the casein. The material thus produced is used for ships' lining plates, floorings, &c. For other uses, such as insulating material for electrical purposes, bath mats, bodies of emery wheels, golf balls, &c., the proportions of the ingredients and the pressure are varied.—L. A.

X.—METALLURGY.

Iron and Steel ; Contribution to the Solution Theory of ——. (*I.*) H. F. von Jüptner. Chem. Zeit. Rep. 1900, **24**, [8], 61. From Oesterr. Zeits. Berg- u. Hüttenw. 1900, **48**, 15, 29.

General Observations on the Solution Theory.—The author calculates the molecular weight of the dissolved carbon from the freezing-point curve of iron-carbon alloys. The size of the molecule is at a maximum between 1,200° and 1,225° C., diminishing as the temperature varies in either direction beyond these limits until it becomes constant between 1,270° and 1,600°, and below 1,130° C. Examination of the fusing-point curves of isomorphous mixtures in relation to the components of the solution, shows that the increase in the size of the molecule of the one component corresponds to a diminution in that of the other, so that there is a tendency to attain a mean molecular magnitude.

Observations on the Fusing-point Curves of pure Iron-Carbon Alloys.—The author regards Austenite as a solution of elementary carbon in iron, since graphite could not be separated out of any other solution, and Martensite as a partly dissociated solution of iron carbide in iron, the calculation of the molecular weight and the number of atoms in the molecule indicating that undecomposed carbide is present along with iron and free carbon. If in iron there is dissolved much carbon and little carbide the result is Austenite, if much carbide and little carbon it is Martensite. He considers that the free carbon, and the free iron in Austenite are present as ions, and that this may have

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some bearing on the varied magnetic and thermo-electric properties of iron alloys at different temperatures.

—W. G. M.

Iron and Steel; The Solution Theory of ——. H. F. von Jüptner. Oesterr. Zeits. Berg- u. Hüttenw. 1900, **48**, 46, 56, and 76.

Molecular Aggregates dissolved in Iron.—A recalescence point corresponds to the separation from solution of a particular ingredient; in simple alloys of iron free from carbon only one point is present in the recalescence curve, and it would seem possible to calculate the molecular weight of the compound or free metal separated. Phosphorus is supposed to occur in iron as Fe_3P, silicon as FeSi and Fe_2Si, tungsten as Fe_3W. Calculations were made with regard to a steel free from carbon containing 4 per cent. of silicon (crit. point 703° C.), a silicon steel poor in carbon (crit. point 730° C.), a phosphor-steel (crit. point 718° C.), and a tungsten steel (crit. point 718° C.).

The calculations showed that in the separation of Fe_3P and Fe_3W, α-iron also separated out. The following molecular weights were obtained:—For Fe_3C, 220 at 810° C.; 296·6 at 720°; 611·3 at 690°. For Fe_3W, 178·4 at 739° C.; for Fe_2Si, 699·5 at 730° and 1567·7 at 703°. For Fe_3P, 625·2 at 718° C.

The numbers of atoms in the molecule were—for Fe_3C, 4·89 at 810° C.; 6·85 at 720°; 13·58 at 690°. For Fe_2Si, 15·0 at 730° C.; 33·9 at 703°. For Fe_3P, 12·57 at 718°. For Fe_3W, 2·17 at 739° C.

The Colorimetric Method of Estimating Carbon in Steels.—The author attempts to correlate the results of the micrographic examination of steels with their behaviour on solution in nitric acid. Ferrite and the dissolved iron in martensite give colourless solutions with copious evolution of gas; an intensely black sediment may be due to the dissolved carbide or carbon ions in the martensite, whilst a flaky brown residue is probably a nitro-product of the cementite. Following the method of Howe, the author has drawn curves showing the correction to be made in estimating carbon by the colorimetric method. The error (loss of carbon) increases with the appearance of simpler carbides. Sauveur draws the conclusion from Hogg's work that this error is in constant proportion to the amount of carbon in the martensite; Stead supposes that in hardened steels all carbon over 0·8 per cent. is in the form of Fe_3C and produces the normal colour, whilst carbon in a less proportion than 0·8 per cent. has a colour value equal to only 0·33 per cent. of C. The estimation of "carbide carbon" is useful, but that of "hardening carbon" is only of value by comparison with a normal steel of similar hardness. Hardening carbon exists above the critical point as "martensite carbon," and below that point as "perlite carbon." The solutions of these two kinds of carbon have different colour values; the relation between the values of carbide, martensite, and perlite carbon is 10 : 8 : 5, combined carbon being represented by the number 9. The proportion may also be stated as 4 : 3 : 2.

Further tests have shown that annealed steel contains no martensite carbon, but carbide and perlite hardening carbon, while hardened steel, besides the carbon of the cementite, contains martensite hardening carbon. A portion of the iron carbide in perlite is soluble in the cold, in nitric acid (perlite hardening carbon), and the remainder dissolves when warmed to 80° C. (carbide carbon). It is remarkable that there is this connection between the colouring power and the degree of polymerisation of the several carbides, for the formulæ of the carbides are also as 4 : 3 : 2. The author proposes the terms bi-, tri-, and tetra- to indicate the form in which the carbon exists; there would then exist in martensite bi-carbon, in cementite bi-, tri-, and tetra-carbon, and in perlite tri- and tetra-carbon.—J. W. H.

Malleable Cast Iron; Annealing ——. H. M. Howe. Eng. and Mining J. 1900, **69**, [13], 382.

The author discusses a paper on this subject read by G. C. Davis at the March meeting of the Foundrymen's Association in the U.S.A.

The end reaction of the operation of annealing cast iron is the change of cementite, Fe_3C, to ferrite, which might be expected to lead to shrinkage rather than expansion, since ferrite is heavier than cementite. Davis, however, confirms the statement which has been repeatedly made that hard or white iron, in annealing, gains both in bulk and weight, notwithstanding the large loss of carbon; the increase in volume is greater than the increase in weight.

The author suggests that the increase in volume is due to the fact, that in the annealing the cementite is first decomposed into ferrite and "temper-graphite"; and that it is the liberation of the voluminous "temper-graphite" within the metal itself which causes the expansion. Another cause of expansion is put forward by Davis, *viz.*, that some of the iron of the packing is deoxidised by the carbon of the casting, or the carbonic oxide resulting from the action of the packing on the casting, and that the iron so reduced is welded to the casting. The gain in weight, which in some cases is as much as 6·76 per cent., is explained in this way. Davis also observed that a considerable amount of sulphur is absorbed during the annealing, in one case 0·035 per cent. This takes place almost entirely in the surface of the casting, the sulphur being probably derived from the "mill-scale" used for annealing the castings.—A. S.

Iron; Peculiar Silicious Efflorescence on Crude. B. F. Fackenthal. Trans. Amer. Inst. Min. Eng., Feb. 1900; Chem. Zeit. Rep. **24**, [11], 95.

The fractured surfaces of crude iron at the Durham (Bessemer) Furnace, Pennsylvania, appeared white and fibrous, though ordinarily consisting of small grains or globules, or irregularly formed thin plates. These parts proved on analysis to contain 94·87 per cent. of silica, with 0·98 per cent. of ferric oxide, 0·25 per cent. of manganic oxide, 0·95 per cent. of titanic oxide, 2·87 per cent. being loss on combustion (due to the presence of graphite). This composition indicates either free silica or some silicide. Microscopic examination of the iron also revealed cubic crystals of titanium carbide and hexagonal graphite scales. The amount of silica varied in different kinds of crude iron, but the graphite was nearly constant in all; the highest percentage of titanium was found in the softest iron.—C. S.

Cyanide Process [*Gold Extraction*]; *Oxygen in the* ——. W. Jones. Eng. and Mining J. 1900, **69**, [14], 404.

The writer confirms the statements which have been made as to the need, in certain cases, of the use of air or an oxidising agent in dissolving gold in potassium cyanide solution. It was shown by experiments, that with slimes which had been stored for some time, and contained organic matter which had undergone partial decomposition, or other oxidisable substances, such as sulphur, arsenic, &c., only a small percentage of the gold was dissolved by the cyanide solution alone, whilst if oxygen was supplied, either from air or potassium permanganate, the whole of the gold was very rapidly dissolved by the cyanide solution. Patents have been granted in the Transvaal for the method of forcing air to the bottom of the vats and allowing it to bubble up through the solution; and for a modification of this method, according to which the slimes are pumped from the bottom of the vat and thrown in at the top, whilst at the same time, air is drawn into the suction pipe.

When the ore does not contain oxidisable matter, the cyanide solution generally carries sufficient air with it.

—A. S.

Pulp Extractor; The Ayton Intermittent Thick ——. Eng. and Mining J. 1900, **69**, [15], 441.

A description is given of a new device for use in connection with pointed settling boxes, to recover the pulp coming from Chilian mills, stamps, &c., in a thickened condition and of a consistence suitable for pan amalgamation, or systems of ore treatment requiring a continuous supply of thick pulp or tailings.

The point of the settling box is provided with a valve, the movement of which is controlled by a lever held in position by means of a spring, and worked by the action of a cam. The extent of the valve opening and the frequency of the periods of discharge are regulated by

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adjusting devices. When the pulp has been allowed to settle or collect at the point of the box for a short period, the valve opens and a portion of the thick settled pulp escapes, the valve being closed again so quickly that the supernatant watery pulp does not reach the level of the discharge opening.

By this method of intermittent discharge, the advantages of a comparatively large opening and of a limited flow of water are combined, so that the "thickness" of the discharged pulp can be maintained, whilst the danger of obstruction of the pipes, and the disadvantage of a small opening under the "full head" of the settling box, which are attendant upon the use of a siphon discharge, are obviated.

At the Bote Reduction Works, Zacatecas, Mexico, 70—75 tons of ore are treated each day. The reduction of the ore is effected by six Chilian mills, 85—90 per cent. (by weight) of water being added. The thin pulp obtained is run into eight settling boxes, from which 78—87 per cent. of practically clear water is returned to the Chilian mills, whilst a continuous supply of pulp containing more than 50 per cent. of dry ore, is delivered from the pulp extractors to the pans.—A. S.

Gold; Electrical Precipitation of ——, on Amalgamated Plates. T. K. Rose. Inst. of Min. and Metall. April 25, 1900.

The author has carried out some experiments on the precipitation of gold from cyanide solutions upon mercury and upon amalgamated copper plates, with electrical currents of varying density. Starting with a current of 1·5 ampère per sq. ft. of cathode, it was found that a large proportion of the gold removed from solution was precipitated on the mercury in the form of a black powder which would not amalgamate except by the addition of sodium amalgam.

The powder was non-adherent and could be readily rubbed off with a feather, but was not easily removed by a jet of water. With a current of 0·30 ampère, about one-half of the reduced gold was amalgamated, and in the case of a copper plate being submerged in the mercury cathode bath, a part of this gold was passed on or driven by the current through the mercury, and was amalgamated with the copper.

As the current density was still further reduced, the proportion of black powder became less, until with a current of 0·04 ampère, only about 3 per cent. of the reduced gold was in this form. With 0·027 ampère the powder was only 0·22 per cent., whilst finally with 0·01 ampère per sq. ft., there was no apparent change of the cathode surface, no black film, and the whole of the gold reduced was amalgamated. Still lower currents gave a clear cathode and confirmed the conclusion that to obtain simultaneous precipitation and amalgamation, the current density must be low and probably not higher than 0·01 or 0·015 ampère per sq. ft. of cathode. With a 0·01 current, the plates kept in good condition during 24 hours, whilst $\frac{1}{2}$ oz. of gold per sq. yd. was deposited on them.

Further experiments as to the practicability of employing copper plates for the electrical deposition of gold from cyanide solutions, showed that the decomposition of the cyanide bath was greater with amalgamated copper electrodes than with electrodes consisting of iron anodes and lead cathodes, although, at the same time, more gold was deposited on the copper than on the lead cathodes, especially when rich solutions were under treatment. These effects were probably due to the chemical action of copper on the solution, working in conjunction with the current. An experiment in which a lead anode and an amalgamated copper cathode were employed, yielded, with a small current of electricity after 24 hours, a certain amount of copper in solution, thus proving that the copper effect is not entirely due to the anode and that the current is unable to protect a copper cathode from attack by the solution.

The conclusions are that mercury or amalgamated copper plates have no advantage over and are not likely to replace the customary lead cathodes in the electrolysis of cyanide solutions. The objections may be summed up as follows: the high cost of mercury, the large surface of cathode consequent upon the necessarily low density of current, the cost of the copper plates the dimensions of which must be still greater owing to the current density being a trifle less than with mercury, and the loss of cyanide due to the solution of the copper cathode.—A. W.

Concentration Process [Gold and Silver]; Elmore ——. C. M. Rolker. Inst. of Min. and Metall., April 25, 1900.

In this process the concentration is effected by mixing the pulverised ore, first with water and then with a quantity of thick mineral oil or residuum from the distillation of crude petroleum oils, and agitating in a horizontally-revolving helically-ribbed mixing drum, in which the metallic constituents, *i.e.* sulphides, &c., adhere to and are separated by the oil which, on standing, rises to the surface. Centrifugal machines are afterwards used to separate the concentrates from the oil. The author has examined the process in operation at Glasdir, in Wales, where the ore is a transition slate containing fine pyrites (copper and iron), and where the proportion of oil used, is one ton to one ton of ore with about 5 tons of water.

Amongst the important factors is the viscosity of the oil, which is influenced by climate, temperature of working, &c. The adhesive power, which shows a predilection for bright unoxidised sulphides, becomes less as the viscosity decreases, although the loading capacity should increase with the lighter specific gravity. The loss of oil by waste and retention in concentrates and tailings has been found by experience with 700 tons, to be 2 gals. per ton of ore treated. Seven runs, treating in all 43 tons of rock, showed an average saving of 69 per cent. of the gold, 65 per cent. of the silver, and 70 per cent. of the copper, with a rate of concentration of about 14 into 1. The ore was of low grade and carried about 0·049 oz. of gold, and 0·8 oz. of silver per ton, and 1·12 per cent. of copper.

The process, however, requires intelligent and experienced manipulation, owing to the necessity of determining and maintaining the right viscosity of the oil, and also the determination, in each instance, of the proportions of oil and water to be used, and the position in the revolving drum at which the oil should be introduced. Furthermore, there are the possibility of local overloading of the oil and loss by its sinking in the water, the chances of low concentration owing to the oil taking up rocky particles, the re-grinding in cases where the sulphides are oxidised or tarnished, so as to get a clean surface, and, at Glasdir, where the copper pyrites adheres more quickly than the iron pyrites, the probability of obtaining richer concentration in copper at the expense of higher gold in the tailings. The advantages are a smaller consumption of water and a higher yield than in wet concentration, at any rate with the ores under consideration, but the process is a dirty one and it is not easy to predict its suitability for application to any particular material without trial.—A. W.

Nickel Arsenide. A. Granger and G. Didier. Comptes Rend. **130**, [14], 914—915.

By passing the vapour of arsenious chloride (by means of a current of carbon dioxide) over metallic nickel at 600° C., occasionally stopping the operation to dissolve away the coating of nickel chloride, and setting to work again on the dried residue, a nickel arsenide $Ni_3 As_2$ was obtained. It is a reddish granular-crystalline substance with metallic lustre, decomposed by heat, soluble in nitric acid, and easily attacked by chlorine or by fused alkalis. It agrees in its characters with the arsenide $Ni_3 As_2$ obtained by Wöhler from the residues of the smalt manufacturer.—J. T. D.

Antimony Sulphide; Action of Hydrogen on ——. H. Pélabon. Comptes Rend. **130**, [14], 911—914.

When hydrogen is sealed up with antimony sulphide, a condition of equilibrium among the four substances, hydrogen, antimony, hydrogen sulphide, and antimony sulphide is reached, depending on certain conditions. If the temperature be below the melting point of antimony sulphide, the final proportion of hydrogen to hydrogen sulphide depends only on the temperature; it is not affected by the initial pressure of the gas, nor by the presence of metallic antimony in addition to that formed in the reaction. When the temperature is above the melting point of the sulphide, the metal

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formed dissolves in the sulphide, and the limit depends on the proportion between the masses of the two, and therefore (with a given amount of hydrogen) on the original mass of the sulphide, the proportion of hydrogen sulphide decreasing as the concentration of the antimony in solution increases; when, however, the sulphide is saturated with the metal, the addition of more antimony causes no change in the equilibrium.

When the initial system consists of metallic antimony and hydrogen sulphide, the limit reached is the same as in the foregoing case, provided the temperature be below the melting point of antimony; but if it be above, the proportion of hydrogen sulphide (52·8 per cent. at 625° C.) is always lower than that reached (56·9 per cent.) when starting from the sulphide and hydrogen. In all cases, the limiting proportion of hydrogen sulphide rises with the temperature. —J. T. D.

Silver Bullion; Volhard's Method for the Assay of ——. T. K. Rose. J. Chem. Soc. 1900, March, 232.

See under XXIII., *page* 470.

Lead; Estimation of —— in the Dry Way. J. Flath. Chem. Zeit. 1900, **24**, [25], 263.

See under XXIII., *page* 470.

Gold; Detection of Small Quantities of —— in Ores. T. Döring. Chem. Zeit. Rep. **24**, [10], 85.

See under XXIII., *page* 469.

Molybdenum; Determination of —— in Alloys. H. Bornträger. Zeits. anal. Chem. 1900, **39**, 91.

See under XXIII., *page* 471.

Iron Ores, Titaniferous; Analysis of ——. Chas. Baskerville.

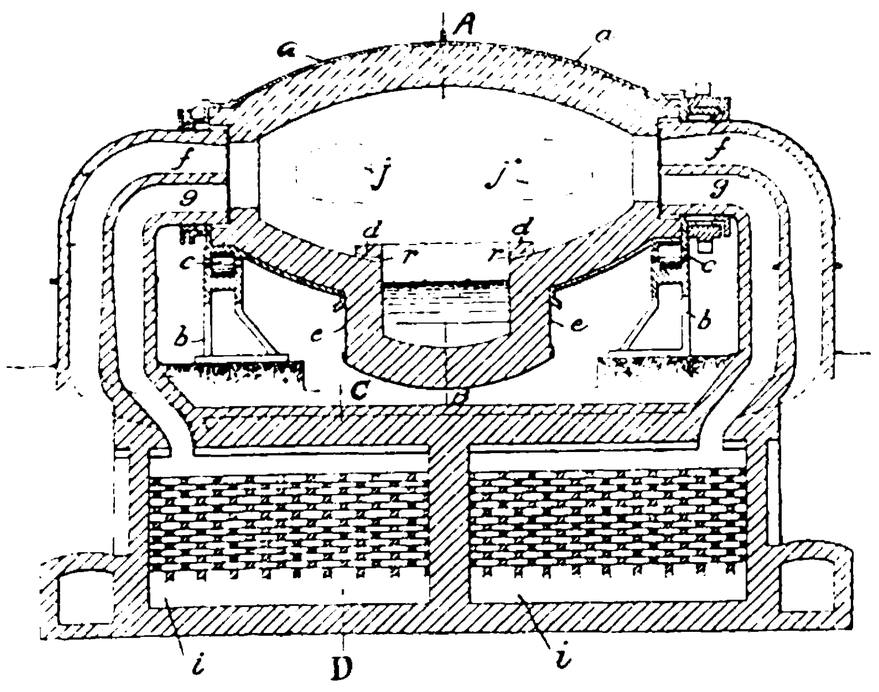
See page 419.

PATENTS.

Steel; Manufacture of ——; and Gas Furnaces therefor. A. Tropenas, Paris. Eng. Pat. 8125, April 18, 1899.

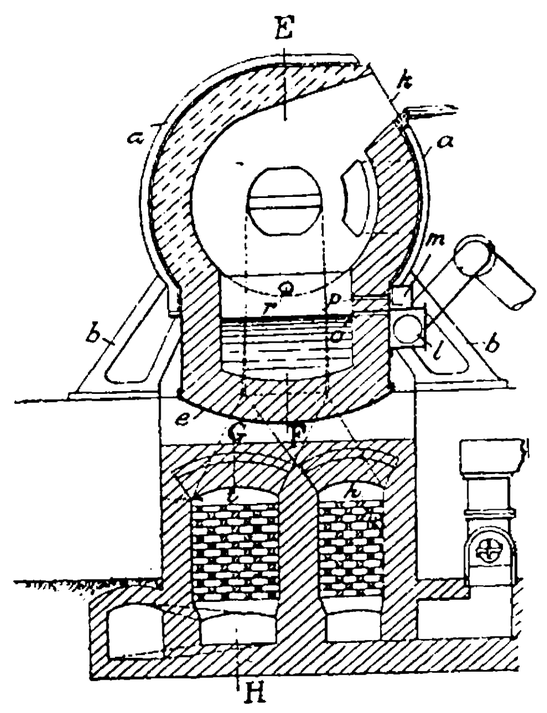
Eighteen claims are made for a combined converter and open-hearth furnace and for the treatment and conversion of iron into steel therein in one or more separate operations. The furnace *a* consists of an oblong hollow structure or suitably lined ovoid shell, capable of being rotated on its horizontal axis by means of trunnions resting on standards *b*, *b*, provided with friction rolls *c*, *c*. In one side of the structure is constructed a crucible or converter *e*, with a suitable opening or mouth *k* provided with a door. The accompanying drawings, in which Fig. 1 is a vertical section

Fig. 1.



along the lines E F and G H of Fig. 2, and Fig. 2 is a transverse vertical section along the lines A B and C D of Fig. 1, illustrate the furnace being used as a converter. The metal is blown by air through tuyères *o* and *p* leading from air boxes *l* and *m*. The charge when decarburised is then run from the converter into the ovoid portion by slightly rotating the furnace, and is mixed with scrap, &c., which had been previously charged through holes *j j* which may be closed, on to the ledges *d d*, where it received a preliminary heating by the gases during blowing. Channels *r r* (Fig. 1) are provided to allow splashings, &c., to drain back into the converter.

Fig. 2.



The furnace is now used as an ordinary open-hearth one by closing the mouth *k* and opening the air and gas valves connected with the regenerative apparatus *i i*, through passages *f g*. Lime is added and the slag is run off and the finished metal finally poured through the mouth *k*, as from a converter.—A. W.

Iron or Steel; Treating Molten ——, with Pulverulent Material, and Apparatus for that Purpose. O. Imray, London. From J. R. Billings, Chicago, U.S.A. Eng. Pat. 11,268, May 30, 1899.

The pulverulent material is forced through a tube dipping into the molten iron or steel in a ladle, so that it can rise through the metal in an uniformly distributed manner. The apparatus consists of a tube coated with refractory material and attached at its upper end to a platform, on the top of which is a filling hopper, and an appliance for working a rod and piston inside the tube. At the lower end of the tube is a valve or plug held up to close its mouth by an outside rod projecting upwards parallel with the tube through the platform, and connected with a spring. The ladle, preferably a deep one, is brought under the platform, so that the plugged tube dips into the molten metal, when force is applied to the piston, which overcomes the spring pressure on the plug and ejects the powder from the tube into the bath.—A. W.

Magnetic Oxide [Iron]; Apparatus or Means for Collecting and Removing from Pickling Vats the Scale or —— removed from the Plates subjected to the Pickling Process. S. O. Cowper-Coles, London. Eng. Pat. 14,055, July 7, 1899.

The apparatus consists of an electro-magnet enclosed in a casing of brass, copper, or other substance not acted on by the pickling solution, the whole being attached to the lower end of a tube which contains and conveys the wires from the magnet to an insulated bar or cross-plate, at its upper end, which holds the dynamo terminals. The electro-magnet is placed or suspended in convenient parts of the pickling bath to attract and collect the scale or magnetic oxide, and thus, by removal, to prevent its dissolving in the acid of the bath and the consequent waste thereof. —A. W.

Aluminium Powder; Process of Manufacturing ——. L. Ott, Roth, Germany. Eng. Pat. 12,154, June 10, 1899.

Aluminium bronze powder is made by pouring molten or fluid aluminium into water and then bringing the thin irregularly shaped pieces of metal thereby formed under stamping presses of any convenient construction to convert them into a fine powder of a bronze colour.—A. W.

Ferrous Chloride, Converting into Ferric Chloride, more especially intended for use in connection with the Separation of Bismuth or Antimony from their Sulphide Ores. J. Ranald, London. Eng. Pat. 12,308, June 13, 1899.

Hot solution of ferrous chloride, preferably contained in the vat wherein bismuth or antimony ores are to be

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subsequently treated, as described in Eng. Pat. 16,622, 1898 (this Journal, 1899, 1130), is transformed into ferric chloride solution by addition of potassium chlorate, in proportion indicated by the equation:

$$6FeCl_2 + KClO_3 + 3H_2O = 4FeCl_3 + 2Fe(OH)_3 + KCl.$$

The ferric hydroxide precipitated may be separated, or redissolved to ferric chloride by addition of hydrochloric acid.—E. S.

Stannic Acid (Oxide of Tin); Process and Apparatus for the Manufacture of ——. H. Jaeger, Kalk-on-the-Rhine, Germany. Eng. Pat. 12,910, June 21, 1899.

Molten tin is forced vertically upwards through a tube with small orifice, secured within a tuyère into which heated air at very high pressure is forced. The tuyère with its central tube opens into an oxidising furnace maintained at a high temperature, and supplied with air blown in through a heater having several horizontal iron pipes. As the jet of tin enters the furnace, with the blast of compressed air issuing from the tuyère around it, the metal is "divided or sprayed into an infinity of oxidised particles," which are carried forward by the action of a blowing fan through one or more heated retorts, in which the oxidation is completed. The stannic oxide is collected in a suitable receptacle.

—E. S.

Bismuth; Extraction of —— from Ores containing Bismuth Oxide, or Bismuth Oxide and Sulphide. J. Ranald, London. Eng. Pat. 13,615, June 30, 1899.

Bismuth is extracted from ores containing the oxide or the oxide and sulphide by crushing and subjecting them to the action of hot or boiling ferric chloride solution, whereby ferrous and bismuth chlorides are produced, and then precipitating metallic bismuth by means of iron. The iron is recovered from the ferrous chloride, with the re-production of the ferric chloride solvent, by electrolysis, or chlorate of potash may be used for oxidising the ferrous salt.

—A. W.

Metals [Gold, &c.]; Solvents for ——, and the Treatment of Gold and other Ores for the Extraction of the contained Metal. S. Trivick, London. Eng. Pat. 9154, May 1, 1899.

An improved solvent for the extraction of gold and other metals from ores, &c., is prepared by adding to a clear solution of calcium hypochlorite, obtained by treating chloride of lime with water, an aqueous solution of ferric chloride as long as the hydrated ferric oxide precipitate redissolves. Alkali hypochlorites may also be used, and the ferric chloride may be replaced by other substances liberating the chlorine or chlorine oxy-acids, with the exception of sulphates and acid sulphates of the alkali metals, such for instance as, ferric sulphate, manganese sulphate or chloride, aluminium sulphate or chloride, oxalic acid, and the like.

The operation may consist of mixing one of these salts with the ore material under treatment and adding thereto, as a lixiviator, an aqueous solution of the calcium or other hypochlorite; or, solid chloride of lime may be mixed with the ore, and a solution of one of the salts used as a lixiviating solution; or, both the salt and the chloride of lime may be mixed in dry, and water alone, or containing sodium chloride, used for lixiviating.—A. W.

Auriferous and other Minerals; Process of and Apparatus for the Treatment of — by Amalgamation. L. Lagarrigue, Paris. Eng. Pat. 11,860, June 7, 1899.

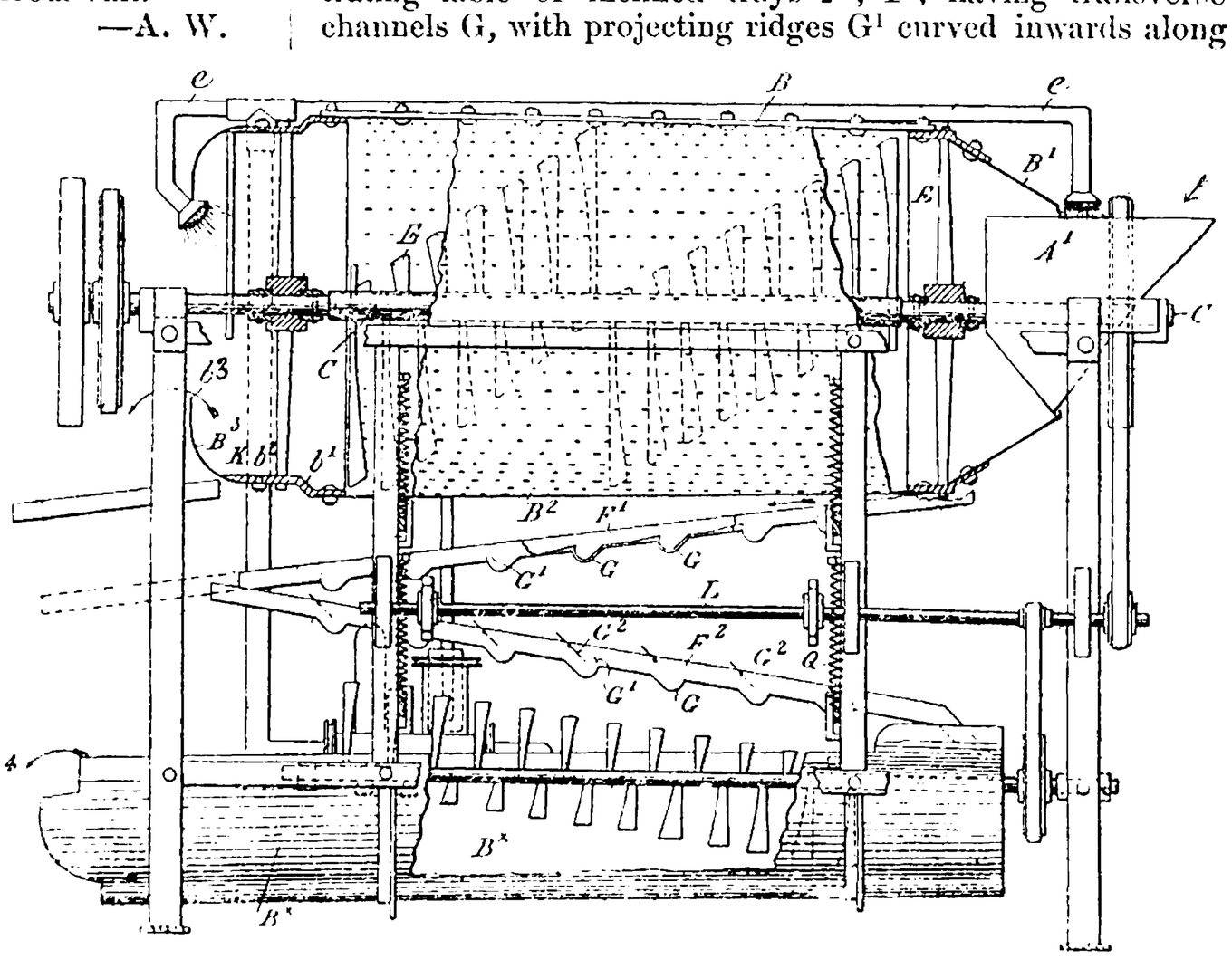
The auriferous sands, &c., either wet or dry, are fed on to and conveyed by endless vertically-placed travelling bands into a deep trough containing mercury. The particles attach themselves to the moving band, and are carried by it into mercury of increasing depth and pressure, and up again to the surface, when they detach themselves from the band and are ejected. There may be more than one conveyor surface according to the amount of immersion necessary to ensure complete exhaustion of the material, the different bands or sheets being preferably placed side by side, or in continuation one against the other in the one trough, so as to prolong the period of immersion.—A. W.

Gold and other Ores; Apparatus for Washing and Amalgamating ——. A. R. Wojciechowski, London. Eng. Pat. 21,533, October 28, 1899.

The apparatus essentially consists of a rotating trough or cylinder, having a downward sloping lower surface from its inlet end and an upward sloping part close towards the outlet end, in combination with straining apertures, a stirring device, and outside sloping trays. The whole is devised more especially for treating sands, alluvials, and loamy material, but it is also suitable for washing quartz or other hard ores.

The accompanying drawing shows the complete form of apparatus as claimed in detail. It consists of a partially-perforated, separating, and concentrating washing cylinder B, having a conical diminishing, receiving, or inlet portion B^1, a conical diminishing central portion B^2, a diminishing shoulder portion b^1, a parallel cylindrical wall portion b^2, a flange B^3, and ridge b^3, making a space or receptacle K for collecting nuggets, &c. The edge b^3 is on a level with the inlet edge of B^1, and is capable of adjustment with the central portion B^2. In combination with the cylinder B is a loose central rotating stirrer shaft C, with mounted stirrer blades E, which may also consist of steel wire tufts, adjustable for local requirements and rotating in the opposite direction to the cylinder B, both being driven by means of an adjoining parallel shaft.

Underneath the cylinder is an amalgamating or concentrating table of inclined trays F^1, F^2, having transverse channels G, with projecting ridges G^1 curved inwards along



the lower edge, and having also baffle plates G^2 over the channels G. The trays are suspended on springs Q for resilient vibration. Attached to the apparatus may be a lower trough B^x, with longitudinal channels and a stirring device.

The material is fed into the hopper A^1, and water is supplied through a spraying pipe *e*. The finest particles pass through the perforations of the cylinder on to the tray F^1 and from thence to F^2 and the trough B^x to the overflow, indicated by arrow. The fine gold amalgamates with mercury in the channels G and the amalgam accumulates in B^x. The coarser particles in the cylinder trend towards the outlet end and continuously overflow at b^3, any

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nuggets or heavy particles gravitating and accumulating at K, to be removed at intervals when the apparatus is stopped.
—A. W.

Ferro-Aluminous Ores; Treatment of ——.
D. A. Pèniakoff, Brussels. Eng. Pat. 3910, Feb. 28, 1900.

THE enrichment of ferro-aluminous ores, such as bauxite, &c., for the extraction of alumina or the metal or its compounds, is carried out by submitting them to a roasting or calcination to convert the ferric oxide into the magnetic oxide or to reduce it to metallic iron, and then crushing and subjecting the powder to the action of a magnetic or electro-magnetic sorting apparatus, whereby the non-magnetic alumina is isolated in a purified condition ready for subsequent treatment in obtaining the metal or salts.
—A. W.

Mineral Wool, also called "Slag Wool" and "Silicate Cotton"; Manufacturing ——. A. D. Elbers, New Jersey, U.S.A. (Under Internat. Conv.) Eng. Pat. 11,544, June 2, 1899.

See under IX., *page* 444.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Ammonia; Properties of Liquefied ——. C. Frenzel. Zeits. f. Elektrochem. 1900, **6**, 477; 485 and 493.

See under XXIV., *page* 470.

Acids; Effect of Salts on the Strength of ——.
S. Arrhenius. Zeits. Phys. Chem. **31**, 197.

See under XXIV., *page* 470.

Lead Accumulators; Improvements in ——. A. Heinemann. Centr.-blatt für Accumulatoren- und Elementenkunde. Through Electrician, 1900, [1140], 785.

UNTIL recently the principal improvements which have been effected in the preparation of lead accumulators have been mechanical rather than chemical, but within the last few years, attempts have been made to employ organic instead of inorganic lead compounds in the manufacture of the active material for the plates. Some organic compounds, such as glycerin and butyric and lactic acids, have the property of forming with lead oxide compounds which dry quickly. The organic paste has the advantage that it can be greatly compressed, and consequently it also possesses greater durability, as the loss of active material caused by the wash of the electrolyte between the plates is diminished. According to the material employed, the most various products are formed in the production of the lead oxide paste, amongst others some of a resinous nature, which are not unlike caoutchouc in their stability, and undergo no further change. These serve to unite the highly compressed lead oxide particles, and offer very little resistance to the passage of the current, on account of the extreme thinness of the film which separates the particles. Those vegetable oils which have already undergone a certain degree of oxidation in the air, and which, like turpentine, will yield an oxidation product by atmospheric oxidation alone, are best suited for the formation of this resinous body by electrolysis. As it is an insulator it could not be employed by itself for the formation of the paste for the plates; the parent body from which it is formed by oxidation is therefore used for this purpose, and the particles of oxide are thus cemented together without being insulated from each other. The author, in his German patent, 107,726 of 1898, proposes to use the oils of the cypress, birch, and pine species. In the following table is given a comparison of the results obtained with a battery constructed according to Heinemann's process, and with batteries made by a German company and by the Fulmen company.

	I. German Accumulator Co.	II. The Accumulator Fulmen S., Paris.	III. Accumulator according to Heinemann's Process.
Type	C.	B.	P.
Dimensions of electrode in mm.	175 × 130 × 5	175 × 100 × 5	180 × 100 × 5
Surface of electrode in sq. dm.	2·275	1·75	1·8
Weight of positive electrode in grms.	680	475	620
Discharge in ampères.	2·3	3·5	2·5
Capacity in ampère-hours.	13·8	17	20
Weight per sq. dm. in grms.	300	272	344
Capacity per sq. dm. in ampère-hours.	6·1	9·7	11
Capacity per kilo. of positive electrode in ampère-hours.	20·3	35·7	32·3
Capacity per kilo. of plates in ampère-hours.	11·6	16·0	17
Capacity per kilo. of cell in ampère-hours.	7·5	10·6	13
Capacity per kilo. of plates at a discharge rate of 1 ampère per sq. dm. in ampère-hours.	8·3	18	24·2

It is stated that after five months continuous use for traction purposes by the Berlin Post Office, the electrodes of No. III. battery were in perfect order, whilst the positive plates of No. II. battery were worn out after 100 charges.
—A. S.

Iodide Solutions; Electrolysis of ——. N. Lewin. Inaug. Diss. 1898, Berlin. From Zeits. für Elektrochem. 1900, **6**, [36], 464—466.

HYPOIODITE is the product first obtained during the electrolysis of solutions of potassium and sodium iodide. On account of its instability, however, it is easily transformed into iodate. In some cases the formation of periodate was observed. By increasing the temperature of the electrolyte sufficiently, the formation of hypoiodite can be entirely prevented when the only product is iodate together with small quantities of periodate. In the case of neutral solutions the yield of active iodine is independent of the concentration of the electrolyte, whereas if the solution is alkaline, an increase of the concentration produces a higher yield. In this respect iodide solutions differ from bromide solutions, since the latter give lower yields at increased concentrations.

The degree of alkalinity affects the results obtained. An electrolyte to which 1 per cent. of KOH has been added gives a lower yield than the same electrolyte to which no free alkali has been added when electrolysed under the same conditions. On the addition of 1 per cent., of free alkali to the electrolyte hypoiodite can no longer be detected. In this case the yield amounts to 20 per cent., whilst in the case of the neutral solution it is as high as 28—30 per cent. By increasing the amount of free alkali added, the other conditions remaining unaltered, there is scarcely any lowering of the yield. By an addition of 3 per cent. of free alkali the yield rises and reaches a maximum value. An addition of more than 3 per cent. then causes the yield to again diminish. A similar maximum value in the yield has been observed by Müller in the case of solutions of alkali chlorides, but a minimum value has never before been noticed. A high current density at the cathode causes an increase in the yield.

When the temperature of the electrolyte is kept low, the yield is increased, but this, in the case of neutral solutions, is somewhat reduced by the formation of hypoiodite, which is easily decomposed electrolytically with an evolution of oxygen.

From the above it follows that the best yield is obtained by conducting the electrolysis at not too low a temperature (22° C.), by the addition of 3 per cent. of free alkali and by employing small cathodes.—J. S.

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PATENTS.

Electrical Batteries. E. W. Jungner, Stockholm, Sweden. Eng. Pat. 7892, April 14, 1899.

THE elements can be employed either in primary or secondary cells, and the holders which contain the active material should be of some metal not attackable by the alkali solutions used as the electrolyte. The active material consists of finely divided metals insoluble in the electrolyte, or oxides of metals which do not give up free hydrogen when the battery is active, and of which the hydroxyl combinations cannot exist in the electrolyte, thus preventing change as regards quantity and chemical constitution in the electrolyte and in its conductivity. Oxyhydrates of the same metal may be added in such proportions that the charging or discharging current causes a simple transfer of hydroxyl, and the electrolyte remains unchanged as regards chemical constitution and quantity.—G. H. R.

Secondary Batteries or Electric Accumulators, Elements for Manufacture and Production of ——. H. H. Strecker, Cologne, Germany. Eng. Pat. 9351, May 3, 1899.

