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The Editor will be glad to consider contributions from those engaged in the Food Industry. Articles intended for publication should be of a practical nature and accompanied by photographs or drawings when possible.

The Future of Dehydration

CAN the dehydrated vegetable industry survive in peacetime? This is a question which has been posed constantly during the latter years of the European war, and by and large the answer has been on the pessimistic side.

There is the memory of the *débâcle* of the 1920's, due to the inability of the dried products to compete either in quality or price with a sufficiency of supplies of good fresh produce.

It does not follow, however, that history will repeat itself; conditions have changed considerably since 1920. At the moment there are sporadic expressions of unmitigated condemnation of present-day dehydrated foods made in the popular press by members of the Forces and others, but we do not think that too much importance should be attached to these.

Published in this issue is a letter on the subject by Mr. Robert A. Templeton, whose company developed from 1935 the first commercial-scale project in vegetable drying ever to have been established in this country, and the points he makes consequently merit the attention of those interested.

The fact of the rapid development of six factories for drying vegetables for cattle food leaves no doubt as to the advantages of dehydrating surplus supplies, given economic methods; but the real question is the supply of dehydrated vegetables for general consumption, and the growing of raw materials *ad hoc*.

One of the prime considerations is production cost. Cheapness may stimulate consumer demand, and enable dehydrated vegetables to meet to some extent the heavy competition of quick-frozen and canned products, not to mention the ordinary fresh products.

The inevitable consumer resistance to familiar foods in a new form has still to be overcome, as it has not yet been offered in the domestic market. The many factors involved render it impossible to prognosticate the final issue.

Another Viewpoint

The emphasis laid by Lord Woolton at a Food Education Society luncheon on the right selection and treatment of food in rebuilding the life of a nation may cause some to ponder whether dehydration is listed among right "treatments." Years of necessity, when to keep our powder dry and our food ditto was the order of the day, provided a different story from the coming days of peace when shipping will be more plentiful; when man will crave for those beefsteaks of yesteryear, if not for one of those "simple dinners" of a mid-Victorian Lord Dudley—turbot, venison, duckling and green peas, chicken, asparagus, and apricot tart! The siege of Paris brought rats and elephant steaks to the table; other experimental dishes, varying from potted ostrich, alligator, and kangaroo "ham" (pronounced "rather dry"), remind us how necessity is the mother of invention where food is concerned, especially when coupled with curiosity, with the desire to try out something new.

In war or in times of necessity one turns to nourishment of any kind. The cat in a news item showed this, when, accidentally stowed away in a crate along with a Diesel engine *en route* from Detroit to the Middle East, it preserved the forty-five lives of itself and four healthy kittens produced on the way by licking "cosmogene" anti-rust compound so liberally spread on the Diesel. But when necessitous times have gone, what then? Dehydration for expeditions, for any war of the future, for meeting famine in far-off places; but hardly for everyday foods, if one is to believe the layman. It may be that dehydrated foods lack that glamour, that "eye appeal," upon which our American friends lay such stress.

The history of dehydration—it has a history—has fluctuated. From the chuño of Chile, the pemmican, dried carrots, and dried meat so thoroughly disliked by our Crimean troops; from Navy broth concentrated to glue-like slabs marked, laconically enough, with a broad arrow, right up to that dehydrated goat served to our soldiers in India (which raised no salute to any Isle of Capri!), the tide has ebbed and flowed.

It may flow again. Dried eggs may be forgotten when the "fresh" product of the British hen—or its counterpart from Australia, China, or goodness knows where—is freely available. Still, there are great possibilities for dehydrated foods, especially for the refrigeratorless home. A plate of good soup which has by-passed the stock pot, or even a meal of beef collops from dried meat, skilfully seasoned, prepared with no more effort than the boiling of a kettle of water, are not without their attraction.

The scientists have done much and will do more—it remains for the manufacturer, with imagination, to do his part.

Stability of Dried Eggs

Dried eggs survive the intense heat of dehydration and long periods of storage at low temperatures without appreciable loss of vitamin A, one of the most unstable food factors, a report to the American Chemical Society shows.

The vitamin A studies were made by S. M. Hauge, F. P. Zscheile, C. W. Carrick, and B. B. Bohren, of the Purdue University Agricultural Experiment Station, Lafayette, Ind., and described in *Industrial and Engineering Chemistry*.

The researchers found little or no deterioration of the vitamin during the dehydration process, when the eggs are mixed, homogenised, and then sprayed through tiny nozzles into a dryer, where hot air removes the moisture and turns the eggs into a powder.

Samples of dried eggs stored at temperatures of 18° below zero and 5° above Centigrade, the usual storage refrigerator temperatures respectively, "retained most of their original vitamin activity," the report said.

"In the samples stored at higher temperatures considerable deterioration had taken place, although the losses of vitamin A potencies were not so great as might have been expected. The greatest losses were observed in samples held at room temperature, where the losses were about 40 per cent. in twelve months. The samples stored in the warehouse retained about 70 per cent. of their vitamin activity, which may be considered satisfactory."

The experiments showed that the rates of loss of vitamin A were greatest during the first three months, after which the vitamin appeared rather stable, but "no explanation can be offered at this time for the apparent inhibition of losses after three months of storage."

Dairy Education and Training

The establishment of a National Dairy Technological Institute is advocated as an urgent necessity by the Education Committee of the Society of Dairy Technology in a report on dairy education. The objects of the Institute, it is suggested, would be:

(*a*) Advanced dairy training in the processing and manufacturing aspects of the industry;

(*b*) The dairy training of engineers;

(*c*) Provision of refresher courses for executive, scientific, and operative staffs of creameries and dairies; and

(*d*) Provision of facilities for testing dairy machinery.

The Education Committee, whose chairman is Professor E. Capstick, state in the report that development within the dairy industry has been so great during the past 20 years that there is an urgent need for better-trained scientific, executive, and operative workers.

The requirements of such personnel in the industry after the war are estimated at more than 400 annually for replacement purposes alone. Requirements due to the expansion of the industry would be additional. The number estimated to be required for replacements is made up as follows: 10 provincial and county milk production officers; 40 county dairy advisers; 20 dairy bacteriologists; 250 senior and junior scientific workers within the industry; and possibly some 100 managers, engineers, and senior plant operatives.

The report recommends that dairy education should follow uniform lines along four definite channels—namely, degree courses in dairy science and dairy husbandry; post-graduate diplomas in dairy bacteriology, dairy husbandry, and dairy technology; two national diplomas in dairying, one specialising in the technology of milk processing and manufacture, and the other specialising in milk production and dairy husbandry; and part-time instruction for a City and Guilds Technological Certificate.

Suggestions are contained in the report for full and part-time courses, and a proposal is made that trade organisations within the dairy industry might favourably consider the provision of several scholarships for university and diploma students and for a few post-graduate scholarships.

Assistance for Export Trade

The Export Guarantees Act, 1945, is a measure designed to help the export trade of this country and, with former Acts, concerns the giving of guarantees by the Government (to U.K. concerns) against the possibility of bad debts by a foreign buyer and other matters. The scheme is a form of insurance, and in connexion therewith information concerning foreign buyers and export business generally is available.

By this 1945 Act the Board of Trade is permitted to give guarantees up to £200 millions (increased from £75 millions), included in which total can be guarantees up to £15 millions (from £7½ millions formerly) for goods not home produced, and in connexion with any matter considered as being conducive to the establishing or encouraging of export sales, up to £5 millions (formerly £2½ millions). Under the last-mentioned head would come such things as fees of experts and consulting engineers, cost of training foreign workpeople, and so forth.

A guarantee generally can cover, apart from actual goods, the execution of works or services (including provision of labour or materials) outside the United Kingdom, and now, instead of formerly where guarantees for these matters were limited to one-third of the price of the goods, there is no limit.

This 1945 Act also introduces a new provision which permits guarantees to be given in respect of sales of goods by U.K firms sent direct from one foreign country to another without coming to this country or by *entrepot* rules through this country —*e.g.*, Dutch goods could be sent from Holland directly to U.S.A. or otherwise through, say, the *entrepot* port of London. This new provision is mostly intended for the merchanting of foreign goods and principally for unmanufactured goods and other primary products not in competition with our export trade in manufactured goods, as these are specifically excluded, unless the Board of Trade considers that the giving of guarantees would not affect the export trade of the United Kingdom. Semi-manufactured goods, however, would come under the new provision; that is, where there is some element of manufacture or treatment—to wit, such products as copper, wool, or rubber.

The principal policy (ordinarily known as the Comprehensive Policy) which gives cover against the possibility of the customer's insolvency (the Insolvency Risk) meets 85 per cent. of the debt, with, in addition, 15 per cent. of all sums recovered from the estate of the debtor.

Another guarantee (the Transfer Risk), being an addendum to the Comprehensive Policy as above, gives insurance against loss or delay due to war circumstances, and meets the possibility that payment may be prevented by war, by civil commotion, or other disturbance in the buyer's country; this policy in most cases covers 90 per cent. of the risk.

The Pre-Shipment Risk Policy meets any loss which may arise through the exporter not being able to ship owing to the buyer's insolvency, by import regulations, by invasion or war, or other catastrophe; this is particularly useful where the goods may have been specially manufactured, are only suitable for a particular market, and so forth.

By another policy, useful in allowing an exporter to quote c.i.f. prices some time ahead of delivery, cover can be obtained against possible rises in marine insurance rates, freight rates, and so forth.

Still another policy will be available shortly, so that if the business submitted is reasonable, not being merely one transaction on one market with one shipment, an exporter will be allowed to exclude markets the trading risks of which he is prepared to take on himself, but the premium for this cover will be higher than that charged where the exporter insures the whole of his export business.

From May 1, 1945, the policies, while covering the same risks as above, have been named differently; thus the Export Credits Guarantee Department (Contracts) Policy is the chief policy embracing all the risks mentioned. Another policy is called the E.C.G.D. (Shipments) Policy, this (at a lower rate than the just mentioned one) not including the risk of loss prior to shipment—that is, only shipments are declared.

Fruit Canning in 1945

Until about the end of June it was not possible for the Ministry of Food to estimate what arrangements could be made for fruit canning this year. It now seems that there will be some quantity of plums available for canning without depriving the fresh fruit market. Other fruit crops are very much smaller and would not by themselves have been sufficient to justify the planning of a canning programme.

The total quantities of fruit canned this season will be small, and the Ministry intends to keep the stocks intact until the new year, when they will be released on points.

During the flush milk season the Ministry has had to devote a large quantity of cans to milk. Production of processed peas and canned soup, the output of which had to be suspended for several weeks, is now being resumed. The range of soups that can be produced is limited by the quantities of flavourings and other ingredients available.

The modest fruit-canning programme will be limited to plums, sour cherries, rhubarb, and wild blackberries. No strawberries, raspberries, loganberries, currants, or gooseberries will be available for the canneries this season, as practically the entire crops are being used for jam-making, vitamin foods, and the fresh fruit market.

Burton-ail

It is not often that Red Indian legends are associated with food production—apart, of course, from the no doubt bowdlerised version of the fertility rite of Indian corn which everybody knows from "Hiawatha." The township of Burton, now known as Albany, in New Hampshire, was traditionally the dwelling-place of an Indian prophet named Chocorua. Being shot and fatally wounded by a white man, Chocorua pronounced a curse which seems to have come partially true: "The Evil Spirit breathe death upon your cattle! Chocorua goes to the Great Spirit—his curse stays with the white man!"

The region near Albany is, in fact, characterised by a disease which has been attacking cattle for many years. It is called "Burton-ail" by dairymen, since it was first observed in Burton. Various causes have been assigned to the condition, but it is now reasonably clear that it is due to cobalt deficiency. Actual evidence regarding a deficiency of cobalt in soils and herbage has not been produced, but a series of case-histories recently published, showing a return to normal of animals treated with cobalt, leaves little doubt about the cure if not the cause.

Cobalt deficiency is widespread in New Zealand and is well known in some parts of Great Britain. Cases of cattle cured of obscure conditions by administration of cobalt have been reported from Florida and Michigan; in the former State the condition is referred to as "salt-sick," and in the latter as "Grand Traverse" or "Lake Shore disease." Cobalt deficiency has been shown to be sometimes strikingly correlated with geological formation. Thus, in Western Scotland, where the condition in sheep is called "vinquish," there is a sharp boundary between rocks poor and relatively rich in cobalt, so that farms, or even parts of one farm, lying on one side of the geological boundary will be affected while adjacent holdings escape.

Cure can be effected by direct administration of a cobalt salt to the animals, or by treating the pasture with a cobalt salt either pure or in mixture with fertiliser. "Cobaltised superphosphate" is a regular article of commerce in parts of Australia and New Zealand. It is suspected that a condition like Burton-ail occurs more widely in North America than has hitherto been realised. Appropriate measures, including the administration of cobalt, may do much to help the thriftiness of cattle and sheep and thus increase the amounts of milk and meat.