THE central portion of the electrode is removed, and into the opening thus formed is inserted a divided ring, or frame, so as to reduce the weight, prevent warping of the plates, and secure the circulation of the electrolyte. The active material for the positive plates which surrounds the central opening is formed of a mixture of litharge and carbonate of lead, which forms a mass the expansion of which in the electrolyte corresponds to that of minium, of the formula Pb_3O_4, under the same action. This mass, after being slightly moistened with a dilute alkali solution, is applied to a frame, and while still in a moist condition, and without drying, is formed in an acidulated salt solution, preferably in one of a sulphate of an alkali, so as to obtain a plate positive of practically uniform capacity, and without a crust on the surface.—G. H. R.

Secondary Batteries, Electrical [Lead-Cadmium]. E. N. Commelin and R. A. Viau, Paris. Eng. Pat. 3753, Feb. 26, 1900.

THE negative electrodes are composed of troughs of insulating material open at the top, superposed vertically over one another, and encased in a box of insulating material. Each trough contains a metallic conductor connected to a collecting conductor embedded in the insulating material of the box. The positive electrodes consist of two perforated or open-work plates of insulating material, enclosing between them conducting strips of lead presenting a part of their face to the perforations of the plates. The active material, peroxide of lead, is enclosed in the hollows or recesses by the three constructive elements. The electrolyte is a solution of sulphate of cadmium or other metal, with an addition of free sulphuric acid, so that during charge, peroxide of lead is formed on the positive electrode and cadmium or other metal deposited in the troughs of the negative electrode, whilst during discharge a reduction of peroxide of lead takes place, and sulphate of cadmium or other metal is formed. There is a modification of the negative electrode in which the conducting strip is made to conform to the shape of the trough.—G. H. R.

Accumulator Plates, Production of ——. [*Fatty Acid Bath.*] Arthur Lehmann, Berlin. Eng. Pat. 9367. May 3, 1899.

THE plates are formed by treating their surfaces first in a bath of an organic acid of the fatty series (thus producing readily soluble lead salts), and then with water, and finally oxidising them in an electrolyte of the usual kind for the production of peroxide of lead.—G. H. R.

Electric Accumulator Plates; Manufacture of ——. Z. Stanecki, Lemberg, Austria. Eng. Pat. 813, Jan. 13, 1900.

THE plates are composed of oxides of lead mixed with distilled water, and after complete drying they are dipped into dilute sulphuric acid, which renders them stone hard and very porous.—G. H. R.

Electrical Accumulators or Secondary Batteries. O. Behrend, Frankfort-on-Main, Germany. Eng. Pat. 12,478. June 15, 1899.

THE electrodes are separated from each other by plates of "loofah," previously subjected to pressure, and the spaces between the plates, and the plates and the receptacles are filled with powdered glass.—G. H. R.

Electrodes for Electrolysers. R. Eycken, Lille, C. Leroy, Wasquehal, and R. Moritz, Lille, France. French Pat. May 23, 1899. Eng. Pat. 22,028, Nov. 3, 1899.

THE electrodes are composed of two permanently connected parts, viz., a supporting base and an electrode proper, the former consisting of a suitably furrowed plate formed of a material capable of being cast, moulded, or shaped, and the latter consisting of wire netting, or perforated corrugated sheet metal. Canals or grooves are provided for conducting the liquids into the furrows, which serve to reduce the layer of liquid to a minimum, to circulate the electrolyte uniformly over the whole electrode, to promote the escape of gases, and to accelerate the separation of the products, a pipe coil being embedded in the casting to heat the liquids in the electrolyser. When the material for the electrodes is unsuitable for casting, &c., the supporting base may consist of a frame in which are fixed thick carbon rods, and the electrode consists of thinner carbon rods pressed against the thick ones, a series of canals and ducts being formed between the two for the circulation of the electrolyte, &c. The electrodes may be cylindrical, prismatic, or other analogous shape, and an electrolyser is built up from them by pressing them together, with or without the addition of diaphragms.—G. H. R.

Graphite, Manufacture of ——. E. G. Acheson, Buffalo, U.S.A. Eng. Pat. 3215, Feb. 17, 1900.

GRAPHITE is produced by treating an aggregation of pieces or particles of carbonaceous material, or non-caking coal, containing inherent impurities capable of forming carbides, and which are naturally evenly distributed throughout the materials, but which are not present in sufficient amount to convert the whole of the carbon into carbide, and can be heated to a charring temperature without destroying the relative positions of the carbon and the impurities. The material is heated electrically to a high temperature by passing a current through it, or by means of a heated conductor, the process being continued until the individual pieces have been progressively converted into graphite in greater proportion than would be produced by decomposition of the relatively small amount of fixed carbide capable of being formed by the impurities naturally present.

—G. H. R.

Electrically Conducting Material; Manufacture of —— [of the Second Class]. E. Sander, Berlin. Eng. Pat. 3731, Feb. 26, 1900.

THE electrically conducting substance consists of a melted mixture of an oxide or oxides of the alkaline earth metal groups, or of magnesium, aluminium, zirconium, or of the rare earths, or mixtures of such oxides, with one or more of the oxides or salts or sulphur combinations of the iron or chromium or platinum groups, or with mixtures of such oxides or salts or sulphur combinations.—G. H. R.

XII.—FATS, OILS, AND SOAP.

Fatty Acids; Volumetric Estimation of ——. J. Swobada. Chem. Zeit. 1900, **24**, [27], 285.

See under XXIII., *page* 474.

Cotton Seed Oil; Detection of ——. B. A. van Kettel. Monit. Scient. **14**, March 1900, 154—156.

See under XXIII., *page* 471.

PATENTS.

Liquid Soap; Improved ——. J. Mendess, London. Eng. Pat. 7163, April 5, 1899.

ACCORDING to this patent a potash or soft soap is incorporated, before completion, with wood-naphtha, or a mixture

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of wood-naphtha with a rectified hydrocarbon, to which a small proportion of ammonia may be added.

Claim is also made for the addition to these ingredients of carbolic acid or other disinfectant, or of a suitable dye, with or without potassium or sodium acetate or phosphate as a mordant.—C. A. M.

Fats or Oils from the Waste Water of Sinks or from other Waste Liquids; Apparatus for Removing Solids and Recovering ——. J. Ashdown, Prahram, Victoria. Eng. Pat. 9115, May 1, 1899.

This specification describes a combination of strainers, baffle plates, and scum-trough, for collecting and recovering oil and grease, also arresting grit and dirt, contained in the waste water from kitchen sinks, &c.—L. A.

Raw Fats; Improved Apparatus for Melting and Roasting ——. F. X. Miller, Ratisbon, Germany. Eng. Pat. 2806, Feb. 12, 1900.

In this apparatus, for the different parts of which claim is separately made, a hollow revolving drum is placed immediately below the feeding hopper, and half filled with water or other liquid. On its periphery are axially arranged troughs lined with waterproof material. The linings lie close against the sides of the troughs when receiving the fat, but as the drum revolves, the water raises the linings from the troughs and discharges their contents into the shaft. The linings being thus inverted, are pressed by the water against the sides of the shaft, and form joints which prevent any vapours escaping through the hopper.

Connected with the hopper by a vertical shaft is a hollow heating cylinder, provided with a helical conveyor or spiral, which can be shifted axially and made to change its direction when the fatty matter accumulates at one end of the cylinder. The revolution or displacement of the conveyor may be prevented by means of a key.

Attached to the top of the heating cylinder is a tube, which may be in the form of a spiral or coil, its object being to cool the boiling contents of the cylinder. There is also a pipe to conduct the escaping vapours to a chimney or condenser.—C. A. M.

Oil Filters; Impts. in ——. G. Fisher, trading as The Kingfisher Patent Lubrication Co., Leeds. Eng. Pat. 7265, April 6, 1899.

The apparatus claimed consists of three parts. The top part, into which the dirty oil is introduced, has a discharge pipe, whose outlet is arranged at such a level that heavy impurities settle before the oil passes into the filtering chamber. The opening of this outlet is protected by a strainer, or by a covering-pipe which forms a siphon, and is kept in its relative position by means of a float, or otherwise. The intermediate section of the apparatus is provided with a wire gauze or sieve and a filtering cloth, through which the oil falls into the storage chamber.—C. A. M.

Oils and the like; Improved Apparatus for Filtering and Purifying ——. H. Beckmann, Magdeburg, Germany. Eng. Pat. 3608, Feb. 23, 1900.

This apparatus consists of an outer vessel with a side funnel-shaped hopper with connecting passage at the bottom, and an inner air-tight vessel provided with an attached chamber communicating with the interior by a passage at the bottom. On this chamber is fixed a porous earthenware cylinder or other suitable filtering medium, and at the bottom of the interior vessel there is a filtering bed.

The impure oil introduced into the hopper enters the bottom of the exterior vessel, and in rising, deposits mechanically part of its impurities. It then passes through the attached filtering-chamber, enters the bottom of the inner vessel, and passes upward through the filter-bed into the inner chamber, whence it can be drawn off through a cock. Air is withdrawn through a tube at the top of the inner vessel so as to create a partial or complete vacuum.

—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

Paints and Varnishes on Steel and Aluminium Plates; Protective Action of —— against Corrosion by Fresh or Salt Water. A. H. Sabin. Eng. and Mining J. 1900, **69**, [14], 416.

Tests were made by the author with about 300 steel and aluminium plates, which, after being perfectly cleaned with a wire brush, were coated with oil paints, varnishes, or enamel paints, prepared with a variety of pigments, and were then exposed for about two years to fresh and salt water. The results appeared to show that generally in pigment paints, the character of the pigment makes little difference as to the permanency of the coating. Varnish paints appeared to wear much better than oil paints, whilst of the former, those containing a larger proportion of oil are the best. Baking is not generally beneficial, except in the case of enamels.—A. S.

Red Lead; Volumetric Determination of ——. J. F. Tocher. Pharm. J. 1900, **64**, [1552], 310.

See under XXIII., *page* 471.

PATENTS.

Metallic Oxides [Iron, &c.]; Manufacture or Production of ——. J. Y. Johnson, London. From Schroeder and Stadelmann, Oberlahnstein-on-the-Rhine, Germany. Eng. Pat. 12,066, June 9, 1899.

Ferric or other metallic oxides are prepared by compressing the corresponding sulphates into bricks or blocks under high pressure, allowing these to harden in dry air until they emit a ringing sound when struck, and then roasting them in a blast furnace at a temperature of between 600° and 1,300° C. according to the shade of colour desired. The porous block, which easily disintegrates, is then treated by wet methods in the usual way, dried, and powdered. Other metallic oxides, such as those of nickel, copper, and cobalt for example, may be prepared "in the finest condition" by similar means.—A. W.

(*B.*)—RESINS, VARNISHES.

Varnish Paints and Metallic Coatings [Protecting Ships' Bottoms]. A. Livache. Bull. de la Soc. d'Encourag. L'Ind. Nat. 1900, **5**, [3], 341—343.

The author has examined specimens of metallic coatings for protecting ships' bottoms, and "varnish paints" made by M. Delbeke, and draws special attention to the former.

The novel feature of these preparations is the employment of finely divided metallic copper—the toxic action of which on vegetable growths has been established—in place of the poisonous double arsenite and acetate of copper.

For wooden ships a preparation of the following composition is used:—"Coal-tar oil" distilling principally at 215° C., 1 part; rosin oil, 1 part; electrolytic copper, 2 parts. 1 kilo. of this preparation, containing 500 grms. of metallic copper, suffices to cover 5—6 sq. m.; it dries in a few hours, and, if applied properly, gives a sufficiently continuous, very thin, but very adherent coating.

For iron vessels an insulating coat is necessary in order to prevent the formation of an electric couple by direct contact of the copper and iron. The insulating coat has the following composition:—Denatured alcohol, 2 parts; insulating product (basis of gum lac), 1 part; sulphide of antimony, together with a small quantity of sulphides of lead and copper, 3 parts. This ground coat, after drying, is covered with a composition similar to that used for wooden ships:—"Light coal-tar oil" distilling at 175°—205°, 1 part; rosin oil, 1 part; electrolytic copper, 3 parts.

Two samples of "varnish paints" were examined. The first, destined for covering the chimneys and hot parts in general, had the composition:—Petroleum spirit distilling at 120°—135° C., 2·5 parts; resin and drying oil, 3 parts;

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mixture of oxide of antimony and argillaceous earth, 4 parts. Applied on sheet iron, this paint forms a coating which does not crack under the influence of heat, and which remains perfectly adherent even when the temperature rises to the point at which carbonisation of the organic matter present begins to take place.

The second sample may be regarded as a mixture of oil paint and varnish. The white preparation has the composition:—Petroleum spirit distilling between 120° and 135° C., 1 part; dammar resin and drying oil, 1 part; colouring matter (zinc oxide), 1 part. This paint dries in less than one hour, and gives a coating possessing a remarkable lustre. Its main disadvantage is a want of flexibility, in consequence of which the coating does not follow so well the deformations or variations of the surface of the object to be protected. The advantages of the paint are a more rapid drying, a brighter lustre, and a cheaper price.—A. S.

PATENTS.

Varnishes, Drying Oils, Enamel Paints, and Wool Washes; Manufacture of ——; applicable also as Insecticides and for other Purposes. J. Vaughan-Sherrin, London. Eng. Pat. 8317, April 20, 1899.

Ten parts of linseed oil are mixed at 315° C. with 5 parts of kauri resin dust, or equivalent material, and "5 parts" of a manganese drier (preferably the acetate) are stirred in gradually. 40 parts of rosin, melted separately, are next introduced, and the whole is cooled to about 35° C., and diluted with about 65 parts of "refined petroleum." This forms a varnish. To prepare a boiled-oil substitute, the proportions are: oil, 10 parts; kauri or dammar dust, 2 or 3 parts; rosin, 40 parts; manganese drier, "3 parts"; petroleum, 100 parts. As the vehicle for an enamel paint, "about double" the former quantity of a manganese drier is used. Lead driers are to be avoided, but "boracic acid" may be adopted instead of a manganese salt. Four parts of the above varnish may be treated with 1 part of 1·140 caustic soda and 2 or 3 parts of petroleum in the cold; after due agitation the gelatinous liquid is suitable for washing wool, adding to water when washing clothes, serves as an insecticide, and is applicable as a boiler fluid, &c.

—F. H. L.

[*Spirit-Proof*] *Sealing and Bottle-closing Wax; Production of ——.* W. Ellram, Simferopol, Russia. Eng. Pat. 12,176, June 10, 1899.

The idea of this invention is to prepare a material that will withstand the softening effect of alcohol, or liquids containing alcohol, and also to produce a sealing-wax less susceptible to changes in weather. It consists essentially of calcium resinate, mixed with a little heavy petroleum oil (solar oil) to render it less brittle, and containing, if desired, a small proportion of oleic acid or an oleate insoluble in spirit, in order that it may be melted by the use of steam heat. The calcium resinate is manufactured by incorporating 3 parts of slaked lime with about 23 parts of molten colophony.—F. H. L.

(C.)—INDIA-RUBBER, &c.

India-Rubber in West Africa. Third Report by R. Schlechter to the German "Colonial Committee." Gummi Zeit. **14**, [22], 347—348.

On the banks of the Nygoko river considerable numbers of Landolphia were observed, also numerous copal trees, which are very plentiful in the districts of the Upper Congo and of its tributaries. Also the Bossasanga, so important for the coagulation of the rubber, is everywhere to be found. Kickxia was found to occur to an enormous extent. One man could in a day collect sufficient milk to produce 5 lb. of india-rubber. The milk of the Kickxia is best coagulated by simply boiling it with water. For this operation earthenware vessels are preferable to metal vessels. Addition of the juice of the Bossasanga plant seems to promote the coagulation, but is without any other advantage. Agitating the milk in a centrifugal machine proved very unsatisfactory as to yield, and the product thus obtained was no better than other preparations. Smoking the milk in the manner practised in Para did not meet with success. The rubber may also be obtained from the milk by mixing the latter with much water, and allowing the mixture to stand for 10 days, drawing off from time to time the clear water through a tap at the bottom of the vessel. A thick rubber curd is thus obtained, which, after kneading and pressing, yields a good product.

—C. O. W.

India Rubber of the Soudan. Hamet. Bull. de la Soc. d'Encouragement, 1900, **5**, [2], 271—276.

The only india-rubber tree of the Soudan which is of any practical value is the Gohine (*Landolphia Hendolotii*). The milk of this tree is of either a white or faint pink colour, and by coagulation yields an india-rubber of a sp. gr. of from 0·920 to 0·930, and containing certain albuminous and resinous impurities. Coagulation can be effected in a variety of ways, but it is important to carry it out in such a manner as to remove from the coagulated rubber as completely as possible the serum of the coagulated milk, which is very prone to undergo fermentation, and this acts very detrimentally upon the india-rubber. This danger is avoided by inducing the coagulation of the milk by means of a solution of the strongly aseptic sodium fluoride, which at the same time produces india-rubber of excellent quality.

The Gohine prospers in the most arid districts of the Soudan. It can be propagated by means of seeds or shoots. An adult creeper yields an annual supply of from 10 to 12 litres of milk, from which from 6 to 7 lb. of india-rubber are obtainable. Only plants above five years of age should be tapped.—C. O. W.

Sulphur [in Vulcanising]; Prevention of the Action of —— upon Textile Fabrics. Gummi Zeit. **14**, [22], 410.

It is supposed that in the process of vulcanisation by high-pressure steam, the action of the latter upon the sulphur results in the formation of sulphuric acid, which acts destructively upon the linen, or cotton textile fabrics, which are either used as insertions in india-rubber goods, or in which the latter are wrapped for the purpose of vulcanisation. To prevent this destructive action, V. Giraud's suggestion to impregnate these fabrics with milk of lime has been used with very satisfactory results.—C. O. W.

PATENTS.

Pneumatic Tyres and other Rubber Articles; Compositions for Repairing ——. M. G. Grout and T. W. Moore, North Yakima, Washington, U.S.A. Eng. Pat. 16,626, Aug. 16, 1899.

This consists of unvulcanised stamp rubber, 2½ lb.; "benzine," ½ gall.; turpentine, ½ pint; and collodion, ½ pint. It is intended for the repair of "single-tube" tyres, and is used with an injecting syringe as usual.

—F. H. L.

Plastic Bodies with a Thin Sheet of Metal; Coating or Covering certain ——. J. A. Daly, Washington, U.S.A. Eng. Pat. 676, Jan. 11, 1900.

The object of this invention is to attach a thin sheet of vulcanised rubber to gold or metal foil, and it refers specially to dental plates. To one side of a sheet of gold is given a rough, spongy surface, either by electro-depositing thereon a layer of gold, silver, or base metal, or by applying a layer of soft solder and sprinkling thereon filings or powder of some metallic substance. This is next painted with rubber solution, or with a cement composed of some vulcanisable base, and when the adhesive is nearly dry, the plate of already vulcanised rubber is laid in position. The connecting film of rubber is finally vulcanised by heating the whole in a suitable plaster of Paris mould.—F. H. L.

Devulcanising Rubber; Apparatus for Use in ——. A. J. Boult, London. From A. H. Marks, Akron, Ohio, U.S.A. Eng. Pat. 2341, Feb. 6, 1900.

This specification describes a horizontal, revolving, jacketed vessel, provided with inlet for steam into the jacket, manhole communicating with the true interior, &c., wherein ground rubber waste can be heated under pressure with "a chemical solution."—F. H. L.

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XIV.—TANNING, LEATHER, GLUE, SIZE.

Tanning Materials; Notes on the Analysis of ——. — Paessler. Zeits. angew. Chem. 1900, [13], 318—323.

THE importance of a thorough mixing of the bulk from which samples are to be drawn is shown by an experiment made with commercial valonia, shaken up in a glass cylinder, and sampled by dividing into strata, 3, 5, and 10 cm. in depth. Whilst selected valonia scales gave 48 per cent. of tanning principles, 14·4 per cent. of soluble non-tannin, 23·1 per cent. of insoluble matter, 0·19 per cent. of sand, and 2·44 per cent. of ash, the average percentages were respectively, 33·8, 14·1, 32·6, 2·54, and 3·29, the limits being 34·9—40, 13·8—14·4, 31·8—36·8, 2·19—6·65, and 3·27—3·48.

The influence of the filter-paper in clarifying solutions of tannin extracts was also examined, the results confirming Procter's recommendation of the Schleicher and Schüll paper, No. 602 "extra hart."

With regard to the hide powder employed to eliminate the tanning principles from solution, the author, acting on Wisinger's proposal to mix it with filter-paper—which regulates the capillarity of the solution, prevents loss by creeping, and decreases the distension of the powder (thereby enabling it to be used in the analysis of acid liquors)—has induced Mehner and Stransky, of Freiberg, to prepare a hide powder containing 15—18 per cent. of filter-paper, this proportion being found as efficient as larger quantities. The tightness with which the powder is packed in the Procter funnel has an influence on the results, the best effect being obtained when the rate of outflow is about 10 drops per minute, so that the 90 c.c. of filtrate take 2—3 hours to run through. Rapid filtration implies an escape of tannin; and prolonged exposure leads to extraction of the soluble matter in the hide powder, *i.e.*, an increase in the non-tannin, the same result being aided by the evaporation of the slowly forming drops.

Again, the filtering temperature has an appreciable influence on the result in the case of sparingly soluble quebracho and other extracts, since excessive cooling causes a separation of part of the dissolved constituents. Thus in a quebracho extract filtered at 25° C. the total soluble matter was found to be 71·4 per cent., whereas when filtered at 10° C. the proportion fell to 63·7 per cent. For the sake of concordance, therefore, the temperature (17·5° C.) recommended by the Copenhagen conference should be adhered to.—C. S.

Chrome Tanning. W. Eitner. Der Gerber, **26**, [608], [609], [611], and [613].

THE author institutes the following comparison between "alum leather," "bark-tanned leather," and "chrome leather."

The first, which is a tawed leather, may be described as pelt impregnated with alum, salt, and other substances, such as flour, yolk of egg, and which by means of subsequent mechanical manipulations has had imparted to it the peculiar qualities for which it is esteemed, *viz.*, the capacity of stretching to an extraordinary degree without resuming its old position, its surface area being thus considerably increased. It is supple, of relatively great strength, but, on the other hand, it is incapable of withstanding certain external influences, such as water, for after continuous exposure to moisture, such leather completely loses all its characteristic qualities, and becomes reconverted into pelt. It is injuriously affected by high temperatures, and destroyed by alkalis or acids. When boiled it is completely converted into glue. These frailties of alumed leather are due to the very insufficient tanning action of the alum salt, for even if the pelt takes up a considerable quantity of these salts, only a small amount is permanently retained. The principal action which the alum salt exerts upon the pelt is to isolate the fibrils one from another, but it leaves them otherwise unchanged. Some of the substances, such as yolk of egg, are retained in the tissue without producing any material change, whilst the other substances only serve to fill and soften the leather.

Bark-tanned leather differs altogether from tawed leather, not only in its general properties, but in its behaviour when exposed to external influence. It lacks the capacity of stretching; in fact, bark-tanned leather increases in thickness at the expense of its surface area. Its strength or power of resisting a tearing strain is less than in the case of tawed leather; this increases in direct ratio with the tannage. Bark-tanned leather is not affected by water to any great degree; it will also stand a much higher temperature without injury, and dilute acids have little serious effect upon it. It is, however, more sensitive to alkaline solutions, because of their solvent action upon the tannins. It is with great difficulty reconverted into glue by boiling.

Chrome leather has a smaller stretching capacity than that of tawed leather, and it has a characteristic spring like india-rubber, so that it is impossible to give a finished skin a larger surface area than the pelt previously had; in fact, it is smaller, as the skin contracts in the chrome tanning. This contraction is accompanied by an increase in the thickness of the tissue, which is effected at the expense of the area. The tanning power of chrome salts is generally stronger than that of alum salts, but is smaller than that of vegetable tannins. A piece of pelt absorbed with alum 2·97 per cent., with chrome alum 10·9 per cent., and with vegetable tannins 30·3 per cent.

A further characteristic of chrome leather is its toughness and resistance to tearing. Generally speaking, the tensile strength of chrome leather is much greater than that of bark-tanned leather, the following figures being obtained in the author's laboratory.

Best bark-tanned belting leather stood a strain of 2·83 kilos. per sq. mm.; the leather increased 25 per cent. in length previous to breaking. Drum-tanned belting leather (Durio's process) had a tensile strength of 2·98 and a stretch of 21·4 per cent. Well-tanned chrome leather stood a strain of 7·4 kilos. and a stretch of 32·5 per cent. Badly tanned chrome leather (over-chromed) gave 2·34 kilos., with a stretch of 23 per cent. Curried alum-dressed belting leather gave 8·35 kilos., with a stretch of 38·25 per cent. Alum-tanned raw hide leather had the highest tensile strength, *viz.*, 9·21 kilos., and stretch 31·4 per cent. previous to breaking.

From the foregoing figures it will be noticed that chrome-tanned belting leather has double the tensile strength of vegetable-tanned leather, but if over-chromed it is weaker. At the same time it will be noticed that chromed leather has slightly less strength than alumed leather; but on taking into consideration the fact that alumed leather is very rapidly destroyed by moisture, temperature, and other external influences, chromed leather will be found to be preferable for the purposes of belting.—J. G. P.

Chrome-Tanned Leather; Lactic Acid in ——. Leather Trades' Rev. **33**, [734], 274.

LACTIC acid is much used by American chrome tanners for bateing and drenching. For calf skins about ½ gall. of 50 per cent. lactic acid to 100 galls. water are used. The skins are bated in a paddle, the temperature being kept at 85°—90° F. For sheep skins, less acid may be used, and the temperature should be about 70° F. For goat skins the goods must be first puered; they are then drenched in a solution of 1 gall. of lactic acid, 400 galls. of water, at a temperature of about 98° F.

Clearing Skins with Lactic Acid.—Hitherto sulphuric acid has been most largely used, but there are many objections to its use, and for this reason lactic acid has largely replaced it in the United States. The general method is to use a bath containing 1 per cent. of 50 per cent. lactic acid in warm water. The skins are dipped in this, or they are brushed over with it previous to dyeing. If they are to be dyed with acid colours, no washing is necessary, but for basic dyes the leather must be thoroughly washed.

—J. G. P.

Moëllon and Rosin Oil in Tanning. Leather Trades' Rev. **33**, [734], 275.

As dégras plays a very important part in the manufacture of leather, and is rather expensive, artificial dégras, or moëllon, has been introduced. This is made from cod-,

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whale-, or other fish-oil by "blowing," which is carried out as follows:—0·3 per cent. of borate of manganese is dissolved in the oil, and the whole is heated to from 90° to 100° C. By means of a compressor air is blown through. After from three to five hours, the oil becomes thick, and the temperature increases to about 120° C. The product answers its purpose fairly well, and is moderately cheap.

Genuine dégras is much adulterated by the addition of wool-fat, fish-oil, tallow, and water.

Rosin Oil.—In some cases dégras can be replaced by an oxidised rosin oil. This is prepared from the refuse rosin from breweries (which is used for pitching casks) or from the tin-plating industry. The waste rosin is placed in a still and distilled, and about 72 per cent. of rosin oil is obtained. This is placed in a vessel through which a steam worm passes, the temperature is raised to 100° C., and air is then blown through, which causes the temperature at first to go down to about 80°; it then begins to rise again, and after three or four hours it has to be carefully watched, as the temperature is apt to go up too rapidly. As soon as the temperature has reached 120°, the steam and air are cut off, and the resulting rosin oil has now become thick and of a brown colour, and is free of lustre.—J. G. P.

PATENT.

Flexible Leather-like Substances; Manufacture of ——. L. Schwarzhuber, Vienna. Eng. Pat. 5937, March 18, 1899.

A LEATHER-LIKE flexible substance is manufactured from wood-veneers by crushing materials containing starch or the like, boiling the same in an alkali lye under pressure of about 3—4 atmos., introducing the veneers into this mass, and eventually boiling the whole under a pressure of about 4—5 atmos.

It is stated that the flexibility thus imparted to the wood is permanent.—J. F. B.

XV.—MANURES, Etc.

Soils, Lime Requirement of; Chemical Methods for Ascertaining the ——. H. J. Wheeler, B. L. Hartwell, and C. L. Sargent. J. Amer. Chem. Soc. 1900, **22**, [3], 151—175.

THE authors' experiments were primarily made with the object of determining the amount of lime required by the upland soils of Rhode Island, without having recourse to field experiments. Several methods were tried, with the following results:—

Reaction of the Soil towards Litmus.—By noting the rapidity and degree with which the soil moistened with water turned blue litmus paper red, and comparing the results with those given by a soil of known character, very satisfactory conclusions could be drawn by an experienced observer.

Müntz's (Ammonium Hydroxide) Method.—When the soil is treated with water containing a little ammonium hydroxide, the liquid, after subsidence of the solid matter, may appear dark brown or black, when the acidity of the soil is principally due to the presence of acid organic substances. This test was found to be reliable with Rhode Island soils and certain soils of New England and New York containing a large proportion of humus, although Snyder has shown that it is not applicable to certain Minnesota soils.

Hollemann's Method (Extraction with Carbonated Water).—Hollemann determined the lime requirement of stiff clay soils in Holland by estimating the amount of calcium oxide extracted from them by means of carbonated water From their initial experiments the authors concluded that this method was unlikely to be of any value in the case of upland soils, like those of Rhode Island.

Tacke's Method was used for determining the relative acidity of peat soils in North Germany, and consisted in determining the amount of carbon dioxide which the acid substances in the soil could liberate from calcium carbonate at the ordinary temperature in an atmosphere of hydrogen. The results given by it in testing the author's upland soils were not promising

Determination of Total Humus by a Modification of Grandeau's Method.—In this the soil was treated with dilate hydrochloric acid, then with dilute ammonium hydroxide, and the amount of humus which dissolved, determined. By this method the authors obtained results approximately proportional to the lime requirement of the soils, as found by field experiments.

Determination of the Amount of Lime removable by Hydrochloric Acid.—The soils were digested for several hours with dilute hydrochloric acid at a high temperature, as in the method of the Association of Official Agricultural Chemists. No reliable deductions as to the lime requirement of the soils could be drawn from the results.

Titration Method.—15 grms. of the air-dried soil were treated with 100 c.c. of decinormal ammonium hydroxide and 100 c.c. of water, and allowed to stand for about 42 hours at the ordinary temperature, the flask being frequently shaken during the first part of the time. An aliquot portion of the supernatant liquid was then withdrawn, and, after the addition of 5 c.c. of seminormal acid for each 20 c.c. of extract, made up to a definite volume. When the precipitated humus had subsided, an aliquot portion of the solution was titrated with ammonium hydroxide, coralline being used as indicator.

The results yielded by this method were in closer agreement with the results of the crop tests than those of any of the other chemical methods tried. The gravimetric determination of the amount of humus dissolved from the soil by ammonium hydroxide, without previous treatment with hydrochloric acid to dissolve the lime and magnesia, gave figures closely approximating to the results of this test.

Colorimetric Method.—The soil was extracted with dilute ammonium hydroxide, and the colour of the solution compared with that obtained under the same conditions from a soil of known character. The authors consider that fairly good results may be obtained in this way in the case of soils the acidity of which is largely due to acid organic substances.

Heating the Soil with Calcium Carbonate in the Presence of Water.—The determination of the amount of carbon dioxide liberated from a weighed quantity of soil under constant conditions gave promising results in the authors' preliminary experiments with the method.—C. A. M.

Soils; Rapid Method for the Determination of Clay in ——. F. Poquillon. Monit. Scient., April 1900, 221—222.

THE method proposed is a modification of the usual process, and consists in the addition of a little ammonium chloride to the water used for levigation, which causes the clay to coalesce and the fine sand to settle more rapidly. The results given agree well with those obtained in the usual way.—H. H. B. S.

PATENTS.

Manure or Fertilizer. O. Barbier, Braux, Ardennes, France. Eng. Pat. 8153, April 18, 1899.

THE manure claimed is manufactured by mixing 50 per cent. of good phosphates of green Ardennes sandstone with 10 per cent. of coal dust and 40 per cent. of schistous stones, and calcining the mixture in a furnace. The product is then ground and sifted through silk bolting cloths having 100 to 200 meshes per square centimetre.—W. P. S.

Manure, Artificial. A. Wenck, Magdeburg, Germany. Eng. Pat. 25,150, Dec. 19, 1899.

To prevent loss of ammonia and the transformation of soluble phosphates into tricalcium phosphate in the processes described under patents No. 4714, 1899, and No. 12,233, 1899 (this Journal, 1899, 846 and 1037), by the addition of lime to the raw products, the inventor uses the following process:—The raw materials (town sewage, "molasses wash," &c.) are mixed with finely powdered calcium carbonate (chalk). Sulphuric acid or phosphoric acid is then added. On stirring, carbonic acid escapes, and the mass is rendered permanently porous, and rapidly dries. Instead of calcium carbonate, some substance which chemically combines with water, such as calcium sulphate

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or acid phosphate, may be added. In this case the product must be mechanically broken up. 100 kilos. of molasses wash, with 25 kilos. of calcium carbonate (or sulphate) and 20 kilos. of commercial sulphuric acid, are suitable quantities to use.—W. P. S.

Fertilizing and Curative Compound, especially for Trees affected with Mussel Blight. E. O. Blackwell, Wynward, Tasmania. Eng. Pat. 3245, Feb. 19, 1900.

THE compound claimed is prepared by dissolving copper sulphate in water and spraying the solution on a mixture of common salt and quicklime. The proportions in the finished compound should be about 80 per cent. of salt, 18 per cent. of lime, and 2 per cent. of copper sulphate. The compound is dug into the earth round the trees, using 15 to 20 lb. per tree.—W. P. S.

XVI.—SUGAR, STARCH, GUM, Etc.

Solubility of Sugar in Solutions of Non-Sugar; Influence of Temperature on ——. I. Schukow. Zeits. Ver. Deutsch. Zuckerind. **50**, 291—321.

THE influence of varying quantities of a number of salts on the solubility of sugar at temperatures of 30°, 50°, and 70° C. were studied, as well as the action of the non-sugar obtained from molasses in the strontium process.

With increase of temperature, the whole of the salts examined have a strong influence on the solubility of sugar in water, increasing the solubility; that is, the melassigenic action of the salts (*i.e.*, their power of promoting the formation of molasses) increases with the temperature. These salts were KCl, NaCl, KNO_3, KBr, and $CaCl_2$.

With increase of temperature, the non-sugar of molasses increases the solubility of sugar in water.

In the case of potassium chloride, sodium chloride, and potassium bromide, the increase of the solubility of sugar increases with the amount of salt present and in an increasing ratio. Calcium chloride follows the same rule; the increase of solubility, however, only begins with a somewhat larger content of salt than in other cases. Potassium nitrate obeys the same law at 70° C., but at 50° C. only with high concentrations, and at 30° C. it is anti-melassigenic at all concentrations examined.

The capability of the non-sugar of molasses to increase the solubility of sugar in water increases with the amount of non-sugar present and in an increasing ratio. The alteration of the quantity of organic non-sugar with one and the same quantity of ash, of the same composition, appears to have little influence on the solubility.

Potassium and sodium sulphate have little influence on the solubility of sugar, even at 70° C.—L. J. de W.

Sugar Solutions; Solubility of some Calcium, Iron, and Copper Salts in ——. F. Stolle. Zeits. Ver. Deutsch. Zuckerind. **50**, 321—341.

SUGAR solutions lessen the solubility of calcium sulphate, as a rule, considerably, especially with increasing concentration and temperature.

Sugar solutions favour the solubility, or rather the decomposition, of calcium sulphide with the increase of concentration and of temperature.

The oxides and hydroxides of iron and the ferroferric oxides are only very slightly soluble in sugar solutions. Of the iron compounds, ferrous sulphide is by far the most soluble.

Sugar solutions act upon ferric oxide, forming a saccharate.

Cupric sulphide is characterised by its easy solubility in sugar solutions.—L. J. de W.

Beetroot Leaves; Ratio of Dextrose and Levulose in ——. L. Lindet. Zeits. Ver. Deutsch. Zuckerind. **50**, 281—289.

AN attempt is made to determine the physiological function of the reducing sugars in the leaves of the beetroot from the relative proportions of dextrose and levulose found at various periods of growth. The beetroot was chosen because it was found that the leaves contained only levulose and dextrose. The quantity of maltose found was never greater than 4 per cent. of the reducing sugars. As the root contains, besides cane sugar, only insignificant quantities of other sugars, the invert sugar found in the leaves grown in the dark, and therefore away from the assimilating influence of chlorophyll, can only arise from inversion of cane sugar.

For analysis, the leaves were separated into blade, ribs, and stalk. These were ground up separately and the juice expressed. It was clarified with sulphate of mercury, a little kaolin being added when necessary to secure a clear filtrate for the polariscope. The sugars were determined by Fehling solution and the saccharimeter, before and after inversion.

In all cases in which an active formation of new cellular tissue may be assumed, as in the leaves of beetroot growing in the dark, the dextrose is found to be in greater abundance than the levulose; but where respiration is more energetic, and new cells are produced more slowly, dextrose disappears more quickly than levulose. Analogous results are found in the analysis of the small leaves, which sprout in the light from a beetroot from which the leaves have been removed, as also of the small leaves of the seed stalk. In this case the levulose appears to be used up.

The difference in the content of dextrose and levulose in the blade and ribs of the leaf at various periods of growth is in agreement with the fact of the more active respiration of the blade, thus confirming the observation of Brown and Morris that it is the dextrose which is used up in preference by the plant during respiration. A further confirmation was obtained in a notable decrease in dextrose during moist weather succeeding a dry period, respiration being more active in a moist atmosphere.

The blades of the heart leaves, the less developed ribs, the leaves of late growth, and the under side of the ribs all contain a smaller proportion of levulose, indicating that the levulose is used by the plant in the formation of new cellular tissue.—L. J. de W.

Starch Syrup in the Manufacture of Foodstuffs; The Unrestricted Use of ——. J. König. Zeits. Unters. Nahr. und Genussmittel, 1900, **3**, 217.

See under XVIII. A., *page* 459.

Sugar; Modification of the Woycicki Method for Estimating —— in Sugar Beet. P. Nyssens. Bull. Assoc. Belge des Chim. **13**, [12], 495.

See under XXIII., *page* 474.

PATENTS.

Flexible Leather-like Substances; Manufacture of ——. L. Schwarzhuber, Vienna. Eng. Pat. 5937, March 18, 1899.

See under XIV., *page* 454.

Starch; Digestion of ——, and Manufacture of Dextrin Pastes and other Products. A. J. Boult, London. From C. M. Higgins, New York, U.S.A. Eng. Pat. 1885, Jan. 30, 1900.

THE process consists in mixing starch with water containing an acid or digesting agent, and applying heat to the mixture for the purposes of digestion, until it is in a condition to form, when cold, a soft paste of white dextrin. A proportion of five parts of starch to eight parts of water is specified. The mass, after digestion, is neutralised by a suitable alkali; the temperature of digestion should be kept below or near the gelatinising point of starch until the gelatinous character has almost disappeared, and it is then raised above the liquefying point before neutralisation. The product has a white colour and a dextrin reaction; it has a soft, pulpy, or unctuous consistency and great adhesiveness.—J. F. B.

Starch; Manufacture of ——. C. B. Duryea, New York, U.S.A. Eng. Pat. 2459, Feb. 7, 1900.

THE starch mass is separated into independent bodies, one of the bodies being composed of granules of one dimension

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and another of the bodies being composed of granules of a different dimension. The inventor finds that the smaller granules, when separated and used by themselves, are admirably suited for certain purposes. The separation is effected by levigation, by continuously running off the water containing the smaller granules in suspension, after allowing the larger granules to settle to the bottom.

—J. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Barley; Variations in the Steeping Process of ——. W. Windisch. Woch. für Brau. 1900, **17**, 205—207.

The effect of curtailing the steeping process and aërating the barley at intervals (see this Journal, 1900, 260) is to hasten considerably the commencement of germination. This has been abundantly confirmed by trials on the large scale, and the time thus gained, generally as much as two days, can be utilised in conducting the process on the floor at a lower temperature, and so obtaining a sounder transformation. The following outlines of the steeping process under various conditions of aëration are said to yield the above desirable results.

Compressed Air Aëration.—The barley is steeped six hours in lime water, followed by fresh changes of water three times in 12 hours. On the second day, air is passed through the mass for six hours, after which the barley receives another 12 hours' steeping in water, and then another 12 hours' aëration with compressed air, no water being given on the floor.

Aëration with the Automatic Sprinkler. — The barley is washed and sprinkled continuously during the first day; on the second day it is left six hours without water, and then sprinkled for six hours. After that it is sprinkled for one hour and left without water for three hours alternately; at the last it is left without water for six hours before removing from the steeping vessel. Not only does the sprinkling water bring fresh air with it, but it also carries off the carbonic acid produced during the process. Even if the sprinkler be run continuously, or with only short interludes, the consumption of water is scarcely more than in the ordinary steeping process with renewals every 12 hours.

Aëration by Frequent Changes of Water.—For preliminary trials, or when neither of the above means are at hand, the following process may be adopted: — The barley is left in "40 per cent. lime water" (40 procentiges Kalkwasser) for four hours, the lime water is run off, and the barley left without water for three hours. The steeping vessel is then filled up with water during one hour and immediately emptied, the barley being left for three hours without water. This is repeated until steeping is complete. This process is rather wasteful as regards water, and possibly the upper layers germinate more rapidly than the lower layers. By all the above methods the barley begins to germinate very soon after the final draining off, and the results are in every way satisfactory.

The author communicates results from practice of trials with the "dry malting" process, and with various periods of steeping and draining.

In the former case, batches of barley were steeped only for 24 hours, and also merely washed and drained off, the necessary water being supplied by sprinkling on the floor. Seven days' germination was sufficient to give a malt with perfect transformation and free from all traces of mould. In the other case—a pneumatic malting on Saladin's principle—the best conditions were found to be two days' steeping and two days without water.

The author remarks that up to the present his researches in this direction have been confined solely to pale malts, so as to obtain by cool germination a properly transformed pale malt with fairly high kilning.—J. F. B.

Yeast; Reproduction of Different Varieties of ——. D. P. Hoyer. Allgem. Zeits. für Bierbrau. **28**, [4], 37—41.

To obviate the difficulties experienced in counting cells grown by Hansen's gelatin method or Lindner's droplet cultures, the author prepared surface cultures on wort gelatin, which offers the additional advantages that the cells can be more easily watched and are all exposed to the same conditions with regard to nutrition and oxygen.

Three temperatures were employed, 6°, 13°, and 20° C.; but as none of the culture yeasts, or *S. ellipsoideus* and *S. pasteurianus*, would reproduce at 6° C., that series of experiments was abandoned. The results, calculated by Pedersen's formula, are given in the following table, which represents the period of generation of the various yeasts, &c., examined:—

Yeast.	Period of Generation.	
	At 13° C.	At 20° C.
	H. Mins.	H. Mins.
Sacch. cerevisiæ:—		
Top fermentation	7 47	4 33
Bottom fermentation	8 56	4 28
Saaz (bottom fermentation)	7 48	4 23
Frohberg (bottom fermentation)	7 21	4 18
Sacch. ellipsoideus I., Hansen	9 4	6 12
„ „ II., „	8 49	6 9
„ Pastorianus I.	6 6	± 3 37
„ „ II.	8 45	5 12
„ „ III.	8 39	6 8
„ anomalus	5 12	..
„ Ludwigii	8 10	..
„ membranæfaciens	7 1	5 13
Schizo-saccharomyces Pombe	..	6 4
Mycoderma cerevisiæ	7 24	± 3 20
S. apiculatus	4 45	..
Torula alba	6 31	..

—C. S.

Alcohol and Pressed Yeast by means of Mucedinæ; Process for Manufacture of ——. Barbet. French Pat. 290,995. Zeits. Spiritusind. 1900, **23**, [14], 127.

Further particulars are now to hand concerning the above process, which was noticed in this Journal, 1900, 164. The ordinary process for saccharification by Mucedinæ necessitates the boiling of the material at high temperatures under pressure, to bring the starch into a suitable condition. This involves a certain amount of burning or caramelisation, affecting the flavour of the products. According to this invention, the grain (more particularly maize) is broken into four or eight pieces by a special mill, and then introduced into a boiler, in which a mixture of water, or preferably clear spent wash, and hydrochloric acid is previously brought to the boiling point. The quantity of the acid varies from 1 to 5 per cent. of the weight of the grain, and the boiling lasts for three or four hours, until the blue iodine reaction is no longer obtained. The wort then contains 20—50 per cent. of glucose, the rest being dextrin. The spent grains are separated either by clearing bottoms, as in the brewery, or by extraction by the process of Bondonneaux and Foret, or else by a battery of sieves. The nearly clear, acid wort is partially neutralised by chalk, lime, or soda, just so far as to bring it into a condition for filtering through a press. After filtration it is passed into the closed fermenting vessel, sterilised by boiling, cooled, and neutralised by soda under aseptic conditions. The pure culture of Mucedinæ is sown at a temperature of 35°—38° C., and after a few hours' saccharification, the yeast is added at a lower temperature. The fermented wash is filtered through a press and the liquid distilled. The advantages of this process are that unburnt spent grains, suitable for fodder, are obtained; the mixture of yeast and Mucedinæ is consequently perfectly white in colour and very effective for baker's use, and the yield of a crude spirit of good quality is almost theoretical. —J. F. B.

Expressed Yeast Extract; Action of Precipitants on ——. *II.* R. Albert and E. Buchner. Woch. für Brau. 1900, **17**, [14], 189—190.

In their first paper (this Journal, 1900, 261) the authors showed that, although zymase could be completely precipitated from expressed yeast extract without loss, it could not be extracted from the precipitates so obtained without a very large deficiency. In the present experiments,

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however, this difficulty has been entirely surmounted by the use of aqueous glycerin for extracting the zymase from the alcohol-ether precipitates. The concentration of the glycerin does not matter in the least; solutions containing from 2·5 up to 20 per cent. gave identical results. A difficulty at first arose in the filtration of the glycerin extracts, which would only filter clear after several hours' filtration. If, however, the precipitate be agitated for half an hour with aqueous glycerin, then mixed with kieselguhr, and poured on several separate filters, sufficient clear extract can be obtained in a reasonable time. The glycerin extracts often had a higher fermentative power than the original expressed extract, due, probably, to a partial inhibition of the destructive proteolytic enzyme either by the alcohol or the glycerin. These glycerin extracts lost their fermentative power on keeping much less rapidly than the original expressed yeast extract. The authors further proved that the process of precipitation and redissolving in aqueous glycerin could be repeated with the glycerin zymase extracts without any loss of zymase, and the solution of the second precipitate was quite as active as that of the first and of the original expressed extract. It was further proved that the concentration of alcohol-ether used was sufficient to entirely destroy the vitality of living yeast.—J. F. B.

Zymase; Biological Significance of —— for Yeast. P. Lindner. Woch. für Brau. 1900, **17**, [13], 173—174.

The drying of culture beer yeast at ordinary temperatures causes the death of all but a very small proportion of the cells; zymase, on the other hand, resists the action of drying perfectly. This sensitiveness of the yeast cells is a great obstacle to the preservation of yeast by drying. Some time ago Will noticed that dried yeast several years old produced distinct fermentative effects in wort, no doubt the result of the still active zymase. The question whether the fermentative effect of the zymase in the case of dried yeast takes place inside or outside the shrivelled cell membrane must be left open, but there is no doubt that this effect is advantageous in the revivification of the few remaining living cells of the dried yeast. It is well known that small quantities of alcohol and carbonic acid greatly restrict the development of bacteria, for instance *termo* species. If wort be sown with dried yeast in which the zymase has been rendered inactive, putrefaction is certain to occur before the few living yeast cells have time to revive and assert themselves; the presence of zymase, however, retards the putrefactive bacteria by the products of fermentation until the yeast cells develop and suppress them. All species of yeast are not so sensitive to the effects of drying as the culture beer yeasts; for instance, the species of *S. Pasteurianus* and other wild yeasts are not killed by drying at ordinary temperatures. This circumstance is a great source of danger in the use of dried preserved yeast, since, although the original percentage of wild yeast may be very small, it is greatly magnified after the majority of the culture yeast cells have been killed by drying; in fact the wild yeasts may then be in overwhelming proportions. The first fermentation in the revivification of dried yeast must be carefully followed with the microscope; the conditions for suppressing the wild yeasts and favouring the culture yeast must be maintained. Not too large a quantity of wort must be used, and the wort must not be too dilute. In large volumes of wort the initial effects of the zymase fermentation will be weak, and putrefactive bacteria will gain a footing. It is not known whether the other enzymes of yeast have any retarding effect on bacteria; these enzymes are certainly active in dried yeast, as is shown by Fischer's method for isolating or extracting them. Moreover, the author has found the gelatin-liquefying enzyme to be active in a yeast culture which had been kept for several years and in which all the cells were dead. The enzymes of yeast no doubt survive the cells in all cases, such as in pasteurised beer and old wines and beers.—J. F. B.

Starch-converting Agents in Brewery; Acids as ——. N. van Laer. J. Fed. Inst. Brew. 1900, **6**, [3], 162—169.

The hydrolysis of starch by acids differs from that by diastase in the fact that the end product is glucose instead of maltose, and that the intermediate carbohydrates are different. The method introduced by P. Callebaut (this Journal, 1900, 65) has been adopted in several Belgian breweries. It consists in partially saccharifying maize grit with dilute hydrochloric acid by boiling under a pressure of 37 lb. per sq. in. until a violet iodine reaction is obtained. The proportions used are 7·5 barrels of water, 17·5 lb. of hydrochloric acid, and 5 qrs. of ground maize. The mass is then discharged into coppers, nearly neutralised with sodium carbonate, run into the mash-tun, and the saccharification completed by malt. The slight acidity is left to promote the solution of sufficient acid phosphates. Full details and notes are quoted by the author of a typical brewing by this process as worked in Belgium. Samples were withdrawn at different stages of the boiling, and examined comparatively. The results show (1) that the major part of the dry extract of the cooked grits is composed of dextrins; (2) that after the pressure attains 37 lb. per sq. in., the production of reducing bodies, mainly at the expense of the dextrins and soluble starch, is more rapid than the solution of the remaining starch. By this process raw grain may be used up to 70 per cent. The beers obtained show but a feeble apparent attenuation of 55·5 per cent. after primary fermentation, due to deficiency of nitrogenous matter, which is insufficient for the exertion of the full power of the primary yeast. In spite of this the beer keeps very well, and many breweries have employed the process for the last 12 months. In the discussion, the author remarked that the breweries in question used the top-fermentation process, and that the yeast crop was perfectly normal and could be used repeatedly. A certain amount of malt is absolutely necessary; otherwise it would be impossible to effect the running off of the wort from the mash.—J. F. B.

Beers; Value of the Unfermentable Residue of ——. R. E. Evans. J. Fed. Inst. Brew. 1900, **6**, [3], 182—197.

Apart from flavour and aroma the consumer judges a beer from its palate fulness, and pays little attention to its alcoholic strength. The fulness is largely determined by the carbonic acid gas retained by it. The total solids of wort may be divided into three classes:—(1) The directly fermentable sugars, which, being converted into alcohol and carbon dioxide, need not be considered here. (2) The more slowly fermentable carbohydrates, which constitute the condition of the beer; these exist only in small proportion, and their quantity is greater, the lower the mashing heat employed. (3) The unfermentable residue, on which the final gravity, fulness, and much of the flavour depends. The sensation of palate fulness was tested by the author with various substances, and the results showed the following order of effect:—(1) A solution containing equal parts of cane sugar and dextrin; (2) cane-sugar solution; (3) glucose solution; (4) beer residue free from alcohol; (5) solution of unfermentable matter from glucose; (6) dextrin solution, according to concentration.

The author further tested the effect of diluting the diastatic action of malt by the addition of flaked maize on the quantity of unfermentable residue. The residue becomes more and more dextrinous and higher in quantity, causing increase of final density. The same results occur by mashing the malt at higher temperatures. An important factor in palate fulness is the degree of curing received by the malt; the highly flavoured bodies produced during the dry heating have an effect out of all proportion to their actual quantity. The application of this factor is limited by the production of colour and the destruction of diastase.

Priming.—The addition of saccharine matters may be made during the boiling of the wort or after primary fermentation. The mode of employing and the nature of the substance added varies largely according to the demands of the consumer.

Analyses are quoted of various invert sugars and glucoses, containing more or less unfermentable and unknown carbohydrates, which latter are quite as important in their effects as the sugar. The quantity of unfermentable matter in these substances can be increased by roasting. The

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semi-caramelised products appear also to have a favourable influence on the clarification and the action of the finings; they also tend to increase the stability, and have some antiseptic value.

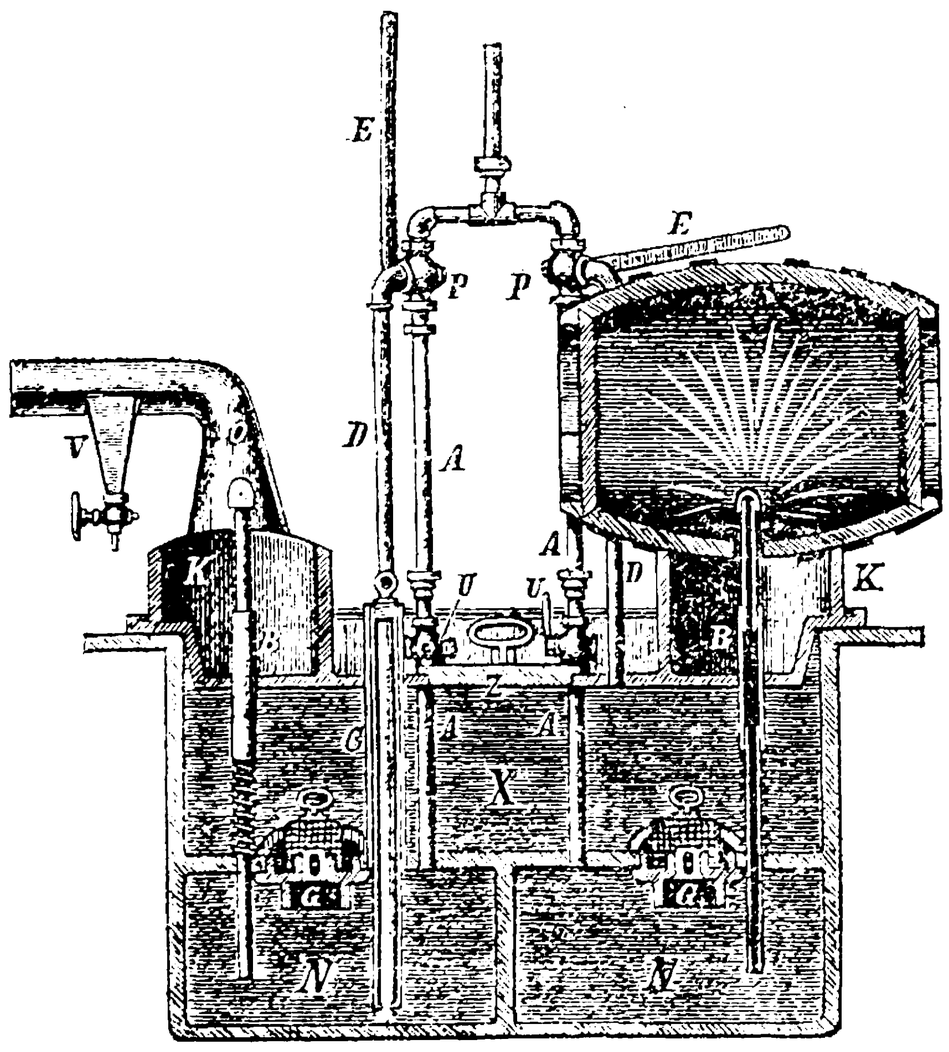
The author thinks that more attention should be paid to the qualitative factors of palatability; that alcoholic strength is a minor detail, and that a better beer, chargeable with less duty, may be prepared by decreasing the alcohol and selecting the most favourable quality and quantity of unfermented residue.—J. F. B.

Hop-Bitter Acid and the Bitter Principle of Beer; Physiological Action of ——. A. Delich. Woch. für Brau. 1900, **17**, [13], 175—176.

Poisonous symptoms have been observed following on excessive beer drinking and after inhalation of hop dust by hop sorters, which have been attributed to the action of the hop-bitter principles. The author quotes at some length the experiments of Dreser (Archiv. experim. Pathолog. 1887, 129). Dreser used the hop-bitter acid isolated by Bungener, by extracting hops with petroleum spirit. This is a crystalline body which is readily oxidisable into an amorphous substance. Dreser injected a 1 per cent. solution of the sodium salt of this acid into the circulation of small animals. The effects are such as to cause retardation of respiration, slowing of the heart, paralysis extending from the hinder parts forward, vomiting, spasms, and finally death; in fact, the symptoms are somewhat similar to those of strychnine poisoning. He found, however, that in the case of warm-blooded animals, the hop acid had no effect when taken into the stomach, only when injected into the blood. These results render the probability of poisonous effects from beer consumption very remote. Moreover, this acid is not present at all in beer; it is altered during fermentation. The bitter principle of beer is identical with the amorphous oxidation product of the hop acid, and Dreser found that this principle was absolutely harmless, even when injected into the blood. No experiments have been recorded as to the physiological action of the more recently described hop-bitter acids of Lintner and Hayduck, nor of the alkaloids of the hop-seeds.—J. F. B.

Pitching [Brewers' Casks]; Modern Methods of ——. Allgem. Zeits. für Bierbrau. **28**, [6], 65—67; [7], 75—79.

The Rauch pitching machine consists of a rectangular vessel set in masonry, and provided with a sheet-iron smoke pipe O (see figure) to carry off the pitch fumes, the



oily parts of which condense and are run off through the funnel V, thus preventing the return of these malodorous constituents to the vessel. The latter is divided into one upper compartment, X, and two lower ones, N N, communicating by way of the valves G G, which open downwards by their own weight, and are covered by bell sieves, to keep back impurities. From each of the lower compartments a pipe, B, terminating in a rose jet, ascends into the shaped pipe K, which serves to support the cask during pitching, and conducts the surplus pitch back into X, where it is freed from mechanical impurities by sifting. Pipes A A and D D, with their three-way taps P P and U U, are connected with a source of compressed air, the air being admitted above the level of the pitch in N, through A, on turning the lever E of tap P. This lever safeguards the attendant from the risk of scalding, since the cask cannot be removed until E has been turned back and the air supply shut off. The taps U also serve to cut off the air supply by directing it into the open air through a branch. When the cask has been lined, the tap P is turned so as to relieve the pressure in N and divert it to X *viâ* D, thus driving the pitch from X into N. A safety-valve is provided.

The pitch is heated to 200°—210° C., and, when the pressure is turned on, ascends with great force through B, and after melting off the old coating, forms a new one. Whilst the surplus pitch is draining from the cask, a second cask is being treated on the other side of the machine, the work being done so quickly that 150—180 casks can be treated in an hour.

As in other cases, the pitch becomes gradually more difficult to melt after the charge has been in use some time, though the difference is less marked than when an open fire is employed.—C. S.

Crude Spirit; Process for Purifying ——. Calmant. French Pat. 291,191; through Zeits. Spiritusind. 1900, **23**, [16], 144.

The fermented wash is first distilled by means of a very simple still, so as to obtain an approximately 30 per cent. spirit. This crude spirit is then passed on to a filter battery containing vegetable charcoal. After filtration it is again distilled so as to yield a spirit of 86—88 per cent. strength. The inferior fore and after runnings (feints) are placed on one side for separate treatment. The 86—88 per cent. spirit is placed in a cylindrical vessel, provided with a stirrer and having a conical bottom. It is then treated with caustic lime in the proportion of 2 to 10 grms. per litre of spirit, according to the degree of impurity. The treatment lasts for from two to six days, with slow continuous stirring.

The solid matter is then allowed to settle, and the liquor is drawn off into wooden vessels, also provided with stirring apparatus. In these vessels it is treated with a concentrated solution of tartaric acid, with constant agitation until neutral.

The liquor is again drawn off from the sediment and filtered through wood charcoal. In this way a pure spirit is obtained of good taste and odour. The feints are treated in a similar manner with caustic potash or lime, and after filtration they are rectified.—J. F. B.

Alcohol from Acetylene; Manufacture of ——. U.S. Consular Reports, 1900, 287.

See under XXIV., *page* 476.

PATENTS.

Yeast; Extraction of the Protoplasm from ——. E. de Meulemeester, Brussels. Eng. Pat. 8780, April 26, 1899. (Under Internat. Convent. from Oct. 15, 1898.)

See Ger. Pat. in this Journal, 1899, 1039.—J. F. B.

Waste Liquors from Manufacturing Processes [Breweries, Distilleries, &c.]; Purification of ——. W. Naylor, Preston. Eng. Pat. 6272, March 23, 1899.

This invention deals with arrangements for producing putrefaction or decomposition of organic matter dissolved

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or suspended in brewery, distillery, or other like waste liquors from factories, unaccompanied by the usual production of acid. The combination of the above arrangements with a filter charged with aërobic or nitrifying organisms is also claimed. These arrangements may further be combined with receptacles placed over the filter, provided with automatic discharging siphons, controlled by floats, the discharge from such receptacles being through a network of perforated pipes placed over the filter, either stationary or in motion.

The liquid is first freed from coarser particles by sedimentation; it is then infected with non-acid-producing organisms by means of strong sewage, and allowed to remain until quite putrid. The nitrifying filter is brought into an active state by means of sewage, and is made up of some porous material, such as coke or broken bricks. The distributing arrangements have the object of controlling the supply and delivering the liquid to the filter in a thoroughly aërated condition.—J. F. B.

Baker's Yeast; Manufacture of ——. A. E. Norgaard, Odiham, Hants. Eng. Pat. 6939, March 30, 1899.

ORDINARY brewer's yeast is diluted with water and saturated with sodium or ammonium carbonate to remove the acid therefrom; the liquid is then drawn off from the settled yeast, which is next washed and placed in a wort, 5 per cent. of it, however, being first separated and boiled before adding to the wort. It is essential that the wort be cooled to the proper temperature of about 83° F. Fermentation is allowed to proceed with aëration until all the sugar has been removed. The wash is then passed into a filter-press, and the yeast is washed with cold water until it is clean.—J. F. B.

Carbonic Acid Gas from Fermenting Vats; Collecting and Utilising ——. J. F. Wittemann, New York, U.S.A. Eng. Pat. 64, Jan 1, 1900.

THIS method of collecting the carbonic acid of fermentation consists in allowing a layer of the gas to form above the fermenting liquid, under atmospheric pressure, and siphoning it off from the bottom of the layer, whereby carbonic acid gas is obtained practically free from air. The apparatus consists of an open fermenting cask, with a bowl floating in the liquid and submerged in the layer of gas formed above the same. A gas receiver is placed at a lower level than the bowl, and a siphon serves for withdrawing the gas from the deep part of the bowl and delivering it into the receiver, which is furnished with a counterbalanced dome. The central portion of the bowl may be made with a depression, so as to allow the gas to be withdrawn from a deeper level. From the gasometer the gas may be passed to storage vessels, from which it can be delivered at any pressure by pumping water in.
—J. F. B.

Air and Carbonic Acid; Apparatus for Mixing in Desired Proportions ——. L. Kallina, Teschen, Austria. Eng. Pat. 2389, Feb. 6, 1900.

THE apparatus comprises "a mixing valve fitted between a pressure-reducing valve connected to a carbonic acid cylinder, and a pipe conveying the mixture to the point of consumption, whereby, by adjusting the said valve, the quantity of air sucked in by the carbonic acid can be accurately regulated." The tube leading from the screw valve of the cylinder containing the liquefied or compressed carbonic acid, is warmed by spirit lamps, and the outlet pipe of the pressure-reducing valve communicates with a funnel closed by an adjustable rotatable disc, into which the nozzle-shaped end of the supply pipe opens. A pointer is secured to the funnel, and the disc has a scale, so that the movement of the latter may be adjusted by the pointer to admit any required proportion of air. The mixture of air and carbonic acid may be used for therapeutical purposes.—E. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Starch Syrup in the Manufacture of Foodstuffs; Unrestricted Use of ——. J. König. Zeits. Unters. Nahr. und Genussmittel, 1900, **3**, [4], 217—220.

STARCH syrup is now prepared in a very high state of purity, and Fresenius and Mayrhofer point out that its use may be advantageous, and that in some sweetmeats it is indispensable. The author argues for a restriction on the use of starch syrup, in the shape of a declaration of its presence. The heat of combustion of starch sugar is less than that of cane sugar; its behaviour under the action of enzymes is different, especially in syrups which contain much dextrin. Starch sugar or syrup is much cheaper than cane sugar. Its sweetening power is only one-third or one-fourth that of cane sugar, and where this fact is an advantage, a declaration could do no harm to the trader. The use of starch syrup in fruit juices enables the manufacturer to make an unfair profit. The presence of starch syrup in conserves of fruit juices prevents the crystallisation of the cane sugar; under ordinary conditions this effect is obtained by increasing the proportion of fruit juice to cane sugar, so that with starch syrup less fruit can be used. Again the viscosity of starch sugar and syrup is higher than that of cane sugar at the same concentration, in proportion to the quantity of dextrin present. The author has carried out experiments on this subject, making determinations both with the viscosimeter and with Weiss' consistency meter, which measures the resistance of the fluid to the rotation of a plate. The results showed that the viscosity and the consistency were in the case of starch sugar 2·0 times, and in the case of a starch syrup 2·3—2·5 times greater at 60 per cent. dissolved solids, than in the case of a solution of cane sugar at the same concentration.

It was found that the differences recorded by the viscosimeter rapidly decreased as more dilute solutions were tested, but that the readings of the consistency meter were in constant proportion for all concentrations, and could be reduced to terms of the effect per 1 per cent. of dissolved solids. This increased viscosity or consistency, when starch syrup is used instead of cane sugar, enables the manufacturer to pass off articles of less real concentration having the same appearance, as those with more substance, when cane sugar is used. In Germany, owing to fiscal reasons and to the high price of cane sugar, the question of the substitution of starch sugar for cane sugar is of more importance than in this country.—J. F. B.

Butter, Renovated; Detection of ——. W. H. Hess and R. E. Doolittle. J. Amer. Chem. Soc. 1900, **22**, [3], 150.

See under XXIII., *page* 472.

Fat in Dairy Products; New Process for the Estimation of ——. Lindet. J. Pharm. Chim. 1900, **11**, 368.

See under XXIII., *page* 473.

Two Ambiguous Reactions [*Formaldehyde in Milk and Sesamé Oil in Butter*]. C. Amthor. Zeits. Unters. Nahr. and Genussm. 1900, **3**, 233.

See under XXIII., *page* 473.

PATENTS.

Baker's Yeast; Manufacture of ——. A. E. Norgaard, Odiham, Hants. Eng. Pat. 6939, March 30, 1899.

See under XVII., *page* 459.

Oats, Wheat, Barley, and such like into Food Stuffs; Conversion of ——. R. Graham, Fife, Scotland. Eng. Pat. 11,203, May 30, 1899.

OATS are kiln-dried and stored for two months. They are then steeped in repeated changes of water and drained,

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being afterwards placed on a porous floor for 14 days with frequent turning over. The oats are then allowed to lie in heaps for about 24 hours, until the temperature rises to 60°F. They are now withered, and dried in a kiln for 100 hours at a temperature of 90° to 170° F. The final operation consists in roasting the treated oats in a metal drum, after which they are allowed to cool, the husks are removed, and the grits ground. Wheat and barley are treated in the same manner, but with slight variations in the time and temperature.—W. P. S.

Milk; Process for Preserving ——. H. J. Bücka and C. Hansen, Frederiksberg, Denmark, and O. B. Wimmer, Copenhagen, Denmark. Eng. Pat. 11,664, June 5, 1899.

Milk is evaporated under a low pressure, with constant stirring, until a sample taken from the pan will powder when cooled to 45° C. When this point is reached, the bulk is cooled to 45° C. and ground to powder.—W. P. S.

Albumose, Manufacture of ——. D. Finkler, Bonn-on-the-Rhine, Germany. Eng. Pat. 13,096, June 23, 1899.

If materials containing gelatin be subjected to an albumosing process, the gelatin bodies are first converted into gelatin-albumose, after which the albumosing of the albumin is effected; during the latter process the gelatin-albumose is also partially converted into gelatin-peptone. The resulting product therefore consists of a mixture of gelatin-peptone, gelatin-albumoses, and albuminous albumoses. As the nourishing value of the gelatin products is very low compared with those of albumin, it is desirable to eliminate them from the albuminous albumoses. The patentee effects this as follows:—The material to be albumosed is first loosened, and washed with acidulated water until the washings no longer give a reaction with tannic acid. The material so treated, which is still acid, is then boiled with 10 to 20 times its weight of water under a reflux condenser, or it is heated either in the acid solution or with the addition of sodium carbonate under a pressure of one to two atmospheres for some hours. The albuminous substances are thereby converted into albumose free from gelatin derivatives. —W. P. S.

Albumin from Rape Seed and Rape-Seed Cake; Preparation of ——. E. Fromm, Freiburg, Baden, and T. V. Bredt, Cologne, Germany. Eng. Pat. 13,252, June 26, 1899.

Finely powdered rape-seed cake is extracted with water at a temperature between 30° and 40° C. The aqueous solution is separated from the residue, and heated to coagulate the albumin. The latter is slightly washed, and dried either in a current of air or under reduced pressure. This is necessary, as the albumin, when first precipitated, can only be filtered with difficulty. The dried mass is powdered, and is then easily washed, filtered, and dried. —W. P. S.

Edible Crustaceæ; Extract from the Flesh of ——. C. Arendt and W. Hönicke, Büsum, Holstein, Germany. Eng. Pat. 1370, Jan. 22, 1900.

According to this patent, fresh unboiled shrimps and prawns are pounded, and freed from the greater portion of their fishy taste and smell by soaking in vinegar and water, and subsequent washing in water. Water is then added to the mass, which is heated; the bouillon obtained is expressed from the solid portion, and whilst hot is cleared with prepared wood shavings, whereby all fishy taste is removed. These shavings are prepared by boiling in water rendered slightly alkaline with sodium carbonate. After cooling, the clear extract is poured off, filtered, and boiled down on a steam-bath to half its bulk. A creatine-pepsin mixture is then added to peptonise the albumins, and the mass is concentrated under reduced pressure at a low temperature to the desired consistency.—W. P. S.

Vegetable Extracts. J. Provoyeur, Ghent, Belgium. Eng. Pat. 16,942, Aug. 21, 1899.

The process claimed in this patent relates to the removal of disagreeable bitter or acid ingredients from vegetable substances or their extracts. Its most important application is in the case of chicory. Ground roasted chicory is thoroughly macerated and extracted with water. The decanted extract is neutralised with magnesia (MgO) and allowed to settle. It is then decanted again (from the precipitated bitter principles) and evaporated to a paste or to dryness.—W. P. S.

Meat Extracts, and the Preparation of the same ——. S. Bergheim, London. Eng. Pat. 3129, Feb. 16, 1900.

The patentee increases the amount of albumin in meat extracts by the addition of a prepared solution of this substance. Albumin is boiled with a suitable quantity of water until the mixture has jellified. A mixture of meat extract and gelatin is also boiled in another vessel and then added to the prepared albumin, keeping the mixture boiling and stirred until it attains the consistency of cream. The following proportions may be used:—Soluble albumin, 60 parts; meat extract, 35 parts; gelatin, 5 parts. The object of the invention is to make an extract containing more than 5 per cent. of albumin, from which the albumin will not separate out.—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

Water; Purification of —— by the Halogens. F. Malméjac. J. Pharm. Chim. 1900, **11**, [8], 364—368.

Bassenge found that chlorine, by 10 minutes' contact in the proportion of 0·0978 grm. per litre, would sterilise water containing the bacilli of Escherich and Eberth. Schimburg found that bromine, by five minutes' contact in the proportion of 0·04 grm. per litre, was equally effective. And Allain discovered that 0·01 grm. of iodine per litre killed, after 30 minutes' contact, all the non-sporing pathogenic bacteria and the majority of saphrophytes.

In order to make an exact comparison of these three reagents, separate quantities of a badly polluted water were treated, under identical conditions, with the same quantity (0·01 grm.) of chlorine, bromine, and iodine. After 30 minutes' contact, the excess of reagent was removed by adding sodium thiosulphate. The following results were then obtained by analysis of the water before and after treatment:—

	Organic Matter by Levy's Permanganate Method.		Free Ammonia.	Albuminoid Ammonia.	Oxygen by Levy's Method.		Number of Organisms.
	Alkaline Medium.	Acid Medium.			1st Day.	20th Day.	
	Parts per Million.						
Original Water	4·4	4·6	Traces	0·24	9·6	12·9	17,500
Water purified by chlorine	3·2	3·6	„	0·16	11·6	15·3	300
„ „ bromine	4·0	3·8	„	0·22	11·3	14·2	190
„ „ iodine	3·8	4·2	„	0·22	10·6	13·1	90

It will be observed that the organic matter has been but little affected, except by chlorine, which has removed only 25 per cent.; the albuminoid ammonia also is reduced most by chlorine; the oxygen unexpectedly has increased, both in the original and also in the treated waters. The most marked effect produced is the great reduction in the number of bacteria. In the original water many liquefying colonies developed, but in the treated waters, none. Thus,

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although chemically not much purification has been effected, from a bacterial point of view the purification has been great.

Of the three halogens, the most convenient from a practical point of view is iodine.

Comparing the purifying action of the halogens with that of alum, it may be noted that Max Teich has shown that alum cannot be trusted to destroy the typhoid bacillus; that the cholera germ is not killed by it in 24 hours; and that bacteria generally, after purification by alum, are not slow in multiplying.—L. A.

Nitrites in Potable Waters; The Importance of the Detection of ——. L. Spiegel. Ber. 1900, **33**, [4], 639—644.

For the detection of small quantities of nitrites, H. Erdmann has recently recommended the use of 1.8-amidonaphthol-4.6-disulphonic acid following the addition of sulphanilic acid (Ber. **33**, 210). Erdmann has also stated that all good potable waters are free from nitrous acid, and that nitrous acid is always found in waters containing animal contaminations. Many pathogenic bacteria produce nitrites under certain conditions, but it is doubtful if Erdmann's method is sufficiently delicate to detect the small quantities produced, when diluted by a large volume of water free from nitrites. Cholera cultures, which give the Indole red reaction on the addition of acids, often contain no nitrites (Beijerinck, Centralb. für Bacteriol. **12**, 715). In the examination of the waters of the Spree in 1885-86, no trace of nitrous acid was found, though at the same time a bacillus producing nitrites was isolated from them. The property of producing nitrites is more prominent among saprophytic than pathogenic bacteria. According to Chabrier (Comptes Rend. **68**, 540; **73**, 485), considerable quantities of nitrites are found in meteoric dust. Thus it is incorrect to say that "every good drinking water is free from nitrous acid." The presence of nitrites has no greater significance than that of other nitrogen compounds.

For the purposes of a rough test for nitrites by the layman, the author recommends guaiacol; this will indicate a suspicious water, but the reaction is not sufficiently delicate to establish absolute non-contamination in waters. The aqueous solution, obtained by shaking and filtering, gives with $\frac{1}{100000}$ N nitrite solution, after adding a few drops of dilute sulphuric acid, almost immediately an orange coloration, and with a solution of one-tenth that strength a coloration in $\frac{1}{2}$—1 hour. Oxidising agents and iron salts, in reasonable quantity, have no influence on the reaction.

—A. C. W.

Lead; Solubility of the —— contained in the Glaze of Stoneware. F. Garelli. Giorn. Farm. Trieste, 1899, **4**, 331.

See under VIII., *page* 443.

Arsenical Wall Papers and Mould Fungi. H. A. Schmidt. Zeits. für angew. Mikroskopie, 1897, 176.

See under VI., *page* 440.

Cystine in Contaminated Waters; The Presence, Variations, and Estimation of ——. H. Causse. Comptes Rend. **130**, [12], 785.

See under XXIII., *page* 472.

PATENT.

Effluents in Towns, Factories, and the like, and in Apparatus therefor; Mechanical Purification of ——. M. May, jun., Frankfurt a/Main, Germany. Eng. Pat. 10,412, May 17, 1899.

For the clarification of crude sewage or trade effluents, a drum sieve, having meshes of from 1·0 to 0·25 sq. mm. area, revolves in a trough into which the effluent is led. The drum is open at one or both ends, and such end or ends fit water-tight in an opening in the end wall or walls of the trough. The liquid which penetrates into the drum flows away through the open end, whilst the solid matter deposited on the exterior is carried up out of the liquid by the revolution of the drum, and is removed by a revolving scraper or brush. A difference of 30—40 cm. between the levels of the liquid inside and outside the drum is a sufficient hydrostatic pressure, so that a drum of 1 metre diameter requires to be half immersed. With very thin or very slimy liquids, peat powder, sawdust, chaff, leaves, or the like may be added to facilitate filtration, a sufficient proportion being about 0·1 part per thousand.—L. A.

(*C.*)—DISINFECTANTS.

Formaldehyde; Sensitiveness of Certain Tests for ——. B. M. Pilhasy. J. Amer. Chem. Soc. 1900, **22**, [3], 132.

See under XXIII., *page* 473.

XIX.—PAPER, PASTEBOARD, Etc.

PATENTS.

Paper Making, and in other Manufactures; Apparatus for Washing Fibrous Materials used in ——. J. H. Annandale, Polton, Midlothian. Eng. Pat. 4756, March 4, 1899.

The apparatus consists of a perforated, cylindrical, horizontal or slightly inclined drum, made up of longitudinal spars surrounded by a shell carrying on its inner periphery a helical blade, the whole revolving in a fixed vat or trough. The material, which is fed in at one end of the drum, is carried through it by the revolving helix, and out at the other end, against a stream of water which is directed through the drum in the reverse direction.—L. A.

Celluloid, Surfaces of ——; *Method of and Solvent Materials for Treating.* A. N. Petit, Newark, Essex County, New Jersey, U.S.A. Eng. Pat. 22,867, Nov. 16, 1899.

A solvent of celluloid, preferably amyl acetate, is mixed with a fixed oil, fatty acid, or similar material, preferably oleic acid, and the celluloid surface to be treated is coated with the mixture and exposed to the air. The surface is thereby rendered appreciably soft and plastic, but not sticky, and is sufficiently soft to permit the instruments employed for engraving, cutting, plowing, or otherwise cutting or ornamenting the celluloid to readily cut into the same. The invention relates particularly to the treatment of phonograph cylinders. For the treatment of celluloid which does not contain pigment, a saturated solution of zinc oxide or chloride, or other metallic salt or pigment, in "butyric amyl" or other solvent for celluloid, may be mixed with the amyl acetate and oleic acid.—L. A.

Celluloid; Reproduction of Clichés, Stamps, and the like in ——. D. Lichtenberg-Madsen, Odense, Denmark. Eng. Pat. 25,519, Dec. 23, 1899.

In a plate of a special kind of celluloid, which contains about 70 per cent. of nitrocellulose, 25 per cent. of camphor, and 5 per cent. of resinous oil or the like, a negative is stamped with the original cliché. The negative thus obtained is then used as a matrix for the stamping of another plate of celluloid containing from 35 per cent. to 50 per cent. of camphor. In this plate an exact copy of the original cliché is obtained. By thus employing two different kinds of celluloid, no tendency to adhere when pressed together is experienced, and there is therefore no need to employ an insulating coating, which would impair the sharpness of the reproduction. Autotype clichés reproducing the fine lines of the net may thus be obtained in celluloid, which has hitherto been impossible.—L. A.

Paper; Improved Process for the Manufacturing of ——. F. A. Fletcher, Watertown, Jefferson County, New York, U.S.A. Eng. Pat. 3595, Feb. 23, 1900.

The process consists in forming a continuous strip of moist paper pulp in a rarefied atmosphere, within a closed chamber, extracting some of the moisture by suction, and some by heat, and passing the said strip through the heated and rarefied atmosphere until it is practically dry, without much compression, in order to produce a soft and porous paper.—L. A.

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XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Rare Earths; Separation of the ——. R. Chavastelon. Comptes Rend. **130**, [12], 781—782.

THE author gives two methods for the separation of thorium, cerium, lanthanum, and didymium.