Changes brought about by cobalt medication are rapid and often spectacular, yet the dosage is homeopathic. Applied as an amendment to soil, a dressing of the order of four ounces of cobalt sulphate per acre has been found adequate, the results on cobalt-deficient soil being a remarkable improvement in vigour and the acquirement of the ability to grow and fatten instead of a condition which can only be described as lingering when it is not fatal.

Egg Preservation

Preserving eggs has for some time been a difficult business—freezing breaks the shells, and waterglass is a nuisance and not of high efficiency for bulk preservation. The U.S. Department of Agriculture has been experimenting with a method of oiling the eggs. All the air is sucked out of the crannies of the shell, and oil is allowed to enter the spaces. By this means the egg has all its pores filled up with oil, yet can be handled like an ordinary egg and does not require to be kept under oil or in a solution. Better understanding of preservative methods comes from the realisation that eggs go stale and bad not because of the entry of bacteria but as part of a natural process of ageing leading to the death of the living egg. The egg has a continuous metabolism; it "breathes out" carbon dioxide just like human beings and the hen, but, unlike them, it requires no oxygen. If this carbon dioxide accumulates in the egg's neighbourhood, it slows down the metabolic reactions which produce it and so postpones the date of decay. Sealing up the shell has this effect: carbon dioxide can no longer escape into the air, but collects inside the egg and acts as a preservative.

British Vegetable Dehydration

This article, prepared by the Technical Staff, Dehydration Division, Ministry of Food, gives in summary form a complete account of the history of the development of the war-time dehydration of vegetables, the processing and drying processes used, and the methods of control in quality.

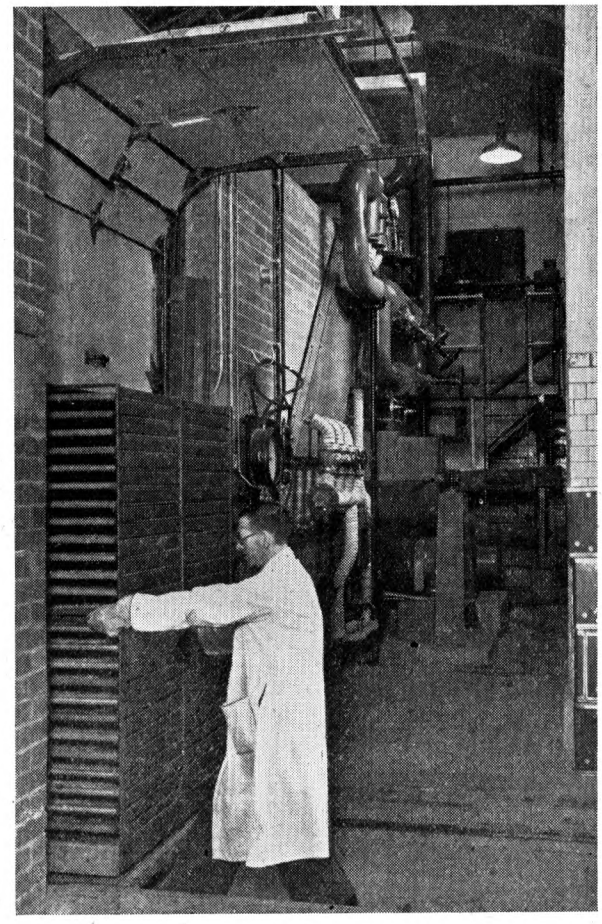
SYSTEMATIC research into the dehydration of foods was undertaken by the Department of Scientific and Industrial Research in 1938. Attention was focused on air-drying of vegetable strips in 1940, and in 1941-42, with the co-operation of two food processing firms, successful small-scale and pilot plant installations were made and sufficient information was gathered to permit large-scale development. This development was fostered in its early stages by the Ministry of Food and commercial production was brought under the Ministry's control. To produce as much as possible as quickly as possible in order to meet urgent Services demands, a standard dehydration plant was developed and installed at a number of factories owned by private firms, some of which, but by no means all, had previous experience of food processing. The plants were run for the Ministry of Food by the firms under a standard financial agreement; the Ministry worked in close co-operation with the firms, employing technical officers to advise the factories and setting up an organisation with the assistance of the Government Chemist to co-ordinate control of quality. A few plants, differing in some respects from the standard plant and incorporating special features of design, were also installed and successfully run by other firms. From 1940 onwards close contact was maintained between the Ministry of Food and the Department of Scientific and Industrial Research in development work on the dehydration of vegetables. The systematic investigation undertaken by the Department of factors influencing the quality and storage life of dehydrated vegetables[5, 6, 7, 8, 9] has continued to provide valuable information for application in commercial production. Grateful acknowledgment is due to Chivers and Sons, Ltd., for their co-operation in the initial small-scale factory experiments, and to H. J. Heinz Co., Ltd., who erected and operated the pilot plant. Both these firms gave valuable assistance in the development of the standard plant. It is also desired to acknowledge the services of Imperial Chemical Industries, Ltd., in installing the standard plant and their assistance in developing the equipment. Information on the latest developments in Canada and the U.S.A. was also utilised. References to some recent publications are given at the end of this article.[1, 2]

By 1944 most of the standard plants were in operation and production consisted mainly of potato, cabbage, and carrot. Small quantities of dehydrated green peas, swedes, and beetroot were also produced at one factory.

The typical production rate of a single standard plant during the year 1944 is shown in Table 1.

TABLE 1.

Vegetable.	*Production: Tons per Working Week.*	*Ratio: Raw (Dehydrated).*
Potato	26	7·5
Carrot	11	16·5
Cabbage ..	6	26



Removing a truck with its load of dried product from the tunnel.

The ratios are averages over the season; the production figures are not maxima, but are representative of steady rates under reasonably favourable running conditions. The plants run for 24 hours a day, 5 to 6 days per week.

Owing to the exigencies of war, standard plants had to be fitted into previously existing buildings, possessing the necessary facilities of water, electricity, steam supply, and effluent disposal, and located where a sufficient labour force was available. Layouts thus varied considerably with the type of building that was used. A feature of the labour situation is the large-scale and successful use of part-time female labour.

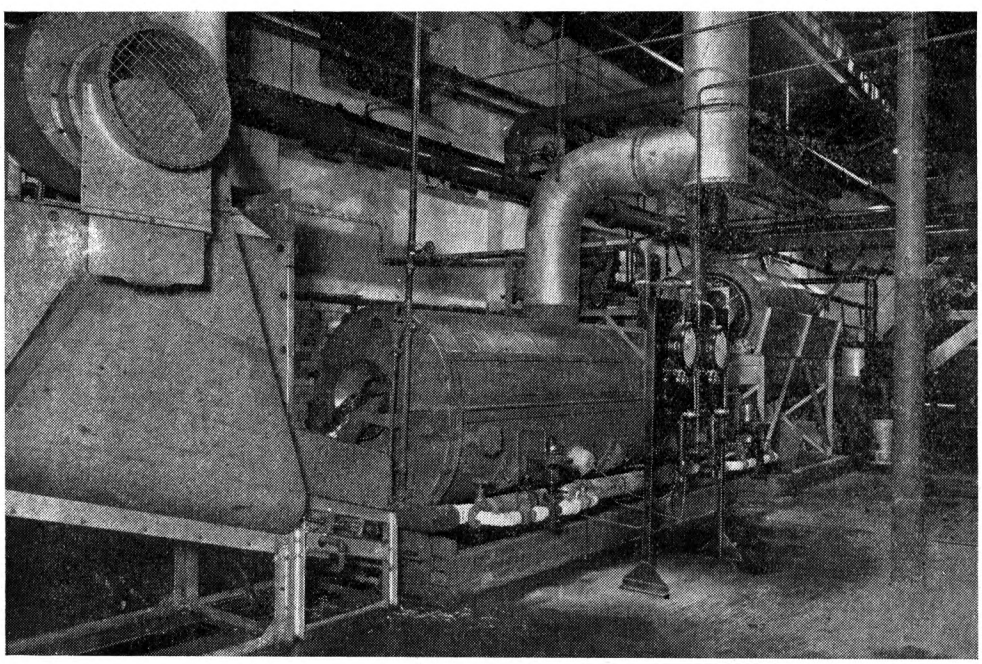
Apart from minor variations, the programme is as follows: Potatoes are processed during the first six months of the year, the potatoes being drawn from field storage in clamps or pits. During the second six months, all factories process cabbage drawn fresh from the field, during all or part of the time, and some process carrot during a three months' season, the carrots again being freshly dug and not stored.

In the rest of this article the operation of the standard plants is briefly described under the headings of Preparation, Scalding, Drying, Packing, Compression, Quality Control, and Specifications. For further details reference may be made to a Handbook[4] prepared by the Ministry of Food for plant operators.

Preparation

Potatoes and **carrots** are loaded, either by hand or by conveyor, into a ground-level feed-hopper and elevated to a rotary pre-washer of standard design, which removes dirt by water-sprays. It delivers to a short inspection belt, where stones and defective roots are removed; the vegetables are then elevated to chutes which deliver to two or sometimes three Urschel-type continuous abrasive peelers. The peeled vegetables fall on to a lateral belt, where further sorting of insufficiently peeled or diseased roots can be done, and are then automatically ploughed off on to three long trimming belts, each divided into three compartments. The vegetables travel down the two outer compartments of the belt and are placed after hand-trimming in the central section, which delivers to another lateral belt. This takes the vegetables to an elevator delivering via chutes to the two Urschel-type strippers; these cut strips of potato and carrot of size 5/16 inch × 3/16 inch in cross section, the broad cut being taken on the rotary knife. The machines have worked well on potato, but have not been entirely successful with carrot, a good deal of cross breakage of the strips taking place. Potatoes and carrots have always been produced in strip form; diced and riced potato have not been produced.

Because of the impossibility of obtaining trimming labour at night under war-time conditions, the whole day's input of potato and carrot is usually washed, peeled, and trimmed in eight to ten hours during the day; part is fed directly to the main processing line, and part to a series of galvanised metal tanks filled with water or very dilute sulphite solution. Here the roots are held during the day, and then flumed back to the processing line to keep it going during the night. Roots are not normally



Part of the processing line showing the strip-washer, the scalder and its control instruments, and the cooler.

Packing dehydrated carrot into four-gallon cans.

held thus in " buffer storage " for more than a single night, and, when used with due attention to plant hygiene, the practice has not produced any deleterious effects.

Cabbages, after rough trimming on wooden tables, are fed directly on to the trimming belts, where stumps and outer leaves are removed on wooden blocks with a sharp knife. They then pass to mechanical corers provided with bits of varying sizes at the end of the belts, which are fed by hand. Both U.S.A. " Buffalo " core-shredders and a corer of a similar type, but with horizontal instead of vertical action, designed in the U.K., are used. Corings were originally included with the shreds for processing, but it was found that their coarseness often led to toughness in the final product, and that they were particularly liable to discoloration (browning) during drying. Corings are, therefore, now excluded. In some cases, especially with small cabbages, hand-coring is used.

Two types of cabbage-shredder, one of the U.S.A. " Buffalo " type and a somewhat similar machine of British design and manufacture, are used with fairly satisfactory results. Careful maintenance of both shredders and strippers has been found to be essential to smooth running and good cutting. The " buffer storage " tanks installed were not designed for cabbage (although at one factory a special design has been introduced for cabbage, with good results), as night storage of cabbage was not anticipated. It had, however, to be undertaken, and it has been found practicable to hold trimmed but uncored cabbages overnight, provided they are fresh, in improvised wooden containers, not under water, in a fairly cool part of the factory. These are cored and shredded as required for night work.

A moving belt carries the strips or shreds to an elevator delivering into a strip-washer. The strip-washer is a rotary washer with a perforated stainless-steel drum, provided with an interior scroll and heavy water-sprays. Its purpose is to wash potato strips free from starch and cabbage shreds free from dirt and grit. Washing of carrot strips is not necessary, and the machine is, therefore, run with the minimum of water or practically dry when processing carrot. Water usage on potato and cabbage is 1,000 to 2,000 gallons per hour.

Scalding

The strip-washer delivers the strips or shreds, which entrain a certain amount of water, via a chute to the rotary scalder, which is of the standard type used for pea-canning, with perforated drum and internal scroll, but specially modified for dehydration. The perforated drum, the scroll and the external casing are made of stainless steel, and the non-stainless parts are either galvanised or fescolised (nickel-coated); there are other minor modifications. The aim in design was to reduce iron contamination to a minimum. Dosing-tanks of stainless steel feed the scalder, through a valve and flowmeter, with sulphite and carbonate as required. Heating is by direct steam injection, the scalder being about one-third full of liquor. The same liquor is normally used without being changed throughout the week, but is changed if a long stoppage occurs. The scalding temperature for all vege-

tables is 210° F. and is thermostatically controlled. The scalding time is about three minutes; occasional batches of potato are scalded for less than three minutes to prevent "mushing," and carrot and cabbage are sometimes scalded for up to four minutes. The vegetable is scalded to a negative peroxidase reaction, a test with guaiacol and hydrogen peroxide being used.