First Method.—Pour the neutral solution of the mixed salts into excess of saturated solution of normal sodium sulphite. Nearly the whole of the thorium remains in solution, the other metals are precipitated. Filter, dissolve the washed sulphites in hydrochloric acid, precipitate the rest of the thorium by hydrogen peroxide, filter, and precipitate the other oxides by ammonia. Suspend the washed oxides in sodium bicarbonate solution, and pass a current of carbon dioxide through: the cerium peroxide dissolves, and can be filtered off. If the residue be brown, the treatment with bicarbonate and carbon dioxide must be repeated till the residue is white or rose-tinted. Should this residue be browned by hydrogen peroxide, more of this must be added, the excess carefully washed out, and the treatment with bicarbonate and carbon dioxide repeated. The pure double carbonates of sodium with lanthanum and didymium are thus left.

Second Method.—Precipitate the four oxides by ammonia and hydrogen peroxide, and treat the washed oxides with sodium bicarbonate and carbon dioxide as above. The lanthanum and didymium are left as before, the thorium and cerium dissolve. Precipitate their oxides by potash or soda, reduce these, and convert into sulphites by sulphurous acid, subsequently converting the sulphites into chlorides; then precipitate the thorium from the hydrochloric acid solution by hydrogen peroxide. Or, dissolve sodium carbonate in the solution of the cerium and thorium peroxides, in quantity sufficient to keep the thorium in solution when converted into sulphite; and in this case be careful in adding the sulphur dioxide to avoid the formation of bisulphites.—J. T. D.

Rare Earths; New Method of Fractionation of Some ——. E. Demarçay. Comptes Rend. **130**, [15], 1019—1022.

THE method consists in crystallising from nitric acid the double nitrates of the earth-metals and magnesium, of the general formula $M_2(NO_3)_6.3Mg(NO_3)_2.24H_2O$. These have been described only in the cases of lanthanum and cerium (Holzmann), but they exist for the whole series of earth-metals up to holmium, though not for yttrium. The double salt of lanthanum is least soluble, and these salts become more soluble and less stable as the molecular weight increases, whilst the presence of one of them lessens still further the solubility of others less soluble. Neodymium and samarium can thus be separated in four fractionations, samarium from the author's unnamed earth Σ in eight or ten, while Σ can only be separated from gadolinium in twelve or more. The separation of the metals above gadolinium is more difficult, though even here, up to holmium, the method is superior to older ones. In these fractionations, yttrium is eliminated among the more soluble double salts; but much yttrium affects the separations injuriously, and the bulk of it should therefore be removed by sodium sulphate or by crystallisation of the nitrates from nitric acid of 1·3 sp. gr. This latter method of separation presents indeed many advantages so long as no metal below gadolinium in atomic weight is present. For the separation of lanthanum, praseodymium, and neodymium, the new method is not better than the crystallisation from nitric acid of the double ammonium salts.

The author points out that in these separations, especially where the salts are colourless, the spectroscope affords the only trustworthy evidence that a complete separation has been effected and a single substance obtained.—J. T. D.

Perchloric Acid; Preparation and Properties of Anhydrous ——. D. Vorländer and R. von Schilling. Annalen, **310**, [3], 369—380.

IN a distilling flask of 300 c.c. capacity were placed 50 grms. of powdered potassium perchlorate (free from chloride, but containing a little chlorate) and 150—175 grms. of sulphuric acid of 96—97·5 per cent. strength. The flask was placed in an oil-bath and connected with a condenser leading to a receiver cooled by ice and salt. Between the receiver and filter-pump was a soda-lime tube; the connections between this and the flask were made by asbestos stoppers, obtained by rolling thin asbestos paper moistened with thick water-glass solution round the tubes. With the bath at 135°—145° C., the anhydrous perchloric acid distils over under 50—70 mm. pressure; the bath is gradually raised to 155°—160° C. until distillation slackens, then to 180°—190°, keeping the level of the oil below that of the contents of the flask. After 1½—2 hours, the distillation becomes extremely slow; the yield is then 22—24 grms. of impure anhydrous acid. *In vacuo*, perchloric acid vapour can be heated to a much higher temperature than the 92° C. found by Roscoe to be the point of decomposition at ordinary pressures. Temperatures up to 115° C. under 90 mm. pressure were observed.

The crude acid is coloured yellow by chlorine peroxide; it contains about 1 per cent. of sulphuric acid, and at times a trace of hydrochloric acid. It is purified by distilling from a water-bath at 45°—65° C. under 50—70 mm. pressure. The distilling flask is provided with a capillary tube admitting dry air. Sulphuric acid and a little monohydrated perchloric acid remain in the flask. The yield is 18—21 grms. of pure colourless acid from 50 grms. of potassium perchlorate. If the acid is to be kept, it is well cooled and poured on to ice made from distilled water or mixed with strong perchloric acid solution.

Anhydrous perchloric acid boils undecomposed at 39° C. under 56 mm. pressure; its specific gravity at 22° C. (compared with water at 4° C.) is 1·764. It does not solidify in a mixture of solid carbonic acid and ether; it mixes with chloroform in every proportion; in a few days the solution turns yellow, and when exposed to the air large crystals of the monohydrate are formed. The acid is insoluble in carbon tetrachloride; a green emulsion is formed on shaking, which becomes warm, turns brown in a few minutes, and foams up, with evolution of hydrochloric acid gas, phosgene, &c. Brown flocks are separated on pouring benzene over two drops of the acid; with equal volumes a green emulsion is formed, which soon explodes. A very violent explosion ensues when the chloroform solution is poured over phosphorus pentoxide.

The gradual decomposition of perchloric acid when kept in the cold and dark cannot be avoided. The purest acid sealed up in glass bulbs turns yellow, and the evolved gases burst the bulbs in 3—4 weeks. The impure acid is more quickly decomposed; it turns brown in 1—2 days. When the brown acid is distilled, the distillate is not colourless; the brown decomposition product, observed by Roscoe, remains in the flask.

The quantity and strength of the sulphuric acid used have great influence on the stability of the crude perchloric acid. The stronger the sulphuric acid, the greater is the decomposition; this is shown to be due to the sulphuric anhydride probably present in hot sulphuric acid of less than 100 per cent. strength (*cf.* Ber. **16**, Ref. 954). Acid containing less than 92—93 per cent. of H_2SO_4 is useless; anhydrous perchloric acid comes over first, and then hydrated acid, which solidifies in the condenser.

The behaviour of potassium perchlorate towards sulphuric acid may be used as a qualitative test of the strength of the acid. If 0·2—0·3 grm. of the pure salt be heated with 2—3 c.c. of the sulphuric acid in a test-tube until white vapours of perchloric acid are evolved, 90—94 per cent. acid becomes yellow, 96—98 per cent. acid dark orange, and 99—100 per cent. acid brown, whilst chlorine peroxide is rapidly evolved, even after removal from the flame.

Another test for sulphuric acid of 99—100 per cent. strength is to heat on the water-bath with acetylphenylglycine-*o*-carboxylic acid, if the acid be above 99·1—99·3 per cent. strength, it is coloured blue or green, due to the formation of indigo sulphonic acids (Ber. **33**, 556).

The yield of perchloric acid is greater the larger the quantity of sulphuric acid used.

Phosphoric and pyrophosphoric acids do not decompose potassium perchlorate.—A. C. W.

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Monomercurammonium Iodide; Formation of —— *from Mercurodiammonium Iodide.* M. François. Comptes Rend. **130**, [15], 1022—1024.

On the careful addition of ammonia solution (sp. gr. 0·923), in small quantities and at long intervals, to mercurodiammonium iodide, the whole being kept for some days at 21° C., the following reaction occurs :—

$$2N_2H_6HgI_2 = 2(NH_2HgI + NH_4I).$$

The composition of the liquid remains constant until the whole of the original salt has been decomposed, but the addition of ammonia beyond this point causes decomposition of the monomercurammonium salt and formation of the iodide of dimercurammonium. The original action is reversible, for the action on monomercurammonium iodide of ammonia solution saturated with ammonium iodide causes the formation of mercurodiammonium iodide.

Monomercurammonium iodide is a white, crystalline salt, differing from mercurodiammonium iodide in that it does not redden in the air and is not soluble in ether.—J. T. D.

Quinine; Notes on ——, *with a Brief History of the Barks from which it is derived.* H. A. Martin. Pharm. Journ. **64**, [1549], 229—231, and [1553], 337—338.

The history of the discovery and early application of the febrifugal properties of cinchona bark, the botanical sources of the barks yielding the highest percentage of quinine, the development of cinchona cultivation in the East, as well as the methods employed of artificially increasing the production of the bark, abnormally rich in alkaloids, are first dealt with in minute detail.

A method followed in India for the preparation of febrifugal alkaloids is as follows :—

Bark in fine powder is mixed in the proportion 100 : 500 with water, containing 8 parts of caustic soda, and with 600 parts of a mixture of amylic alcohol 1 part and kerosene 4 parts; this mixture is briskly agitated in large vessels for several hours and allowed to rest; the oily layer is then removed and shaken out with dilute sulphuric acid; the aqueous solution thus obtained is neutralised with alkali and crystallised. The crystals are drained, redissolved in 50 parts of boiling water, decolorised with animal charcoal, and recrystallised.

The only difficulty which presents itself is the separation of quinine and cinchonidine sulphates, which can only be effected at present by repeated recrystallisations from boiling water.—J. O. B.

Quinine Acetate. J. Rutherford Hill. Pharm. J. 1900, **64**, [1556], 416.

Quinine acetate, $C_{20}H_{21}N_2O_2.C_2H_4O_2.H_2O$, forms light, filiform, white, silky crystals, rather smaller and duller in appearance than those of quinine sulphate. The crystals are permanent in the air at the ordinary temperature, but on heating at 100° C., the whole of the acetic acid, as well as the water of crystallisation, are driven off. The aqueous solution is almost neutral, or very faintly alkaline, and, as in the case of the sulphate, exhibits a bluish fluorescence, which is greatly intensified on the addition of excess of acetic acid. The salt is freely soluble in hot water, and in cold water to the extent of 1 in 52. It is also soluble in 90 per cent. alcohol, nearly 1 in 7 (1 in 8·5 by volume); chloroform, about 1 in 12 (1 in 8 by volume); ordinary ether, about 1 in 130 (1 in 172 by volume); and in absolute ether, about 1 in 390 (1 in 542 by volume).

When excess of ammonium acetate solution is added to a saturated aqueous solution of quinine acetate, the mixture in a short time becomes solid owing to the formation of the bulky quinine hydrate; this takes place even in presence of considerable excess of acetic acid.—A. S.

Alkaloid Salts; Action of Chloroform and Similar Solvents on ——. E. Schaer. Pharm. J. 1900, **64**, [1552], 308.

The author discusses the theoretical aspect of the action of solvents like chloroform, ether, benzene, &c., on alkaloid salts, and then gives the results of some experiments. It was found that the extraction of alkaloids from solutions of their salts by chloroform and ether is not restricted to the cases of caffeine, colchicine, narcotine, papaverine, atropine, delphinine, and veratrine, but appears to be of more general occurrence. It was observed that, whilst chloroform extracted relatively large quantities of veratrine from acid solutions of the alkaloid, ether extracted very much less, especially in cases where the solutions were distinctly or even strongly acid. Similar results, as regards extraction of alkaloid, were obtained on treating solutions of atropine salts with chloroform or ether; for instance, a solution of 0·102 grm. of atropine in water, acidified by tartaric acid, yielded to chloroform by successive treatment with 30 c.c. (*in toto*) of this liquid, 0·0623 grm.; under parallel conditions, ether extracted the larger quantity of 0·0913 grm.—A. S.

Solanaceæ, Some Alkaloids of the ——. J. Gadamer. Annalen, **310**, [3], 352—363.

This paper is a reply to O. Hesse (this Journal, 1899, 1151).

Atropine.—Whilst Hesse had obtained inactive atropine from *Scopolia atropoïdes*, the author had also prepared it from the commercial levorotatory alkaloid and he had thought it quite unnecessary to advance proofs that the rotatory power of active atropine was due to the presence of hyoscyamine. Hesse's statement, that the inactive atropine isolated by the author was already present in the hyoscyamine used, is incomprehensible, in view of the known conversion of hyoscyamine into atropine. Crystallised alkaloid from *hyoscyamus muticus*, consisting of almost pure hyoscyamine, was found to have changed to the extent of about two-thirds into atropine, after keeping for a year. The transformation of atropine gold salt into hyoscyamine, observed by Hesse, is thus remarkable, especially as it means the transformation of an inactive substance into one of a single optically active form.

Hyoscine, Atroscine, and Scopolamine.—The author reiterates the facts which led to the conclusion that Hesse's atroscine and Schmidt's *i*-scopolamine were hydrates of the same alkaloid (this Journal, 1898, 945). Hesse now admits this identity, but considers that the dihydrate (atroscine) is the labile form. A sample of atroscine kept by the author for 18 months in a well-closed vessel has changed into *i*-scopolamine. Hesse's hyoscine is active scopolamine, which is converted into *i*-scopolamine by sodium hydrate at 0° C.—A. C. W.

Antipyrine and Mercury; New Chlorinated Compound of ——. J. Ville and C. Astre. Comptes Rend. **130**, [13], 837—840.

A solution of 27 grms. of mercuric chloride and 40 grms. of common salt in 500 c.c. of water, to which 50 c.c. of hydrochloric acid have been added, is poured slowly into a solution of 500 grms. of antipyrine in 500 c.c. of water. Crystals separate, which, after washing and drying, have the composition $(C_{11}H_{12}N_2O)_2.HgCl_2.HCl$. Towards some reagents (hydrogen sulphide, sodium hydroxide, copper, &c.) this compound behaves like the ordinary mercuric salts; but towards others (sodium carbonate, potassium iodide, stannous chloride) its behaviour is quite different, not only from that of the mercuric salts, but also from that of the compound of antipyrine with mercuric chloride obtained by Hirsch and Schuyten. Like the latter compound, however, it shows all the antipyrine reactions. The authors regard it as a complex hydrochloride.—J. T. D.

Methyl-2-heptene-4-on-6, and the Synthesis of an Aliphatic Isogeranic Acid. F. Tiemann. Ber. 1900, **33**, [3], 559—566.

Besides the natural methylheptenone, occuring in lemongrass oil and citronella oil, two isoheptenones are known. One of these was prepared by Léser's method (Bull. Soc. Chim. **17**, 108). The fraction distilling between 160°—190° C. was purified by conversion into the labile soluble hydrosulphonate, by shaking with a solution of normal sodium sulphite and sodium bicarbonate, extracting with ether, decomposing with rather less than the theoretical quantity of caustic soda, and steam distilling (this Journal, 1899, 169, 513). The product boiled at 178°—180° C.

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(corr.). The yield was 50 per cent. of the theoretical. Isomethylheptenone is a colourless liquid, with an odour resembling that of amyl acetate. It forms a solid compound on shaking with commercial sodium bisulphite solution, which is only completely decomposed by steam distilling with caustic soda. The semicarbazone melts at 100° C., and after many recrystallisations at 113° C. The characteristic disemicarbazone melts at 182° C. On oxidation by permanganate (to the glycol) followed by chromic acid, isovaleric acid is produced.—A. C. W.

Diethyl-Glycocoll-Guaiacol (*"Guaiasanol"*). Einhorn and Huetz. Münch. Med. Woch. Through Pharm. Post. 1900, **33**, [3], 35.

DIETHYL-GLYCOCOLL-GUAIACOL hydrochloride—

$$C_6H_4(OCH_3)OCO - CH_2 - N(C_2H_5)_2HCl.$$

This body has a faint odour of guaiacol. It is readily soluble in water. The solution is neutral in reaction, and liberates diethyl-glycocoll-guaiacol as an oily substance, on the addition of alkaline carbonates. (See also this Journal, 1900, 371.).—J. O. B.

β-Naphthol Cresotinic Acid, "Epicarin." Oesterr. Zeits. für Pharm. 1900, **54**, [5], 124.

THIS substance is a condensation product of cresotinic acid and β-naphthol, and whilst possessing properties like those of β-naphthol, it is said to be less toxic, and more soluble. It readily forms normal, soluble salts, the sodium salt being especially soluble. It occurs as a reddish-yellow powder with an acetous odour, and is very soluble in alkaline solutions, also in ether, alcohol, and vaselin.—J. O. B.

Chrysanthemum; Essential Oil of ——. G. Perrier. Bull. Soc. Chim. **23**, 216—217.

A GREENISH oily liquid, obtained from the green leaves of the chrysanthemum plants, which yield about 0·16 per cent. Odour recalls those of mint and camomile. Boils at 160° C.; deposits at − 15° C. a small quantity of amorphous solid, becomes very thick at − 21° C., and solidifies completely in a bath of solid carbon dioxide and ether; sp. gr. at 15° C., 0·92; refractive index at 18° C. = 1·4931. Acid to litmus; combines in part with sodium bisulphite. The product of its saponification with potash, when decomposed by hydrochloric acid, yields a solid product with the odour of angelic acid.—J. T. D.

Sandalwood Oil; West Indian ——. H. von Soden. Pharm. Zeit. **45**, 229; Chem. Zeit. Rep. **24**, [11], 92.

THIS oil, which is obtained from *Amyris balsamifera*, has for its principal ingredient a sesquiterpene alcohol, named by the author "amyrol" ($C_{15}H_{25}OH$) isomeric with santalol. Amyrol is an almost colourless, viscous liquid, of about the same consistency as Venice turpentine, with a faint aromatic odour, and it is soluble in 3—3½ parts of 70 per cent. alcohol. In addition to small quantities of still unrecognised substances of strong odour, the oil also contains a large amount of sesquiterpenes, which the author is endeavouring to isolate.—C. S.

Sandalwood Oil; West Indian ——. E. Deusson. Archiv. Pharm. 1900, [238], 149; Chem. Zeit. Rep. **24**, [11], 92. (See preceding abstract.)

THE author has detected a sesquiterpene alcohol, together with 16—17 per cent. of a sesquiterpene, identified as cadinene, $C_{15}H_{24}$.—C. S.

Papaïn; The Action of Heat upon ——. V. Harlay. J. Pharm. Chem. 1900, **11**, [6], 268—272.

PARALLEL experiments on the digestion of fibrin by papaïn which had been heated to 100° C. for three hours, and papaïn which had been dried *in vacuo*, showed no difference. Tyrosinase gives the same red coloration, changing to green in each liquid after the digestion. Solutions of papaïn were then heated at 55°, 60°, 65°, 80°, 81·5°, 82·5°, 83·5° C. for half an hour, and digestions performed with these solutions. The results indicated that under the conditions of experiment papaïn is destroyed at 82° C. Similar colorations were obtained with tyrosinase in all cases, the liquids resulting from the digestion by heated papaïn gave less intense coloration.—A. C. W.

PATENTS.

Magnesium Superoxide; Production of ——. A. J. Boult, London. From R. Wagnitz, Berlin, Germany. Eng. Pat. 11,534, June 2, 1899.

A COMPOUND, stated to act as an antiseptic, containing magnesium peroxide, is obtained by mixing 50 parts of magnesium hydrate or hydrocarbonate, moistened with about 5 parts of water, with 10 to 12 parts of sodium peroxide, care being taken to prevent undue heating. According to the second claim, a part only of the magnesium hydrate or carbonate is mixed with the sodium peroxide in a dry state, and then the remainder of the magnesia is moistened and added.—E. S.

Bismuth Compounds [*Double Lactate Tannates*]. G. B. Ellis, London. From La Société Chimique des Usines du Rhône, Lyons, France. Eng. Pat. 11,866. June 7, 1899.

THE patentee claims as new products, double salts of bismuth with lactic and tannic acids, and the processes for their production, which consist in adding tannic acid to a solution of bismuth lactate and in digesting bismuth tannate with lactic acid. The compounds are said to be suitable for medicinal purposes.—A. C. W.

Certain Organic Sulphates [*of Phenols and Alcohols*] *and Derived Substances* [*Vanillin*]. A. Verley, Paris. Eng. Pat. 27,521, Dec. 30, 1898.

THE following processes are claimed:—Pyridine and chlorosulphonic acid combine in an indifferent solvent; if an alcohol or phenol be added, the pyridine salt of the phenol or alcohol sulphate is formed; then, by adding alkali and distilling, the pyridine is removed, and the organic sulphate may be obtained by the action of acids. If potassium eugenol sulphate be boiled with alkalis, the corresponding iso-eugenol compound is formed, which when boiled with acids, gives iso-eugenol. By the oxidation of iso-eugenol by ozone or electrolysis, vanillin is produced.—A. C. W.

Highly Oxidised Organic Bodies [*Peroxides*]. A. Verley. Paris, France. Eng. Pat. 27,522, Dec. 30, 1898.

THE claims are for the manufacture of highly oxidised bodies by passing a current of ozonised air through unsaturated substances such as terpineol, methylheptenone, citral, &c., extracting with ether, drying over calcium chloride, and evaporating the solvent *in vacuo*.—A. C. W.

Iodochloroxyquinoline; Impt. in ——. A. Bischler, Basle, Switzerland. Eng. Pat. 3915, Feb. 28, 1900. Date claimed under International Convention, Sept. 7, 1899.

THE claims are for the production of iodochlor-5-oxy-8-quinoline by the action of potassium iodide and sodium hypochlorite, or other iodising agents, on 5-chloro-8-oxyquinoline, and for the substance as a new article of manufacture. It is a greyish-yellow powder, almost insoluble in water, melting at 178°—180° C., and is applicable as a substitute for iodoform.—A. C. W.

Cinnamic Acid, Derivatives of ——. H. E. Newton, London. From The Farbenfabriken vormals F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 12,492, June 15, 1899.

WHEN the salts of nitroso-β-naphthol or of its derivatives are mixed with sand and heated at 250° C., *o*-cyanocinnamic acid or its derivatives are formed. This acid (or its derivatives), on heating on the water-bath in aqueous solution with sodium hypochlorite, is converted into *o*-amidocinnamic acid (or its derivatives). The processes described are claimed.—A. C. W.

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Benzoic o-Sulphamide; Organic Combinations of the Anhydride of —— [*Salts of Bases*]. C. K. Mills, London. From A. and L. Lumière, Lyon-Monplaisir, France. Eng. Pat. 25,151, Dec. 13, 1899.

THE patentee claims the following processes for the manufacture of combinations in which the anhydride of benzoic *o*-sulphamide plays the part of an acid:—Action of barium "saccharinate" on organic sulphates; double decomposition of the alkaline "saccharinates" with the salts of organic bases; action of "saccharin" on the bases, without water, in the presence of appropriate solvents; for organic bases other than alkaloids, direct action of "saccharin" upon the base in presence of water or other solvents. Among the bases mentioned are caffeïne, strychnine, quinoline, piperazine, phenetidine, antipyrine. The products are stated to be useful as antiseptics and antifermentatives.

—A. C. W.

XXI.—PHOTOGRAPHY.

Safe Light [*Photography*] *for the Dark Room.* K. B. Cooper. Brit. Journ. Phot. **47**, [2082], 197.

THE author gives formulæ for colour filter solutions to be used in glass tanks before the dark-room lamp, instead of the usual ruby glass, to provide a safe light. Using a carriage candle as the source of light at 1½ ft. distance, A is suitable for rapid plates, B for ordinary plates, and C for bromide papers:—

——	A.	B.	C.
Eosin.....	1 grain	½ grain	¼ grain
Metanil yellow	12 grains	6 grains	3 grains
Water.....	48 oz.	48 oz.	8 oz.

—J. W. H.

Copper Toning Solutions. W. B. Ferguson. Phot. Journ. **24**, 1900, 133.

THE author modifies the process for the copper toning of chlor-bromide and bromide of silver prints, by substituting potassium citrate for ammonium carbonate. He gives the following formula: 10 per cent. aqueous solutions are made of copper sulphate, normal potassium citrate, and potassium ferricyanide; for use, 75 c.c. of copper solution are mixed with 570 c.c. of potassium citrate solution, and 66 c.c. of the solution of potassium ferricyanide. An emerald-green liquid is thus obtained, which keeps well; prints treated with it first assume a purple-black tone, and then, after further treatment, a cherry-red tint, the whites of the picture remaining perfectly clean. If tartaric acid be added to the copper solution, and neutralised with carbonate of soda, and ferricyanide of potassium also added, a toning bath is obtained which acts slowly, and produces a brown tone; the whites do not, however, remain as clean as before.—J. W. H.

Reducers; Per-Salts as ——. Lumière Frères and Seyewetz. Brit. Journ. Phot. **47**, 184.

A REDUCER for photographic negatives which will have the opposite effect of ammonium persulphate (*i.e.*, will increase the contrasts) is often required to bring an over-exposed and over-developed negative into a printable condition.

Such reducers are unsatisfactory in some respects. Two solution methods, in which the oxidising agent and the solvent of the product cannot be mixed together, as in the case of the copper chloride and sodium thiosulphate reducer, are inconvenient, because the progress of reduction cannot be watched, and Farmer's one solution reducer of potassium ferricyanide and sodium thiosulphate acts irregularly, unless constantly rocked, and loses its properties very quickly.

The authors have studied the behaviour of various metallic per-salts with a view to obtaining a single solution reducer.

Of all the salts and mixtures of salts examined, cerium salts, especially the sulphate, gave the best results; the nitrate becomes rapidly reduced in aqueous solution; normal ceric sulphate precipitates in the presence of much water, but the addition of a little sulphuric acid prevents this, by formation of an acid salt, and does not affect the gelatin; its ready solubility in water, its good keeping qualities, when acidulated with sulphuric acid, its rapidity and uniformity in action up to the exhaustion of the solution, make it a very convenient reducer; it may be used for bromide prints without any danger of staining. The solution is best made by adding 4 c.c. of sulphuric acid to every 100 c.c. of a 10 per cent. solution of the salt. This solution does not remove fine details in the shadows in preference to other parts of the negative, as does Farmer's reducer; its action may be controlled by dilution, a 5 per cent. solution acts more on the opaque parts than on the shadows.

The authors regard the chemical reaction as a solution of the silver by a part of the acid of the salt, and that this occurs always when the heat of formation of the per-salt is less than the heat of formation of the silver salt; this explains why some per-salts reduce while others do not.

—J. W. H.

Photographic Development; The Influence of Gallic Acid on ——. Lüppo-Cramer. Phot. Corr. 1900, **37**, 161; Chem. Zeit. Rep. **24**, [22], 80.

AN alkali carbonate solution of gallic acid, which of itself is incapable of affecting the latent image, in combination with a small quantity of metol (sulphonate salt of monomethyl-*p*-amidophenol), quite incapable alone of producing this result, gives in normal time a fairly strong negative. After many experiments, the author found that no generalisation with regard to similar substances could be made, and endeavoured to discover whether the effect was really due to reduction of silver, or to the formation of oxidation products from the gallic acid solution. Two comparable negatives were treated for this purpose with potassium ferricyanide and sodium thiosulphate; the image on the plate developed without the addition of gallic acid could be reduced to clear glass in a few minutes, whilst that developed with this addition, even after 15 hours' treatment, still had a brown deposit of small density in the half-tones. This staining, or formation of oxidation products, is proportional, according to the author, to the amount of actual reduction. Such a method of development, though useless in practice, has some theoretical interest from the fact that a body useless as a developer assists in the production of the image by a secondary action of intensification.

—J. W. H.

Ferrocyanides; Toning with ——. L. P. Clerc. Brit. Jour. Phot. **47**, [2085], 249.

WHEN a photographic print is immersed in a solution of a ferricyanide of a metal, the silver image becomes converted into one of ferrocyanide of silver and the metal. As most ferrocyanides are highly coloured, this method enables one to produce prints of several colours. Owing to the instability of these ferricyanides, it is best to generate the salt when required, by mixing a solution of alkali ferricyanide with a solution of a salt of the metal, taking care that this salt has no action itself on the silver image. An excess of alkali ferricyanide should be avoided, since this favours the formation of ferrocyanide, which may precipitate some of the salt of the other metal; in order that such precipitation should not take place on the film itself, the solution must be kept covered in a feeble light and at rest, so that there is little chance of diffusion before the soluble salt first formed becomes changed to the insoluble one. Dilute solutions of carbonates affect the method, and ordinary tap water should not be used without acidulation to get rid of dissolved calcium carbonate. When toning without intensification is required, the silver ferrocyanide may be removed by a solvent, such as alkali thiosulphate or sulphocyanide, or it may be used as the basis of new coloured products. The silver prints developed to suit the method, fixed and washed, are placed previous to immersion in the toning bath for a few minutes, into an oxidising bath of a 1 per cent. solution of nitric acid or ammonium persulphate; this removes any substances besides silver, which might reduce the ferricyanide solution. The ferricyanide solution (A) consists of 10 grms. of potassium

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ferricyanide and 100 grms. of acetic acid (glacial) in 1,000 c.c. of water.

The solutions containing the characteristic metals are made up by taking 10 grms. of either uranic acetate (solution B.), or 10 grms. of ferric ammonium citrate (solution C.), or 10 grms. of ammonium molybdate (solution D.), together with 10 grms. of glacial acetic acid and 1,000 c.c. of water.

To obtain various tones, one may mix the solutions in the following proportions:—

Tone.	Solutions.			
	A.	B.	C.	D.
Sepia brown	1	2	..	..
Reddish-brown	5	7	..	..
Fiery red	50	55	..	..
Blue	50	..	75	..
Green	1	1	1	..
Sepia brown	5	..	..	6
Reddish-brown	1	..	..	1

After uranium toning, reduction or clearing of the prints may be made with ordinary water, or better, with a solution of sulphocyanide; after iron toning, sodium thiosulphate, or, if the fog be small, a 1 per cent. solution of ammonia, may be used; a sodium thiosulphate solution may also be used to reduce or clear the prints after molybdenum toning.

Copper is not readily adapted to this method, owing to the insolubility of cupric ferricyanide; the author used with success an acid solution of potassium oxalate as a solvent; recently Ferguson has recommended a neutral solution of potassium citrate. To prepare the bath, 7 c.c. of a 10 per cent. solution of cupric sulphate and 6 c.c. of a 10 per cent. solution of potassium ferricyanide are added in the order given, to 100 c.c. of a 10 per cent. solution of normal potassium citrate. The image cannot be safely cleared after toning; by adding a small quantity of ferric ammonium citrate to the bath, violet instead of purple tones may be obtained. In all cases the original image may be restored, if the silver has not been removed from the film, by first getting rid of the coloured ferrocyanide, by a solution of an alkali carbonate in the case of uranium, or by dilute alkali hydrate solution in the case of iron, and then, after the remaining silver ferrocyanide has been converted into chloride by dilute hydrochloric acid, by exposing and by developing, reducing to metallic silver.

—J. W. H.

PATENTS.

Photographic Silver Prints; Process for Intensifying ——. C. D. Abel, London. From The Actiengesellschaft für Anilinfabrikation, Berlin. Eng. Pat. 11,025, May 26, 1899.

A MODIFICATION of the "Agfa" intensifier, by the addition of alkali chlorides, and omission, if desirable, of the potassium thiocyanate. The solution may be made up by adding equal parts of mercuric thiocyanate and sodium chloride to two and a half times their total weight of water; or, 10 parts of the double salt of mercuric thiocyanate and potassium thiocyanate and 6 parts of sodium chloride are dissolved in 50 parts of water. For use either of the solutions are diluted with water in the proportion of 1 : 10. The inventors claim the process for intensifying silver prints by the action of a solution containing (1) "a double salt of mercuric thiocyanate with a chloride of an alkali, alkaline earth, or ammonia," or (2) "a mixture of the double salts" as above, "in both cases with an excess of the alkali salts employed."—J. W. H.

Photographic Chemicals; Packing and Dispensing of Minute Quantities of ——. J. J. Griffin and Sons and F. Heaton, London. Eng. Pat. 12,337, June 13, 1899.

THE claims are:—(1) "the method of dispensing minute quantities of photographic chemicals," in "crystals or powder," by "mixing them with an innocuous substance" and measuring off in doses as required; (2) "the use of chlorate of potash as a diluent" for chloride of gold; (3) "a glass tube open at both ends and provided with a transverse partition dividing the tube into two compartments" for holding the different ingredients.—J. W. H.

Photographic Paper for Printing Out and other Purposes. The Rotary Photographic Co., Ltd., London. Eng. Pat. 12,585, June 16, 1899.

A TRANSPARENT and grainless paper is coated on both sides with emulsion of different degrees of sensitiveness; in this way there is no necessity for the usual baryta or lime dressing to support the films, since the first coating will prevent the second from sinking into the fibre of the paper. The claims are:—(1) "a photographic paper having a surface on either side of different degrees of sensitiveness"; (2) a "transparent" paper, as above.—J. W. H.

Photographic Roll-Films. C. D. Abel, London. From The Actiengesellschaft für Anilinfabrikation, Berlin. Eng. Pat. 2770, Feb. 12, 1900.

THE claim is:—In photographic roll-films, the coating of the wrapper or covering which comes into direct contact with the sensitive film, with a layer impermeable to water.

—J. W. H.

XXII.—EXPLOSIVES, MATCHES, Etc.

Gunpowder on the Works of the New Admiralty Harbour, at East Cliff, near Dover, on the 14th Jan. 1900; Report [to Home Office] on the Circumstances attending an Explosion of ——. M. B. Lloyd, H.M. Inspector of Explosives.

"THE explosion occurred on one of the 'benches' on the face of the cliff, and about 60 ft. from the top. On this bench two holes had been bored. The borers were clearing up preparatory to leaving work, and the chargemen had brought down a bag containing 28 lb. of gunpowder, which had been ordered to be used for the two holes. One of the men on the 'bench' struck a match, and immediately afterwards the powder in the bag exploded. Six men who were on the 'bench' were severely burned, and one died a few days after the accident."

The usual practice is to explode four cartridges of tonite at the bottom of the hole. This produces an enlargement there, with the view of affording more room for the gunpowder, and the operation is known as "socketing." After waiting 10 minutes the powder charge is inserted in the hole. Contradictory evidence was given as to the operation of "socketing" having taken place. The inspector considers the accident was primarily due to one of the men having struck a match to light his pipe and then inadvertently thrown the lighted match on the powder, which was contained in a cotton bag.

The contractors had stringent rules posted over the works forbidding smoking, but he considers they had not taken sufficient precautions to prevent accident by explosion. The charge of powder should have been brought to the hole in a strong wooden or other suitable receptacle, which would have prevented sparks, or the lighted match, from coming in contact with the explosive. Further, there should be an interval of at least 30 minutes between socketing and charging the hole with fresh explosive.—W. M.

Modern Explosives; Researches on ——. II. W. Macnab and E. Ristori. Proc. Roy. Soc. **66**, [428], 221—232.

THE object of the experiments was to endeavour to find a means of determining more accurately than has hitherto been done the temperature reached when an explosive is fired in a closed vessel. A modification of the method developed by Sir W. C. Roberts-Austen was employed. A thin platinum wire was melted by the heat of the explosion, but a thick wire was unaltered. This showed that the temperature was above the melting point, and also that the duration of the maximum temperature was very short. From this it was argued that if rhodium-platinum couples of different diameters, sufficiently thick not to be melted during explosion, were used in a bomb, the deflections of the galvanometer indicated, would vary

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inversely with the sizes of the wires forming the couples; that in this way data might be obtained from which might be calculated the deflections of an infinitely thin couple which could be capable of taking up the heat in an infinitely short time, and that this deflection, expressed in degrees, would represent the actual temperature reached. Couples formed of wires of pure platinum and platinum alloyed with 10 per cent. of rhodium, varying in diameter from 0·01 to 0·044 of an inch, were employed. Each couple was sucessively fixed inside the bomb, and deflections of a spot of light reflected from the mirror galvanometer, on firing the explosive, were photographically recorded.

Fig. 1.

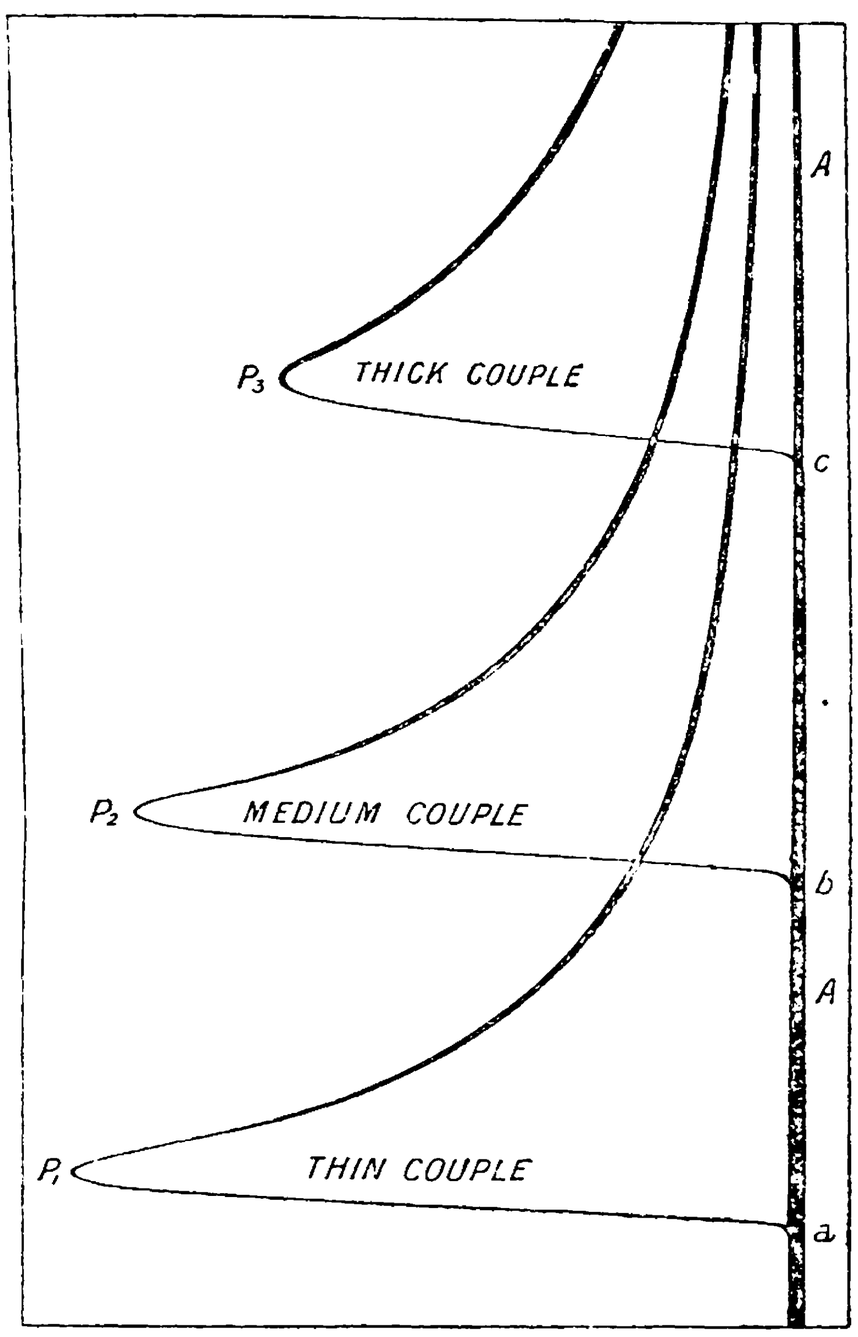
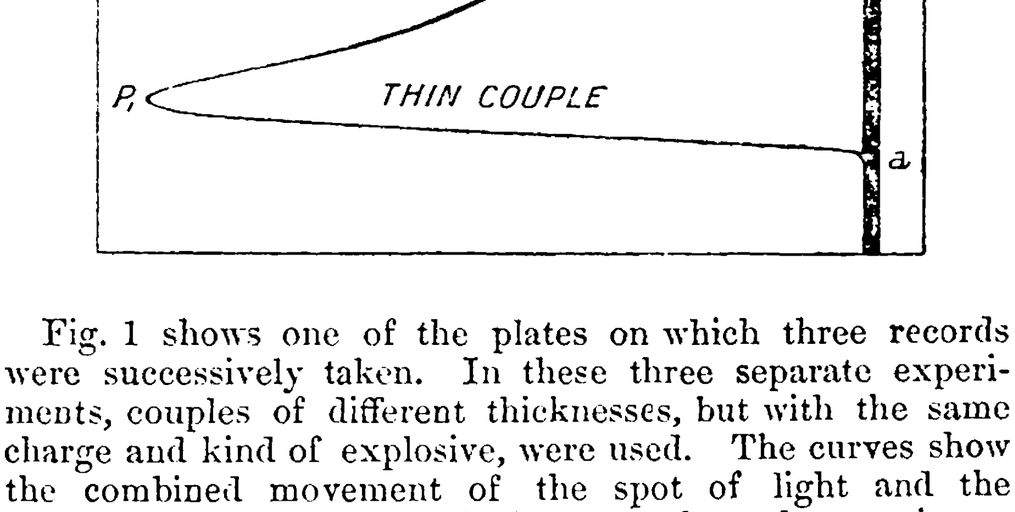


Fig. 1 shows one of the plates on which three records were successively taken. In these three separate experiments, couples of different thicknesses, but with the same charge and kind of explosive, were used. The curves show the combined movement of the spot of light and the photographic plate, and it is seen that the maximum deflections, as shown by P_1 P_2 P_3, are in inverse order to the thickness of the couple used, the greatest deflection being obtained with the thinnest couple.

Fig. 2.



Two series of experiments made with two different explosives, ballistite (composed of 30 per cent. of nitroglycerin and 70 per cent. of guncotton), and gelatinised guncotton, were carried out with a number of different couples, and the results, expressed as curves in Fig. 2, show the gradual rise of the deflections as the thickness of the couple diminishes; but throughout, the guncotton curve is below the ballistite curve, thus indicating that the temperature reached during explosion of the guncotton, is lower than that of the ballistite.

Experiments made with the following explosives showed that the relative temperature can be easily ascertained. Guncotton gave the lowest temperature, and in order came cordite, ballistite (composed of 70 per cent. of soluble nitrocotton and 30 per cent. of nitroglycerin), and ballistite (composed of 50 per cent. of soluble nitrocotton and 50 per cent. of nitroglycerin). Another series of experiments is in progress for determining the other necessary elements which will be required before the value of these deflections of the galvanometer can be accurately expressed in degrees of temperature.—W. M.

PATENTS.

Matches; Manufacture of ——. W. H. Akester, Fulham. Eng. Pat. 6723, March 28, 1899.

The claim is for "the preparation of red phosphorus and chlorate of potash for use in the manufacture of strike-anywhere matches, consisting in grinding each or either such substance under benzol saturated with paraffin wax, or other solid hydrocarbon soluble in benzol, and the evaporation of the benzol taken up by the mass of the treated substance, so as to leave the particles of the latter coated with the wax."—G. W. McD.

Phosphorus; Treating Amorphous ——. S. P. Thompson, West Hampstead. Eng. Pat. 6818, March 29, 1899.

Red phosphorus is ground under benzol, naphtha, &c., with the addition of 2 to 7 per cent. of anthracene or paraffin wax. On evaporation of the liquid, the preparation of red phosphorus remaining behind, forms a substitute as regards its ready inflammability for yellow phosphorus. In place of anthracene, &c., nitro-substitution products of the hydrocarbons may be used, such as dinitrotoluene, in which case acetone is used as the solvent.—G. W. McD.

Matches; Manufacture and Packing of ——. L. Cobbaert, Belgium. Eng. Pat. 7276, April 6, 1899.

A complete apparatus for making and packing matches in the continuous system is described. The chief points consist in the manner in which the match sticks are secured in the frames, the arrangements resulting from the same, and the movements involved. A large number of detailed drawings accompany the specification.—G. W. McD.

Explosives; Impts. in ——. C. H. Curtis, London, and G. G. André, Argyllshire. Eng. Pat. 9062, May 1, 1899.

Ammonium picrate is used as the basis of this explosive, which is said to be suitable for guns of any calibre. Since ammonium picrate does not contain sufficient oxygen for complete combustion, barium and potassium nitrates are added in such quantity as is determined by the end in view, and nitrocotton is also used as a means of quickening combustion and rendering the powder more smokeless. When the proportion of barium nitrate is about 2 to 10 of picrate, the carbon is converted into carbon monoxide. When the proportion is increased to about 12·4 to 10 of picrate, the carbon is converted to carbon dioxide. The successive additions of nitrate serve to raise the temperature of combustion, increase the pressure of the gases, and quicken combustion. The following are the proportions given for various powders:—

——	Shot-Gun Powder.	Rifle Powder.	
Ammonium picrate	1·00	1·00	1·00
Barium nitrate	1·05	0·70	0·60
Potassium nitrate.....	0·15	0·15	0·05
Guncotton (13 per cent. N).	..	..	0·15

The proportion as well as the quality of the guncotton may be varied to suit requirements. The latter variety of

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rifle powder, when granulated to the fineness of "No. 6 for black gunpowder," is suitable for use with service rifles. The ingredients are mixed and incorporated under runners with from 5 to 8 per cent. of water, pressed, and granulated. —G. W. McD.

Matches; Manufacture of ——. C. C. Budde, Copenhagen. Eng. Pat. 3055, Feb. 15, 1900.

THE combination of a chlorate of a divalent or polyvalent metal with one or more bichromates of the alkali group. The splints, after being saturated with water, are impregnated at the tip with, preferably, chlorate of barium, and an igniting composition containing bichromate of potash applied to the impregnated end. The composition of the paste is given as potassium chlorate, 25·4 parts; sulphur, 9·6 parts; copper oxide, 10 parts; bichromate of potash, 5 parts; glue, 5 parts.—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

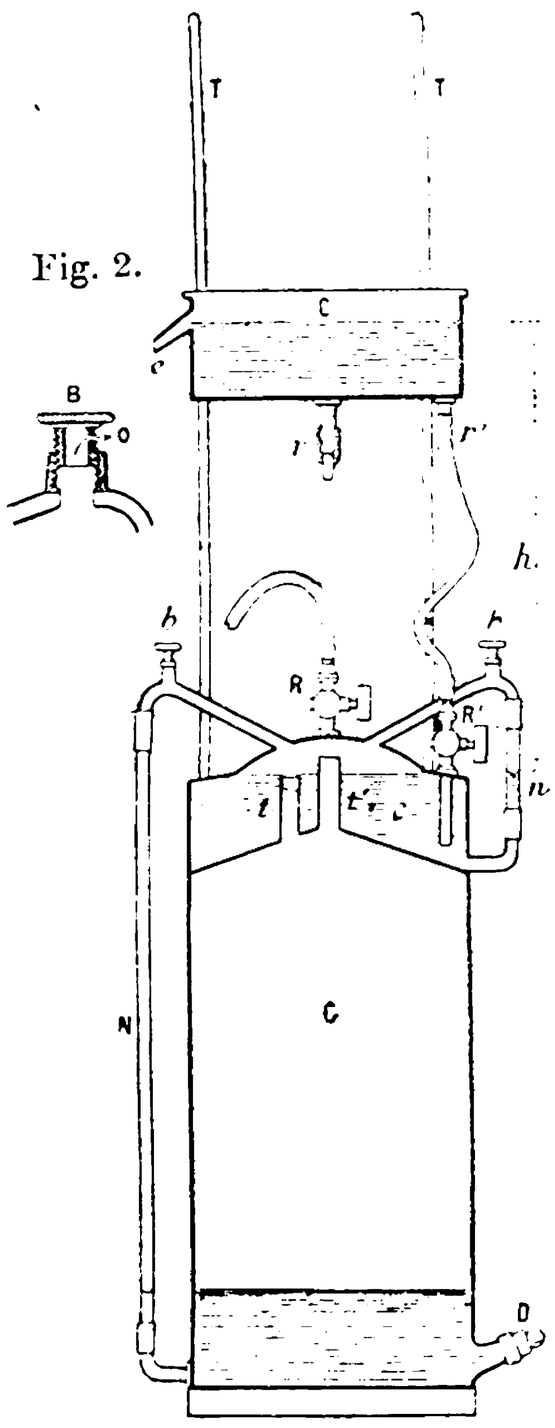
APPARATUS, ETC.

Gasholder; A New —— for Delivery at Constant Pressure. J. Riban. Bull. Soc. Chim. **23**, 222—226.

THE apparatus is shown in elevation and section in Fig. 1. The body of the gasholder, G, is furnished, by means of a conical partition, with an internal trough, *c*, through which pass the two tubes *t* and t^1. The reservoir C is clamped to the three tall rods T, by means of which it can be raised or lowered, and is provided with the two exit-tubes *r* and r^1, and with the overflow-tube *e*. The gauge-tubes N and *n* are furnished at their uppermost points with screw-caps, *b*, each pierced with a small lateral hole O (see Fig. 2), which is uncovered when they are unscrewed. Connexion having been made between r^1 and R^1 by rubber tubing, water is poured into the apparatus till it issues from the holes in the screw-caps. These are then closed, and very soon the holder will be filled, as is indicated by the issue of water from R. The cocks being closed and the cap D opened, the holder is now filled with gas in the usual way. It is clear that the internal trough *c* will be left full of water. When a stream of gas at constant pressure is wanted, R^1 is opened; water flows into the trough, overflows into the holder by *t*, compressing the gas, and the flow of water ceases when the internal pressure is that due to the head of water *h*. On opening R, gas issues, and all that is necessary is to keep the level in C constant by a sufficient stream of water, the overflow escaping by *e*. Should it be desired to collect a jar of the gas, connection is made between R and *r*; the latter is, as a rule, closed by a cap of rubber and glass rod. The dimensions of C and *c* are chosen large enough to allow of expansion and contraction through changes of laboratory temperature without escape of gas or entrance of air. The cock R^1 can thus be left open and the gas be maintained under pressure, so that any slight leaks entail only loss of gas, not contamination with air.—J. T. D.

Fig. 1.

Fig. 2.

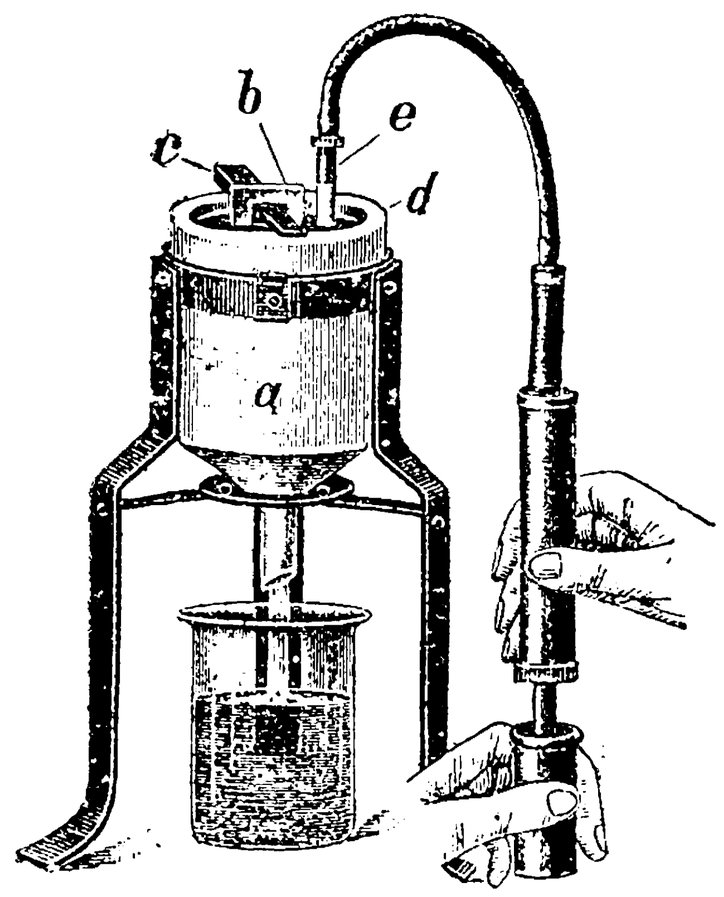


Filter Press for Laboratory Use; Simple ——. W. von Loeben. Chem. Zeit. **24**, [19], 193.

THE filter press shown in the drawings is designed for filtering boiling-hot or volatile liquids, for which the ordinary aspirator is inapplicable; and, since it can be worked under a pressure of as much as four atmospheres, it is also suitable for highly viscous fluids or mucilaginous precipitates.

Fig. 1 gives a general view of the apparatus, and Fig. 2 a vertical section of the filtering chamber. The vessel *a* is

Fig. 1.



of porcelain, and is fitted with a perforated false bottom, *i*. The lid *b* is traversed by a tube, *e*, the central bore of which does not extend quite to the bottom, but is intersected by a cross bore so as to assume the form of a reversed T; and a piece of rubber tubing, *k*, is slipped over the lower end to cover the lateral apertures of the bore and form a valve. By attaching an ordinary cycle pump to the tube *e*, air can be forced into *a*, in order to exert pressure on the contents and drive them through the layer of filtering material on the false bottom.

Metal fittings for the lid being undesirable in laboratory work, an air-tight joint is secured by making the lid *b* and the opening through which it is inserted (Fig. 3) elliptical

Fig. 3.

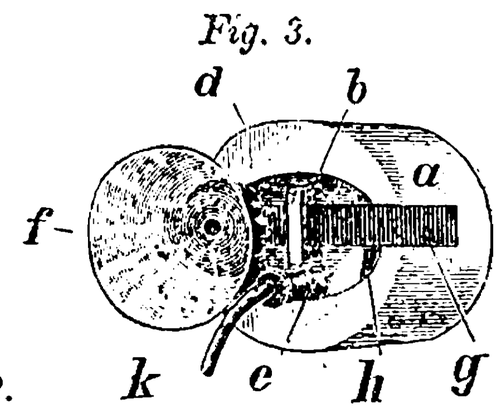


Fig. 2.

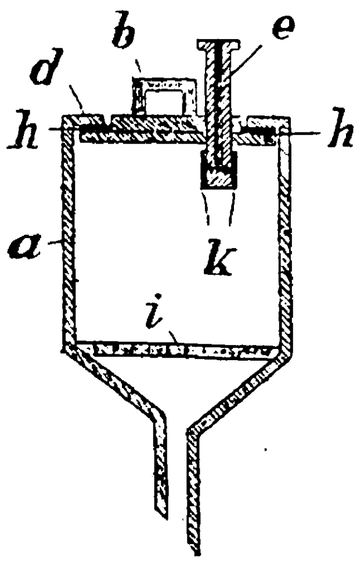
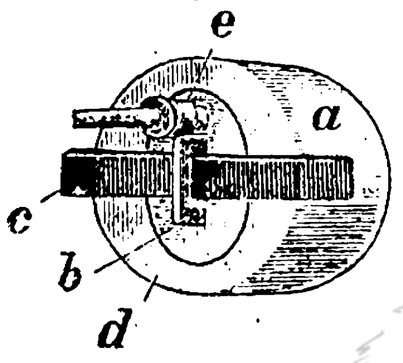


Fig. 4.



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in shape, the lid being also flanged so that when closed, its central position is flush with the top of the vessel *a* (Fig. 4). A flat rubber ring, *h h* (Fig. 2), fits on the flange, and the lid is kept in position by a wooden wedge, *c*, pushed home through the lid handle, the internal pressure also assisting to keep the joint air-tight.

A filter paper is laid on the false bottom *i*, and, if necessary, kept in place by two semi-rings of porcelain. The lid is then inserted in the vessel and held in the position show in Fig. 3 by a strip of wood, *g*. The funnel *f* is then inserted in a hole in this strip, and the liquid to be filtered is poured in, whereupon the lid is turned round to close the vessel, and the strip *g* replaced by the wedge *c*; air is pumped in as already described, and filtration proceeds rapidly.

In the case of precipitates that crack before all the liquid is through, and, by so doing, allow the air to escape and reduce the pressure, the author adopts a suggestion made by Piloty, and covers the precipitate with a second filter paper. A thin rubber balloon is then slipped over the lid, so as to be inside the filtering chamber, and air is pumped in slowly until the balloon has entirely filled the space in *a*. At this stage the pressure can be increased without risk of bursting the balloon; and when the whole of the filtrate is down, the pressure can be relieved by puncturing the rubber with a needle inserted from below through *i*. The balloon can be used over again when repaired with rubber solution. An ordinary cycle-pump pressure gauge can be used when it is desirable to work at any given pressure.—C. S.

Wire Gauze and Sand Baths; Aluminium Plates as a Substitute for ——. Fritsch and Venator. Chem. Zeit. 1900, **24**, [27], 286.

In place of the ordinary water- or sand-bath, the authors make use of large aluminium plates, 500 × 500 mm. and 4 mm. in thickness. They state that on these, evaporations proceed quietly and rapidly, whilst the plates are not attacked by acid vapours. Instead of wire gauze, small aluminium plates, 170 × 170 mm. and 3 mm. in thickness, may be used over an ordinary Bunsen flame. When the liquid in the vessel is to be evaporated to dryness, it is advisable to place a thin asbestos board between the glass and the aluminium plate.—C. A. M.

Indicator; A New ——. J. Formánek. Zeits. Anal. Chem. 1900, **39**, [2], 99—103.

Alizarin Green B (Dahl and Co., Barmen) is recommended as a very sensitive indicator. Its aqueous solution has a dirty green colour; it is turned a carmine red by acids and a pure green by alkalis. The colour change is not sharp in presence of ammonium compounds, and it is affected by carbonic acid in the same way as litmus is.

—E. H. T.

Laboratory Processes; Need for Uniformity in Certain ——. S. F. Burford.

See page 420.

PATENTS.

Refractometers for Liquids. C. Pulfrich, Jena, Germany. Eng. Pat. 9308, May 3, 1899.

Instead of employing two prisms, as in the "Abbe refractometers," only a single prism is employed, which is combined with a telescope, "in front of the objective" of the latter, so that, of the two refracting surfaces of the prism, the more oblique one forms the front surface of the total instrument.—R. A.

Butyrometer; Improved ——. A. Mercier, Virton, Belgium. Eng. Pat. 2201, Feb. 3, 1900.

The apparatus is of the centrifugal type, and the revolving beam is rotated by a coiled spring, which acts on a socket geared by a pawl and ratchet wheel to the beam. The ratchet mechanism permits the continued rotation of the beam by its own momentum, after the actuating spring has become relaxed.—R. A.

INORGANIC CHEMISTRY.—QUALITATIVE.

Borates; Detection of ——. H. Bornträger. Zeits. Anal. Chem. 1900, **39**, [2], 92.

When heated on platinum foil, in a non-luminous flame, borates give unsatisfactory or else no colorations, but a beautiful green colour is produced when they are heated with hydrofluoric acid, or with ammonium nitrate and ammonium chloride, or with a mixture of any two of the three common mineral acids. The coloration is more immediate and more intense than that obtained in the ordinary test with alcohol and sulphuric acid.—E. H. T.

Gold; Detection of Small Quantities of —— *in Ores.* T. Döring. Berg- u. Hüttenm. Zeit. **59**, 49, 73, 97; Chem. Zeit. Rep. **24**, [10], 85.

The author examined the method proposed by Ohly—extraction with iodine tincture, impregnating a strip of paper and incinerating the latter, a purple coloration then indicating gold; or extraction with bromine water and precipitation (as gold purple) with stannous chloride. He finds, however, that the iodine extract produces a brown tinge, but not rose or purple, on incineration, and therefore prefers a mixture of bromine and ether, which is quicker and gives a better coloration. The paper should be impregnated with magnesium nitrate, which is afterwards converted into a sparingly soluble double salt by exposure to ammonia and ammonium carbonate vapour. The limit of delicacy of the reaction was found to be 0·00000425 grm.

With ores containing iron, lime, or substances soluble in the bromine-ether mixture, the incineration method is unsuccessful, and is only suitable for pure gold quartz or solutions of the pure metal.

On the other hand, the precipitation of the bromine extract by stannous chloride is applicable to ores containing undecomposed pyrites, as well as antimony and arsenic, a preliminary roasting being, however, preferable when sulphides of the heavy metals are present. 100 grms. of ore are agitated with 1—2 c.c. of bromine-ether mixture, diluted with 50 c.c. water after two hours, digested two hours longer, concentrated to one-fifth, and treated with a little bromine water followed by stannous chloride. In presence of tellurium the resulting black precipitate may mask the purple coloration. This method is sensitive to 0·5 grm. of gold per ton.—C. S.

Nitrites in Potable Waters; The Importance of the Detection of ——. L. Spiegel. Ber. 1900, **33**, [4], 639.

See under XVIII. B., *page* 461.

INORGANIC CHEMISTRY.—QUANTITATIVE.

Chlorides; Volumetric Estimation of —— *by Mercurous Nitrate.* L. L. De Koninck. Bull. Assoc. Belge des Chim. **14**, [1], 27—28.

The fact that the highly coloured precipitate of mercurous chromate produced even in acid solutions behaves like silver chromate, *i.e.*, does not form in presence of soluble chlorides, led the author to hope that mercurous nitrate might be advantageously employed for the titration of chlorides, and perhaps bromides, by using potassium chromate or bichromate as the indicator. Unfortunately it proves unsuitable, the indicator giving the reddish tinge of chromic acid instead of the decided yellow furnished in the Mohr method, and the colour change to rose-red is consequently difficult of detection. Furthermore, the precipitate produced as the end point is approached, is orange-yellow instead of red, and points to the formation of a compound of chloride and chromate. In view, therefore, of these results and of the satisfactory action of pure calcium carbonate in neutralising chloride solutions, which can then be estimated by the Mohr method, it is considered inadvisable to pursue the subject further.

—C. S.

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Bromides; Volumetric Determination of —— in Presence of Chlorides and Iodides. J. V. Weszelszky. Zeits. Anal. Chem. 1900, **39**, [2], 81—91.

In an acid solution, chlorine converts iodides into iodates, but decomposes bromides with liberation of bromine. On the other hand, in a hot alkaline solution, bromides are oxidised to bromates. The author bases his method upon these facts. The apparatus employed is a slight modification of that used by Bunsen and Fresenius in analysing manganese dioxide.

To the acidified solution of the halides, sufficient chlorine water is added to oxidise the bromide and iodide present. The excess of chlorine and the liberated bromine are then distilled off into a weak solution of caustic potash, the latter part of the distillation being carried out in a current of carbon dioxide. The distillate is then treated with chlorine water and evaporated to dryness. The residue is dissolved in water, acidified, treated with potassium iodide, and then titrated with sodium thiosulphate. The iodine, left in the retort as iodate, is determined in a like manner. For the success of this determination, it is essential that iron, arsenic, and antimony compounds be absent.

—E. H. T.

Chromates, Estimation of —— by Mercurous Nitrate. L. L. de Koninck. Bull. Assoc. Belge des Chim. **14**, [1], 23—27.

The author recommends the following method: — The chromate solution is brought to a condition of normal acidity by the addition of nitric acid, and, after heating to about 50° C., is treated by agitating with successive additions of a solution of mercurous nitrate (112·144 grms. per litre), until precipitation is complete, the whole being then cooled down and agitated at intervals to bring down the small quantity retained in solution by heat. If the liquid exhibits any colour, imperfect precipitation is indicated, and may be remedied by adding more of the reagent and shaking without heat. The precipitate may be washed on a filter or in a Gooch crucible with hot or cold water, no addition of the precipitant being necessary. When a paper filter is used, calcination is effected in a porcelain crucible, some difficulty being experienced in afterwards cleaning a platinum vessel. The method is considered superior to the other gravimetric methods, and sufficiently rapid to replace volumetric methods in industrial analyses.—C. S.

Silver Bullion; Volhard's Method for the Assay of ——. T. K. Rose. J. Chem. Soc. 1900, **77** and **78**, [448], 232.

Van Riemsdijk has stated that with pure silver, Volhard's method of estimation gives results accurate to 0·25 part per 1,000. The author states that by taking the following precautions, a limit of accuracy of less than 0·1 per 1,000 can be obtained in testing the purity of fine silver.

One grm. of silver is dissolved in a slight excess of dilute nitric acid in a bottle fitted with a stopper, and the solution heated till all traces of nitrous acid are expelled. 100 c.c. of a standardised solution of ammonium thiocyanate are added from a burette, which has been found by repeated trials to deliver a constant quantity of solution, the variation in the amount being less than 0·0025 c.c. The strength of the thiocyanate solution is adjusted so that from 0·5 to 1·0 mgrm. of silver remains in solution. The bottle is well shaken and its contents immediately filtered. The precipitate needs very little washing, as the loss of even 2 or 3 c.c. of the liquid would not affect the result. 5 c.c. of a saturated solution of ferric nitrate are added, and a decinormal solution of ammonium thiocyanate run in drop by drop. When all the silver is precipitated, the addition of one drop (0·05 c.c. equivalent to 0·05 mgrm. of silver) of the thiocyanate solution converts the colourless solution to one of a pale straw colour. No time is saved by omitting to filter off the main bulk of the precipitate, as it must then be allowed to settle after each addition of thiocyanate solution, and the end reaction is not observed so easily, although quite distinct when 0·25 c.c. is added at a time.

Equally good results can be obtained for alloys containing less than 50 parts of copper per 1,000 of silver, but with a larger proportion of the former metal, the colour of the copper nitrate masks the end reaction, the light straw colour not being obtained until the real limit is passed. In this case it is necessary to use checks of pure silver, with the addition of about the same amount of copper as in the alloys to be assayed. With this precaution, fairly good approximate assays can be obtained with alloys as low as "300 fine." The above method is stated to be less liable to error, although far less rapid than the Gay-Lussac method as ordinarily practised in mints, the limit of accuracy of which is 0·2 to 0·3 per 1,000.

—A. S.

Lead; Estimation of —— in the Dry Way. J. Flath. Chem. Zeit. 1900, **24**, [25], 263—264.

Experiments on the fluxing of a lead ore containing 72·35 per cent. of Pb (as determined by the wet method), and consisting of fragments, grains, and coarse and fine powder, gave the following results, 25 grms. of ore, 60 grms. of flux, and an iron crucible being used in each experiment:—

—	Sodium Carbonate.	Borax.	Tartar.	Assay Result.
	Per Cent.	Per Cent.	Per Cent.	Per Cent. of Pb.
1	50	45	5	71·4
2	70	25	5	71·9
3	76	19	5	71·8
4	88	7	5	70·2

In experiment (1) the action was too violent, in (2) the whole operation was satisfactory, and rather better than in (3), whilst in (4) the slag was so sluggish that many shots of lead were left in it. Experiments specially directed to that end showed that there was no absolute necessity to use tartar, but its use is generally to be recommended, to afford a reducing agent for oxides either present in the ore or produced in course of assaying. The flux mixture recommended for all lead ores, whether sulphide or oxide, consists of 70 per cent. of calcined sodium carbonate, 28 per cent. of calcined borax, and 2 of tartar. The dry assay, although often condemned as inaccurate, only requires a certain amount of practice. The following table gives a comparison between the results obtained with several ores by the wet and dry methods respectively:—

Ores or Products.	Results.	
	By Dry Way.	By Wet Way.
Lead ore, fragments	67·0	67·45
„ „ „	47·2	47·80
„ „ grains	70·5	71·12
„ „ „	46·8	47·65
„ „ powder	75·4	76·15
„ „ „	43·0	43·92
„ slimes	74·5	75·42
„ „	28·2	29·50
„ ore with pyrites	59·0	59·95
Pyromorphite	71·0	71·40
White lead ore	65·1	65·40
Mine smalls	5·7	6·48
Flue dust	59·0	60·48
Lead slags	0·5	1·25

But these differences do not hold good for all classes of ores; for example, an ore crushed to a fine meal gives a lower result than when in grains. When copper is present, about two-thirds of the copper passes into the lead. In antimonial ores, &c., the greater part of the antimony passes into the lead. When less than 0·5 per cent. of Sb is present in the ore, no deduction is made.—W. G. M.

Lead; Electrolytic Determination of —— in the Sulphate and Chromate. C. Marie. Comptes Rend. **130**, [15], 1032—1033.

Lead sulphate or chromate can be easily dissolved in nitric acid if ammonium nitrate be added to the acid in small portions at a time. For 0·3 grm. of lead sulphate about 5 grms. of ammonium nitrate are needed; the amount

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of nitric acid is not important, provided it be diluted after solution to a strength of about 10 per cent. Electrolysis can then be easily effected in the ordinary way. By this method the lead in lead glasses can readily be determined, the glass being attacked by hydrofluoric acid containing sufficient sulphuric acid to convert the bases into sulphates. Large excess of sulphuric acid should be avoided.—J. T. D.

Molybdenum; Determination of —— in Alloys. H. Borntträger. Zeits. Anal. Chem. 1900, **39**, [2], 91. (See this Journal, 1898, 1184.)

About 1 grm. of the alloy is dissolved in 50 c.c. of aqua regia on a water-bath, and the solution evaporated with hydrochloric acid. By treating the residue with 50 per cent. alcohol, and filtering, the greater part of the insoluble molybdic acid is obtained on the filter. The filtrate is evaporated, and the residue again treated with alcohol. The molybdic acid is collected on the tared filter, dried, and weighed; other metals present are determined in the united filtrates.—E. H. T.

Red Lead; Volumetric Determination of ——. J. F. Tocher. Pharm. J. 1900, **64**, [1552], 310—312.

The author states that for the more accurate and rapid determination of red lead, he found that by using normal nitric acid (sp. gr. 1·05) in place of the comparatively strong acid (sp. gr. 1·2) recommended by Sutton, very satisfactory results could be obtained.

2·064 grms. of red lead are treated with 50 c.c. of nitric acid (sp. gr. 1·05), the Pb_3O_4 being completely resolved into PbO_2 and $Pb(NO_3)_2$ in the cold. The mixture is brought nearly to boiling, 50 c.c. of $\frac{1}{5}$ normal oxalic acid run in, the solution boiled, and, after the addition of some dilute sulphuric acid, titrated with permanganate.

Satisfactory results may also be obtained with nitric acid of sp. gr. 1·2, if the method be modified in the following manner:—After decomposition of the residual lead peroxide with $\frac{1}{5}$ normal oxalic acid, barium hydrate is added to neutralise the excess of nitric acid, the oxalic acid at the same time being partly precipitated. Neutral sodium sulphate solution is then added, forming sodium nitrate and barium sulphate, and then dilute sulphuric acid to decompose any barium oxalate which has been formed. The solution is then titrated in the usual manner with permanganate.

The author recommends the above modifications, in which ease, rapidity, and accuracy are all combined; but he also describes three other methods:—

(1) Nitric acid (sp. gr. 1·3) with oxalic acid alone; (2) hydrochloric acid with potassium iodide and thiosulphate; (3) Mohr's alkalimetric method with subsidence. —A. S.

Copper; Precipitation and Separation of —— in Alkaline Solutions by Hydrazine Sulphate or Hydrochloride. P. Jannasch and K. Biedermann. Ber. 1900, **33**, [4], 631—636.

Copper sulphate solution is added to a cold solution of 5 grms. of caustic soda in 50 c.c. of water, then 1—2 c.c. of hydrazine sulphate solution of 3 per cent. strength. On warming on the water-bath, cuprous oxide is precipitated; this changes to metallic copper on the addition of a further 3 c.c. of hydrazine sulphate solution. The precipitate settles quickly. The liquid is diluted with boiled water and filtered through a double filter (a smaller inside a larger). After washing, and drying at 90° C., the filter paper is burnt apart from the precipitate, and the whole then ignited in a current of oxygen. The oxygen may be dispensed with, if the copper be well exposed to the hot air by stirring.

Separation of Copper and Zinc.—A 10 per cent. caustic soda solution should be employed. Porcelain vessels must be used: glass is attacked by the hydrazine solution, and the precipitate adheres obstinately to platinum. Traces of zinc hydroxide, which are very occasionally found in the precipitate, may be removed by washing with warm dilute caustic soda solution. The filtrate is acidified, and the zinc precipitated by sodium carbonate.

Copper and Arsenic (as arsenic acid) are separated in a similar manner. After removal of copper, the filtrate is acidified by hydrochloric acid and a little nitric acid, evaporated down to 80 c.c. with constant additions of nitric acid, and the arsenic precipitated by magnesia mixture.

Separation of Copper and Tin.—The pure metals were employed. The mixture was dissolved in not more aqua regia than was necessary to give a clear solution; this was diluted with an equal volume of water, and added, drop by drop, to a hot solution of caustic soda (15 times the weight of the metals) containing 2—3 grms. of hydrazine hydrochloride. If hydrazine sulphate is used, traces of tin are often found in the precipitate, which cannot be removed by washing with caustic soda. The solution was heated for some time before cooling, diluting, and filtering. The filtrate was acidified by hydrochloric acid, precipitated by ammonia, the precipitate dissolved by ammonium sulphide, the solution heated for some time on the water-bath, and then slightly acidified by hydrochloric acid. After warming for one hour, the precipitate settles, and is easily filtered; it was converted into stannic oxide by ignition in oxygen. The test analyses quoted are satisfactory.—A. C. W.

ORGANIC CHEMISTRY.—QUALITATIVE.

Indigo; Detection of —— in presence of other Blue Dyestuffs. F. H. van Leent. Zeits. Anal. Chem. 1900, **39**, [2], 92—95.

To discover if Indigo could be extracted from textile fibres by means of phenol, some fibres of dyed shoddy were treated with this liquid in a test-tube, and the whole placed in a boiling water-bath for an hour with occasional agitation. The blue solution was then poured off and the material washed two or three times with strong alcohol; the fibres were quite white. In this way indigo can be completely extracted; Indirubin is also dissolved by phenol, but the addition of an excess of alcohol precipitates the Indigo if present, the residual liquid being coloured red. The effect of heating a number of blue dyestuffs in a similar manner is given below:—

Pure Indigo.....	Colour completely extracted; fibre white.
Indigo and Sandal-wood.....	Indigo removed; fibre red-brown.
Indigo and Alizarin Blue on Chrome Mordant.	Indigo removed; fibre blue.
Indigo on Alizarin.....	Indigo withdrawn; fibre red.
Indigo-Indophenol (in the same vat).	Most of the colour extracted; fibre still slightly blue.
Indigo Sulphonic Acid	Little colour removed; fibre blue.
Brilliant Sulphone-Azurin....	Nothing extracted; fibre unchanged.
Indulin	A little colour withdrawn; fibre blue.
Alizarin-Indigo Blue	Nothing removed; fibre unaltered.
Alizarincyanine	Liquid slightly red; fibre blue.
Anthracene Blue.....	A little red extracted; fibre unchanged.
Logwood on Alum, Chrome, and Antimony Mordants.	No change.

It is accordingly concluded that this treatment with phenol at 100° C. affords a good means of distinguishing Indigo from other blue dyestuffs upon textile fibres. The test is not so suitable in the case of cotton goods dyed with pure Indigo, since the Indigo is partially extracted, besides which, Indoïn is dissolved out, and the fibre remains white.—E. H. T.

Cotton-Seed Oil; Detection of ——. B. A. van Kettel. Monit. Scient. **14**, March 1900, 154—156.

Pentosan Test.—In 1897 (Ber. Nederl. Maatschap. Pharm., Oct. 1897) the author described a test based upon the fact that several vegetable oils, and notably cotton-seed oil, contain traces of pentosans, whilst animal oils are free from such bodies. In using the test, 10 grms. of the oil are heated in a test-tube with a few c.c. of hydrochloric acid (sp. gr. 1·06) until the acid vapours have permeated the whole of the oil. The tube is then left for 10 minutes for the acid and oily layers to separate, and on now adding a solution of phloroglucinol hydrochloride, a red ring is formed at the junction of the liquids, in a few minutes, in the presence of pentosans.

Among the oils which do not give the pentosan reaction are cacao butter, earth-nut oil, croton oil, rape-seed oil, and linseed oil. Two specimens of pure olive oil examined by the author also gave negative results.

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Cavalli's Reaction for Cotton-Seed Oil.—In the present paper the author compares his reaction with that of Halphen and that of Cavalli, which latter consists in treating the oil with a mixture of 2 grms. of resorcinol, 20 c.c. of water, and 15 c.c. of sulphuric acid, a red coloration changing to blue being obtained with cotton-seed oil on shaking.

Comparative Sensitiveness of the Tests.—Six samples of cotton-seed oil of different origin and a sample of cotton "stearin" were tested. With Halphen's reagent all the samples gave a red coloration, with the exception of a crude yellow Egyptian oil. With Cavalli's reagent only two of the oils gave a pronounced reaction, whilst one gave a faint reaction. With the author's reagent, five of the samples, including the Egyptian oil, gave a marked coloration, and the other two a faint reaction.

The crude Egyptian oil was treated with animal charcoal and the filtrate tested with Halphen's reagent, but as the red coloration was still not obtained, the conclusion was arrived at that this oil did not contain the substance producing the reaction.

Cavalli's reagent was regarded as unreliable in view of of the results of these experiments.

The author found that his own reagent was capable of detecting 10 per cent., and sometimes 5 per cent., of cotton-seed oil in earth-nut oil.

Detection of Cotton-Seed Oil in Butter.—A small quantity of the butter was dissolved in benzene, the solution filtered, the solvent evaporated, and the residue tested with Halphen's reagent. In 20 samples the author only once detected cotton-seed oil.

Pentosans in Heated Cotton-Seed Oil.—Holde and Pelgry (this Journal, 1899, 711) have shown that cotton-seed oil loses its property of giving a coloration with Halphen's reagent when heated to 220°—250° C. The author has tested his pentosan reagent on the six oils mentioned above after heating them for 30—40 minutes at about 250° C. Of the oils thus treated, only two gave a coloration with Halphen's reagent, whilst with the author's reagent two gave negative results; four, faint reactions; and one, a pronounced reaction. (*Cf.* this Journal, 1899, 865.)—C. A. M.

Butter, Renovated; Detection of ——. W. H. Hess and R. E. Doolittle. J. Amer. Chem. Soc. 1900, **22**, [3], 150—152.

Manufacture.—"Process" or renovated butter is manufactured by mixing the melted fat of unsaleable butter, and cooling the mass quickly to prevent the "butter oil" from separating. The added milk soon becomes sour and coagulates, furnishing an artificial curd, which contains about the same proportion of nitrogen as that of the curd of genuine butter. As there is no material difference in the chemical properties of the fat of renovated and ordinary butter, the authors mainly rely upon an examination of the curd to detect the adulteration. The following method of analysis has given satisfactory results.

Tests for Butter Fat.—The purified melted fat is examined with the butyro-refractometer. At 25° C. the reading seldom varies from 51° in the case of "process" butter. A determination of the Reichert value may also be used to ascertain the absence of oleomargarine.

Tests of the Curd.—When about 1 grm. of butter is heated over a free flame, the mass shows a characteristic foamy appearance, whereas "process" butter bumps and splutters, and does not foam. This difference is due to the cohesive properties of the curd of pure butter. Oleomargarine behaves in the same way as process butter, but will have been excluded by the previous tests.

Appearance of the Curd.—The sample is melted, the fat decanted, and the curd washed with ether, allowed to dry in a thin layer on a glass plate, and compared with the curd obtained in the same manner from pure butter. The physical appearances of the two curds are very different, especially when magnified three to six diameters. The curd from genuine butter is a gelatinous ropy mass of an amorphous non-granular appearance. It is the proteid of cream, and only dissolves after prolonged treatment with acids or alkalis.

The curd from "process" butter is the proteïd of milk (caseïn). It is a flaky, granular, non-cohesive mass, which is readily soluble in acids or alkalis.

Identification of the Source of the Curd.—From 25 to 100 grms. of the sample are melted in a beaker at 45° to 50° C., the fat decanted as completely as possible, and the residue of curd, water, salt, and remainder of the fat, transferred to a moistened filter. The water passing through contains the soluble proteïds. A few drops of acetic acid are added to the filtrate, and the liquid heated to the boiling point. In the case of pure butter, only a slight milkiness is produced (absence of albumins), whilst with the filtrate from the curd of "process" butter, there results a flocculent white precipitate of milk albumins.

Other tests for albumins can also be employed, such as that of Liebermann, according to which a violet coloration is obtained on adding strong hydrochloric acid to a solution of albumin.

It is noteworthy that "process" butter does not yield a clear fat on melting, even after, in certain cases, as long as 48 hours, whilst with pure butter the fat becomes clear as soon as melted.

Quantitative Examination of the Curd.—When the curd has been derived from milk, the ratio of caseïn to albumins should be the same as in milk (9:1). In the "process" butters on the market, the authors found the ratio to be as 8·6 is to 1.

For this estimation 50 grms. of the sample were treated with ether, the ethereal solution of fat decanted, and the residue transferred to a separating funnel, and repeatedly washed with ether. The caseïn was filtered off, washed with water, and its nitrogen determined by Kjeldahl's method. The filtrate from the curd was acidified with acetic acid, heated to the boiling point, the precipitated albumins filtered off, and their amount calculated from the results of a determination of the nitrogen. (See this Journal, 1899, 388.)—C. A. M.