Potato is dosed with sodium metabisulphite, the *p*H of the scald liquor attaining equilibrium at about 6·2; the sulphite content of the dehydrated potato must fall within the range of 50 to 300 p.p.m. of SO_2. Cabbage is dosed with sodium sulphite and with sufficient sodium carbonate to maintain a *p*H of 7·2 to 7·6; the sulphite content of the dehydrated cabbage must fall within the range 500 to 3,000 p.p.m. of SO_2. The carrot scald liquor is not dosed. The total soluble solids content of the scald liquor rapidly rises to an equilibrium value; an overflow of liquor takes place constantly, due in part to condensation of the steam used for heating and in part to water entering the scalder from the strip-washer. The equilibrium values of total soluble solids usually obtained are 2·5 per cent. for potato, 1·5 to 2·5 per cent. for cabbage, and 3 to 4·5 per cent. for carrot.

The vegetables are delivered from the scalder to the moving belt of a specially designed cooler, in which air is blown up through the layer of vegetables by two fans. This cools the vegetables so that they can be handled in tray-spreading, and prevents them from over-cooking after scalding (potato especially). A small amount of water is also driven off in the cooler. The vegetables are then loaded on to the trays, being metered, by volume, by a device known as a "strickling-box" fed from the cooler and operated by hand. The trays, which have a light, tubular metal frame, are spread by hand at the rate of about 7 per minute, and are loaded at 1½ lb./sq. ft. with potato and carrot and 1 lb./sq. ft. with cabbage. The tray mesh is 5 per inch, of tinned or galvanised steel wire. The loading device has proved satisfactory in delivering equal weights of vegetable to each tray, but as it is not fully automatic, its operation has required constant care, particularly with cabbage. (Typical figures for range in tray-load with potato are 10 to 14 lb.)

Drying

Two trolleys, each carrying 50 trays, are loaded every half-hour, and inserted abreast into the tunnel drier, which is of Ministry of Food design. It consists of two tunnels side by side, the first or "wet" section with concurrent air flow and the second or "dry" section with countercurrent air flow. Air is drawn through heater batteries and into centrifugal type (multivane) fans, in line with the tunnels. A diffuser with adjustable splitters is fitted between the fan exit and the entry to the drying section in each tunnel. The average air speeds (approaching the first trolleys) are 850 and 650 feet per minute for the "wet" and "dry" tunnels respectively. Recirculation is provided for in both tunnels, and the "wet" tunnel derives its air, via an adjustable cross-over duct, from the "dry" tunnel. The drier is normally run with 6 pairs of trucks in the first or "wet" section and 7 pairs in the "dry," the total drying time being thus 6½ hours. Temperature at the entry to both "wet" and "dry" tunnels is thermostatically controlled. Inlet air temperatures to both tunnels and the wet and dry bulb temperatures at the exit end of the "wet" tunnel are recorded on thermographs. Mechanical pusher-gears are used to move the trucks through the tunnels.

Table 2 gives typical drying conditions for the three vegetables; the truck interval is 30 minutes and the total drying time about 6½ hours; temperatures are in degrees Fahrenheit.

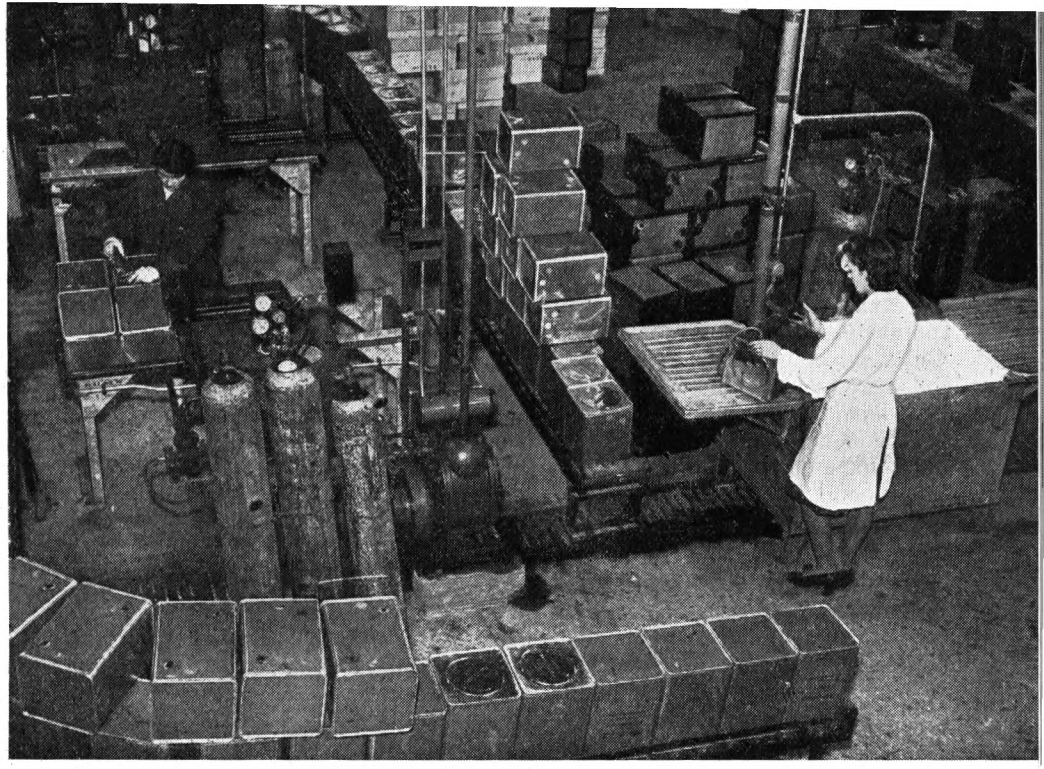
TABLE 2.

	"Wet" Tunnel Entry.	*"Dry" Tunnel Entry.*	*"Wet" Tunnel Vent.*	
	Dry Bulb.	*Dry Bulb.*	*Dry Bulb.*	*Wet Bulb.*
Cabbage	185	145	140	105
Carrot	210	160	140	105
Potato	205	155	145	110

These figures are averages based on a large number of observations made at factories in production, and are fairly representative. Fairly wide variations are, of course, observed in practice, depending to some extent on the variety of vegetable used and the time of year it is processed, and also on processing conditions. One of the most important requisites for efficient drying is found to be even tray-loading and spreading; with cabbage in particular local overloading of trays leads easily to the production of partially dried patches of material. It should also be noted that, on the basis of recent experience, a lower finishing temperature, 140° F. instead of 145° F., is now recommended for cabbage to prevent heat-damage ("scorching").

Packing

The dehydrated vegetable, on removal from the drier, is briefly inspected on the trays for any scorched or partially dried material, which is occasionally found; the trays are then tipped on to an unloading table, where further inspection takes place. Then the material either passes to the compression section or is packed loose by hand into 4-gallon cans at the rate of 12 lb. potato, 10 lb. carrot, and 4 lb. cabbage per can. At the same time, samples are taken from a well-mixed mass of material for laboratory examination. The cans are closed with a lever-lid, and, after dating and coding, move, usually by conveyor, to soldering-tables, where a tagger-plate is applied over the lever-lid to give a gas-tight closure. As the cans used are



Part of the packaging line showing gas packing and can testing.

stencil-lacquered with a specified anti-dazzle paint, the packing of potato is completed by painting the top of the can, and cartoning or boxing it ready for dispatch. Carrot and cabbage are gas-packed, each tin being perforated with two brogue-holes, and evacuated and filled with nitrogen in a special chamber. After soldering the brogue holes, each can is tested by inflation with nitrogen to 2 lb. pressure to detect any can-body or soldering leaks, which are repaired; all seams are then treated with a bitumen dope to seal minor leaks, and the cans are prepared for dispatch.

Compression

A standard installation for the compression of dehydrated vegetables into blocks of high density was developed and designed by the Ministry of Food, on the basis of laboratory experiments carried out by the Department of Scientific and Industrial Research. The installation has been completed only in certain of the standard plants, and at these cabbage and carrot have been fairly successfully compressed on a commercial scale. The total production of compressed dehydrated carrot and cabbage to date does not, however, exceed 150 tons. For compression *carrot* strips from the tunnel are heated in a " conditioner " in dry air for about eight minutes at 160° F.; they are then at once compressed at a pressure of 2,240 lb./sq. inch for 40 seconds. A 9-inch square block is produced, which is cut by guillotine into 3-inch squares, and packed into a 4-gallon can at 28 lb. per can. *Cabbage* shreds from the drier are heated in humid air in the conditioner, being exposed to an atmosphere at 140° F. dry bulb and about 115° F. wet bulb for ten minutes, the product having a moisture content of about 8 per cent. The material is then at once pressed at about 2,000 lb./sq. inch for thirty seconds; the 9-inch square block produced is guillotined into 3-inch squares, which are dried in a small, cross-flow tunnel drier for twelve hours at 120° to 125° F., to bring the moisture content to below the specified level of 7 per cent. The blocks are then packed into 4-gallon cans at 22 lb. per can.

Small-scale production of compressed potato has been undertaken experimentally at one factory, and some tons of blocks have been made, but the quality of the product, though fairly good, has not been considered fully satisfactory; experimental work is continuing.

Quality Control

Special laboratories with standard equipment are in operation at all factories in order to provide for chemical control of processing and for assessment and grading of the quality of the dried product. Half-hourly or hourly samples are taken, and a large proportion of these are tested by the laboratory staff for moisture content, culinary quality, sulphur dioxide content where necessary, and per-

oxidase. In addition, in order to provide for full co-ordination of testing, five samples per week are sent by each factory to a laboratory under the Government Chemist, where they are examined and the results compared with those obtained by the factory for duplicate samples. This arrangement provides a constant check on the accuracy of factory tests, desirable in view of the arbitrary nature of some of them. If necessary, factory grading of production can be amended on the basis of the Government Laboratory tests.

Culinary quality is judged by a joint Ministry of Food—Government Laboratory Panel. Other tests are performed by the Government Chemists staff, to whose skill and care in dealing with the very large number of samples involved much of the success of the scheme for quality control is due.

Specifications

Moisture Content.—The target is carrot and cabbage with less than 6 per cent. moisture and potato with less than 8 per cent. moisture. To provide working latitude maxima of 7 per cent. for carrot and cabbage and 9 per cent. for potato are specified. Material of higher moisture content is graded as sub-standard. As an example, it can be stated that during 1944 potato season approximately three-quarters of the production had a moisture content within the range 6 to 8 per cent. These figures are naturally dependent on the technique used for moisture content determination, details of which are given in the Ministry Handbook.[4]

Culinary Quality.—Samples cooked under standard conditions and tasted by an approved panel have to be awarded a mark of not less than $2\frac{1}{2}$ out of 4 on an arbitrary scale; batches showing samples with less than this mark for either colour, flavour, or texture are graded as sub-standard. The target figure, 3 or more marks out of 4, indicates that the product closely resembles good fresh vegetable. It is achieved by a considerable proportion of the production.

Sulphur Dioxide.—The target for potato is 100 to 200 p.p.m. SO_2 and for cabbage 1,500 to 2,000 p.p.m. To provide working latitude, ranges of 50 to 300 p.p.m. for potato and 500 to 3,000 p.p.m. for cabbage are specified. As an example it can be stated that, during the 1944 potato season, about two-thirds of the production had an SO_2 content within the range 100 to 200 p.p.m.

Peroxidase.—A standard test, carried out on all samples, must give a negative result or show only minute traces of peroxidase. Methods of carrying out this test and also the sulphur dioxide determination are given in the Ministry Handbook.[4]

Blemish Count.—This has only been specified, up to date, for potato. The target is less than 10 blemishes (defects) in a sample of 50 g. of dried strip, but owing to circumstances a maximum of 15 blemishes per 50 g. has been fixed for the time being.

Bacteriological surveys of factories have been carried out by Ministry staff and many samples examined for bacteria.[3] As a result of this work, recommendations on plant hygiene are made to the factories, but bacteriological standards have not yet been fixed. The scalded product is found to be practically sterile, but some contamination, at times considerable, usually occurs on the cooler and tray-spreading apparatus. Special cleaning techniques for this part of the plant are being devised.

Similarly, a number of investigations have been made or are planned on vitamin retention in processing and drying, and vitamin assays are made from time to time, but again no specifications for vitamin content have been proposed. Late spring cabbage normally gives a dehydrated product containing 400-500 mgm. of ascorbic acid per 100 g., and summer and autumn cabbage a product containing 250-350 mgm. per 100 g.

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Dried Soup Powders

I. PRECOOKED

The soup powders described in this series of articles were developed for the purpose of feeding populations in emergency conditions. In Part I are discussed the composition, preparation, nutritive values, and storage properties of soup powders which require the mere addition of hot water to be ready for consumption. The soups are highly nutritious and form valuable emergency meals, or additions to the diet in circumstances where fresh vegetables are not obtainable.

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BRIEFLY described, dried soup powders are cooked *purées* of vegetables, with or without meat, dried on a roller drier. The powder so obtained is flavoured and subsequently packed in an inert gas—nitrogen.

There is nothing novel in preparing soup powders in this way. For example, Lake (1889)* describes the preparation of soups by this means. Lake's patent does not include gas-packing the product, but gas-packing was already in use for preserving dried foodstuffs long before the present war began. It is understood that some dried soup powders of American origin are prepared by drying on specially designed roller driers. What we have done is to study how best to produce a nutritious article, using only standard equipment, and to pack this material in the manner which gives the maximum retention of flavour and nutritive values.

The laboratory work began in 1940. Full-scale experimental work, under the supervision of the Ministry of Food, began in 1941, with the co-operation of two firms who possessed the necessary processing and drying equipment, and the experience required to convert the laboratory-scale project to the commercial scale.

Composition and Preparation

The soups are prepared as far as possible from fresh materials, the addition of dried or otherwise processed materials to the *purée* being kept to a minimum. Typical recipes for (*a*) a vegetable soup, and (*b*) a meat and vegetable soup, are given in Table 1.

Cooking is carried out in stainless steel kettles, heated by steam injection, and fitted with stirrers. The oatmeal and salt are added to a small quantity of water, which is then brought to the boil. The other ingredients are added in the following order: lean meat, fat, carrot, potato, cabbage, yeast extract, and pepper.

The pan is kept boiling (or above 80° C.) during the addition, since tests have shown that the slow heating up from the cold, which follows massive additions of vegetables, results in great destruction of ascorbic acid. The vegetables are cut into slices about $\frac{1}{2}$ inch thick. Any machine which cuts cleanly may be used for slicing, but it is essential to avoid undue chopping or tearing. Fine chopping leads to great losses of ascorbic acid—*e.g.*, a soup made from finely cut cabbage and potato contained only two-thirds of the ascorbic acid in one made from coarsely chopped material. Fine chopping of the potato also produces a soup powder which does not reconstitute properly. The reason for this has not been fully investigated, but it appears to be due to hydrolysis of the starch as a result of the chopping. The vegetables should be fed to the pan as soon as possible after the slicing; this is particularly important with the cabbage.

If a meat soup is being prepared, the meat is closely minced and then roasted in ovens; the addition of raw, or boiled, meat gives a soup with no perceptible meat flavour. If dried meat is used, it is mixed to a stiff paste with water before roasting.

TABLE 1.

WEIGHTS OF PREPARED, CLEANED INGREDIENTS REQUIRED TO PRODUCE ONE TON OF PURÉE.

Ingredient.	*Weight (lb.)*	
	Vegetable Soup.	*Meat and Vegetable Soup.*
Lean beef ..	—	320
Fat	25½	55
Potato	920	650
Carrot	460	350
Cabbage ..	230	192
Oatmeal ..	44	43
Yeast extract* ..	17½	13
Salt	17½	17
Pepper	¾	½

* With at least 400 I.U. of vitamin B_1 per ounce.

* *British Patent No. 3409.* Merrell-Soule Co., New York.

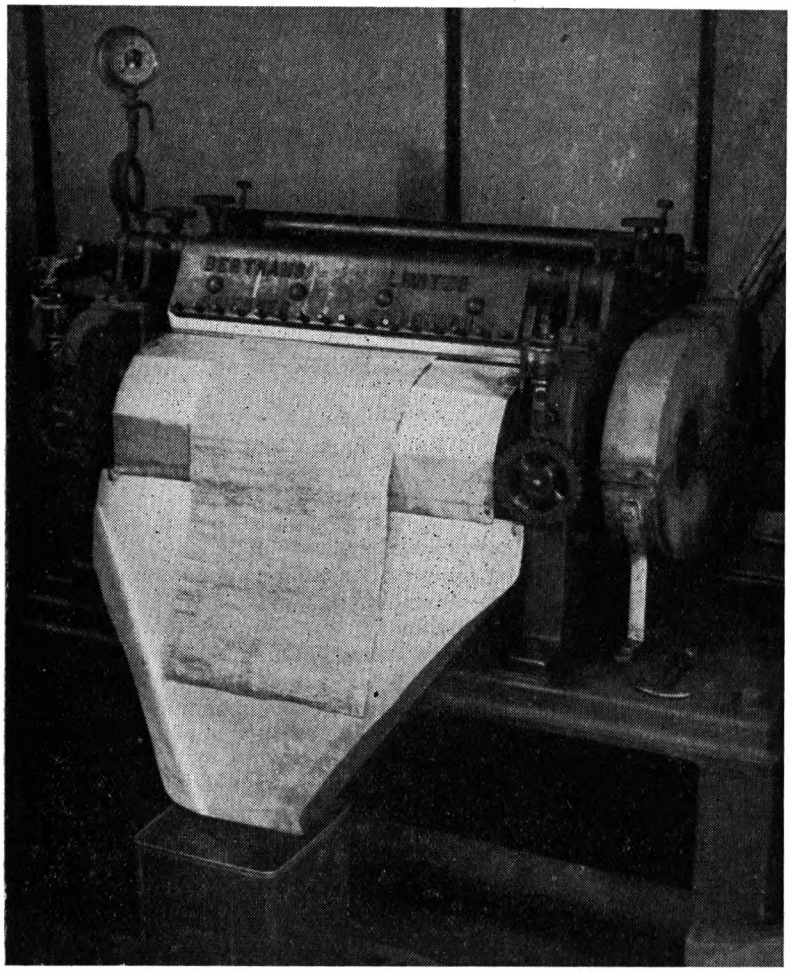

Fig. 1.—Laboratory model roller drier, with drums 2 ft. long shown with aprons fitted to lead film away from roller surface. This model is fitted with adjustable dams to restrict length of rollers in use: note film width indicating that half the total length is being used.

The batch is next passed through a peg-mill (of the Kek type) to break it down into a smooth *purée*, and is dropped into a heated storage tank, where it is held at a temperature not less than 70° C. (to guard against bacterial spoilage). From this tank it is pumped to the spray pipe of the drier.

The Drying Operation

The driers are the ordinary twin-drum machines used for drying milk, but the speed of rotation must be very considerably reduced from the normal 15 r.p.m. down to about 2 to 4½ r.p.m., depending on the size of the drums. Sixty-inch machines may be run at the higher speed, but larger machines must be run more slowly. The steam pressure used is about 45 lb./square inch. It has been found essential to keep the surfaces of the drums in good condition; severe pitting or scoring leads to burning of the film, and irregular drying. Certain types of roller drier need modification to the knife position. Thus, Milne machines dry soup best if the knives are lowered until the edges are horizontal to the axes of the drums. On machines which dry satisfactorily with the knives in the usual high position it is necessary to fit smooth metal aprons to lead the film from the knife edge steeply down into the collecting bins (see Figure 1). If aprons are not fitted, the falling dry film adheres to the rising, drying film, and is carried back to the knife edge, where it rolls up in wet "sticks."

Under the conditions described above, the rate of drying is about 5 cwt. of *purée* per hour on a 60-inch machine, or 10 cwt. per hour on an 80-inch machine. The equivalent yields of powder are 90 and 180 to 200 lb. respectively.

The dried soup forms a good film, with a water content of about 6 to 8 per cent. Since the storage life is improved by reducing the water content, the powder is sieved and dried in a cabinet drier to about 4 per cent. water content.

Composition and Drying Properties

The recipes quoted give soups which dry well. Certain variations in the quantities of the various ingredients are tolerable, and it is possible to include other ingredients, such as swedes or soya flour

(which may replace some of the meat), but experience has shown that there is not much latitude in the amount of fat which should be present. About 5 per cent. of fat (measured on the dry weight of the powder) must be included, to assist the doctor knives to part the film from the rollers. While it is desirable to increase the fat content to as high a value as possible, in order to give a high calorific value to the soup, the limit is set by two considerations; the first is palatability, and the second is the need to prevent the fat separating out from the *purée* while drying. If the fat exceeds about 10 per cent. on the vegetable soup formula, the soup is rather greasy to the palate; the aim is to produce a vegetable soup powder with about 8 per cent. of fat. More fat can be tolerated in a meat and vegetable soup than in a plain vegetable soup, but if in excess of about 20 per cent. (on dry weight) it tends to separate in the trough of the rollers; 15 per cent. is about the optimum value for the fat content of a meat and vegetable soup.

The presence of the oatmeal greatly assists in preventing separation of the fat while drying, and in thickening the reconstituted soup.

The production of a good film by the drier depends on the potato content of the *purée*. Since the potato is a cheap and nutritionally valuable ingredient, we have not attempted to reduce the amount very greatly, but a soup containing two-thirds of the amount of potato given in Table 1 dries well.

The carrots are included in order to increase the vitamin A content of the powder, and to improve flavour; the effect of large increases in carrot content has not been investigated.

Cabbage is added to improve flavour and as a source of vitamin C, but if the fresh cabbage is very rank an excess may introduce undesirable flavours. One of the reasons why the surface of the rollers should be kept in good condition, and the steam pressure kept as low as possible, is that cabbage scorches very readily, and in the presence of fat gives a most objectionable "bubble-and-squeak" flavour.

If the temperature conditions mentioned above are observed, there can be no fermentation of the soup before drying, with attendant production of undesirable substances. Observations have shown that the powder obtained from the driers is practically sterile.

Flavouring and Colouring

The soup powder as it comes from the driers has a good, clean, vegetable, or meat and vegetable flavour, but lacks piquancy. The problem is to introduce distinctive flavours without bacterial contamination of the product. The best and cleanest method of flavouring the soup is by the addition of essential oils, such as mint and thyme oils for vegetable soup, and pimento and clove oils for meat and vegetable. Very small quantities are needed (only 0·001 per cent. for strong oils). To obtain uniformity various carriers or diluents have been proposed—*e.g.*, propylene glycol—but the safest and cheapest is water. Water emulsions of the oils containing permissible emulsifying agents—*e.g.*, aged aluminium hydroxide—are sprayed into the powder in a mixing machine. This does not increase the water content of the powder by more than 0·1 to 0·2 per cent.

The soup powder normally has a light buff colour, but the colour may be changed by adding edible colour material, either before or after drying. None of many edible colours so far used affected the storage properties of the powder.

The powder does not store well in air (see section on "Storage" below). It has therefore been packed in commercial nitrogen in "6-ounce," 1 gallon, and rectangular 4-gallon tins. This gas-pack contains about 0·5 to 0·7 per cent. oxygen.

The packages mentioned above hold 2½ ounces, 4½ lb., and 18 lb. of soup powder respectively. These quantities are equivalent to 1 pint, 30 pints, and 120 pints of soup containing 12 per cent. solids. All that needs to be done to reconstitute the powder is to add it slowly to the requisite amount of hot or boiling water, stirring quickly all the time. The resultant soup is quite thick, making a satisfactory meal by itself. Addition of water to the powder is to be avoided; this results in the formation of lumps.

Nutritional Properties

The soup powder is a valuable foodstuff, a half-pint portion of the reconstituted soup making a substantial contribution to the daily requirements of vitamins A, B_1, and C, and adding useful amounts of protein and fat. Typical analyses of the powders are given in Table 2.

TABLE 2

ANALYSES OF SOUP POWDER.

Type.	*Protein.*	*Fat.*	*Carbo-hydrate.*	*Fibre.*	*Calories per 100 g. Powder.*
	(*g. per 100 g. Powder.*)				
Vegetable ..	11	7	68	5	400
Meat and Vegetable ..	24	17	48	4	450

The vitamin contents depend on the amounts present in the fresh materials, and vary with the season of the year. It has been shown that the dry powder retains most of the vitamins A and B_1 of the fresh ingredients, and about 60 per cent. of the ascorbic acid. Most of the loss of ascorbic acid takes place during preparation of the vegetables and in cooking. Minimal values for vitamin content are, per 100 g. powder: 40 mg. ascorbic acid, 7,500 I.U. carotene, and 150 I.U. of B_1.

There is no loss of vitamin C on reconstitution of the soup, and none is lost if it is kept hot for an hour or so. Losses during storage are dealt with below.