Alcohol, Commercial; Detection of Benzene in ——. G. Halphen. J. Pharm. Chim. 1900, **11**, [8], 373—375.

The author's method consists in the isolation of the hydrocarbon, the preparatiom from it of the diazo derivative, and the combination of this with α-naphthol, yielding an orange-red azo colour.

10—20 c.c. of the spirit are placed in a separating funnel, 5—10 c.c. of carbon bisulphide are added, and, after agitation, ten times the volume of a 20 per cent. salt solution are poured in. The liquid is cautiously shaken and allowed to rest; the carbon bisulphide containing the hydrocarbon is then drawn off into a test-glass of 100—125 c.c. capacity. It is next vigorously stirred for 2—3 minutes with a mixture of 10 c.c. of Nordhausen sulphuric acid and 1 c.c. of fuming nitric acid. The greater part of the carbon bisulphide is decanted off, and 5 c.c. of water are added to the residual liquid, which develops enough heat to evaporate the remainder of the CS_2. The acid solution, having been further diluted with 15—20 c.c. more water, is shaken with 4—5 c.c. of ether, and the ethereal solution, after once washing with water, is evaporated to expel the ether. The residue containing the nitro derivative is mixed with about 20 c.c. of water acidified with HCl, one drop of platinum chloride solution, and 0·2 to 0·3 grm. of zinc dust. After 10 minutes the liquid is filtered, cooled to 15° C., acidified, if necessary, with hydrochloric acid, and treated with from 4 to 5 drops of a 10 per cent. solution of sodium nitrite. After a few seconds the excess of acid is neutralised by adding sodium carbonate. To the liquid, containing precipitated zinc carbonate, two drops of an alkaline solution of α-naphthol are added. This solution is composed of α-naphthol, 0·1 c.c.; caustic soda solution of 36° B., 5 c.c.; and water, 100 c.c. If benzene had been present, an orange-red colour would be produced.—L. A.

Cystine in Contaminated Waters; The Presence, Variation, and Estimation of ——. H. Causse. Comptes Rend. **130**, [12], 785—788.

The author has demonstrated the presence of cystine in various well- and river-waters, and has shown that its

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presence and amount are connected with outbreaks of typhoid fever. The amount, both in well-waters near Lyons and in the water of the Rhone, varies with the season, reaching a maximum about September and a minimum about March. The determinations are made by a colorimetric method. A 5 per cent. solution of sodium-*p*-amidobenzenesulphonate is made, and precipitated by mercuric chloride; the washed precipitate is dissolved in saturated sodium chloride solution, and will then keep for any length of time. At the moment of using, it is diazotised by a 0·4 per cent. solution of potassium nitrite. In a stoppered vessel are placed 100 c.c. of the water to be examined, 5 c.c. of the chloromercurate reagent, 2 c.c. of the potassium nitrite solution, and 15 drops of normal hydrochloric acid. The whole is shaken and left to itself in the dark for six hours, when an orange colour develops if cystine be present, which is not destroyed on the addition of sulphurous acid and further standing for two hours. This may be used either as a qualitative test for cystine, or, by comparison with similar tests worked on known amounts of cystine, as a quantitative method for its estimation.—J. T. D.

Doubtful Reactions [*Formaldehyde and Sesamé Oil*]. C. Amthor. Zeits. Unters. Nahr. und Genussmittel, 1900, **3**, [4], 233—235.

Reaction for Formaldehyde.—N. Leonard and H. M. Smith (this Journal, 1899, 522) described a test for formaldehyde in milk, whereby a violet coloration is produced on warming with concentrated hydrochloric acid. W. W. Fisher remarked that this coloration was also produced when boric acid was present in the milk instead of formaldehyde, and that the coloration was probably due to an alteration of the casein by the preservative. The author states that any milk, even in absence of boric acid and formaldehyde, will give a red-violet coloration when heated with strong hydrochloric acid of 1·19 sp. gr. The coloration is apparently due to the albuminoid in presence of sugar. If sour milk, most of the sugar of which has disappeared, be employed, the reaction is very much weaker. This coloration is obtainable without warming, but in a less degree. When flesh or egg albumin is warmed with hydrochloric acid, a faint coloration is observed, but if sugar be added it becomes intense. The colorations, especially in the case of milk sugar, are very permanent.

Reaction for Sesamé Oil.—Butter contains small quantities of milk sugar as well as albuminoids, and unfiltered butter also gives a violet coloration when heated with hydrochloric acid; old butter, from which the milk sugar has mostly disappeared, gives little or no coloration. This albuminoid-sugar reaction is due to the furfural produced from the sugar, since the addition of furfural and hydrochloric acid suffices to produce the coloration in the cold. The official test for the presence of margarine manufactured from sesamé oil in butter consists in shaking the butter with furfural and hydrochloric acid for half a minute, with the production of a red coloration. The author points out that in view of the above observations, positive results as to the presence of sesamé oil may be erroneously obtained with pure butters, unless the butter be previously freed from all albuminoid matter, either by filtration or by solution in ether.—J. F. B.

Formaldehyde; Sensitiveness of Certain Tests for ——. B. M. Pilhasy. J. Amer. Chem. Soc. 1900, **22**, [3], 132—135.

Trillat's Test.—This consists in heating a dilute solution of formaldehyde with a few drops of sulphuric acid and dimethylaniline for 30 minutes on the water-bath, then making the liquid alkaline, again heating to expel the excess of dimethylaniline, and filtering. On moistening the filter paper with acetic acid and sprinkling lead dioxide over it, a blue coloration is said to indicate the presence of formaldehyde.

The author describes a number of experiments, from which he concludes that this test does not show the presence of formaldehyde, but of dimethylaniline or its salts incompletely volatilised.

Lebbin's Test (this Journal, 1898, 74).—According to the author this test is not capable of detecting more than 1 part of formaldehyde in 200,000 of water.

Morphine Hydrochloride with Sulphuric Acid (this Journal, 1898, 955) was not found to be sensitive for solutions of formaldehyde containing less than 1 part in 1,000.

Phenylhydrazine Hydrochloride (this Journal, 1898, 954).—In the author's opinion this is the most sensitive test. 3 c.c. of a solution containing 1 part in 250,000, when heated with 5 drops of the reagent and 5 drops of sulphuric acid, gave a light green tint after three minutes, and a decided coloration after 10 minutes.

Rimini's Test (this Journal, 1898, 697).—The limit of sensibility was found to be about 1 in 1,000,000.—C. A. M.

ORGANIC CHEMISTRY.—QUANTITATIVE.

Cochineal and Carmine; Simple Method for the Valuation of ——. G. F. Merson. Pharm. J. 1900, **64**, [1552], 309.

The author recommends the following method of determining the "colour value" of cochineal. 0·5 grm. of the finely powdered sample is heated to boiling with 30 c.c. of distilled water and 5 drops of liquor ammoniæ (sp. gr. = 0·959). The solution is strained through cotton wool into a 100-c.c. flask and the insoluble residue washed with sufficient water to produce 100 c.c. of filtrate. The marc on the wool should now be quite colourless. 25 c.c. of the solution are taken, mixed with 5 c.c. of strong hydrochloric acid, and made up to 100 c.c. with distilled water. A solution of chlorinated lime (or soda), containing 1 per cent. of available chlorine, is then run in till the cherry-red colour changes to dull orange, the liquid being briskly agitated after each addition. The chlorinated lime (or soda) solution is now added, 0·1 c.c. at a time, till the liquid is decolorised. When the operation is almost complete, the burette reading is noted; then, after a further addition of 0·1 c.c., the liquid shaken slightly. If there now be no difference between the colours of the two layers of liquid, the reaction is complete, but if the lower stratum be darker, the chlorinated solution is added drop by drop till the end point is reached. It is recommended that a second titration be performed more carefully. The number of c.c. of chlorinated solution used, multiplied by eight, gives the quantity of solution required to destroy the colouring matter of 1 grm. of the sample of cochineal. The author found that to bleach 1 grm. of high-grade cochineal, about 20 c.c. of solution are required, and he proposes to use this number multiplied by five, *e.g.*, 20 × 5 = 100, as the standard "colour value." In 31 samples of commercial cochineal, the "colour value" varied between 48 and 114; the dark grain insects were relatively better than the silver grain.

The author concludes by suggesting that, in view of the wide variation in tinctorial power shown by commercial cochineal, as also the absence of any relationship between the ash content and the colour yield, some test for colour valuation should be added to the present official tests.

The above method may also be used for the valuation of commercial carmines, 0·1 grm. of the sample being treated precisely in the same way as the cochineal, except that boiling and filtration are not necessary.—A. S.

Fat in Dairy Products; New Process for the Estimation of ——. M. Lindet. J. Pharm. Chim. 1900, **11**, [8], 368—373.

This process depends upon the fact that a concentrated solution of resorcinol dissolves casein, solution being so perfect that the liquid will pass freely through a porcelain filtering tube. 100 c.c. of a solution made by dissolving 100 grms. of resorcinol in 100 c.c. of water will dissolve, at 15° C., about 23 grms. of casein.

In presence of resorcinol, milk, as an emulsion, at the temperature of the water-bath, is completely broken up or destroyed, and the fat rises to the surface, but is often contaminated by small clots of casein, which are precipitated by drops of condensed water falling into the liquid from the upper part of the tube. This inconvenience is avoided by adding a small quantity of alkali to the milk, and by agitating strongly on first heating, afterwards more gently, so as to form a layer of fat on the surface, which prevents evaporation. To facilitate the reading of the

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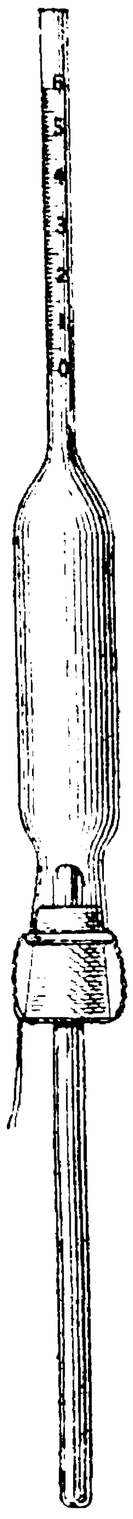
volume of fat which rises, the lower liquid may be tinted with Aniline Violet.



The apparatus used is shown in the figure. It has a capacity of about 15 c.c., and is graduated at the narrow end. In the analysis of milk the tube is placed graduated end downwards; the narrow end is closed by a rubber stopper and filled with mercury. 5 grms. of resorcinol are then introduced, followed by 5 c.c. of milk, 2 drops of caustic soda solution of 36° B., and 1 drop of Aniline Violet solution. The rubber stopper carrying a glass rod having been inserted and tied down, the tube is inverted, the rubber cap removed from the narrow end, and the tube immersed up to the end in a boiling water-bath. The casein rapidly dissolves, if occasionally agitated, and as soon as the fat forms a clear layer on the surface, it is forced up into the graduated tube by pushing in the glass rod, and the volume is read off. The whole operation takes about half an hour. The graduation of the tube is based upon the author's calculation that 1 grm. of fat occupies, at the temperature of the water-bath, 1·154 c.c. Each division of the tube is made to hold 0·0577 c.c., and is further subdivided into tenths. Working on 5 c.c. of milk, each subdivision therefore represents 0·1 grm. of fat per 100 c.c. of milk.

In the analysis of cheese, 1 grm. of the sample and 15 c.c. of a hot solution of 100 grms. of resorcinol in 100 c.c. of water are introduced into the tube and heated in the water-bath. In 10—15 minutes the fat is ready to read off. Each division of the graduated tube, of which there are 50, has a capacity of 0·01154 c.c., and represents 1 per cent. by weight of fat in the cheese.

The analysis of cream is conveniently made after suitable dilution with water.—L. A.

Fatty Acids; Volumetric Estimation of ——. J. Swoboda. Chem. Zeit. 1900, **24**, [27], 285.

In titrating fatty acids the author proposes to dissolve the fatty acids in a mixture of 1 part of absolute alcohol with 2 parts of amyl alcohol. With this solvent an aqueous solution of alkali can be used without causing the fatty acids to separate, and the colour reaction of the indicator is distinct.—C. A. M.

Sugar; Modification of the Woycicki Method for Estimating —— in Sugar Beet. P. Nyssens. Bull. Assoc. Belge des Chim. **13**, [12], 495—496.

The results obtained by the Woycicki method being found too low unless the pulp be of the consistency of cream, the author proposes to combine this method with the hot-water method.

The pulp is weighed out on tared parchment paper, and the whole introduced into a 250-c.c. Fleischmann enamelled iron pan, hermetically closed with a caoutchouc joint. Lead subacetate and water are then introduced with a Le Docte pipette, the mixture is agitated, and the closed pan heated to 75° C. for 20 minutes on the water-bath. When re-cooled the contents are agitated a second time, and then filtered and polarised in the usual manner. If the parchment paper has been vaselined, the pulp separates readily, and the paper need not be placed in the pan.—C. S.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Ammonia; Properties of Liquefied ——. C. Frenzel. Zeits. f. Elektrochem. 1900, **6**, 477—480, 485—489, and 493—500.

Carefully purified liquid ammonia possesses a very low electrical conductivity, *viz.*, $1{\cdot}33 \times 10^{-7}$ at − 79° C., and consequently obeys Kohlrausch's rule, which states that, with the exception of molten salts, no single pure substance exists which by itself is dissociated to any great extent.

The temperature co-efficient of the conductivity is 1·9 per cent., and diminishes rapidly as the impurities in the ammonia increase. In this respect ammonia resembles water.

Ammonia may be regarded as a weak tribasic acid. The evidence for this is to be found in the fact that there are three anodic decomposition points and in the primary evolution of hydrogen.

The slight effect which is produced by the addition of water to ammonia and the almost complete disappearance of the anodic points of decomposition, lead to the conclusions that the added water exists almost entirely as such and that scarcely any formation of ammonium hydroxide takes place. This accounts for the weak basic character of aqueous ammonia solutions, since the ammonium hydroxide presumably present is almost completely decomposed into NH_3 and H_2O.—J. S.

Liquid Ammonia Solutions; Electrical Conductivity of ——. E. C. Franklin and C. A. Kraus. Amer. Chem. J. 1900, **23**, [4], 277—313.

The ammonia used was the "liquid anhydrous ammonia" of commerce, such as is employed for refrigerating purposes.

The authors prepared pure liquid ammonia by the action of sodium upon the foregoing, and the subsequent distillation of the sodium amide thus obtained. They have devised an apparatus, fully described in the original, adapted for the study of the conductivity of liquids of low boiling-points.

The results obtained were briefly as follows:—Salts are generally dissociated to a less degree in ammonia than in water. The limit of molecular conductivity of binary salts in ammonia at − 38° C. ranges from about 290 to 340 Kohlrausch units, which is much above the conductivity of the same salts in solution in water at 18° C. Ostwald's law of dilution holds approximately for binary salts. Silver iodide is dissociated in ammoniacal solution, although not to so great extent as other binary salts. Mercuric chloride reacts with ammonia to form the compound $HgCl_2.12NH_3$, which loses 10 molecules of ammonia when heated at atmospheric pressure, forming the compound $HgCl_2.2NH_3$, which is identical with mercuri-diammonium chloride. Mercuric cyanide and silver cyanide conduct in ammoniacal solution, but the conductivity in neither case changes much with the dilution. The molecular conductivity of the former falls slightly, that of the latter rises somewhat. Strontium nitrate was the only ternary salt examined. It has a high molecular conductivity in ammonia solution, and, as in water solution, it approaches its maximum more slowly than do the binary salts. Many of the nitro compounds are good conductors in ammonia solution, some of them approaching the binary salts in their power to carry the current. The acid and basic amides generally dissolve in ammonia to form good conducting solutions. The conducting power of the acid amides ranges from the fraction of a unit to that of the binary salts. The authors confirm the statement of Cady (J. Phys. Chem. 1897, **1**, 707) that ammonia solutions of the alkali metals conduct electricity without polarisation at the electrodes. The conductivity changes but slightly, if at all, with the concentration. These solutions exhibit positive temperature coefficients.—A. S.

Acids; Effect of Salts on the Strength of ——. S. Arrhenius. Zeits. Phys. Chem. 1899, **31**, 197—229.

The author determined the influence of salts upon the strength of acids by observing the effect produced on the rates of inversion of cane sugar by acetic, formic, or phosphoric acid by the addition of varying quantities of the following salts: potassium chloride, chlorate, or nitrate, sodium chloride, bromide, or nitrate. The greatest concentration of the salt solution employed was 0·125 normal. It was found that the relative increase (z) of the inversion velocity is nearly proportional to the square root of the quantity (c) of salt present. Thus, if c and z are the

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values for one salt solution, and c^1 and z^1 for another, the ratio log z/z^1 : log c/c^1 has the value 0·543 with 0·05 normal acetic acid and sodium chloride, and the value 0·52 with 0·025 normal acetic acid and potassium nitrate, chloride, or chlorate, or sodium nitrate. Taking into account the dissociation of the acids, it appears that as the concentration of hydrogen ions in the solution increases, the value (x) of the above ratio shows a continuous increase, z at the same time gradually decreasing. The proportion of sugar contained in the solution has no appreciable influence on the value of x, but the temperature, on the other hand, exercises a very marked influence.

The determination, in the above manner, of the effect produced upon the reaction velocities of weak acids by the addition of salts, is complicated by three disturbing factors, for which corrections have to be made: (1.) The action of the neutral salt itself in producing inversion of the sugar. (2.) A slight chemical action between the acid and the added salt. (3.) The action of the salt in increasing the dissociation constant of the acid; corresponding to this is a similar increase in the dissociation constant of a salt solution as the concentration increases, the increase following the same law in both cases.

By experimenting with solutions of varying strength of the mixtures, potassium chloride and ammonium chloride, potassium nitrate and potassium chlorate, and potassium nitrate and sodium nitrate, the author found that the conductivity of a mixture of two salt solutions of equivalent strengths is equal to the mean of the conductivities of the separate solutions, the ionic concentration being unchanged by the mixing. Calculations made, according to Noyes' view, that the dissociation factor depends only on the concentration of the non-dissociated part of the dissolved salt, do not agree with the observed numbers. The diminution in the solubility of a slightly soluble salt effected by the addition of one of its ions to the solution, is in apparent contradiction with these experiments; in this case it is assumed that the solubility of the non-dissociated portion of the dissolved salt remains constant. The author, however, concludes that this assumption is erroneous, since, in experiments with the sodium and silver salts of valeric, monochloracetic, butyric, propionic, and acetic acids, it was observed that the solubility of the non-dissociated silver salt decreases very considerably when the corresponding sodium salt is present. A similar effect is produced on the solubility in water of potassium hydrogen tartrate when methyl or ethyl alcohol, cane sugar, or glycerin is added to the solution.—A. S.

Phosphorescent Substances which lose their Phosphorescence when Heated, and Regain it when Cooled. G. le Bon. Comptes Rend. **130,** [14], 891—894.

Certain specimens of radio-active substances were found to phosphoresce, but to lose this power when heated to 200° C., regaining it on cooling. Others, possessing no visible phosphorescence, acquired it for a short time on heating, but it rapidly disappeared. To discover whether these changes were due to chemical actions, the author investigated other substances, notably quinine sulphate. This, on being heated to 200° C., became phosphorescent; but after a very few seconds the phosphorescence ceased, and appeared again on cooling, lasting this time for a longer period. While hot, the quinine sulphate showed radio-active characters, discharging an electroscope in its neighbourhood. The phosphorescence here occurs, according to the author, during the dehydration and re-hydration of the salt on heating and cooling, and persists only while these actions are going on. It is thus shown that chemical action, as well as radiation, can produce one of the fundamental phenomena of radio-activity.—J. T. D.

Calcium Carbide; Reducing Action of——. Geelmuyden. Comptes Rend. **130,** [15], 1026—1029.

Boric anhydride, heated in the electric furnace with calcium carbide, yields no carbon boride, but a fused mass of crystals of calcium boride.

Pyrites, tetrahedrite, galena, stibnite, and magnesium sulphide are all reduced when heated with calcium carbide in the electric furnace, leaving calcium sulphide; but the metals, except the iron of pyrites and the copper of tetrahedrite, are all volatilised. Aluminium sulphide was not reduced when thus treated.—J. T. D.

Amyl Chloride; Reaction of —— *on Calcium Carbide.* P. Lefebvre. Comptes Rend. **130,** [15], 1036—1039.

On passing the vapour of amyl chloride over calcium carbide heated to dull redness, the chief reaction occurring is expressed by the equation—

$$CaC_2 + 2C_5H_{11}Cl = C_2H_2 + 2C_5H_{10} + CaCl_2.$$

Part of the acetylene, however, dissociates into carbon and hydrogen, and some of the hydrogen thus liberated acts on more of the acetylene, forming ethylene. There seems to be, too, a dissociation of some of the amylene into ethylene and propylene. All the products are thus satisfactorily accounted for, both as to nature and quantity.—J. T. D.

Strontium Dioxide; Heat of Formation of ——. de Forcrand. Comptes Rend. **130,** [15], 1017—1019.

The heat of formation of solid SrO_2 from solid SrO and gaseous oxygen (10·875 cal.) is inferior by more than 1 cal. to the corresponding figure (12·10 cal.) in the case of barium compounds; this accounts for the fact that anhydrous strontium dioxide is more difficult to obtain and less stable than anhydrous barium dioxide. The heat of hydration of strontium dioxide, however (with $9H_2O$, 20·48 cal.), is more than 2 cal. above that (with $10H_2O$, 18·20 cal.) of barium dioxide. Hydrogen peroxide acting on dissolved strontia evolves almost as much heat as a strong acid, forming a precipitate of $SrO_2.9H_2O$, which may be looked on as its hydrated normal salt.—J. T. D.

Sulphur, Perfluoride of ——. H. Moissan and P. Lebeau. Comptes Rend. **130,** [14], 865—871.

Pure dry fluorine is passed over sulphur in a copper tube, connected at the further end with a copper spiral condenser, which can be cooled by a mixture of solid carbon dioxide and acetone; the whole apparatus is filled with pure dry nitrogen before admitting the fluorine. When the whole of the sulphur has disappeared, the spiral is disconnected, furnished with a metallic delivery tube, and allowed to rise in temperature; the issuing gas is collected over mercury. It consists of two parts, one absorbable by caustic potash, the other not; the latter is the perfluoride of sulphur, SF_6. It is a colourless, inodorous, tasteless gas, solidifying at −55° C. to a crystalline mass, which melts and boils at a temperature very slightly higher; it is very slightly soluble in water, rather more so in alcohol, and incombustible. It is extremely inert, resembling nitrogen in its characters; it is not decomposed by a red heat, nor is it acted on by *potash* and *lead chromate* in fusion, nor by *copper oxide* at a red heat. Exposed to the induction-coil discharge, it is decomposed with increase of volume, furnishing a gas absorbable by water with deposition of silica, and another absorbable by potash. *Hydrogen* has no action, even when heated, but when the mixture is submitted to the discharge a yellow solid is formed, which seems to arise from the reaction of previously formed hydrogen sulphide and fluoride with the glass of the vessel. The *halogens* do not act on the gas at all, nor does *oxygen*, except under the coil discharge. *Sulphur* vapour at a high temperature produces fluorides containing less fluorine. *Phosphorus, arsenic, boron, silicon, carbon,* are all without action. *Sodium* does not act on the gas till the temperature has risen almost to its boiling point, when vivid incandescence occurs, and the gas is absorbed; similar reactions, but much less vigorous, are shown by *calcium* and *magnesium. Hydrochloric acid* gas has no effect, but *hydrogen sulphide* at a red heat acts readily, yielding sulphur and hydrofluoric acid, the latter of which then acts on the glass of the vessel. *Ammonia* has no action on the perfluoride.—J. T. D.

Sulphur Perfluoride, The Density and Analysis of ——. H. Moissan and P. Lebeau. Comptes Rend. **130,** [15], 984—988.

Determinations of the density of sulphur perfluoride by Moissan and Gautier's apparatus gave a mean figure of 5·03 (theory for SF_6 = 5·06).

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Gravimetric determinations of the sulphur and fluorine were carried out by decomposing a known amount of the gas by heated sodium vapour, and determining the sulphur and fluorine in the sodium sulphide and fluoride thus formed. Good results were obtained in accordance with the above formula.

The hexavalent function of sulphur in the compound is therefore established. The authors draw attention again to the extreme inertness of this compound, and to the complete lack of analogy, as to their sulphur compounds, between fluorine and chlorine.—J. T. D.

Friedel and Crafts' Reaction; Action of Aluminium Chloride in ——. G. Perrier. Ber. **33**, [6], 815—816.

In the preparation of ketones it has been shown (Ber. **32**, 2414, and Comptes Rend. **116**, 1300) that the reaction takes place in two stages:—

$$(1.)\quad 2RCOCl + Al_2Cl_6 = (RCOCl)_2Al_2Cl_6.$$

$$(2.)\quad (RCOCl)_2Al_2Cl_6 + 2C_mH_n = 2HCl + (RCOC_mH_{n-1})_2Al_2Cl_6.$$

The double compound is prepared by warming together equimolecular proportions of the acid chloride and aluminium chloride, and is subsequently allowed to act on the corresponding amount of the hydrocarbon in carbon bisulphide solution. When the theoretical amount of hydrochloric acid has been evolved, the solution is allowed to cool, and the double compound of the ketone and aluminium chloride separates in a crystalline form. This, on decomposition with cold water, yields the ketone almost pure. The method possesses advantages over the ordinary procedure in that no tarry products are formed; and, further, the difference in solubility in carbon bisulphide of the aluminium chloride double compounds of the different isomers which may be formed, is sufficiently great to render their separation a simple matter.—T. A. L.

Alcohol from Acetylene; Manufacture of ——. U.S. Consular Reports, 1900, 287—294.

The synthetic production of alcohol from acetylene by way of ethylene and ethylsulphuric (sulphovinic) acid, was first investigated by Berthelot. Calculating the probable cost of the production of alcohol in this way, the *Moniteur de l'Industrie du Gaz* estimates 53·25 francs per hectolitre, taking calcium carbide at the low cost price of 20 centimes per kilo., whereas the value of alcohol is only 30 francs per hectolitre. According to some processes, ethylene is evolved directly by the action of dilute acid on a mixture of calcium carbide and zinc. In others a chemical reducing agent, such as chromous oxide, is used. It has also been proposed to absorb the acetylene in hydriodic acid solution, with production of ethylene di-iodide, $C_2H_4I_2$, from which alcohol is obtained by heating with water, zinc, and zinc oxide under pressure. Acetylene may also be converted into ethylene, and the ethylene may be heated with concentrated hydriodic acid, with production of ethyl iodide; silver acetate then converts this into ethyl acetate, which may be saponified by potash.

If acetylene be passed through a solution of mercuric chloride, traces of aldehyde are produced, from which alcohol may be obtained by reduction with hydrogen. All the authorities are unanimously agreed that, although alcohol can be obtained from acetylene, the yields are so poor and the process so costly that this method cannot hope to compete industrially with the fermentation process. The only patents covering processes for the production of alcohol from acetylene appear to be those of F. R. Coudert, jun., New York (Amer. Pat. 608,652), and of The Alcohol Syndicate, London (Eng. Pat. 1208 of 1898).

Attention is incidentally called to the method of obtaining 100 per cent. absolute alcohol from spirits containing over 10 per cent. of water, by shaking the spirits (3 parts) with calcium carbide (1 part) and allowing the mixture to remain for about 24 hours before distilling.—J. F. B.

Miscible, Partially, Aqueous Inorganic Solutions. G. S. Newth. Proc. Chem. Soc. **16**, [222], 87.

When strong aqueous ammonia (sp. gr. 0.880) is added to a saturated solution of potassium carbonate and the liquids shaken together, two distinct layers separate out, just as in the case of water and ether. At ordinary temperatures it is found that the potassium carbonate solution dissolves about 37 per cent. of the ammonia solution, while the latter dissolves about 6 per cent. of the potassium carbonate solution by volume.

The solubility of each liquid in the other increases with rise of temperature, the curves of their solubilities intersecting at 43°, above which temperature the solutions are miscible in all proportions. A small amount of added water is also found to increase the mutual solubility; with 12·9 per cent. of added water, the separate phases cease to exist above 10°, whilst if 18·1 per cent. of water be added, the liquids are miscible in all proportions at all temperatures above 0°. When cooled below these critical temperatures, the clear solution instantly becomes turbid by the separation into two liquids. No other aqueous solutions of inorganic substances have as yet been found which exhibit a similar behaviour, but strong aqueous solutions of trimethylamine and triethylamine behave in a like manner with a saturated solution of potassium carbonate.

Glucoside from Willow Bark; A New ——. H. A. D. Jowett. Proc. Chem. Soc. **16**, [222], 89.

Having had occasion to examine a bark purchased as that of black willow, which could not be further identified than as some species of *Salix*, it was found that the glucoside contained in the bark was not salicin, but a new compound. Chemical examination has shown it to be the glucoside of *m*-oxybenzaldehyde, and the name *salinigrin* is provisionally suggested for it. It is contained in the bark to the extent of about 1 per cent., and is a white crystalline substance melting at 195° (corr.).

It is soluble in 52·2 parts of water and in 218·2 parts of alcohol at 15°, and is lævo-rotatory, $[\alpha]_D^{15} = -87·3°$. From salicin it is sharply distinguished by yielding a colourless solution with sulphuric acid, salicin under similar conditions producing a blood-red colour. Its formula is $C_{13}H_{16}O_7$, and it splits up, on hydrolysis, into *d*-glucose and *m*-oxybenzaldehyde.

New Books.

Verdampfen, Kondensiren und Kühlen, Erklärungen, Formeln und Tabellen für den Praktischen Gebrauch. Zweite, durchgesehene Auflage. Von E. Hausbrand. Julius Springer's Verlag, Berlin. 1900. Price M. 9.

This work, the first edition of which received notice in this Journal, 1899, 955, has now reached a second edition. This is practically a reprint of the first edition, with a few corrections, &c.

The Calculations of Analytical Chemistry. By Edmund H. Miller, Ph.D., Instructor in Analytical Chemistry and Assaying, Columbia University. The Macmillan Company, New York, U.S. America. Macmillan and Co., London. 1900. Price $1.50.

A work of 179 pages, and ending with tables of logarithms to page 183. "It is intended for use in scientific schools and colleges in connection with courses of analytical chemistry, and aims at giving a logical treatment of the calculations required of the analyst."

Lexicon der Kohlenstoff-Verbindungen. Von M. M. Richter. Zweite Auflage der "Tabellen der Kohlenstoffverbindungen nach deren empirischer Zusammensetzung geordnet." 27te bis 39te Lieferung. Verlag von Leopold Voss, Hamburg and Leipsic. 1900. Price M. 1.80 per Number. Williams and Norgate, 14, Henrietta Street, Covent Garden, London. H. Le Soudier, Paris. G. E. Stechert, New York.

See this Journal, 1899, 1162. Lieferungen 28 to 39 of the Lexicon may now be had.

Ze zbiorów Biblioteki Głównej Politechniki Łódzkiej

SEVENTEENTH REPORT OF THE COMPTROLLER-GENERAL OF PATENTS, DESIGNS, AND TRADE MARKS, WITH APPENDICES, FOR THE YEAR 1899. 165. Price $2\frac{1}{2}d$.

THIS report shows that in 1899 there were 25,786 applications for patents, the number of patents sealed being 14,160; in the same year 18,470 designs and 3,777 trade marks were registered. The number of complete specifications in 1899 was 14,005, as compared with 14,167 in 1898, and 15,135 in 1897. The effect of the Workmen's Compensation Act is shown by a number of inventions for guards for preventing accidents in working circular saws. The number of inventions relating to organic acids and salts has increased more than fivefold since 1884; the increase in this class of invention in recent years has been caused mainly by the development of acetylene lighting.

As regards foreign legislation affecting patents and trade marks during 1899, a law came into operation in Denmark amending the Danish Trade Mark Law of 1890, a new Trade Mark Law was passed in Guatemala, and new Acts regarding patents, designs, and trade marks came into force in Japan on 1st July last. In the colonies an Act was passed to consolidate the Patent Law of New South Wales, an Ordinance was enacted in Malta to amend and consolidate the patent laws, and to provide for the registration of designs and trade marks, and an Ordinance was passed in St. Lucia to regulate the issue of patents.

Trade Report.

OFFICIAL NOTICES.

OPERATION OF THE PATENT ACTS: COMMITTEE APPOINTED.

Standard, May 24, 1900.

The Board of Trade have appointed Sir Edward Fry (Chairman), Sir Richard Webster (Master of the Rolls), Sir Edward Carson, Q.C., M.P. (Solicitor-General), Sir William H. Houldsworth, M.P., Mr. F. J. S. Hopwood, Mr. S. E. Spring Rice, Mr. J. Fletcher Moulton, Q.C., M.P., Colonel Thomas W. Harding, Mr. Edward Carpmael, and Mr. Herbert Hughes to be a Committee, with the following reference:—

"While Her Majesty's Government do not think it desirable, and do not propose, to establish any general system of examination as to the novelty of inventions in respect of which applications for Letters Patent are made, and do not require any inquiry into any such system of examination, the Committee hereinbefore appointed is to inquire into the working of the Patents Acts with reference to the following questions:—(1) Whether any, and, if so, what, additional powers should be given to the Patent Office to (a) control, (b) impose conditions on, or (c) otherwise limit the issue of Letters Patent in respect of inventions which are obviously old, or which the information recorded in the Office shows to have been previously protected by Letters Patent in this country; (2) whether any, and, if so, what, amendments are necessary in the provisions of section 22 of the Patents, &c. Act, 1883; and (3) whether the period of seven months' priority allowed by section 103 of that Act to applicants for Letters Patent under the International Convention may properly be extended, and, if so, on what conditions."

The Board of Trade have appointed Mr. Arthur Paget, barrister-at-law, to be Secretary to the Committee.

TARIFF CHANGES AND CUSTOMS REGULATIONS.

UNITED STATES.

Tariff Classification of Dyes and Magnesium.

Dyes or Colours derived from Coal-Tar Products.—(1) Alizarin Blue G, Alizarin Blue W, and Alizarin Blue G A (paste or powder), is the dyestuff long known in commerce as Gallein; (2) the dyestuff described in invoices variously as Gallocyanine, Alizarin Blue "violet shade," and Alizarin Blue "V S," is the article long known as Gallocyanine, and belongs to the series of Oxazine dyes; (3) the article described as "Prune pure," "Prune powder," and as "Prune" is similar to Gallocyanine; (4) Alizarin Yellow, and Alizarin Yellow R, Alizarin Yellow O, Alizarin Yellow G, Alizarin Yellow G G W, Alizarin Yellow R W (paste or powder), are chemically Metanitraniline Azosalicylic acid, and belong to the series either of azo or oxyketone or related dyestuffs; (5) Dyestuffs described variously as Alizarin Brown, Alizarin Brown O, Alizarin Brown No. 1131, and otherwise (paste or powder), are chemically Anthragallol; (6) so-called Alizarin Green, Alizarin Green S W, Alizarin Green S, Alizarin green L, and Coerulein M S (paste or powder), are the article long known in commerce as Coerulein, which is made by heating Gallein with concentrated sulphuric acid.

None of these are exempt from duty under paragraph 469 of the Tariff, but are dutiable at 30 per cent. *ad valorem* under paragraph 15, as coal-tar dyes or colours.

Coal-Tar Products and Dyes, Benzidine Base, &c.—(1) Free benzidine base, a product of coal tar, not diazotised or azotised, and which is intended for use in the production of substantive azo dyes, is exempt from duty under the provision in paragraph 524 of the Tariff for Benzidine.

(2) Azoparanitraniline or Azoparanitraniline P N, new, "Dianisidine salt," and Diazoamido-toluol, are products of coal tar, and dutiable as such at 20 per cent. *ad valorem* under paragraph 15 of the Tariff. They are not dutiable at 30 per cent. *ad valorem* as coal-tar dyes or colours under paragraph 15, nor are they exempt from duty, as has been claimed, as "Dianisidine," or otherwise under paragraph 524, being intended and adapted for use, in combination with other substances, in dyeing fibres or fabrics and in the production of coal-tar dyes or colours.

(3) Formaldehyde, mentioned in protests as "Formal," is a product of formic acid and alcohol, and not a product or preparation of coal tar. It is in the nature of a gas, and, when dissolved in water, is used as a medicine and as an antiseptic, and for other purposes.

Magnesium.—Magnesium powder is free of import duty.

Magnesium ribbon is not free of duty as magnesium, but is dutiable, as a manufacture of metal not specially provided for, at the rate of 45 per cent. *ad valorem.*

Customs Decisions.

Creolin—Medicinal Preparations.—(1) Creolin is a product or preparation of coal tar, not a colour or dye, and is used chiefly, if not exclusively, by physicians and surgeons in their profession as a germicide, antiseptic, or otherwise medicinally as a cure or remedy for diseases or affections of the human or animal body, or as a preventive thereof. Being "medicinal," it is expressly excluded from the provisions of paragraph 15 of the Tariff, and as a chemical compound is dutiable at the rate of 25 per cent. *ad val.* under paragraph 3, if not as a medicinal preparation under paragraph 68.

(2) Antiseptics, germicides, and disinfectants, being used chiefly, if not exclusively — internally or externally — to destroy or to arrest the growth of disease germs or putrefactive bacteria, are "medicinal preparations" within the common and professional understanding.

Parchment Paper.—Paper made from wood pulp, subjected only to the single process of immersion in an alkaline solution, and not commercially known as parchment paper, is dutiable as paper not specially provided for at 25 per cent. *ad val.* under paragraph 402 of the Tariff, and not as parchment paper under paragraph 398.

Philosophical Instruments.—Analytical balances are held to be philosophical instruments, and are entitled to entry free of duty under paragraph 638 of the Tariff.

EXTRACTS FROM DIPLOMATIC AND CONSULAR REPORTS.

BRITISH TRADE WITH BORDEAUX IN 1899.

Foreign Office Annual Series, No. 2415, *May* 1900.

(1.) *Exports from Bordeaux.*—12. The sugar exported was that of the French colonies in a raw state, 8,551 cwt.,

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against 5,497 cwt. in 1898, and refined lump sugar, 2,315 cwt., against 2,584 cwt. in the previous year.

17. The pure oils exported were: olive oil, 7,340 cwt., against 6,315 cwt. in the previous year; castor oil, 3,151 cwt., against 4,733 cwt.; arachide (ground nut) oil, 16,811 cwt., against 12,760 cwt. in 1898; and cotton-seed oil, 1,899 cwts.

34. Under chemical products the principal items exported were: chestnut and other vegetable tannin extracts, 83,960 cwt., against 69,545 cwt.; oxide of zinc, 772 cwt., against 2,508 cwt.; glycerin, 1,103 cwt., against 1,996 cwt.; raw tartar, 2,185 cwt., against 13,062 cwt.; cream of tartar, 37,832 cwt., against 32,303 cwt. in 1898.

36. The principal item under the class called perfumery is that of common soap, not for toilet purposes, 433 cwt.

43. Under the heading of prepared hides, the only items of importance were: tanned goat and sheep skins, 5,010 cwt., against 3,615 cwt.; curried calf skins, natural colour, 274 cwt., against 1,616 cwt.; and tinted or dyed dressed calf skins, 2,112 cwt., against 920 cwt. in 1898.

51. Practically the whole of the manganese ore exported went to Great Britain, in addition to which was sent 467 tons of copper ore, 928 tons of zinc ore, and 970 tons of lead.

(2) *Imports into Bordeaux.*— The amount of linseed oil imported was 518 cwt., against 889 cwt.; of cotton-oil, 9,802 cwt., against 10,493 cwt. in 1898.

Of chemical woodpulp were imported 31,757 cwt., against 913 cwt. in 1898.

38. Although there was a falling-off in the coal tar, all that was imported came from the United Kingdom, and in addition also 24,530 cwt. of bitumen.

42. The principal item imported under copper was under the heading of "Pure, or alloyed with zinc or tin; of first fusion, cast in lumps, bars, pigs, or slabs," 3,069 cwt., against 1,032 cwt. in 1898. The other items were rolled or hammered, 121 cwt.; and wire, 31 cwt.