Storage

The evaluation of the storage life of the powder involves the consideration of two factors—palatability and retention of vitamin content. The former is of major importance, since it is loss of palatability which ultimately determines the storage life. This is simple to estimate by means of consumer-reaction tests. Reliable estimations of vitamin contents by chemical methods are not easy because of the proved or, in the case of thiamin, suspected presence of interfering substances. In the case of ascorbic acid these are difficult to eliminate, but with carotene they are fairly easily removed. Biological assay of ascorbic acid is difficult because guinea-pigs will not ingest sufficient of the soup, either dry or reconstituted. The difficulties involved in the chemical estimation of ascorbic acid in dehydrated foods have been pointed out in papers by Mapson and his colleagues (*J.S.C.I.*, 1943, **62**, 223; *Nature*, 1943, **151**, 222). The earlier estimations were made by direct titration against indophenol, and may have given values which were too high. For these reasons we cannot give exact figures for changes in vitamin contents on storage of the soup powder, but it is possible to indicate broadly the changes which occur.

Vitamin B_1 is simply dealt with, since it appears to be stable throughout the range of temperatures (15° C. to 37° C.) and moisture contents (3 per cent. to 8 per cent.) used.

In air the loss of ascorbic acid is rapid at 37° C. and 8 per cent. moisture content, the rate of loss falling with reduction in moisture content and reduction in temperature. Thus at 37° C. and 8 per cent. moisture content two-thirds of the ascorbic acid is lost in one month, whereas at 3 per cent. moisture content and 37° C. the loss in one month is negligible. At 15° C. the corresponding losses are one-third and none. In the absence of oxygen the rate of loss is considerably diminished. Thus in nitrogen at 37° C. and 8 per cent. moisture content the loss in two months is only 28 per cent. (*cf.* 67 per cent. loss in air in one month).

In the absence of oxygen there is practically complete retention of carotene. Observations on gas-packed soup powder indicate that moisture content and temperature (in the range 15° to 37° C.) are without effect. In air packs the loss of carotene is very rapid at all moisture contents, approximately half being lost after six months at 15° C. and after two months at 37° C.

From the aspect of palatability the behaviour of the powder on storage is indicated in Table 3. The two easily distinguishable types of deterioration which occur are the development of (*a*) a burnt flavour due to caramelisation of the carbohydrates and (*b*) "off" flavours derived from the carrot.

The relationship between moisture content, temperature, and rate of development of the burnt flavour is clearly shown in the table. This rate is increased by rise in temperature and by increase in moisture content. There appears, however, to be a critical moisture content round about 3 per cent. below which caramelisation occurs only very slowly even at 37° C. Packing in an inert gas does not affect the rate of caramelisation.

Unlike caramelisation, the appearance of "off" flavours derived from the carrot is largely dependent on the presence of oxygen in the pack, and their development appears to be accelerated by those conditions which retard caramelisation—*i.e.*, low moisture content and low temperature. This is true, though to a less degree, even for the gas-packed powder. As a result of this effect there appear to be optimum moisture contents for maximum storage life, varying with the temperature of storage. At 15° C. the optimum content is about 5 per cent., at 28° C. about 4 per cent., and at 37° C. about 3 per cent. At moisture contents of 6 per cent. and over it is caramelisation which first renders the soup unpalatable, but at moisture contents of 4 per cent.

TABLE 3

STORAGE PROPERTIES OF ROLLER-DRIED MEAT AND VEGETABLE SOUP POWDER

Moisture Content of Powder. (Per Cent.)	*Type of Pack.*	*Time Elapsing before the Development of Objectionable "Off" or Burnt Flavours. (Months.)*					
		"Off" Flavours.			*Burnt Flavours.*		
		15° C.	*28° C.*	*37° C.*	*15° C.*	*28° C.*	*37° C.*
8	Air	7	5	4	9	3	1½
	Nitrogen	>18	*	*			
6	Air	7	5	4	9	5	2
	Nitrogen	>18	*	*			
5	Air	4	5	4	18	12	3
	Nitrogen	>18	>18	*			
4	Air	2	4	4	>18	>18	5
	Nitrogen	18	18	*			
3	Air	1	3	3	>18	>18	>18
	Nitrogen	15	15	18			

* "Off" flavours undetectable in presence of very strong burnt flavours.

and under the "off" flavours from the carrot are responsible for loss of palatability.

Under the optimum storage conditions for each temperature the powder has been kept in the laboratory for eighteen months at 15°, eighteen months at 28°, and fifteen months at 37°, with very little loss of palatability. Commercial gas-packs of the powder have been examined after storage in the Mediterranean zone for almost two years and they were found to be still in good condition.

The original intention of the work described above was to produce an emergency food which could be prepared merely by the addition of hot water without the necessity of any cooking or even of bringing to the boil. If used in the household in the ordinary way, bringing to the boil would not essentially impair its advantages as a quick precooked ready-to-use foodstuff, and when used in the household other dried powders, extracts, and flavouring substances can be added to give variety —*e.g.*, separated milk powder improves the flavour and imparts more creamy texture to the reconstituted soup; 12½ per cent. by weight is the optimum addition.

If it is desired to reduce the price of the soup, roller-dried potato flour or soya-bean flour may be added when it is prepared. Such additions may, of course, be made by the manufacturer, but they have the disadvantage from his point of view that their inclusion always raises the difficulty of introducing bacterial contamination and thus reducing the quality of his product in so far as approximate sterility is concerned.

Summary

1. The precooked dried soup powder is prepared by:

   (*a*) Cooking together fresh vegetables and meat.
   (*b*) Converting the cooked mixture into a *purée*, and
   (*c*) Drying this *purée* on roller driers.

2. To the powder so obtained may be added flavouring agents and edible colours.

3. The powder retains most of the vitamins A and B_1 present in the fresh ingredients, together with about 60 per cent. of the vitamin C.

4. The powder, packed in nitrogen, has a storage life of about a year and a half at ordinary temperatures, and about a year at tropical temperatures.

5. Soup is readily prepared from the powder by addition to hot water.

The authors wish to acknowledge the assistance received in this work from Messrs. Nestlé's Milk Products, Ltd., and the Wilts United Dairies, Ltd., at whose factories the large-scale experimental work was carried out. The small-scale work was facilitated by the loan of a laboratory model roller drier by Bertrams, Ltd., Edinburgh. The vitamin assays were made by Mr. A. Ward, Miss N. A. Potter, and Mrs. A. M. Worden. The article is published by permission of the Department of Scientific and Industrial Research and the Dehydration Division, Ministry of Food.

Dehydration Division, Ministry of Food.
Low Temperature Research Station, Cambridge.
Dunn Nutritional Laboratory, Cambridge.
Wilts United Dairies, Ltd.

Meat Dehydration Research

REGARDED as an outstanding technological achievement in the food field, the development of successful methods for the dehydration of meat has been reported upon in Circular No. 706, U.S. Department of Agriculture. Besides dealing primarily with processes of dehydration, the investigation included studies of packaging, storage, chemical and bacteriological changes, compressibility, rehydration, and the nutritive value and palatability of the products.

Eight methods of dehydration, embodying mechanical features that had proved to be successful with other products, were tested. Special attention was given to adaptations that would make the methods most suitable for meat. The investigators also designed new equipment. The experimental work involved many combinations of equipment, conditions, and procedures.

Of the various processes studied, the vacuum rotary gave indications of combining the most good points. It derives the name from the vacuum principle, used to accomplish the drying in a minimum of air, and from rotary agitation of the meat in a steam-jacketed cylinder. Meat processed by this method had good rehydration capacity, thiamine retention, palatability, and keeping quality, and had other desirable characteristics. The vacuum rotary process, moreover, is simple, combining both precooking and drying in one machine. However, other processes such as the kettle air rotary, the kettle cabinet (which may be considered as representing also the kettle tunnel process), the drum air flotation, and the freezing cabinet process excelled with respect to rate of drying, continuity of operation, palatability of freshly dehydrated product, or otherwise.

Control over processing temperatures and the oxidising influence of air was found to be an important aid to successful dehydration. Dehydrated raw meat, as removed from the drier, appeared to be generally a better product than dehydrated cooked meat but presented a problem in keeping quality requiring further study.

High stability in dehydrated meat, signifying resistance to the development of rancidity, is desirable for three principal reasons: to ensure flavour, vitamin content, and longer storage life. The experimental data indicate that dehydrated meat that is rated high in palatability by a panel of well-trained judges will rate well in stability.

Tests on oxidation and rancidity showed the importance of using, for dehydration, fresh meat that had not been aged. Meat may be fully acceptable for table use and yet be unsuitable for dehydration because of

previous action by enzymes or exposure to oxidation by air. Conditions of processing, packaging, and storing that reduce exposure to air are helpful in obtaining good keeping quality. The use of small quantities of gum guaiac as an anti-oxidant improved the keeping quality of dehydrated meat.

Studies of packaging and storage showed that metal cans were the best containers for dehydrated meats and kept them in satisfactory condition for long periods.

The most satisfactory substitute for cans was the envelope-type, lead-foil bag.

Dehydrated meats canned by the vacuum pack process retained their palatability slightly better than those canned in an atmosphere of nitrogen. Nitrogen-pack products, in turn, were slightly better than air pack meat. Low storage temperatures aided in retaining palatability of canned dehydrated meats, the ratings being based on appearance, odour, flavour, and texture. Package requirements for meat of high stability need not be so stringent as for meat of low stability.

Compressing dehydrated meat makes it more compact and, by forcing out air, reduces oxidation and contributes to the prevention of rancidity. Compressing at a moderately high temperature prior to packaging is a promising way of removing excess fat.

When meat in fresh condition is properly dehydrated to a moisture content of 10 per cent. or less and packed in hermetically sealed metal cans, it is a safe food from the bacteriological point of view. Under conditions unfavourable to the growth of moulds in dehydrated meat there is slight opportunity for bacteria to develop, but reconstituted meats, unless refrigerated, should be eaten promptly, since they are a good medium for the development of bacteria. Thorough cooking of reconstituted meats is desirable.

Several processes of dehydration provide opportunities for controlling the proportions of protein, fat, and ash, as well as of moisture, in the resulting products. Any step resulting in decrease in fat content is generally accompanied with an increase in protein and ash, and *vice versa*.

The capacity of dehydrated meat to absorb and hold moisture to a degree approaching its original condition is aided by a high protein content, minimum coagulation (denaturation) of the protein in the processing, and fine grinding. To ensure meat of good dehydration quality, the dehydration process should be one that will not harden the surfaces of the meat particles.

The protein of dehydrated pork, beef, and mutton, as determined by rat-feeding tests, was of relatively high growth-promoting value and digestibility.

The content of vitamins in dehydrated meat varied widely. Thiamine content was most affected by the dehydration process. Losses in riboflavin and nicotinic acid were relatively small. The inclusion of anti-oxidants during processing resulted in better retention of the vitamins. Thiamine in the dehydrated product was greatly affected by storage, the loss being nearly 100 per cent. after storage for eight weeks at 110° F.

Tests of the palatability of meat reconstituted, without seasoning, immediately after dehydration showed that a precooking temperature of 165° F. gave a more acceptable product than precooking at 212°; but the meat precooked at the higher temperature retained its palatability somewhat better in storage.

The flavour of dehydrated meat was not so pronounced as that of fresh meat.—*Through National Provisioner.*

Correspondence

The Future of Dehydration

TO THE EDITOR OF FOOD MANUFACTURE

DEAR SIR,—My interest in what has come to be known as "dehydration" is based on the peacetime values of the process concerned, though, of course, like many others, my company has done what it has been permitted to do in co-operation with the Ministry of Food in its emergency use of the process for special wartime purposes.

The question which I find springs to most minds is whether vegetable drying (or dehydration) will continue after the War on its present scale, or indeed upon any scale at all. Doubtless many of the enquirers have it in their minds that a similar wartime development during the last war failed to hold its own under conditions of peace, with the result that by the mid-1920's every single unit of that previous programme had fallen out because of the general inability to compete in either quality or price with a sufficiency of supplies of good fresh produce. The same experience, with one or two minor exceptions, occurred in Canada and the United States of America.

The answer to the question, however, need not necessarily be the same, and it must be divided into two parts. Here, in England, between 1934 and 1939 it was quite definitely established that a quick process of economic drying, applied to a surplus of any given vegetable, was not only economic but also essential from the point of view of stable marketing of the crop, and an organisation capable of handling about 100,000 tons of such surplus per annum was agreed as far back as 1938 for peacetime requirements. We may take it that, subject to the economy of the process (which must be very cheap), the allocation of the units (which must lie in the surplus areas so as to limit strictly costs of intake transport), this part of vegetable drying will continue. Indeed, as I have said, it existed before the War, and while the process and the factories concerned have been used by the Ministry of Food during the War, this part of the total service remains very little—if at all—altered by the emergency programme, and there is every reason to suppose that it will resume its useful pre-war function in the not-too-distant future. This process allied to surplus does not yield a finished product which competes with fresh vegetables as such.

The second part of the question contains the real query. The Ministry of Food's work in dehydration has been largely devoted to what we know as strip-drying—that is, the production of strips of a given vegetable which must be so carefully prepared and so kindly treated in process that the finished product *will re-take its water* and may be used as *direct replacement* of the same vegetable with which such a product would naturally compete. It is not a job of surplus disposal; on the contrary, it would only alter the form of demand since the consumers would be the same. It is a process of drying which, under peacetime conditions, has never yet succeeded in competing on the question of cost. It is a wartime need, by which the Government has, without much regard for expense, reduced the weight and/or bulk of the vegetables which they wish to send to the troops in various

parts of the world, and it follows that a product is obtained which has enabled the Service men to get some vegetables when otherwise they might have had none at all.

Now, whether this process (upon which the Ministry of Food has concentrated with the result that we now have a number of factories with quite a reasonably substantial production) can continue when the Services demand ceases is the real issue before us. It is, I think, first, a question of production cost and quality; secondly, a question of public inclination, convenience and saving in labour, and sooner or later national policy must be considered; thirdly, it is a question of the relative suitability for the consumer demand of (*a*) quick-freeze products, (*b*) canned products, as compared with (*c*) dehydrated products. Putting it another way, I feel that before we can be sure of a continuance of post-war dehydration for *direct* consumption, it is first necessary to be certain that production cost *allows* it; secondly, that quality does not *obstruct* it; thirdly, that national policy and consumer alike *approve* it; and finally, that quick-freeze and canning do not in fact on one or another of all of these counts beat it to the winning post of consumer demand.

It is early yet to say too much about production costs. At their present level they seem to me to be much too high, but there may be ways of reducing them. Quality is undoubtedly good, but comparing the finished product with, for example, quick-freeze goods or canned goods we have still to await the views of the public as to which they will finally prefer. I cannot help feeling, too, that we will all be wise to bear in mind that dehydration does mean the taking of the vegetables in, say, Lincolnshire, and using coal and labour to remove the water before transportation to, say, London, where the water is added back and approximately the same quantity of coal used by the housewife or restaurant *chef* in the re-constitution and cooking as would have been used in preparing the natural produce.

This last is not a point in my view to be lightly dismissed. The consumer demand of vegetables (including potatoes) runs into several millions of tons per annum. If we suppose that the time might come when even only one million tons would be expected by the public in dried form rather than in fresh, wet form, we have to allow for approximately one million tons of coal for all purposes (heat, light, power), and on present experience something in the region of 200,000 men and/or women as *extra costs*—that is, *extra* usage of our national assets over and above what is used in the handling and normal cooking of fresh vegetable produce. It seems to me only common sense that sooner or later a national point of view, considering whether it is right in the broadest sense to use these assets for this purpose, may have to play a part in the ultimate decision which is as yet so difficult to foresee, and any progress we can make in the way of reduction of costs—measured by usage of either coal, manpower or money—is bound to be a great step in favour of the possibility of at least partial continuance of vegetable drying for direct consumption after the War.

Yours faithfully,

ROBERT A. TEMPLETON,
Managing Director,
The Farmers' Marketing and Supply Co., Ltd.

Two Books for Millers

It is exceptional for two books of direct interest to the milling industry to appear almost simultaneously, particularly when they are by the same author. Within the last few months a second edition of J. F. Lockwood's *Provender Milling* (Liverpool, 15s. net) has been published and also a new book called *Flour Milling* (Liverpool, 25s. net) has appeared by the same author.

These are both technical works with an interest chiefly confined to the flour and provender milling industries, but there are chapters and features in the two books that will prove of value and interest to other sections of industry, particularly food manufacture. The discussions on the control of pests, of temperature and humidity, of packing, storage, and loading, and of exhaust systems, to mention only a few, are not restricted in interest to the flour or provender miller, but must appeal to all food manufacturers.

Mr. Lockwood's knowledge and experience of and in the flour milling industry are well known. Apart from being one of those directing an important milling engineering company he has made many international contacts and accumulated a store of knowledge which he is now generously bestowing upon the milling industry. In the Foreword to *Flour Milling*, Sir Ernest Simon says: "It is unusual for a firm to publish the scientific knowledge that forms the basis of its success, but we have decided to do so both in our own and in the public interest." It augurs well for the flour milling industry that the head of one of the leading firms in the field of milling engineering should express such sentiments. Much general information has been, in the past, hidden under the bushels of jealousy and the fear of competition—information that could easily have been made available to all concerned. It is good to see that a firm such as Henry Simon, Limited, has decided to open its coffers of information, accumulated during a long period of hard work and effort, and to distribute the proceeds so freely and generously to the milling industry.

Provender Milling is a reprint of the first edition published in January, 1939. The author states that "the war has prevented any major developments in technique and it has, therefore, been decided to reprint the book in its original form except for a few minor alterations and corrections." There has been a great demand for the book and the appearance of this second edition will be welcomed. Provender milling can no longer be regarded as the Cinderella of the flour milling industry. It has assumed a definite entity of its own. "Balanced rations" is now a commonplace term and to-day animal feeding is understood as a psychological operation of the utmost importance to human feeding; the day of the barn door fowl and the promiscuous root-seeking pig is over. We now must regard the feeding of our livestock as of supreme importance to our well-being and health in addition to the contentment of the animals.

Provender Milling comprises thirty-five chapters divided into three main sections—raw materials, machinery, and manufacturing processes. In a book of this type the arrangement is difficult and Mr.

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Technical Advances in the Production of Dried Egg

F. C. BATE-SMITH and J. R. HAWTHORNE
Low Temperature Research Station, Cambridge.

THREE years' experience has given users in this country a sufficient opportunity of forming an impression of the virtues and limitations of spray-dried whole egg, or at least of the representative form of the product which has been available. A similar period of large-scale production has also widened the experience of manufacturers and technicians in the producing countries and of scientists in this country concerned with quality control, enabling an impression to be formed of the potentialities for improvement when conditions of production and distribution return to normal.

Storage Life of Dried Foods

It is now well recognised that dried foods are not necessarily indefinitely durable, merely because they are "dry" and therefore immune from attack by micro-organisms. Full-cream dried milk is well known to possess a limited storage life on account of oxidation of the fat by atmospheric oxygen, with the production of tallowy off-flavour. Dried egg also will deteriorate in the same way, but a more rapid and extensive change occurs during storage which is unconnected with oxidation and leads to the characteristic stale off-flavour difficult to describe in brief terms; perhaps the best description is "cardboardy." Fresh spray-dried egg, when carefully prepared, is entirely free from off-flavour of any sort.

Spray-dried egg of good flavour finds many uses in the household in which it can replace shell eggs sufficiently well, and some in which it replaces them perfectly.

Intensive work has been going on in many countries to discover how imperfections can be remedied, and an account of this work, in so far as it may be published at present, will be attempted. First, however, something must be said of the methods which have been devised for studying the product and evaluating its quality.

Methods of Examination and Correlation of their Results

The evaluation of the most important quality of any foodstuff, its flavour, can only be done in the first place by actual tasting, and until the reliability of a single trained taster has been demonstrated, the consensus of opinion of a number of tasters has to be secured. The system suggested by Bate-Smith, Brooks, and Hawthorne,[1] employing a panel of not less than four, and preferably five or six tasters, has been generally adopted both here and in the producing countries. In this system a range of 8 marks for a sample with perfectly fresh flavour to 0 for one which is so repulsive as to be inedible is divided into unit steps, each representing a clearly recognisable difference in intensity of off-flavour from the ones immediately above and below it. Experience has shown that these steps progress more or less logarithmically with increasing intensity of off-flavour, as would be expected in conformity with the Weber-Fechner law.

Along with the deterioration in flavour that takes place during storage, it has been observed that the solubility of the egg powder in salt solution increases,[1] and the fluorescence of an aqueous extract[2] or of the dry powder[3] increases. These changes are intimately and quantitatively connected with the change in flavour, so much so that for many samples it is possible to equate flavour score reasonably accurately with a function of solubility and fluorescence.[3] These physical changes are now known to be largely due to the presence in egg of a small percentage of glucose.[4, 5] During storage of the dried egg glucose gradually disappears, and it is not surprising, therefore, that there is a close correlation between flavour score and the glucose content of the powder.[6] This relation holds sufficiently well even though the loss of glucose is due to fermentation of the liquid egg before drying (resulting in a powder with a sour taste), or from a combination of the two causes, though a still better correlation would be expected if the two types of deterioration could be taken separately into account. This is possible since fermentation of the pulp usually produces acid, which can be determined by titration. The result of these recent advances is that the checking of quality primarily by physical and chemical means instead of by the tedious and always debatable method of the taste panel is well in sight.

Possible Means of Improving Quality

The first step that comes to mind is the production of powder of low moisture content. It is well known that the rate of deterioration in storage decreases progressively with decrease in moisture, but there are two considerable difficulties in the way of exploiting this knowledge. The first is to produce

powder of low moisture content without scorching it or adding uneconomically to the costs of drying. The second is to keep the powder dry when prepared. Under the average conditions of storage in this country (say, 40 to 60 per cent. R.H.), dried egg will reach equilibrium at about 6 to 8 per cent. of moisture. Powder prepared with 5 per cent. moisture will therefore need comparatively little protection against subsequent uptake of moisture. A package offering resistance to temporary conditions of high humidity will suffice. The situation is very different when it is required to keep the moisture content below 2 per cent. A sealed metal container is then the only form of package which will provide the necessary resistance to moisture uptake.

Although full details of preparation are not yet available, it is known that dried egg of only 2 per cent. moisture is being made in the United States for army requirements.[7] To produce powder with this low moisture content in a single operation would, it might be thought, entail a considerable risk of scorching, but it is possible to avoid this in some types of plant by pre-heating the pulp, immediately prior to atomising, to as high a temperature as is possible without coagulating the proteins.

Incidentally, the pre-heating of the pulp amounts to pasteurisation, a treatment which can but be beneficial in lowering the number of micro-organisms in the final product. It is reassuring to learn that this process can be carried out on a commercial scale with material so sensitive to heat as liquid whole egg without affecting its flavour or solubility.

Judging from what has been written on the subject in the technical journals during the past few years, the question of hygiene in the breaking and drying plants has been number one priority with the responsible authorities and the managements in the producing countries. As a result, the necessary hygienic conditions are thoroughly established and the occurrence of powder spoiled through fermentation or putrefaction of the pulp is rare indeed. Subsequent pasteurisation is useless, of course, in making good damage which may have been caused by the unrestrained activity of bacteria.

Controlled Fermentation

Nevertheless, controlled fermentation with selected organisms may be a useful tool in the improvement of dried whole egg. It has already been mentioned that glucose naturally present in the egg is associated with, if not responsible for, many of the deteriorative changes which take place in the dried product. The removal of some or all of this glucose has a marked effect on the stability of the powder. Removal was effected by Hawthorne and Brooks[4] by use of yeast, in which case acid was not produced and little change in *pH* was noted. Stewart *et al.*[5] fermented with a species of Pseudomonas isolated from commercial liquid egg which produced acid and caused a reduction in *p*H. An almost equal improvement in keeping quality, so far as solubility (but not fluorescence) is concerned, could be brought about by an equivalent addition of acid, and it may well be that careful adjustment of *p*H by addition of a suitable acid can be employed as a protection against loss of solubility during storage.

A vigorous search is also being made for means of inhibiting the "glucose reaction" other than by fermentative removal. One method of doing so is by adding a fairly large amount of sucrose or lactose to the pulp before drying.[8] This has the disadvantage, of course, that the resulting powder can only be used for sweet products, but the "sugar-dried" egg has the additional supreme advantage for baking uses of possessing all, or nearly all, the aerating properties of the original fresh egg. A few other substances have been found which, when added to the pulp before drying, protect the dried egg against deterioration (specifically loss of solubility) during storage, but they are hardly commercial practicabilities. Among these are glycine and alanine, added at the rate of 1 per cent. to the pulp.

With spray-dried egg of the moisture content to which we are accustomed, oxidation is only of secondary importance. If, as may well happen, highly stabilised powders come into commerce in the future, oxidation may yet prove to be a limiting factor in storage. The simplest way to deal with this problem, especially if the powder has in any case to be carefully protected against uptake of moisture, is to pack in metal in inert gas or vacuum. There is evidence, however, that significant oxidation takes place even in pure nitrogen, possibly as a result of previous loose combination between constituents of the egg and oxygen. According to Brooks,[9] oxidation in presence of air can be retarded by adding a very small amount of cysteine to the pulp before drying, and it is likely that cysteine would prevent the small drop in flavour observed in the gas-packed powder.