43. The lead imported was chiefly in crude lumps and pigs, 16,391 cwt., against 6,124 cwt. in 1898.

44. The tin imported was entirely in a crude state.

45. There was again a substantial increase in the importation of chemical products, the principal items being: bicarbonate of soda, 921 cwt., against 2,768 cwt.; sal ammoniac, 9,924 cwt., against 7,751 cwt.; superphosphate of lime, 6,304 cwt., against 21,253 cwt.; chemical manure, 166,910 cwt., against 77,867 cwt.; products distilled from coal tar (creosote), 367,570 cwt., against 237,582 cwt.; and sulphate of copper, 229,192 cwt., against 266,088 cwt. in 1898. Other items were: caustic soda, 198 cwts.; oxide of lead, 345 cwts.; carbonate of magnesia, 412 cwt.; chloride of lime, 269 cwt.; glycerin, 1,167 cwt.; sulphate of lime, 787 cwt.; and others not specified, 2,963 cwt.

48. The chief item under paint and colours was ground oil paint, 283 cwt., a great falling off from 751 cwt. in the previous year. Under this heading may also be mentioned ink for writing or printing, 20 cwt., being half the quantity imported in 1898; ground ochre, 96 cwt.; and pastes prepared with water for wall-papers, 70 cwt.

49. There was a fair increase in toilet soaps, principally in transparent kinds, which amounted to 123 cwt., against 26 cwt. in 1898. Of condiments, were imported 109 cwt. of mustard, and 86 cwt. of others, including sauces. The blacking imported in 1899 amounted to 93 cwt., against 86 cwt. in 1898.

52. The principal articles of pottery imported were: common earthenware, 71,834 cwt., against 4,204 cwt.; varnished or enamelled pottery, 169 cwt.; earthenware pipes, 165 cwt.; and fine earthenware, 153 cwt. against 147 cwt.; and porcelain, 58 cwt., against 76 cwt. in 1898.

64. The items of chief importance under prepared hides are: tanned or dressed goat, sheep, or lamb-skins, 315 cwt., against 117 cwt.; and other tanned or dressed skins, 327 cwt., against 162 cwt. in the previous year.

The importation of sulphate of copper during 1899 was 12,000 tons, of which 11,460 tons were of British manufacture. Owing to the formation of a syndicate, copper rose, and with it sulphate of copper. Vineyard owners, favoured by fine and dry weather, had little to fear from the usual cryptogamic maladies of the vine, and used as little sulphate of copper as possible. Towards the middle of the season, manufacturers sent forward a considerable stock on consignment to Bordeaux, but, with the fine weather and no malady appearing, this stock (about 2,500 tons), remained unsold, and will only be used in 1900.

The vines were also free from "oïdium," so the demand for sublimed sulphur was very limited. Only about 2,500 tons of brimstone reached this port, a decrease from 1,000 to 1,500 tons compared with former years. Prices were higher than last season, but with the stocks remaining over they are likely to fall again during 1900.

Prices of creosote rose high during 1899, owing to a large demand, especially from the United States, and, consequently, the French railway companies stopped creosoting sleepers as much as possible. Trials have also been made of this product in small quantities, mixed with lime for coating vines during the winter, and it is hoped by this an insect known as "cochenille" may be destroyed. So far no remedy has been discovered against this pest. The total importation to Bordeaux during 1899 was 18,378 tons.

Stocks of resin and pitch remained on hand at the commencement of 1899, and prices ruled lower than in 1898. The production of 1899 was larger than ever known before, and consequently there is an enormous stock of clear pitch on hand, which it is impossible to sell at present. On the other hand, the stock of resins has run out.

Sales of turpentine were very easy on the Bordeaux market during the whole of 1899, notwithstanding the large supplies brought into the markets of Mont de Marson, Dax, and Bordeaux. The stock remaining on hand at the end of the season was very small owing to the large amount exported.

There are three petroleum refineries in the Department of the Gironde, *viz.*, at Blaye, St. Loubés, and Bègles. The first two have special bonded tanks, so that the duty is only paid on the petroleum as it is refined, at the rate of 90 fr. (3*l.* 12*s.*) per ton. The duties paid by the three refineries in 1898 amounted to 160,940*l.* on 43,538 tons of petroleum. The refined article sells from the refineries as follows:— Petroleum, 31 fr. (1*l.* 5*s.*) per 22 gallons; essence, 38 fr. 50 c. (1*l.* 10*s.* 10*d.*); and best, 45 fr. (1*l.* 16*s.*).

None of the oil is exported. These refineries give work to about 400 men. The raw material is imported from Russia and the United States, almost entirely in British tank steamers. The amount of crude petroleum imported in 1898 was 30,884 tons, and in 1899, 28,365 tons.

Lower Languedoc makes use of the waste produce of wool mills, which, after special treatment, is converted into fertilising material and is much valued by vine-growers. The amount made in 1899 was 5,801 tons, valued at 21,000*l.*, as against 5,265 tons in 1898.

Trade of Bayonne in 1899.

Foreign Office Annual Series, No. 2415, *May* 1900.

Owing to the high prices for turpentine the proprietors are tapping many pine trees, but the temperature is not favourable for the production, which will probably be late, and less than other years.

The price of resins will be high on account of the stock being exhausted. As regards essence of turpentine, the prices of the American supply will have to be taken into consideration, particularly this year, as there is a question of reducing the customs duty; nevertheless, it is believed prices will remain high.

Large quantities of chestnut wood have been shipped during the past year to Nantes and Rouen, where the dye is extracted. There are at present no firms here working this branch of trade; it is, however, reported that a German company proposes starting.

There are very few manufactories in this district, although there are large tracts of waste land on both the right and left bank of the River Adour, available for such works.

Amongst the most important foundries is the Compagnie des Hauts Fourneaux. During the year 1898 the firm purchased 130,000 tons of iron ore, 4,200 tons of manganese ore, 3,600 tons of chrome ore. 37,000 tons of limestone, 140,000 tons of coal, and 85,000 tons of coke were also consumed.

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The chemical works of La Société de Saint Gobain, which are being pushed forward with activity, and principally produce superphosphates and various chemical substances, chiefly acids, have opened a new branch of trade in this district. They have already received from Great Britain a few cargoes of phosphates, slag, and coals. The principal articles produced are: sulphuric acid, nitric acid, sulphate of iron, sulphate of copper, and superphosphate.

Chemical Trade of Havre.

Foreign Office Annual Series, No. 2387, *March* 1900.

The port of Havre has been declining in prosperity as a business centre for some years past, but it nevertheless remains the first market in the world for coffee, and second for cotton. The imports of chemicals, &c., of British manufacture are not on so large a scale as one would expect those of one of the chief continental ports to be. They are as under :—

——	1897.	1898.	1899.
	Tons.	Tons.	Tons.
Copper sulphate	50	25	5
Chloride of lime	35	..	..
Ammonium salts	50	30	818
Soda bicarbonate	54	18	19
Caustic soda	14	52	153
Boric acid	1	2	1½
Coal-tar products	10,827	6,236	8,787
Soap	..	1	7
Oil paints	48	8	46

Openings for Trade in Northern Spain.

Foreign Office Annual Series, No. 2407, *April* 1900.

A beet sugar factory, called Azucarera Gallega (Sociedad Anonima) has been established with a capital of 3,500,000 pesetas. The offices of the company are at Corunna, and the factory at Caldas de Reyes, about seven miles from the port of Villagarcia. The contract for machinery was given to a German firm, as the general opinion seems to be that no country can compete with Germany in this class of machinery, the price to be paid being 40,000*l*. The building and ground occupy about 20 acres, and will, it is estimated, cost about 20,000*l*. The whole of the cement required is coming from France and Belgium, as the English is found too costly. To introduce cement into this country a cheap article must be produced, otherwise no market can be found here.

It is proposed to devote about 3,000 acres of land to sugar beet culture, which does not entail an increased expenditure commensurate with the increased value of the crop compared with other agricultural produce of this country. But however favourable the soil and climate may be, if a due regard is not paid to the proper preparation of the soil before planting, a good and paying crop cannot be expected. The company will start working on September 1 next, and the fertilisers are coming from Germany. The price to be paid per ton of roots is 35 pesetas, the company supplying cultivators with seeds and fertilisers. There is no reason why British chemical manure manufacturers should not compete with Germany by quoting to the company for phosphoric acid, lime, magnesia, potash, and nitrogen, which are the principal fertilisers employed in beet cultivation. The excise duty will be 26 pesetas per 100 kilos. The suitability of soil and climate and the enormous import duty on sugar, namely, 1 peseta per kilo., is undoubtedly the reason of the rapid extension in Galicia of the beet sugar industry.

Already large sugar factories and sawmills are in course of erection, and science and modern industrial methods of production will, no doubt, be employed in the immediate future to develop the great natural resources, and to utilise the raw materials in which the country abounds.

Sugar-Beet Industry of Maryland, U.S.A.

Foreign Office Annual Series, No. 2398, *April* 1900.

The result of the trials in the cultivation of the sugar-beet by the Maryland Agricultural Experiment Station from 1879 to the present time, proves that the climate of the state is not favourable to its successful raising. The average quantity of sugar obtained was only 12 per cent., with a purity of less than 80 per cent. The temperature in the summer was found to be too high, and the hours of sunshine not sufficiently long. This caused the beets to mature too quickly. The conclusion reached was that Maryland could not compete with the states further north, where the hours of sunshine were longer and the heat less severe.

Phosphates in America in 1899.

Foreign Office Annual Series, No. 2394, *April* 1900.

The authorities of the State of South Carolina appear to be giving especial care to the development of the phosphate deposits of the State. A large syndicate, known as the Virginia-Carolina Company, has been buying up most of the fertiliser factories of this and other States, and probably a phosphate trust will be formed, somewhat similar to the Standard Oil Trust. The above-mentioned company is said to have bought up some of the land deposits, as well as one of the companies now mining in the navigable waters of the State under license granted by the Legislature.

Shipments of phosphate rock from the port of Charleston during the year ending September 1, 1899, were 110,945 tons, compared with 92,691 tons shipped the year before. Of last year's shipments only 1,550 tons went abroad, the remainder going to American coastwise ports, mostly Baltimore, Richmond, New York, Boston, and Philadelphia.

Florida has now changed places with South Carolina as the principal factor in the production of the world's supply of phosphate. Germany has now become America's best customer, and Holland is also a good one for the phosphate output. Large sums have been expended in fitting up as exporting points, for Florida and Tennessee rock, the following named places: Fernandina, Tampa, Punta Gorda, Key West and Pensacola in Florida, and Brunswick and Savannah in Georgia, which places have all felt the benefit of this trade; the past year having been a good one in the phosphate industry.

The total shipments of Florida rock during the year ending August 31, 1899, were 776,176 tons, of which 615,953 tons went to foreign countries and the remainder to domestic ports and places by rail in the United States. Of the foreign shipments, Savannah handled 68,220 tons and Brunswick 71,494 tons, the rest going from the Florida ports already mentioned, but principally from Fernandina which exported 244,690 tons.

Tennessee has many grades of phosphate rock, and prices vary both as regards quality and the relative convenience of mines to railway and water facilities for reaching shipping ports for foreign export. The three principal varieties of rock now mined are black nodular phosphate, white bedded phosphate, and white breccia phosphate.

Three years ago Tennessee rock was worth 1 dol. 25 c. to 1 dol. 45 c. per ton, and the annual product was 142,225 tons, while during the past year it is estimated that 500,000 tons were mined at prices from 3 dols. 50 c. to 4 dols. per ton. Last year's phosphate business of this State was nearly double that of the previous year, when the total shipments were 272,191 tons, as compared with the estimate of 500,000 tons for last year.

The extent of the phosphate mining industry in North Carolina is still comparatively small, the reports for last year showing that only 13,750 tons were mined, in comparison with 12,500 tons for the year before. It is expected, however, that this industry will increase considerably in the future, when shipments to outside places may be made, and the business perhaps become more important than it is at present.

From a recapitulation of the foregoing figures it will be seen that the total amount of the phosphate rock industry of this district during the year ending September 1, 1899, was 1,382,473 tons, of which Florida is credited with 776,170 tons; South Carolina, 481,076 tons; Tennesse, 111,477 tons; and North Carolina, 13,750 tons.

Among last year's new industrial features were small shipments of phosphate to China and Japan. The quantities so far are only about a few hundred tons, but they indicate

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the opening of a new trade channel, which might grow to more importance hereafter. There is now an impression prevailing that the Chinese are beginning to learn the value of fertilisers from their countrymen in the United States, some of whom have been very successful in growing early market vegetables, &c.

The imports of chemicals at Charleston, used in the manufacture of fertilisers, during the year ending September 1, 1899, were as follows :—

Chemicals.		Quantities.
Kainit	Tons	46,422
Pyrites	„	45,913
Sulphur	„	7,400
Manure salt	„	7,404
Chloride of potassium	Lbs.	17,273,038
Nitrate of soda	„	7,496,367
Sulphate of potash	„	387,176

The total value of which was 827,792 dols., in comparison with imports of a similar character the previous year, valued at 840,338 dols., a decrease last year of about 13,000 dols. in the value of chemical imports.

Copper Industry of Maryland, U.S.A.

Foreign Office Annual Series, No. 2398, *April* 1900.

Three veins of copper exist in the neighbourhood of Baltimore, but when the vast deposits of copper ore were discovered in the western states, their working became unprofitable, and they are now all closed. As far back as 1817 smelting works existed in Baltimore, and one is at present in operation smelting ore almost entirely obtained from Montana. The copper is refined by an electrolytic process, and it is then cast in the form of cakes, ingots, or wire bars, and chiefly sent abroad, the quantity exported in 1899 being 91,286,813 lb., an increase of over 5,000,000 lb. compared with 1898. Sulphate of copper is used in this country for the manufacture of Paris green and in dye works; it is sent to Europe for use in the vineyards. The sheet copper mill which is attached to the works is one of the largest in the country, and produces also tinned and silver-plated copper.

Cotton Oil at Norfolk, Va., U.S.A.

Foreign Office Annual Series, No. 2328, *April* 1900.

Within the past year the Cotton Oil and Fibre Company, of Philadelphia, with a capital stock of 3,000,000 dols., have erected a plant here at a cost of 400,000 dols., for the manufacture of cotton-seed oil and meal. In connection with the cotton-seed mill the company has a cotton-spinning mill with a daily capacity of 5,000 lb. for producing cotton yarn, thus consuming all the short staple coming from the seed, which is useless to other cotton-seed oil companies, this company being the only one to combine a cotton yarn spinning mill with a cotton-seed crushing mill.

Chemical Trade of Kansas City, U.S.A.

Foreign Office Annual Series, No. 2414, *May*, 1900.

There are manufacturing lines in which Kansas City might reasonably be expected to excel—in particular all manufactures from bone material, which the cattle industry here renders so abundant. Animal charcoal might be profitably manufactured with all its by-products, and various works in horn and bone might be established.

As an instance of success attending the establishing of manufactures, it may be mentioned that a chemical company recently started for the manufacture of sulphuric acid and other chemicals necessary in manufactures has already had an advance sale of its entire product for at least 12 months ahead, and this in spite of the fact that its works are not yet completed or in operation. The chemical company referred to is situated near the large smelting works in Argentine (some five miles only from Kansas City), and the pyrites is thus cheaply obtained from the tailings shipped to the smelter.

In connection with the question of animal charcoal works, it should be mentioned that much attention has lately been given in parts of Nebraska to the growing of sugar beets, so that a market for the animal charcoal for sugar-refining purposes might be secured, and again, the by-products, such as bone fertilisers, might any time be required locally, though at present these would require to be exported to find a market.

Trade of Lombardy in 1899.

Foreign Office Annual Series, No. 2413, *May* 1900; *and Bd. of Trade J., May* 24, 1900.

The Consul reports a considerable increase in the imports of chemicals for fertilising purposes. Germany supplies most of the salts of potash, and the United Kingdom the sulphate of ammonia. The nitrates came, of course, chiefly from South America.

A new industry, which has now assumed considerable importance in Italy, is the manufacture of carbide of calcium. The United States and France occupy the first and second places as producers of carbide, this country coming next.

The Edison works at Paderno, where a force of some 13,000 horse-power is derived from the river Adda and employed for producing electricity, which is carried by overhead cable to Manzo and Milan, was described in a previous report.

Another enterprise of a similar nature, but on a larger scale, is now on the eve of completion.

The "Società Lombardia per distribuzione di energia Elettrica," a company formed in 1897 with a capital of 320,000*l.*, recently increased to 400,000*l.*, obtained a concession from the Government on the river Ticino, at Vizzola, some miles below its issue from Lake Maggiore, and immediately set about constructing works for the development of hydraulic force of 20,000 horse-power (theoretical), which will give 10,000 effective horse-power of electric energy for industrial purposes, after making full allowance for loss in transmission.

It was originally intended to bring all this electric energy into Milan, a distance of 25 miles, but the whole of it has now been disposed of in and about the manufacturing towns of Gallarate, Busto Arsizo, Legnano, and Sarsuno, which lie between Vizzola and Milan, a district which already, for the cotton industry alone, uses steam to the extent of 10,000 horse-power.

The price varies according to the importance of the supply required, but the average at which the whole of this force has been contracted for, is 8*l.* 4*s.* per kilo-watt per annum for use during 12 hours a day. Firms working 24 hours a day only pay a very slight increase.

Production of Sulphur in Sicily.

Bd. of Trade J., May 24, 1900.

H.M. Consul at Palermo reports the production and exports of sulphur from Sicily for the first three months of the current year, as follows :—

——	Production.	Exportation.
	Tons.	Tons.
January 1900	41,643	41,041
February	35,263	52,369
March	42,132	73,016
Total	119,038	166,426

The stocks on the 31st December 1899 amounted to 262,087 tons, and on the 31st March last to 214,681 tons.

Naxos Emery.

Foreign Office Annual Series, No. 2411, *May* 1900.

A depôt of Naxos emery has been established at Syra. This step now averts all the difficulties hitherto experienced by the shippers, either in dealing with the native emery labourers, or the danger incurred by the loading of vessels

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at Liona and Montzouna Bays, which are absolutely unprotected in rough weather. The depôt will maintain a quantity up to 5,000 tons of well-selected mineral in stock. The price of the emery delivered at the depôt is 106 fr. 50 c. per French ton, which includes the tax of 7 dr. 90 l. per ton levied by the Government. Some 500 tons have recently been sold at the depôt for exportation to Boston, the operation having been completed very satisfactorily in less than two days.

In certain European ports Naxos emery has been found mixed with that of Asia Minor, the value of which is not one-third that of Naxos, and for obvious reasons the vessels carrying it make a point of calling at Naxos on their way to complete the cargo taken at Smyrna. British manufacturers should insist on a Consular certificate of origin being furnished with every consignment, and the fact, as the case may be, that other emery has been shipped from another port may likewise be recorded.

In 1889 a total of 5,139 tons of emery stone, valued at 21,848*l.*, was consigned to buyers for exportation abroad, and about 276 tons to the lessees of the emery stores recently established at Syra, where the same price, *viz.*, 106 fr. 50 c. per French ton, is charged as when obtained at Naxos. The consignment of emery at the ports of Liona and Montzouna is henceforth prohibited.

Volcanic Cement and Lava at Santorin (Cyclades).

Foreign Office Annual Series, No. 2411, *May* 1900.

The volcanic cement exported, amounting to 75,000 tons, was mostly sent to Roumania for the great harbour works of Costanza. The Santorin lava is sent to Alexandria for use in the street paving of that town. The following is the accepted analysis of this lava (black stone) :—

	Per Cent.
Silica	72·00
Peroxide of iron	5·80
Alumina	8·50
Oxide of manganese	3·50
Lime	3·60
Magnesia	1·00
Sulphur	Traces.

Kaolin and Sulphur at Milo (Cyclades).

Foreign Office Annual Series, No. 2411, *May* 1900.

The output of mineral produce at Milo last year was somewhat more satisfactory than that of the previous year, and a start was made with kaolin, of which an extensive lode seems to have been discovered and taken in hand. About 2,000 tons have been exported, the value of which amounted to about 65,000 dr.

The quality of the Milo kaolin seems to have given satisfaction to the firms employing it, such as porcelain and paper manufacturers, calico bleachers, and chemical producers, and samples were submitted to the Association of Chambers of Commerce in London last year.

About 16,440 tons of manganese, valued at 986,400 dr., were exported to Great Britain and Belgium. The production for the last 10 years, 1889–99, amounted to 121,560 tons, mostly disposed of in Great Britain.

The sulphur mines at Firlingos are progressing favourably in extension. The output, which in 1898 was only 1,100 tons, amounted last year to 2,000 tons, exported on an overage at 210 dr. per ton, or a total of 42,000 dr.

An important lode of kaolin has also been discovered in the adjoining island of Kimolos, the working of which is about to commence.

Valonia Production in Greece.

Foreign Office Annual Series, No. 2408, *April* 1900.

Notwithstanding the drought experienced during the winter of 1898, the valonia crop proved considerably above the average, which is to be accounted for by the very short produce of the preceding year.

The various districts gave as follows :—

District.	Quantity. 1899.	Quantity. 1898.
	Tons.	Tons.
Acarnania and Etolia	5,000	1,650
Laconia and Arcadia	4,100	3,000
Achaia	900	500
Total	10,000	5,200

The prices of valonia realised were fairly good. Laconian and Arcadian produce fetched about 7*l.* to 7*l.* 10*s.* f.o.b. per ton in bulk, the remainder of the crop about 10*s.* less. This is equivalent to a cost, freight, and insurance price of about 8*l.* 10*s.* to 9*l.* United Kingdom by sailing ship.

About half the annual crop is shipped to the United Kingdom, the rest being sent to the Continent. Some 2,500 tons of the 1899 crop still remain in Greece for sale.

During the last 20 years valonia has declined in value about 50 per cent., as cheaper, though less efficient, substitutes have been discovered. The consequence is that the valonia oak tree is less carefully guarded, and many trees are being cut down.

Copper Sulphate in Greece.

Foreign Office Annual Series, No. 2408, *April* 1900.

It is difficult to ascertain exactly how much sulphate of copper is used annually in Greece, as it is now being manufactured in the country. In 1897 and 1898 the importation amounted to about 3,000 tons, principally from Great Britain. Last year the importation was considerably curtailed by the high price, which reached 28*l.* per ton duty paid. Of late, advertisements have appeared in the local press recommending vineyard proprietors to use only the sulphate of copper made in Greece, which, it is stated, is cheaper than that imported from abroad, and contains 95 per cent. of sulphate of copper, whereas what comes from Great Britain consists principally of sulphate of iron, and is consequently of no efficacy against *peronosporos*. Unless these reports can be contradicted it is evident that the importation of the article from Great Britain will have to be entirely given up.

Production of Arsenical Pyrites in Norway.

Bd. of Trade J., May 24, 1900.

H.M. Consul-General at Christiania reports that the Christiania Mining Company is just now sending its first large consignment, amounting to about 60 tons, of arsenical pyrites from its mines near Bandak, in Thelemarken, to Germany *viâ* Skien. The chemical factories in Germany produce arsenic from the pyrites, which yield about 30 per cent.

Chemical and Wood-Pulp Trade of Stockholm.

Foreign Office Annual Series, No. 2401, *April* 1900.

The prices of superphosphate, bone-meal, and Thomas's phosphate, rose greatly owing to the Spanish-American war, and remained high after it terminated.

The duty imposed upon superphosphate is much felt by farmers, who in this way have to pay heavily for an article that has become almost indispensable to Swedish agriculture. In consequence of this and the unfavourable weather, there has been a great falling-off in the quantity of artificial manures used, and the quality—with a view to economy—has been of cheaper and inferior sorts. A new kind of manure, Wiborg phosphate, which contains phosphoric acid, has not yet been much employed, but it is hoped that the works at Lulea will be able to supply the want by producing a good article at a moderate price.

The quantity of machine oils imported has more than doubled within the last 10 years, owing to the development of industrial undertakings, and the increased use of machinery. Mineral oils, being cheaper than either animal

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or vegetable oils, are much more employed, the proportions being about 10 to 1. The prices of mineral oils in 1899 went up about 20 per cent. on account of the war in South Africa (which affected freights) and other causes. The quantity of machine oil imported in 1890 was 2,980,239 kilos., and in 1899, 6,105,275 kilos.

The growing number of new factories did not spoil the market for the sale of chemical wood-pulp. On the contrary, the demands, owing to the greatly increased circulation of newspapers caused by the American and South African wars, continued to increase. The United States and Canada—usually the rivals of Sweden in this industry—have ordered considerable quantities of cellulose in this country. The year ended with good prospects and the following favourable prices :—

For—	Per Ton, f.o.b., in a Swedish Port, according to Quality and Time of Delivery.			
	Currency.		Sterling.	
	From—	To—	From—	To—
	Kroner.	Kroner.	£ s. d.	£ s. d.
Sulphite, unbleached ...	135	155	7 10 0	7 12 2
Sulphate „ ...	130	150	7 4 5	7 6 8

Prices of mechanical wood-pulp, which began very badly after the unfavourable year 1898, rose about 50 per cent. towards the end of 1899. Thus 26 kr. (1*l.* 8*s.* 11*d.*) to 45 kr. (2*l.* 10*s.*) per ton f.o.b. in a Swedish port were paid for some time, afterwards 60 kr. (3*l.* 6*s.* 8*d.*) to 85 kr. (5*l.* 14*s.* 4*d.*), all f.o.b. in a Swedish port, according to quality, &c.

GENERAL TRADE NOTES.

The Camphor Monopoly.

Comm. Intelligence, May 12, 1900.

We understand that Samuel and Co., an English firm, have secured the Formosa camphor monopoly for ten years. The Formosa Government buys crude camphor at 35 yen per picul, and will receive from Samuel and Co. 95 yen per picul for first-class, and 85 yen for second-class camphor. The contract provides that the Company must place it upon the Hong Kong and London markets at certain prices, and must furnish the Formosan Government with securities to the amount of nearly 2,000,000 yen. The firm is required to keep 3,500,000 yen invested in the business for at least eight years.

Of the six millions catties of camphor produced in the world, Formosa produces five millions. In Java, Sumatra, Borneo, and Japan the exhaustion of the supply is in sight, whereas in Formosa there is an ample supply for the next 80 years, and since 50 years suffice to bring a camphor tree to maturity, Formosa may be regarded as a perennial mine; judicious planting is alone required.

A recently-issued British consular report on the trade of Japan does not take a very hopeful view of the development of Formosa, as the tendency of the Governor-General's Office to create monopolies of the principal industries, and the still unsettled condition of the island, which suffers from frequent outbreaks of the natives, and the ravages of the plague, militates against commercial development. Wages and the price of commodities have undergone a considerable rise since the island passed into the Japanese possession.

The principal camphor districts extend from Rato to Rinkipot, about 80—90 ri (Japanese miles), and from Hinan to Shukomaki, about 20 ri, these two mountainous chains being almost exclusively covered with camphor trees. The changes to be introduced by the Government embrace vigorous measures for the repression of the wholesale depredations which have hitherto taken place, and the introduction of a properly organised system of forestry. The number of camphor stills operated will also be greatly reduced. A large Government factory is being erected at Taipeh, in which the raw camphor will be pressed and freed from oil, water, and dirt. It is in contemplation ultimately to extend the operations of this factory to the refining of camphor and its extraction from the oil pressed from the raw product, but meanwhile the oil will be placed in the hands of two Japanese firms for treatment. (See also this Journal, 1899, 799.)—H. H. B. S.

Mineral Production of Germany.

"Glückauf," through Eng. and Mining J., April 28, 1900.

The following table shows the ores and other minerals produced by German mines in 1899. The figures are in metric tons :—

——	1898.	1899.	Changes.
Coal	96,309,652	101,621,866	I. 5,312,214
Brown coal (lignite)	31,648,898	34,202,561	I. 2,553,663
Total coal	127,958,550	135,824,427	I. 7,865,877
Asphalt	67,649	74,770	I. 7,121
Petroleum	25,989	27,027	I. 1,038
Rock salt	807,792	861,123	I. 53,331
Kainit	1,103,643	1,108,154	I. 4,511
Other potash salts	1,105,212	1,392,247	I. 287,035
Iron ore	15,901,263	17,989,665	I. 2,088,402
Zinc ore	641,706	664,536	I. 22,830
Lead ore	149,311	144,370	D. 4,941
Copper ore	702,781	733,619	I. 30,838
Gold and silver ores	14,702	13,506	D. 1,196
Cobalt, nickel, and bismuth ores.	3,157	1,270	D. 1,887
Manganese ore	43,354	61,329	I. 17,975
Pyrites	136,849	144,602	I. 7,753

Increases are shown in all the important minerals with the exception of lead ore. The gain in coal was 6·2 per cent., and in iron ore mined 13 per cent.

The production of metals from the ores mined, and also from ores imported, was as follows, in kilograms and metric tons :—

——		1898.	1899.	Changes.
Gold	Kilos.	2,847	2,605	D. 242
Silver	„	480,578	467,593	D. 12,975
Quicksilver	„	4,182	2,657	D. 1,525
Copper, fine	Tons	30,695	34,626	I. 3,931
„ black	„	62	103	I. 41
Lead, pig	„	132,742	129,225	D. 3,517
„ litharge	„	3,857	3,562	D. 295
Zinc or spelter	„	154,867	153,155	D. 1,712
Nickel and nickel salts ...	„	1,692	1,747	I. 55
Antimony and manganese.	„	2,711	3,149	I. 438
Arsenic and arsenic products.	„	2,679	2,423	D. 256
Tin	„	993	1,481	I. 488
Sulphuric acid	„	772,595	837,839	I. 65,244

The nickel salts include also bismuth and uranium salts. The tin is metal recovered from scrap, old plate, &c. The sulphuric acid last year included 813,141 tons ordinary acid, 19,526 concentrated acid, and 5,142 tons copper sulphate. The pig-iron production has already been reported. It was 8,029,305 tons in 1899, and 7,402,717 tons in 1898, showing an increase of 626,588 tons last year.

The production of salts from solution in the various works was as follows, in metric tons :—

——	1898.	1899.	Changes.
Common salt	565,683	571,104	I. 5,421
Aluminium sulphate	35,366	37,693	I. 2,327
Glauber salts	69,111	69,216	I. 105
Potassium chloride	191,347	207,506	I. 16,159
Potassium sulphate	18,853	26,103	I. 7,250
Potassium-magnesium sulphate..	13,982	9,765	D. 4,217
Magnesium sulphate	30,295	39,540	I. 9,245

Other minor products not given in the table, but reaching some 500,000 marks in total value, included graphite, kiesert, borax, tin ore, uranium ore, tungsten ore, alum

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ores, iron pyrites, sulphur, cadmium, alum and magnesium chloride.

QUANTITIES AND VALUES OF THE UNDERMENTIONED ARTICLES EXPORTED FROM ITALY DURING THE YEARS 1898 AND 1899 RESPECTIVELY.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
	100 Kilos.	100 Kilos.	1,000 Lire.	1,000 Lire.
Charcoal (tons)	32,443	48,928	1,557	2,251
Copper, brass, and bronze	4,621	13,545	638	2,614
Dyes, including sumac	167,959	129,397	3,695	3,106
Glasswares	38,987	42,945	3,509	4,295
Hides, raw	97,918	117,890	17,142	22,200
„ tanned	12,235	12,469	5,006	5,298
India-rubber manufactures.	2,625	3,258	2,635	3,721
Lead	58,698	24,967	2,054	999
Matches	20,000	18,000	2,778	2,620
Oils, olive	411,748	506,352	40,353	55,738
„ essential	4,583	5,888	5,959	8,244
Paper	104,616	122,176	5,013	5,651
Quicksilver	2,442	2,235	1,172	1,229
Soap	26,952	38,693	1,566	2,085
Sulphur	4,058,234	4,240,183	41,800	43,462
Tartars	174,555	163,320	13,964	13,392
Zinc ore (tons)	130,064	140,107	13,006	16,813
Total of all exports	..	..	1,203,569	1,431,417

QUANTITIES AND VALUES OF THE UNDERMENTIONED ARTICLES IMPORTED INTO ITALY DURING THE YEARS 1898 AND 1899 RESPECTIVELY.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
	100 Kilos.	100 Kilos.	1,000 Lire.	1,000 Lire.
Coal and coke (tons)	4,431,524	4,859,556	137,377	150,646
Copper, brass, and bronze	57,531	65,938	8,186	12,956
Dyes, bark	390,828	475,161	8,654	10,517
„ indigo	4,335	3,985	4,769	3,985
„ coal tar, &c.	26,800	31,048	11,145	11,337
Gums and resins	146,531	136,609	3,616	3,561
Hides, raw	205,499	215,430	36,262	41,141
„ tanned	15,593	17,173	11,737	14,934
India-rubber and gutta-percha, raw.	5,846	6,408	5,144	6,152
India-rubber and gutta-percha, manufactured.	2,530	2,525	2,121	2,291
Lead	14,306	39,904	500	1,596
Nitrate of soda	204,225	226,915	4,240	4,802
Oils, olive	162,441	151,765	15,432	15,177
„ cotton-seed	79,481	57,159	4,371	3,430
„ mineral (heavy)	183,762	190,660	4,672	4,541
„ petroleum	706,545	713,907	12,011	14,992
Seeds, oil	513,203	543,067	16,944	18,037
Sulphate of copper	255,602	274,078	11,758	17,267
Sugar	730,986	626,896	20,591	17,688
Tin	17,445	12,618	3,495	4,296
Zinc	58,273	65,279	1,929	2,302
Total of all imports	..	..	1,413,335	1,506,561

QUANTITIES AND VALUE OF THE UNDERMENTIONED ARTICLES IMPORTED INTO SPAIN DURING 1898 AND 1899.

NOTE.—*Peseta* = 9·6*d*.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
	1,000 Kilos.	1,000 Kilos.	1,000 Pesetas.	1,000 Pesetas.
Hides, raw	4,926	9,620	9,582	19,241
Varnished leather	84	197	1,776	4,145
Hides, tanned	99	256	1,485	3,837
Animal fats	7,696	18,148	5,387	12,704
Guano and natural manure.	13,614	22,181	2,995	4,968
Artificial manure	47,589	79,571	9,994	16,770

IMPORTS INTO SPAIN DURING 1898-99—*cont.*

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
	1,000 Kilos.	1,000 Kilos.	1,000 Pesetas.	1,000 Pesetas.
Alkaline carbonates	26,574	34,805	5,846	6,978
Coal	1,244,345	1,555,800	37,330	45,674
Coke	196,224	208,789	5,887	6,264
Colours, artificial	402	609	3,218	4,879
Dye, extracts	1,843	2,911	1,935	3,057
Glass	1,688	2,995	1,350	2,396
Indigo and cochineal	192	234	2,113	2,577
Copper and brass, sheets	585	893	1,052	1,608
„ „ worked	369	667	1,476	2,669
Tin	833	937	1,750	1,967
Nitrate of soda	38,322	56,408	10,730	15,794
Paper pulp	17,071	21,153	2,902	3,591
Paper (value)	..	..	1,310	2,348
Paraffin and stearin	1,556	2,475	1,945	3,094
Porcelain	281	504	730	1,311
Sugar	8,682	9,404	4,083	4,473
Oil seeds	19,931	24,706	7,574	9,388
Tar and asphalt	28,720	37,827	2,298	3,026

QUANTITIES AND VALUES OF THE UNDERMENTIONED ARTICLES OF DOMESTIC PRODUCE EXPORTED FROM SPAIN IN 1898 AND 1899.

Articles.	Quantity.		Value.	
	1898.	1899.	1898.	1899.
	1,000 Kilos.	1,000 Kilos.	1,000 Pesetas.	1,000 Pesetas.
Hides (untanned)	6,785	5,455	15,778	12,521
Salt	219,700	331,081	3,295	4,966
Esparto grass	49,319	47,821	5,425	5,260
Blende	48,557	63,438	2,671	3,429
Copper ore	899,238	948,917	32,373	34,261
„ regulus	31,573	28,423	26,836	24,160
Iron ore	6,558,060	8,606,558	72,139	94,672
„ pyrites	256,341	319,284	3,076	3,831
„ ingots	46,127	40,879	4,151	3,679
Lead (argentiferous)	91,936	68,974	32,178	24,141
„ other	87,581	92,123	24,523	25,795
Manganese	125,291	139,352	7,142	7,944
Galena	5,169	7,641	1,602	2,369
Quicksilver	1,741	3,221	9,404	17,394
Zinc	4,552	2,389	2,504	1,314
Paper (cigarette)	1,727	1,658	4,147	3,981
Preserved food	11,926	10,804	17,890	16,207
Soap	6,563	6,847	3,413	3,561
Tartars	8,487	9,636	4,244	4,818

BOARD OF TRADE RETURNS.

SUMMARY OF IMPORTS.

Articles.	Month ending 30th April	
	1899.	1900.
	£	£
Metals	2,139,860	2,447,877
Chemicals and dyestuffs	520,524	500,206
Oils	828,934	874,687
Raw materials for non-textile industries.	3,934,956	4,804,304
Total value of all imports	39,357,022	42,621,876

SUMMARY OF EXPORTS.

Articles.	Month ending 30th April	
	1899.	1900.
	£	£
Metals (other than machinery)	2,863,743	3,968,636
Chemicals and medicines	724,988	892,007
Miscellaneous articles	2,849,275	2,968,242
Total value of all exports	19,457,546	22,645,147

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Imports of Metals for Month ending 30th April.

Articles.		Quantities.		Value.	
		1899.	1900.	1899.	1900.
				£	£
Copper :—					
Ore	Tons	2,939	4,543	38,173	56,009
Regulus	„	4,117	6,609	113,129	204,159
Unwrought	„	6,180	6,092	434,045	460,909
Iron :—					
Pig and puddled	„	11,610	7,483	34,371	34,721
Ore	„	597,133	542,380	461,906	480,701
Bolt, bar, &c.	„	5,311	4,536	36,764	36,179
Steel, unwrought	„	10,665	3,674	49,087	31,192
Lead, pig and sheet	„	15,835	14,758	220,471	246,662
Pyrites	„	59,982	55,076	94,938	96,674
Quicksilver	Lb.	48,556	75,056	5,077	9,505
Silver ore	Value £	..	..	81,763	85,177
Tin	Cwt.	31,450	45,208	173,265	303,602
Zinc	Tons	5,827	7,166	147,430	155,253
Other articles	Value £	..	..	248,541	247,134
Total value		..	..	2,139,860	2,447,877

Imports of Chemicals and Dyestuffs for Month ending 30th April.

Articles.		Quantities.		Value.	
		1899.	1900.	1899.	1900.
				£	£
Alkali	Cwt.	11,554	28,247	6,105	13,742
Bark (Tanners', &c.)	„	22,209	24,160	9,021	9,180
Borax	„	24,246	5,706	12,180	3,373
Brimstone	„	28,729	32,408	7,201	6,874
Chemicals	Value £	..	..	115,402	135,296
Cutch and gambier	Tons	1,109	2,519	21,463	52,535
Dyes :—					
Alizarin	Value £	..	..	17,801	17,335
Anilin and other	„	..	..	41,137	49,107
Indigo	Cwt.	6,764	2,574	101,887	34,841
Nitrate of potash	„	24,899	25,947	21,874	22,207
Valonia	Tons	3,117	3,587	36,288	37,049
Other articles	Value £	..	..	130,165	118,667
Total value		..	..	520,524	500,206

Imports of Raw Material for Non-Textile Industries for Month ending 30th April.

Articles.		Quantities.		Value.	
		1899.	1900.	1899.	1900.
				£	£
Bark, Peruvian	Cwt.	2,442	7,131	6,382	15,866
Bristles	Lb.	318,552	391,468	45,911	73,240
Caoutchouc	Cwt.	45,335	58,047	600,497	886,655
Gum :—					
Arabic	„	6,651	4,590	15,779	12,129
Lac, &c.	„	10,990	14,590	39,964	46,210
Gutta-percha	„	4,316	9,406	57,460	97,255
Hides, raw :—					
Dry	„	44,978	95,983	123,535	275,199
Wet	„	53,240	39,557	116,005	87,989
Ivory	„	430	746	18,030	24,972
Manure :—					
Guano	Tons	3,033	3,564	13,025	17,314
Bones	„	5,976	4,250	27,099	19,297
Nitrate of soda	„	27,513	30,824	215,892	261,238
Phosphate of lime	„	35,199	29,667	54,199	53,209
Paraffin	Cwt.	97,833	106,810	87,209	144,746
Linen rags	Tons	1,253	1,767	12,110	17,759
Esparto	„	20,616	17,961	77,035	69,821
Pulp of wood	„	30,382	35,413	140,824	181,890
Resin	Cwt.	87,694	167,614	17,985	40,342
Tallow and stearin	„	233,491	197,205	255,190	260,452
Wood :—					
Hewn	Loads	198,832	185,634	376,275	391,976
Sawn	„	205,249	192,046	521,291	545,751
Staves	„	6,783	10,104	39,887	57,260
Mahogany	Tons	7,509	6,757	71,610	66,077
Other articles	Value £	..	..	1,001,432	543,148
Total value		..	..	3,934,956	4,804,304

Besides the above, drugs to the value of 90,247*l.* were imported, as against 90,910*l.* in April 1899.

Imports of Oils for Month ending 30th April.

Articles.		Quantities.		Value.	
		1899.	1900.	1899.	1900
				£	£
Cocoa-nut	Cwt.	57,971	67,019	72,571	81,924
Olive	Tuns	1,758	1,543	64,140	59,408
Palm	Cwt.	70,252	54,065	77,588	67,676
Petroleum	Gall.	22,387,679	19,167,866	422,136	471,520
Seed	Tons	3,794	1,996	70,464	49,719
Train, &c.	Tuns	1,130	798	19,817	16,864
Turpentine	Cwt.	15,715	31,713	25,250	61,842
Other articles	Value £	..	..	76,968	65,734
Total value		..	..	828,934	874,687

Imports of Manufactured Articles for Month ending 30th April.

Articles.		Quantities.		Value.	
		1899.	1900.	1899.	1900.
				£	£
Cement	Tons	..	7,918	..	17,694
China and earthenware.	Cwt.	..	31,481	..	79,592
Glass :—					
Sheet	„	127,349	110,667	61,515	61,717
Plate	„	33,550	43,039	38,644	47,560
Flint	„	..	39,133	..	78,163
Bottles	Gross	100,067	131,348	43,092	54,460
Other	Cwt.	68,190	20,432	117,408	37,772
Glue, size, and gelatin.	„	..	20,217	..	45,273
Leather, unmanufactured.	„	137,464	103,569	834,252	693,284
Paints and pigments.	Value £	..	..	..	101,593
Paper, pasteboard	Cwt.	413,531	524,153	288,966	363,138
Scientific instruments.	Value £	..	..	..	57,371
Soap and soap powder.	Cwt.	..	14,009	..	18,482
Zinc manufactures.	„	25,195	33,048	35,235	43,548
Total of manufactured articles..		..	..	..	..

Exports of Miscellaneous Articles for Month ending 30th April.

Articles.		Quantities.		Value.	
		1899.	1900.	1899.	1900.
				£	£
Gunpowder	Lb.	468,400	497,500	10,925	10,976
Military stores	Value £	..	..	84,363	99,904
Candles	Lb.	2,331,300	1,795,400	33,457	32,755
Caoutchouc	Value £	..	..	114,485	116,747
Cement	Tons	23,386	35,094	47,543	65,923
Products of coal	Value £	..	..	144,712	156,464
Earthenware	„	..	..	140,896	189,364
Stoneware	„	..	..	13,982	13,917
Glass :—					
Plate	Sq. Ft.	134,646	150,689	7,706	8,930
Flint	Cwt.	6,740	6,886	17,001	17,270
Bottles	„	75,596	64,284	36,215	29,739
Other kinds	„	21,888	16,601	20,362	18,300
Leather :—					
Unwrought	„	12,115	9,756	119,393	109,682
Wrought	Value £	..	..	27,728	33,956
Seed oil	Tons	3,091	4,023	57,478	97,641
Floorcloth	Sq. Yds.	2,420,400	2,374,900	100,972	106,516
Painters' materials	Val. £	..	..	151,756	166,040
Paper	Cwt.	85,361	85,036	131,163	130,816
Rags	Tons	4,714	5,310	24,118	33,190
Soap	Cwt.	75,597	72,392	78,360	79,167
Total value		..	..	2,849,275	2,968,242

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EXPORTS OF METALS (OTHER THAN MACHINERY) FOR MONTH ENDING 30TH APRIL.

Articles.		Quantities.		Value.	
		1899.	1900.	1899.	1900.
				£	£
Brass.....	Cwt.	8,624	10,477	42,738	56,491
Copper:—					
Unwrought....	„	40,249	20,979	143,468	82,343
Wrought	„	14,113	19,689	57,005	86,234
Mixed metal...	„	5,603	12,838	18,529	42,921
Hardware	Value £	..	..	125,155	121,915
Implements.....	„	..	..	110,546	126,671
Iron and steel ...	Tons	278,464	334,297	2,045,951	2,899,745
Lead.....	„	3,184	2,217	49,199	42,983
Plated wares...	Value £	..	..	37,128	31,809
Telegraph wires..	„	..	..	49,719	257,089
Tin	Cwt.	6,096	7,176	33,714	50,573
Zinc.....	„	14,125	12,523	17,120	12,732
Other articles...	Value £	..	..	86,240	107,684
Total value		..	..	2,863,743	3,968,636

EXPORTS OF DRUGS AND CHEMICALS FOR MONTH ENDING 30TH APRIL.

Articles.		Quantities.		Value.	
		1899.	1900.	1899.	1900.
				£	£
Alkali	Cwt.	286,202	332,021	74,917	99,014
Bleaching materials	„	114,845	112,053	28,720	32,591
Copper sulphate ..	Tons	5,048	9,844	103,523	231,960
Chemical manures	„	36,985	27,614	197,084	187,270
Medicines.....	Value £	..	..	97,200	94,907
Other articles...	„	..	..	223,544	246,265
Total value		..	..	724,988	892,007

Monthly Patent List.

* The dates given are the dates of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

7080. A. J. Boult.—From P. Audouin, France. Improvements in or relating to condensers. April 17.

7129. W. Venier and M. Schmid. Improvements in and relating to refrigerating apparatus. April 17.

7590. A. Scholl. Improvements in apparatus for drying materials. Complete Specification. April 24.

7854. F. T. Brearley. Improvements in and relating to annealing furnaces, and in tools for use therewith. April 27.

8003. W. P. Thompson.—From E. W. Howell, United States. Improvements in or in connection with artificial refrigeration. April 30.

8042. C. A. Allison.—From W. H. Gomes, United States. Improvements in air compressing and refrigerating apparatus. Complete Specification. May 1.

8044. A. Roebelen. An improved freezing apparatus. Complete Specification. May 1.

8428. J. E. J. Baxter and G. E. Simpson. Improvements in furnaces. May 7.

8763. J. McNeil and C. McNeil. Improvements in evaporating or concentrating apparatus. May 12.

COMPLETE SPECIFICATIONS ACCEPTED.

1899.

10,181. G. Bestwick. Means for preventing radiation of heat from boilers, pipes, and the like. March 28.

12,184. S. E. Alley and D. Mathieson. Apparatus for evaporating, condensing, or heating feed water. May 2.

12,508. M. Waissbein. Distillation of solid and liquid matters. May 16.

13,317. T. Howard and Co., Ltd., and J. E. Howard. Air and gas compressors. May 2.

15,286. L. Lederer and J. Gottlieb. Automatic carburetters. April 25.

15,387. J. McLay. Heat non-conducting coverings and mode of manufacture. May 16.

22,787. A. Totte. Apparatus for digesting and concentrating or drying organic substances. May 9.

1900.

2072. V. Söngen. Filters. April 25.

5248. E. Sharaud. Furnaces. May 2.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

7190. J. Wiesner. Improvements in the process of and apparatus for manufacturing compressed fuel. April 18.

7203. H. A. Pearson and W. P. Thompson. Improvements in the manufacture of anthracite briquettes. April 18.

7209. O. Lindemann.—From E. Körting, Germany. Improvements in apparatus for purifying gases. Complete Specification. April 18.

7210. C. A. von Welsbach. Improvements in osmium illuminating filaments. April 18.

7211. C. A. von Welsbach. Improvements in the manufacture of osmium vacuum lamps. April 18.

7252. H. Bleach and H. d'Alquen. Improvements in the manufacture of illumination lights and other lights. April 19.

7423. H. Pettibone. Improvements in apparatus for the manufacture of gas. Complete Specification. April 21.

7446. T. Hill and M. Hill. Improvements in and relating to apparatus for generating acetylene. April 23.

7481. A. F. Spooner.—From C. Bouché and F. P. de la Montluel, France. Improvements in carburetters. April 23.

7539. R. Morin. Improvements in apparatus for generating acetylene gas. Complete Specification. April 24.

7595. W. P. Thompson.—From A. Simonini, United States. Improvements in or relating to self-lighting gas burners. Complete Specification. April 24.

7596. W. P. Thompson.—From A. Simonini, United States. Improvements in lighting devices for causing the ignition of illuminating gases and vapours. Complete Specification. April 24.

7751. G. Seagrave. Improvements connected with apparatus for generating acetylene gas. April 26.

7859. G. W. Johnson.—From La Compagnie Française de l'acétylène dissous, France. Improvements in means for generating acetylene gas, and for lighting by means of such gas. April 27.

7863. V. B. Lewes. Improvements in or relating to the manufacture of coal gas. April 27.

7905. The Patent Aggloment Fuel Syndicate, Ltd., H. C. B. Forester, and J. A. A. Yeo. Improvements in or relating to the manufacture of artificial fuel, and apparatus therefor. April 28.

Ze zbiorów Biblioteki Głównej Politechniki Łódzkiej

7933. L. Pink and Vulkan Gesellschaft für Selbstzündende Glühkörper mit beschränkter Haftung. Improvements in the manufacture of substances for use in impregnating incandescent bodies or mantles for illuminating purposes. April 28.

8082. The Petolite Fuel Syndicate, Ltd., and E. Johnson. Improvements in the manufacture and production of a combustible material or compound for use in the manufacture of briquettes of artificial fuel. May 1.

8100. E. Bellan and G. Camus. Improvements in carburetters. Complete Specification. May 1.

8348. O. Knöfler. Improvements relating to the production of intense light. May 5.

8372 G. Gröndal. Improvements in and connected with the manufacture of charcoal, coke, and the like. May 5.

8415. O. Münsterberg. Improved means of obtaining intense heat for lime-light or other purposes. May 7.

8416. C. Pieper. Improvements in the production of carburetted air. May 7.

8433. F. Dannert. Process for the production of electrically conductive illuminating bodies. Complete Specification. May 7.

8434. F. Dannert. Process for the production of electric incandescence bodies. Complete Specification. May 7.

8503. P. R. de Faucheux d'Humy and R. McKenzie. Improvements in the manufacture of anthracite briquettes. May 8.

8634. J. St. Clair Legge. Improvements in means or apparatus for renovating gas incandescent mantles. May 10.

8635. J. St. Clair Legge. Improvements in and relating to vapour incandescent lighting. May 10.

8655. R. J. Moss. An improved acetylene gas generating plant. May 10.

Complete Specifications Accepted.

1899.

8938. The Patent Aggloment Fuel Syndicate, Ltd., H. C. B. Forester, and J. A. A. Yeo. Manufacture of artificial or patent fuel, and apparatus therefor. May 9.

9573. T. Clarkson and The Clarkson and Capel Steam Car Syndicate, Ltd. Burning of inflammable gas or vapour, and apparatus therefor. May 9.

10,241. O. Imray.—From Oesterreichische Gasgluhlicht and Electricitäts Gesellschaft, Austria-Hungary. Electrical incandescent lamps with osmium filaments. May 16.

10,710. T. G. Allen, jun. Method of securing an automatically controlled supply of water to the carbide of calcium in acetylene gas generators. May 16.

10,983 J. Stewart-Wallace, W. B. Cowell, J. R. Paisley, and J. S. K. Welch. Manufacture of gas for motive, heating, and lighting purposes. May 9.

11,056. L. A. Fallot and E. Delaunay. Acetylene gas generators, and carbide cartridges for use therewith. May 2.

12,938. J. E. Dowson. Manufacture of generator gas and apparatus used therewith. April 25.

13,155. E. Wright. Manufacture of artificial fuel. May 2.

13,310. H. Talbot. Lanterns for incandescent gas lighting. May 2.

14,010. J. S. Swinburne and C. H. Stearn. Means for use in the production of radiation and light by electricity. May 16.

14,072. H. S. Elworthy.—From J. Zuberbuhler, India. Automatic generator and storage vessel for acetylene gas. May 16.

14,379. R. Goodwin. Composition for purifying acetylene gas. May 16.

16,079. C. S. Cochrane. Fuel. April 25.

16,459. J. Ponces. Acetylene gas generators. April 25.

20,622. P. Schreck. Acetylene gas generators. May 2.

21,200. J. Jackson. Incandescence gas burners. April 25.

24,360. J. St. Leger McGinn. Gas apparatus. April 25.

1900.

3335. F. W. C. Schniewind. Regenerative coke ovens. April 11.

4200. L. F. Bergdolt. Acetylene gas generators. May 2.

4229. J. Liddle.—From H. Luckenbach and W. McPhee, United States. Apparatus for volatilising and burning oil &c. May 16.

5821. J. B. de Léry and C. G. Richardson. Incandescible elements, and method of making the same. May 9.

6213. F. W. Golby.—From A. Müller, Germany. Incandescence gas burners. May 9.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

Applications.

7911. J. Rütgers. Improvements relating to solutions or emulsions of tar oil suitable for the impregnation of wood. Complete Specification. April 28.

8141. J. R. Hatmaker.—From J. A. Just, United States. Solidification of mineral oil distillates. May 2.

Complete Specification Accepted.

1899.

12,232. C. Still and The Gewerkschaft König Ludwig. Method of recovering by-products in the manufacture of coke. May 2.

IV.—COLOURING MATTERS and DYES.

Applications.

7074. C. D. Abel.—From Actiengesellschaft für Anilinfabrikation, Germany. Manufacture of a black colouring matter directly dyeing cotton. April 17.

7075. C. D. Abel.—From Actiengesellschaft für Anilinfabrikation, Germany. Manufacture of a black colouring matter directly dyeing cotton. April 17.

7076. C. D. Abel.—From Actiengesellschaft für Anilinfabrikation, Germany. Manufacture of a black colouring matter directly dyeing cotton. April 17.

7175. A. Mouneyrat. A process for producing bromo-iodo derivatives of organic compounds containing nitrogen, and for the production of dichlorodiiodo-hexamethylene-tetramine. Filed April 18. Date applied for Oct. 21, 1899, being date of application in France.

7261. O. Imray.—From Die Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of a blue sulphurised dyestuff. April 19.

7291. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. Improvements in the manufacture or production of dyestuffs of the anthraquinone series. 19 April.

7292 H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. The manufacture or production of blue trisazo dyestuffs. April 19.

7331. C. D. Abel.—From Actiengesellschaft für Anilinfabrikation, Germany. Manufacture of a black colouring matter directly dyeing cotton. April 20.

Ze zbiorów Biblioteki Głównej Politechniki Łódzkiej

7332. C. D. Abel.—From Actiengesellschaft für Anilinfabrikation, Germany. Manufacture of a black colouring matter directly dyeing cotton. April 20.

7333. C. D. Abel.—From Actiengesellschaft für Anilinfabrikation, Germany. Manufacture of a black colouring matter directly dyeing cotton. April 20.

7477. C. D. Abel.—From Actiengesellschaft für Anilinfabrikation, Germany. Manufacture of a black colouring matter directly dyeing cotton. April 23.

7692. G. W. Johnson.—From The Chemische Fabrik Griesheim-Elektron, Germany. The manufacture or production of nitronapthalene derivatives from 1:4-chloronitronapthalene. April 25.

7984. J. Imray.—From La Société L. Durand, Huguenin et Cie., Switzerland. Manufacture of new colouring matters. April 30.

8008. R. B. Ransford.—From L. Cassella and Co., Germany. Production of a new nitro amido-diphenylamine disulpho-acid and secondary disazo dyestuffs therefrom. April 30.

8229. G. W. Johnson.—From Kalle and Co., Germany. Improvements in the manufacture or production of substantive dyes or colouring matters. May 3.

8825. G. W. Johnson.—From C. F. Boehringer and Soehne, Germany. The manufacture and production of oxyphenyltartronic acids. Complete Specification. May 12.

Complete Specifications Accepted.

1899.

11,882. O. Imray.—From F. Sachs, Germany. Manufacture of condensation products from aromatic nitroso and methylene compounds. May 9.

13,213. H. E. Newton. — From The Farbenfabriken vormals F. Bayer and Co., Germany. Manufacture or production of new azo colouring matters, and of new intermediate products for the production of such colouring matters. April 25.

13,251. C. D. Abel.—From Actiengesellschaft für Anilinfabrikation, Germany. Manufacture of black colouring matters directly dyeing cotton. April 25.

13,905. R. B. Ransford.—From L. Cassella and Co., Germany. Manufacture of colouring matters from polynitro derivatives of oxydialphylamines. May 9.

13,978. C. D. Abel.—From Actiengesellschaft für Anilinfabrikation, Germany. Manufacture of blue dyestuffs directly dyeing cotton. May 9.

13,979. O. Imray.—From Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of oximes of aromatic nitro compounds. May 9.

14,117. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Manufacture and production of new colouring matters of the anthracene series. May 9.

14,151. O. Imray. — From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of substantive azo-dyestuffs derived from pure para-phenylenediamine. May 2.

14,238. F. Kehrmann. Manufacture of chloro-substitute rosindulines. May 2.

14,389. L. O. Helmers. Soluble sulphonic acid salts of alkaline earthy metals and metals proper and their sulphonic acids, and process of making the same. May 16.

14,479. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Manufacture of new colouring matters of the anthracene series. May 2.

14,552. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. Process for the production of indigo or its derivatives, and of intermediate products for use therein. May 16.

14,695. H. E. Newton. — From The Farbenfabriken vormals F. Bayer and Co., Germany. Process for the production of nucleinic acids. May 16.

14,964. H. E. Newton. — From The Farbenfabriken vormals F. Bayer and Co., Germany. Manufacture or production of new dyestuffs of the diphenylnaphtylmethane series. May 16.

14,980. G. W. Johnson.—From C. F. Boehringer und Soehne, Germany. Manufacture and production of aromatic amido-aldehydes. April 25.

18,409. A. F. Poirrier. Manufacture of new substantive black colouring matters. May 16.

1900.

3041. H. H. Lake. — From Chemical Works, formerly Sandoz, Switzerland. Production of dyestuffs. May 16.

5385. O. Imray. — From The Society of Chemical Industry in Basle, Switzerland. Manufacture of pure sulphurised derivatives of indophenols. May 9.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Applications.

7189. P. Jeanmaire. Improvements in mercerising apparatus. Complete Specification. April 18.

8267. C. Baswitz. An improved process and composition for rendering textile fabrics and the like non-inflammable and waterproof. Complete Specification. May 4.

8459. J. A. Prescott. Improvements in or relating to apparatus for preventing the waste of yarn during the process of doubling. May 8.

1654. O. Kopp and E. Usuelli. Improvements in apparatus for stretching and mercerising cotton yarn. Complete Specification. May 10.

8799. J. Duquesnoy. A new or improved product or artificial silk, suitable for the production of thread. May 12.

Complete Specifications Accepted.

1899.

9521. A. J. Boult.—From J. Dolder, Germany. Apparatus for use in mercerising or treating with liquid skeins, hanks, and yarns. May 16.

10,943. J. S. Lord and G. S. Lord. Machine for mercerising, sizing, or dyeing yarns, and for like uses. May 2.

11,122. C. A. Rigault. Process for the chemical decortication of ramy, flax, hemp, jute, alfa, and phormium, and other fibres. May 2.

11,156. S. Lorentz. Method and apparatus for the production of yarn rovings or slubbings. April 25.

13,331. J. Imray.—From The Consortium Mulhousien pour la fabrication de fils brillants, Germany. Production of cellulose solutions adapted for spinning. April 25.

14,558. A. M. P. Bouilliant. Preparation and treatment of textile fibres. May 9.

15,064. O. Imray.—From G. Roland and F. Peterhauser, Germany. Process for decoloration of rags and shoddies. May 9.

18,884. J. Imray.—From E. Bronnert, Germany. Production of cellulose solutions adapted for the manufacture of threads. April 25.

1900.

5825. J. Y. Johnson.—From W. H. Drury, United States. Machinery for manufacturing yarn from fibrous materials. May 9.

5994. F. W. Golby.—From G. G. Hepburn, Russia Waterproofing process. May 9.

Ze zbiorów Biblioteki Głównej Politechniki Łódzkiej

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

Applications.

7388. G. Comber and J. C. Chorley. Improvements in colouring fabrics composed of vegetable or animal textile fibres. April 21.

7500. R. B. Ransford.—From L. Cassella and Co., Germany. Improvements in dyeing. April 23.

7686. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. Improvements in dyeing with amido-oxyanthraquinone sulphonic acids. April 25.

7809. J. Major and T. J. Wood. An improvement in apparatus for dyeing, bleaching, or otherwise treating with liquid cops of spun yarn. April 27.

7829. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Improvements in indigo-vat dyeing. April 27.

8237. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Process for obtaining on the wool fibre blue to black-blue dyes fast to light from mono-azo-dyestuffs and copper salts. May 3.

8541. F. Taylor, A. Cooke, B. W. D. Montgomery, and The Lishman Process Bleaching Company. Improvements in appliances to be employed in the process of bleaching. May 9.

Complete Specifications Accepted.

1899.

13,657. O. Imray. — From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Dyeing cotton without previous mordanting. May 2.

1900.

6945. L. Bündgens and J. Bündgens. Apparatus for use in dyeing or otherwise treating fabrics with liquids. May 16.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

7265. C. Brueder. Improvements in the treatment of fecula and other amylaceous matters by alkaline chlorites and hypochlorites. Complete Specification. April 19.

7282. C. M. Joseph (*dit* Claudius) Limb. Improvements in or relating to the production of metallic carbides and derivatives therefrom. Filed April 19. Date applied for, Nov. 27, 1899, being date of application in France.

7301. E. A. Behrens and J. Behrens. Improved process for manufacturing acetic acid. Complete Specification. April 20.

7558. C. S. Bradley and C. B. Jacobs. Improvements in processes of and apparatus for the manufacture of nitrogen compounds from atmospheric nitrogen. Complete Specification. April 24.

8688. J. J. Meldrum and A. W. Lawton. Improvements in and connected with the manufacture of common salt. May 11.

Complete Specifications Accepted.

1899.

12,226. R. Haddan.—From E. Gorgo, Italy. Processes and apparatus for evaporating brine. May 9.

23,024. G. N. Vis. Process for the purification of brine. May 16.

1900.

3193. C. C. Moore. Method of decomposing crude borates with the production of boracic acid and other products. April 25.

6045. G. T. Holloway and H. W. Lake. Preparation of tungstates and other tungsten compounds, and of metallic tungsten and its alloys. May 9.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

7052. F. Mountford and W. Freakley. New or improved apparatus or machine for automatically decorating tiles and other similar articles of pottery-ware, glass, metals, and other substances. April 17.

8002. L. Koerfer. Improvements in or relating to glass bricks or blocks. April 30.

8309. H. E. Knospel. Improvements in the production of partially or entirely opaque and coloured glass. Complete Specification. May 4.

8385. C. Bateson. Improvements in furnaces for melting glass, puddling iron, or like operations. May 7.

8629. C. Beadle. Improvements relating to the manufacture of pottery. May 10.

Complete Specifications Accepted.

1899.

11,744.—A. J. Boult.—From G. B. M. Gray and W. H. Wranzer, United States. Moulds for making glass or similar ware. May 2.

21,946. F. K. Cheese. Glass tiles and their manufacture. May 9.

1900.

4678. H. Kjaertinge. Manufacture of glass vessels or reservoirs. May 9.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

7096. A. Grünberg. Process and apparatus for producing artificial stone free from air. April 17.

7139. E. H. Hurry and H. J. Seaman. Improvements in process of manufacturing Portland cement and apparatus therefor. Complete Specification. April 17.

7148. F. Kilby. Improved furnace for burning cement, lime, bricks, and the like. April 18.

7848. A. Renault and G. Cusson. Improvements in machines for purifying and separating flours, cements, and other pulverulent materials. April 27.

7925. A. Ducloux. Improved process and apparatus for converting compressible earths into resistant earths for the foundations of structures. Complete Specification. April 28.

7938. K. Witz. A process for the manufacture of artificial marble. April 28.

7945. A. Gray. Improved construction of fire-proof flooring or roofing. April 28.

8409. G. Warren. Improvements of kilns and drying process for cement and similar materials. May 7.

8633. G. Kistner. An improved roofing tile made of artificial cement. Complete Specification. May 10.

Complete Specifications Accepted.

1899.

9543. F. C. Reincke. Machines for the manufacture of artificial stones. May 9.

11,536. J. H. McLean. Manufacture of artificial stone, and apparatus to be used therefor. May 9.

13,595. C. L. Booth. Construction of drying rooms or chambers, especially suitable for treating cement, slurry, and the like. May 9.

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14,038. R. S. Smethurst. Material to be used as a waterproof covering for roofs, or as a substitute for glass and other like purposes. May 16.

15,080. A. G. Salamon. Manufacture of refractory materials for building and other purposes. May 16.

16,653. C. F. Cross and E. J. Bevan. Manufacture of refractory materials for Building and other purposes. May 9.

16,732. C. D. Abel.—From the firm of Berliner Holzcomptoir, Germany. Process for the preservation of wood. May 16.

18,809. W. Schwarz. Process of preparing the raw materials for the manufacture of calcareous sandstone. May 9.

1900.

4244. R. Fimmen. Process and apparatus for the manufacture of artificial stone. April 25.

5829. J. F. De Naeyer. Process of making artificial stone. May 9.

5893. H. H. Lake.—From American Wood Fireproofing Co., Ltd., United States. Fireproofing and preserving of combustible substances. May 9.

X.—METALLURGY, MINING, Etc.

Applications.

7147. C. F. Claus, jun., and O. J. Steinhart. Improvements in obtaining antimony and tin from complex sulphide ores. April 18.

7170. J. B. de Alzugaray. Improvements in extracting metals from their oxides and in forming alloys. April 18.

7206. W. W. Fyfe. Improvements in and connected with furnaces for converting metallic oxides into metal. April 18.

7308. J. Ward. Improvements in and relating to ingot moulds for casting steel ingots. April 20.

7364. S. Fredinnick and A. Wetzstein. Desilverising apparatus. Complete Specification. April 20.

7447. G. B. Cruickshank, H. R. S. Coleman, and P. Cruickshank. Improvements in apparatus for reclaiming tin from tin scrap. April 23.

7726. R. W. E. MacIvor. Improvements in the manufacture of monoxide of lead. April 26.

7821. W. H. Hyatt. A process for the improvement of aluminium and its alloys. April 27.

7946. S. Cowper Coles. Improvements in galvanizing. April 30.

8066. A. J. Rossi, J. MacNaughton, and W. D. Edmonds. A new or improved process of producing alloys of iron and titanium. Complete Specification. May 1.

8080. A. G. Lundin. Improvements in steel castings and the manufacture thereof. Complete Specification. May 1.

8081. A. G. Lundin. Improvements in steel castings and the manufacture thereof. Complete Specification. May 1.

8133. H. W. Hemingway. An improved process for stripping the tin from tinned iron and recovering the respective metals. May 2.

8184. C. Goedecke, jun.—From C. Goedecke, Germany. An improved blast furnace for smelting dusty and fine granular iron ore. May 3.

8363. C. O. Harz and H. von Miller. Improvements in coating or overlaying with gold, silver, and other metals. May 5.

8385. C. Bateson. *See* Class VIII.

8481. B. Talbot. Improvements in the art of manufacturing iron and steel. May 8.

8518. J. Novel. Improvements in the process of soldering aluminium and other metals. Complete Specification. May 8.

8573. K. Orth. Apparatus for casting pig iron. May 9.

8784. M. B. Baird. Improvement in the manufacture of steel by the Bessemer process. May 12.

8801. W. H. Hyatt. A system for the improvement of aluminium and aluminium alloys. May 12.

Complete Specifications Accepted.

1899.

10,850. T. Ryan, jun., and N. Hughes. Extraction of zinc from substances or compounds containing the same. May 2.

12,711. R. H. Wainford. Casting or molten metal-pouring apparatus or plant. May 2.

13,670. R. A. Hadfield. Manufacture of steel castings such as projectiles. May 9.

15,206. C. G. Meissner and R. Bennewitz. Process for hardening steel. May 2.

20,583. H. H. Lake.—From M. Costello, United States. Treatment of ores or the like for determining the presence of gold therein. May 16.

1900.

472. G. Harrison.—From Messrs. C. Casoretti and F. Bertani, Italy. Process and apparatus for obtaining zinc from its ores. May 2.

1025. H. Birkbeck.—From E. W. Hopkins, Germany. Crucible furnaces. May 16.

1892. H. J. Haddan.—From A. G. Clark, United States. Process for treating ores for the recovery of metallic ingredients. May 9.

2290. H. G. C. Thoféhrn. Process and apparatus for the oxidation of metallic compositions or combinations containing copper, lead, or other metals for separating purposes. May 9.

4771. F. W. Hawkins and E. J. Lynn. Refining of metals. April 25.

6045. G. T. Holloway and H. W. Lake. *See* Class VII.

XI.—ELECTRO-CHEMISTRY and ELECTRO-METALLURGY.

Applications.

7198. W. P. Thompson.—From A. Sinding-Larsen, Norway. Improvements in the method of producing complex chemical compounds by electrolysis with alternating currents. Complete Specification. April 18.

7245. H. Leitner. Improvements in the production of plates for secondary batteries. April 19.

7246. H. Leitner. An improved secondary battery. April 19.

7372. A. Tribelhorn. An improved manufacture of electrodes. April 20.

7513. S. Cowper-Coles. Improvements in secondary batteries. April 24.

7725. A. G. Nesfield. Improvements in or connected with electric accumulators or storage batteries. April 26.

7768. E. W. Jungner. An improved negative accumulator electrode. Complete Specification. April 26.

8226. P. Schmitt. Improvements in plates for secondary batteries. Complete Specification. May 3.

8299. J. Y. Johnson.—From H. J. Dercum, United States. Improvements relating to two-liquid primary batteries and regenerating the same. Complete Specification. May 4.

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8300. J. Y. Johnson.—From H. J. Dercum, United States. Improvements relating to two-liquid primary batteries and regenerating the same. Complete Specification. May 4.

8471. L. Renaud. Improvements in electrical accumulators. Complete Specification. Filed May 8. Date applied for Dec. 6, 1899, being date of application in France.

8586. C. Martin. Improved galvanic battery. Complete Specification. May 9.

8827. H. W. Butler. Improvements in or connected with electrical batteries. May 12.

Complete Specifications Accepted.

1899.

9134. F. Mouterde. Electric accumulators. May 9.

11,166. P. Marins. Electrolytes for deposit of metals. May 16.

11,244. H. Blumenberg, jun. Compound for battery solutions. May 2.

13,074. P. Schoop. Apparat us for electrolysis. May 2.

13,593. D. Tommasi. Secondary batteries. May 9.

1900.

5232. P. Kennedy. Storage batteries. April 25.

5321. H. J. Haddan.—From C. A. Lindstrom, J. Hewitt, and T. Hewitt, United States. Plates for storage batteries. May 9.

6296. W. Borchers. Electric furnaces. May 9.

XII.—FATS, OILS, and SOAP.

Applications.

8078. C. H. Fitch. Manufacture of a new detergent compound. Complete Specification. May 1.

8090. J. Rattaire and A. Cottard. An improved soap. May 1.

8582. W. Schuh. An improved process for making albuminous soap. Complete Specification. May 9.

Complete Specifications Accepted.

1899.

15,159. E. G. Scott. Refining glycerin, and apparatus therefor. May 9.

1900.

5227. W. Fraser and J. Bryson. Apparatus for cooling mineral oils and separating solid paraffin therefrom. April 25.

6753. H. J. Haddan.—From R. H. Adams, United States. Process for purifying linseed oil and other vegetable oils. May 16.

XIII.—PAINTS, PIGMENTS, VARNISHES, RESINS, INDIA-RUBBER, Etc.

Applications.

7563. R. W. E. McIvor and A. D. Hunter. Improvements in the manufacture of white lead, and apparatus therefor. April 24.

7726. R. W. E. McIvor. *See* Class X.

7871. W. H. Gould. Improved paint and caulking composition. Filed April 28. Date applied for, Sept. 28, 1899, being date of application in United States.

7950. W. T. Hey and E. Bailey. Means of coating cork with rubber for the purpose of producing a substitute for solid rubber. April 30.

8238. K. Koppert and H. Seidel. Manufacture of blacking for leather. Complete Specification. May 3.

8567. H. Hamet. Apparatus for vulcanising articles of caoutchouc. Filed May 9. Date applied for Feb. 16, 1900, being date of application in France.

8820. E. R. Blundestone. New process and method for producing white lead. May 12.

Complete Specifications Accepted.

1899.

9337. R. H. Mercer. Paint removers. May 9.

9338. R. H. Mercer. Distemper compositions and paints. May 9.

12,211. A. Frank. Production of carbon, and utilisation of such carbon in the manufacture of pigments, inks, and the like and cementation of metals. May 2.

13,499. E. L. Lefranc. Process of grinding colours employed for ceramic purposes. May 2.

XIV.—TANNING, LEATHER, GLUE, and SIZE.

Applications.

7700. J. Hanson. Improvements in leather substitutes. April 26.

7765. P. Grosfils. A new or improved size substitute. Complete Specification. April 26.

7850. W. T. Forbes. An improved method of treating hides and skins and apparatus connected therewith. April 27.

7922. W. P. Thompson.—From The Firm of W. Collin, Germany. An improved process for marbling or decorating leather. Complete Specification. April 28.

8429. A. J. Boult.—From O. Poppe, Germany. Improved manufacture of artificial leather. May 7.

Complete Specifications Accepted.

1899.

10,985. J. Y. Johnson. — From W. F. Sykes, United States. Dyeing and tanning skins. May 2.

13,563. C. O. Natusch. Process of tanning. May 16.

17,854. R. B. Arthur. Process for treating leather and similar substances. May 16.

1900.

3383. M. R. Mindus and K. F. F. G. Sommer. Rapid tanning process. May 2.

XV.—AGRICULTURE and MANURES.

Application.

8512. H. A. Hobson. Process of treating leather waste and woollen waste for the production of manure. May 8.

XVI.—SUGARS, STARCHES, GUMS, Etc.

Applications.

8159. R. Schrader. An improved machine for making molasses fodder. Complete Specification. May 2.

8305. F. R. Bramsch. A new or improved process for purifying molasses and sugar juices for the purpose of obtaining German yeast. May 4.

8306. F. R. Bramsch. A new or improved process for obtaining German yeast and alcohol from molasses or sugar juices without addition of cereals and without lactic acidity. May 4.

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8514. The Société Anonyme Alliance Industrielle. A process of rendering soluble amylaceous or starchy matters for use in brewing and distilling and in the manufacture of syrups. Filed May 8. Date applied for Nov. 14, 1899, being date of application in Belgium.

XVII.—BREWING, WINES, SPIRITS, Etc.

Applications.

8125. J. House and E. W. Lancaster. Improvements in and connected with apparatus for fermenting, collecting the gas given off during the process of fermentation and afterwards using the same to re-carbonate ales, lager beers, and other beverages.

8306. F. R. Bramsch. *See* Class XVI.

8391. C. Carter. Improvements relating to means for cooling the contents of "squares" in breweries. May 7.

8514. The Société Anonyme Alliance Industrielle. *See* Class XVI.

Complete Specifications Accepted.

1899.

12,819. A. J. Boult. — From G. Sändker, Belgium. Method and apparatus for the production of alcohol. April 25.

16,159. E. Barbet. Fermentation processes. May 2.

16,233. E. Barbet. Industrial distilling, and apparatus therefor. May 2.

16,234. E. Barbet. Production of rum. May 9.

1900.

3672. J. A. Ruckdeschel. Apparatus for making coloured malt and for pasteurizing beer in large quantities. April 25.

XVIII.—FOODS, SANITATION, Etc., and DISINFECTANTS.

Applications.

B.—Sanitation.

7240. E. G. Weddell. Improvements relating to the purification of greasy water. April 19.

7397. W. Pemberton. Improvements in apparatus for softening and purifying water. April 21.

8224. T. I. Goldie. Improvements in or relating to structures for the bacterial treatment of sewage, and in apparatus connected therewith. May 3.

8670. G. C. Marks.— From The Compagnie Générale de Travaux Sanitaires (Société Anonyme), Belgium. An improved furnace for incinerating dirt and refuse of towns. Complete Specification. May 10.

Complete Specifications Accepted.

A.—Foods.

1899.

3204. H. J. Dunn. Manufacture of food powder and extract.

B.—Sanitation.

1899.

11,994. W. C. C. Pakes. Apparatus for bacteriological treatment of sewage. May 2.

11,995. W. Pare. Apparatus for the treatment of sewage or other liquids. May 9.

12,793. G. A. Abbott. Manufacture of filtering material. April 25.

1900.

2665. J. Delattre. Apparatus for purifying waste and impure wate rs, particularly such waters as contain greasy matters. May 16.

4735. A. J. Boult.—From C. L. Kennicott and C. J. Blair, United States. Water purifying apparatus. April 25.

XIX.—PAPER, PASTEBOARD, Etc.

Applications.

7830. W. Friese-Greene and P. E. Knell. Improvements in the manufacture of paper. April 27.

7873. T. Lumb, jun., J. W. Lumb, and B. Lumb. Improvements in and relating to the manufacture of press paper. April 28.

8062. W. Friese-Greene and P. E. Knell. Improvements in the manufacture of paper. May 1.

Complete Specifications Accepted.

1899.

13,287. J. Chaubert. Composition for the manufacture of celluloid. April 25.

13,331. J. Imray.—From The Consortium Mulhousien pour la Fabrication de fils brillants, Germany. *See* Class V.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, and EXTRACTS.

Application.

7199. W. P. Thompson.—From E. Gfeller, Switzerland. Improvements in the manufacture of saccharine. April 18.

Complete Specifications Accepted.

1899.

9962. G. B. Ellis.—From La Société Chimique des Usines du Rhône anciennement G. P. Monnet et Cartier, France. Manufacture of saccharine. May 16.

12,942. E. Miran and F. Schwarz. Preparation of perfumes. April 25.

13,703. J. F. von Mering. Manufacture of ethylmorphine. May 9.

13,899. A. J. Boult.—From L. Bernegau, Germany. Method of treating kola nuts, and products obtained thereby. May 2.

14,236. C. D. Abel. From The Actien Gesellschaft für Anilin Fabrikation, Germany. Manufacture of artificial perfumes. May 16.

14,388. L. O. Helmers. Preparations of albumine and sulphonised carbon compounds, and process of making the same. May 16.

14,565. E. Taeschner. Process for producing a fluid extract of thyme. May 16.

15,208. E. Erdmann. Manufacture of isatoic acid. May 9.

XXII.—EXPLOSIVES, MATCHES, Etc.

Applications.

7152. E. H. Eisenhart, G. M. Justin, and C. W. Miller. Improvements in machinery for the manufacture of matches and boxes, and depositing matches therein. April 18.

7583. H. E. Sturcke. Improvements in explosives. Complete Specification. April 24.

7713. E. A. Le Sueur. Explosive mixtures, and art of manufacturing and preserving same. April 26.

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8359. C. O. Lundholm and J. Sayers. Improvements in explosive compounds. May 5.

8462. A. Reichwald.—From the Firm of F. Krupp, Germany. Improvements in or connected with time fuses. May 8.

8758. T. Jevlev. Improvements in explosives. Complete Specification. May 11.

Complete Specifications Accepted.

1899.

7276. L. Cobbaert. Manufacture of matches. April 4.

10,137. J. W. Kynaston. Manufacture of ammonium nitrate. May 16.

11,929. J. Selwig. Apparatus for transporting guncotton or similar nitrated substances freed from the surplus of acid in nitrating or acid-centrifugals. May 16.

12,316. A. J. Boult.—From J. F. T. Sargent, United States. Process for producing nitro-explosives. May 9.

13,171. E. H. Durnford and G. H. Wadsworth. Manufacture of smokeless powder. May 9.

1900.

5830. R. Haddan.—From Vereinigte Köln-Rottweiler Pulverfabriken, Germany. Method of producing nitrocellulose which is specially suitable for the manufacture of explosives. May 9.

Printed and Published by Eyre and Spottiswoode, East Harding Street, London, E.C., for the Society of Chemical Industry.—P 537

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