To summarise at this stage, the results of recent scientific work suggest that in the future the following changes may be effected in spray drying eggs.

1. Drying to low moisture (not more than 2 per cent.)
2. Packing in gas-tight tins in inert gas or vacuum.
3. Addition of substances to the pulp before drying to prevent denaturation and oxidation in the powder during storage.
4. Controlled fermentation of the pulp prior to drying.
5. Pasteurisation of pulp.

Colour

Although of secondary importance to flavour, colour is a character to which some attention could profitably be paid in the production of dried egg. The main contributory factor is the colour of the yolk, and this can be predetermined within very

wide limits by controlling the feed. The pigment of feeding stuffs which find their way into the yolk are mostly of a carotenoid nature. When the content of such pigments in the feed is low the dried egg is pale and has a pinkish tinge. Maize in the feed produces yolks of a rich, deep yellow due to its providing zeaxanthin.

Whether highly coloured or pale, dried egg becomes dark and dull in colour during storage, especially at high temperature. This change is also due to the "glucose reaction" mentioned previously and is much retarded by removal of the glucose before drying, or to some extent by addition of lactose.[8]

In evaluating the colour of dried egg, two considerations need to be borne in mind. Firstly, the facilities available to those who will want to evaluate the product, and secondly the uses to which the egg is put in which colour is important. In the latter connection the appearance of the dry powder may not be the best guide to its colour value, and the colour of, for instance, a fat solvent extract might be a truer guide. However, this field has been little explored as yet, and until this has been done the colour of the powder is likely to be a sufficient indication of its colouring value for most purposes.

For the evaluation of colour in commercial practice a colour chart is suggested. Such a chart, comprising a range of fifteen slips of varying depths of natural and deteriorated colour, has been used in this laboratory for some years, and its wider distribution in a revised form is under consideration.

In the laboratory the colour of such materials as dried egg would be determined by analysing the reflected light in terms of the trichromatic co-efficients according to the convention adopted by the International Commission on Illumination, and these colour charts are regarded as a convenient substitute for this determination when the necessary instruments are not available.

New Types of Dried Egg

(1) *Sugar-dried Egg.* The production of this product has been undergoing trial on a commercial scale for some time, and limited quantities may shortly be available to the baking trade. In the laboratory experiments 10 or 15 per cent. of sugar was added to the pulp,[8] but these amounts represent awkward fractions of the finished product, and would make the recalculation of formulæ a complicated problem for the baker. Production, therefore, now aims at a product having egg solids to sugar exactly in the ratio of 2 to 1, which, for a pulp having 27 per cent. solids, would mean $13\frac{1}{2}$ per cent. sugar added to it. The difference in effectiveness between 15 per cent. and $13\frac{1}{2}$ per cent. of sugar should not be marked.

There is ample evidence, both from the laboratory and the bakery, to show that in aerating power for sponge cakes this product falls very little short of fresh or frozen egg, even after several months' storage and a journey through the tropics. If full-scale commercial production proves equally successful, this product should find a ready market after the war.

(2) *Dehydrated Cooked Egg.* For purposes which can readily be imagined, an egg product was sought which would be attractive when eaten dry, and would be stable under moist and possibly very hot conditions, although wrapped only in waxed papers or films. Ordinary spray-dried egg would not conform to these requirements, but it was found that when egg pulp was coagulated by heat, minced, spread on trays, and dehydrated in a current of warm air in a cabinet drier the product had some of the properties looked for.[10] It was of a crisp, nutty consistency, rather browner in colour than spray-dried egg, and having a pleasant cooked egg flavour. Dried cooked egg is exceptionally stable during storage and especially so compared with ordinary dried egg at high temperatures. Apart from the use for which it was designed, this product appears to have possibilities in commerce, not merely on account of its undeniably high nutritive value, but also from its good keeping qualities and intrinsic attractiveness. The uses envisaged for it in compact diets for services' and other expeditionary purposes were: compressed or moulded together with sugar and dried milk; as a sweet egg block; flavoured with cheese in a savoury block; and baked in a sweet biscuit. In all of these the nutty grains are a considerable and unusual attraction. Similar items might find an outlet in ordinary civilian use. Other obvious possibilities for an egg product of this sort are as a component of breakfast foods and pudding mixes. In the latter instance the binding properties of uncooked egg could not, of course, be looked for, but the extra stability of the cooked product would be an asset when distributing it mixed with cereal in non-metal packages.

(3) *Mixed Egg and Milk Products.* Finally, the possible advantage of drying egg and milk or milk products together should be touched upon. The technical indications of such an advantage have already been mentioned in connexion with the stabilising effect of sugars on dried egg during storage. Experiments in which 10 per cent. of dried whey (which contains 70 per cent. of lactose) was added to pulp before spray drying are quoted by Brooks and Hawthorne.[8] The protective effect of the dried whey was of the same order as that of 10 per cent. of lactose. The uses of such products might again be in the bakery or in prepared pudding mixes and the like.

It is clear that the technical advances in the drying of egg are by no means exhausted. Little mention has been made of methods other than spray-drying, since in the years under review the spray-dried product has monopolised the technical

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Rations for R.A.F. Polar Flights

IN the polar flights made by the Lancaster "Aries" it was decided that in case of a forced landing in the arctic regions the aircraft should carry emergency rations for the crew of nine, sufficient to last 28 days. These were designed and prepared by the Low Temperature Research Station of the Department of Scientific and Industrial Research, in close consultation with W/Cdr. Macrae of the R.A.F. Institute of Pathology and W/Cdr. Winfield of the R.A.F. Institute of Aviation Medicine, who was the medical officer on the flights.

For this purpose the normal rations available were not altogether satisfactory, as they would have been too weighty and bulky. Thus the use of dehydrated foodstuffs was indicated, and, in view of the development of compounded food tablets, an approach was made by the Air Force authorities with a view to a ration being specially made for the job in the Low Temperature Research Station.

It was anticipated that if the aircraft were forced down there was a good possibility that some of the aviation spirit could be salvaged. A stove had been prepared to burn 100 octane spirit, and its use for cooling purposes and for melting snow and ice to reconstitute dehydrated food was possible. Clearly the amount of fuel available was not unlimited, and the ration had to be so designed as to use it economically, and in case no fuel was saved a substantial proportion of it could be eaten dry and be palatable in that form.

The ration pack was designed so that most of the food took the form of blocks.

These consist of mixtures of dehydrated foods with added sweetening and flavouring materials where appropriate, so that each is a ready-made meal requiring only the addition of water. They are fabricated into tablets of standard size (usually 2 in. by 2 in. by 0·9 in.). They are made by one of two processes. Those containing dried foods of large particle size, such as dehydrated meat or vegetables, are made by compressing the mixture in a hydraulic press. The pressed block can be broken down easily in the hand and reconstituted when any lumps are broken up by the swelling of the larger particles. Where the particle size of the material is much finer, as with spray-dried powders such as milk or egg, such compressed blocks would be very difficult to crumble and, furthermore, lumps escaping crumbling would remain as unreconstituted lumps and mar the smoothness of the product. Thus they are prepared by casting the mixture hot into moulds with added molten fat. The fat binds the particles when cold and the block can be dissolved by adding it to the boiling water. The heat of the water melts the fat and the enrobed particles of food go into solution without any lumps being formed. The texture of these blocks is such that many of those containing milk powders are palatable when eaten as sweets.

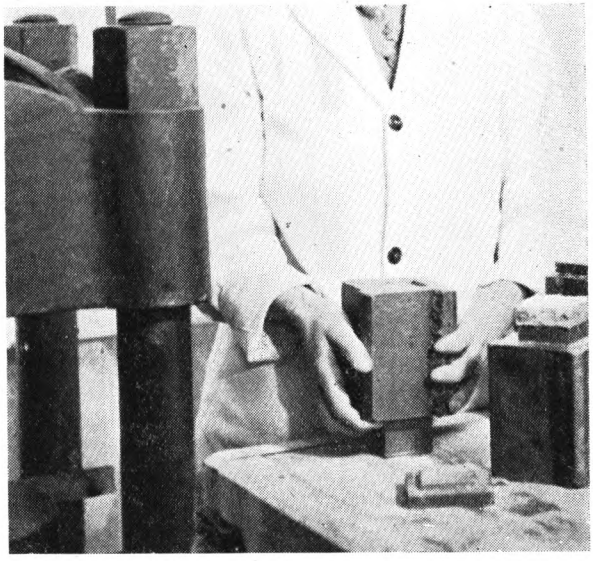
A sufficient range of these blocks had been developed and tested to enable four different menus to be prepared to relieve the monotony of the diet.

The menus finally agreed upon were based on the following:

	Day 1.	*Day* 2.	*Day* 3.	*Day* 4.
Total Calories/man ..	3,430	3,380	3,400	3,550
,, wt. food/man/gm.	704	708	715	706
,, wt. fat/gm. ..	185	184	177	213
Per cent. fat	26	26	25	30

The computed total weight on this basis was 393 lb. and, allowing 3 lb. for immediate wrappings of the blocks, this increased the total to 396 lb. It was found that rations for two days could be packed into a standard 4-gallon can, which not only was most convenient as a master container but also could be gas packed to ensure that the food remained in the best condition possible. The fourteen cans required increased the total weight to 435 lb.

To simplify unpacking and utilisation and to reduce the amount of labelling required the seven or nine blocks of each item required for one day were held together by adhesive tape in a vertical stack. These stacks of blocks were assembled and labelled before the packing of the cans was com-



Many food blocks were made by compressing the mixture in heavy steel moulds, using the hydraulic press on the left of the photograph.

menced, and this procedure made the packing operation much simpler; the whole ration laid out on the laboratory bench was quite an impressive sight, as the illustration shows, though it was difficult to realise that it represented rations for 252 people for one day. Still more so when all was packed inside the fourteen cans all neatly stacked in a pile measuring 66½ in. by 19 in. by 14 in. A further seventeen cans could have been filled with the water removed from the food during the dehydration process.

Finally, it may be interesting to dwell on the theoretical aspect of the provision of a calorific level of 3,400 per day, with a total weight of 704 gm. per man. If the diet were made up of pure carbohydrate, pure fat and pure protein *alone*, then, using the factors 4·9 and 4 respectively as the number of Calories derived from each gramme of food, a diet containing 25 per cent. fat would have an overall calorific value of 5·25 Cals./gm.; a diet giving 3,400 Calories, as in Day 3, would therefore weigh 647 gm. This is an absolute minimum, below which it would be impossible to go. This figure takes no account of the residual water content of dehydrated foods, of salt or minerals or roughage. The weight of 715 gm. achieved in practice includes, in addition to water and roughage, some 8 gm. of salt and 13 gm. of tea. It is therefore considered that, for a ration which gives three normal meals a day, it would be virtually impossible with the materials available at present to reduce the weight of the ration further. The tinplate cans used and the immediate wrappings contributed some 40 lb. to a total of 435 lb. gross, but this is very modest compared with most emergency rations even when master containers are excluded. The robustness of the package and the fact that it could be gas packed were advantages which outweighed the extra weight involved. The only other possibility would seem to be in the use of light metal alloys for such a purpose.

It is considered that these types of food may be of great value for future polar expeditions.

Technical Advances in the Production of Dried Egg

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field. Some hints of activity in the direction of freeze-drying[11] have been dropped from time to time, however, and the commercial possibilities of this method must by no means be ruled out of account.

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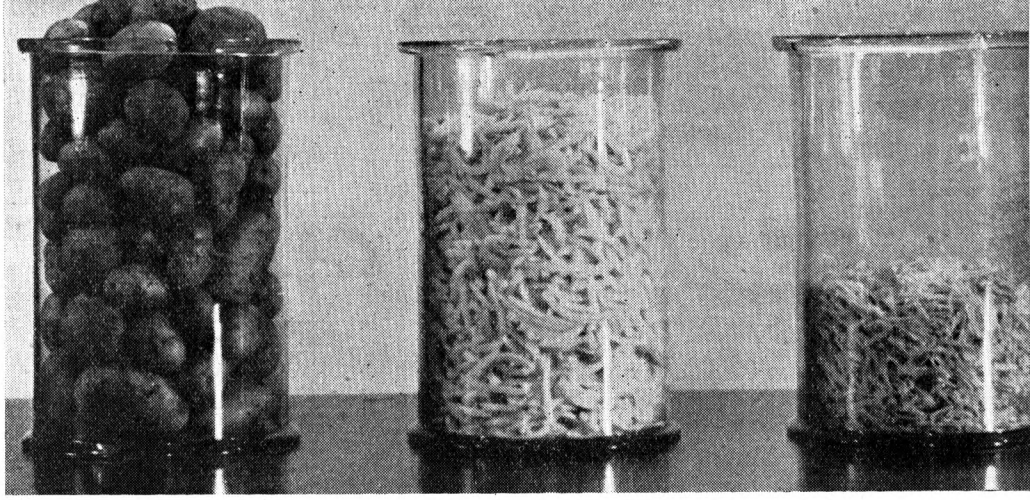
The ration for 9 men for 28 days on the laboratory bench before packing. These blocks have now twice been flown over the North Pole.



The metamorphosis of the potato.

The Drying of Potatoes*

H. G. WAGER, R. G. TOMKINS, S. T. P. BRIGHTWELL, R. J. L. ALLEN and L. W. MAPSON

IN THE past, dried potato, although satisfactory as a source of calories, has often been unsatisfactory in culinary quality and antiscorbutic activity. Early reports that dried potato prevented scurvy on sea voyages (*Analytical Sanitary Commission*, 1852[1]) and in the Crimea (Anon.[2]) were not supported by later experience in the field (Smart[14]). More recent laboratory investigations have given conflicting results; for example, Ranganathan[12] found that potato dried in a factory retained about 50 per cent. of its ascorbic acid, but Howes[7] reported that the greater part of commercially produced material was devoid of ascorbic acid. Anomalies in the determination of ascorbic acid in dried potato by the usual chemical method were reported by Bukin and Povolotskaya,[4] Kröner and Lamel,[8] and Scheunert and Reschke.[13]

The method of preparing dried potato strips for culinary use is described by Nichols *et al.*,[11] and is the method that is mainly discussed in this article. In a final section, however, the production of riced potato is briefly discussed. A specialised commercial plant for the preparation of this product has recently been described (Anon.[3])

Analytical Methods

Ascorbic acid was determined chemically by titration against 2:6 dichlorophenol-indophenol, according to methods described by Harris and Olliver,[6] and Harris, Mapson, and Wang,[5] and, when sulphite was present in the extract, by the method described by Mapson.[9] Estimations of ascorbic acid in raw or scalded potato strips were carried out on duplicate 10 g. samples made up of small broken pieces. For dried strips a 5 g. sample was reduced to a powder and an aliquot was used from which to prepare the extract.

Sulphite was determined by the method of Monier-Williams,[10] using N/50 NaOH for titrating the distillate, and values are expressed as parts per million of SO_2. The way in which the SO_2, so determined, is combined in the tissue is not fully known and may differ in different stocks and at different stages of processing; it will be hereafter referred to as sulphite.

*p*H was determined with a glass electrode. Soluble solids in liquors were determined by evaporating the liquid nearly to dryness on a hot plate and finishing the drying to constant weight in a vacuum oven at 37° C.

PREPARATION OF STRIPS

Peeling and Trimming

Potatoes were usually peeled in a carborundum peeler and trimmed by hand. This resulted in a considerable loss of material at all seasons of the year, averaging about 27 per cent., and with a range from 16-39 per cent., depending on the size and shape of the tubers and on the proportion of diseased tissue.

Peeling was also carried out by using hot lye—*i.e.*, sodium hydroxide solution—to soften the skin

* *This is the fourth article of a series on work done at the Low Temperature Research Station, Cambridge, on the drying of vegetables. For earlier articles see J.S.C.I.*, **62**, 145 and **63**, 78 and 225.

and then washing off the partially destroyed tissue with sprays of water. By this method the loss of weight in peeling freshly dug tubers was as low as 7 per cent. and potatoes stored for nearly a year lost only 20 per cent. Lye peeling requires rather accurate control of the time of immersion and of the temperature and concentration of the lye if losses are to be low.

When certain stocks of potatoes are peeled and held, either in air or in water, for any considerable length of time, they discolour because of enzymic oxidation. The pigment formed is not removed or destroyed at any later stage of processing; therefore its formation must be prevented. This can be done by adding a small amount (0·001-0·01 per cent.) of Na_2SO_3 to the water in which the potato is immersed. A solution of 1-2 per cent. sodium chloride decreases the discoloration but does not prevent it.

Cutting into Strips and Washing

Cutting tubers causes much cell damage, with consequent loss of starch and soluble material, so that from this point of view pieces should be as large as possible. On the other hand, the time required for drying increases rapidly with increase in thickness of the piece and also the reconstitution of large pieces is incomplete. Thus, the size of strip used has to be the result of a compromise, allowance being made for these three major factors.

Free starch on the surface of strips gelatinises during scalding, and, if much is present, the strips cohere during drying and are glutinous after drying and cooking. The strips must, therefore, be washed free of surface starch before scalding. The standard size of strip used in this work was between $\frac{3}{16} \times \frac{3}{16}$ in. and $\frac{1}{4} \times \frac{1}{4}$ in. in cross section, and the following are the losses incurred during the washing of such strips. A group of ten stocks were processed in January and, on the average, 100 g. of strips contained 20·7 g. of dry matter. During washing 100 g. of fresh strips increased in weight to 103·7 g. and from the wash liquor 2·7 g. of starch and 0·98 g. of soluble matter were recovered. Hence, 7·4 g. of water were taken up during washing and 3·68 g. or 18 per cent. of the dry matter was lost. The uptake of water during washing varied greatly and was dependent on the previous history of the potatoes; if they were slightly wilted due to long storage the uptake was as high as 20 per cent., whilst, on the other hand, freshly dug tubers sometimes lost water.

Thus, in the preparation of potatoes for scalding there is a loss of 15-30 per cent. of the weight, as purchased, during peeling and trimming, and a further loss of 15-20 per cent. of the dry matter of the peeled tubers during the washing of the strips, or, in all, 30-45 per cent. of the dry matter of the potatoes as purchased.

The magnitude of the loss of material during washing strips varies with the dimensions of the strips. Figures for the yield of dry matter obtained with strips of various sizes are given in Table 1. The differences in yield result from varying losses of starch and soluble material during washing and scalding, but since the loss during scalding changed little with size of strip the differences may be taken as representing the effect of size of strips on losses during washing. It appears from the table that an increase in the cross sectional area of the strips above the standard size ($\frac{3}{16}$ to $\frac{1}{4}$ in. square) has but a small effect on the loss of material during washing but that decrease causes a rapid increase in losses.

TABLE 1

SIZE OF STRIP AND YIELD

Cross-Section of Strips (approx.).	*Yield of Dry Strips as a Percentage of the Weight of Raw Tubers*		
	Majestic.	*Arran Banner.*	*King Edward.*
Thin flakes	14·2		
$\frac{3}{32}'' \times \frac{3}{32}''$	16·5	18·9	18·3
$\frac{3}{16}'' \times \frac{3}{16}''$	18·0	21·0	20·2
$\frac{5}{16}'' \times \frac{5}{16}''$		21·7	21·2

In washing strips there was a loss of ascorbic acid which varied from 0 to 23 per cent., with an average of 11·3 per cent. (twenty-nine determinations). The large scatter was due partly to sampling error and partly to variation in technique during estimation. In the single instance in which aneurin was determined in the unwashed and in the washed strips there was a loss of 12 per cent. during washing. Leaching from living cells is a slow process and very little would be expected to occur in the short time required for washing. Losses should result, therefore, only from washing away the contents of cells broken open during the cutting of the strips, and hence the percentage loss of all cell constituents should be the same. In the present experiments the average loss of starch, 10-15 per cent., of ascorbic acid, 11 per cent., and aneurin, 12 per cent., is in good agreement, and it seems very probable that the percentage loss of all other cell constituents would be similar. Clearly, losses of starch, ascorbic acid, and aneurin will be greater if thinner strips are cut.

SCALDING THE STRIPS

Methods

Potatoes dried after scalding or blanching—*i.e.*, partial cooking in boiling water or steam—when reconstituted and cooked are much superior in flavour and texture to potatoes dried raw.

Water-scalding was mainly carried out in a steam-jacketed pan and the liquor brought back to the boil in ½-1 minute after the addition of the strips. In steam-scalding the strips were spread evenly and not too thickly, about 1-2 lb. per sq. ft., on trays, which were placed in a cabinet into which steam was then blown through many jets, sweeping out the air. The rate of heating of the

strips in this case was limited by the rate of heat transfer from flowing steam to the strips. About 1½ minutes was required to reach a temperature of 99-100° C.

Potato strips were judged to be adequately scalded when their peroxidase systems were inactivated, when they were translucent, tasted cooked, and were softened. The time required for scalding depends on the temperature of the scalding liquor, the thickness of the strips and, to a less extent, on the variety and age of the raw material. Owing to the variability of the heat treatment received by the different pieces during a single scald, it is desirable to scald for at least 30-50 per cent. longer than the minimum time required to satisfy the above-mentioned conditions. The time interval between incomplete scalding and overscalding is short, and if potato strips are overscalded they cannot be spread on trays without serious breakage and mushing, which slows up the rate of drying and spoils the cooking quality. This tendency to mushing is worse in floury than in waxy potatoes, and for this reason is worse in mature than new potatoes.

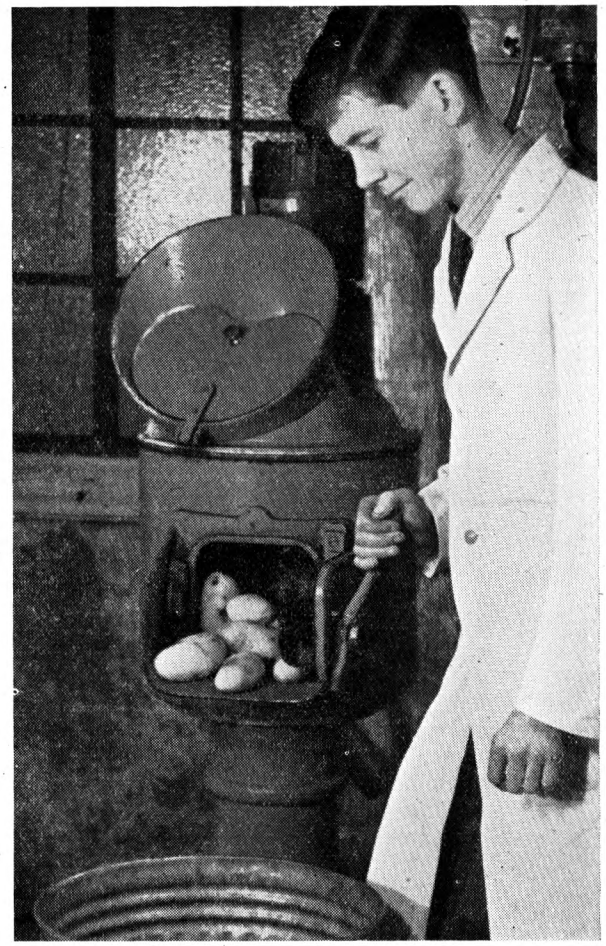
In general, the time required adequately to scald in water at 100° C. potato strips $\frac{3}{16}$-$\frac{1}{4}$ in. square in cross-section varied from about 1½ to 2 minutes and increased rapidly as the temperature was lowered.

Potato strips were adequately scalded in steam in about 3 minutes—*i.e.*, 1½ minutes to reach 100° C. and 1½ minutes at 100° C.

pH of the Scalding Liquor

Many stocks of potato when cooked whole and allowed to stand for 10-30 minutes develop a grey colour, mainly at the stem end of the tuber. This type of blackening is often referred to as stem-end blackening. Scalded potato strips are also liable to develop a grey colour, and the two phenomena appear to be related. The pigment is sensitive to change of *p*H and is colourless, or nearly so, in acid solutions; in consequence, scalding in acid solutions improves the colour of potato strips. The optimum *p*H for the scalding liquor depends on the stock of potato used and on the scalding conditions, and especially on the reagent used to control the *p*H, but a suitable *p*H for many stocks is about 5·8-6·2.

The texture of potato strips also is affected by the *p*H of the scalding liquors. Scalding in acid solutions (*p*H 5·0) gives a tough strip and scalding in alkaline solutions (*p*H 8·0-8·5) gives a very soft one. The change from the acid to the alkaline type of scalded strips takes place progressively as the *p*H is changed. The tougher acid scalded strips were easier to handle while cooling and putting on to trays to dry as they were less liable to mush; also the dried strips separated one from the other more easily. The contrary effect was observed when strips were scalded in alkaline conditions.



The potatoes are peeled in an abrasive peeler.

Incorporation of Sulphite

Sulphite was added to potato during scalding with the object of improving the retention of ascorbic acid during processing and drying and the keeping quality of the dried strips. Sulphite was incorporated by scalding the strips in water containing sodium sulphite or metabisulphite. There is, as shown in Table 2, a fairly direct relationship between the uptake of sulphite by the strip and its concentration in the scalding liquor for any given stock of potatoes, but a considerable variation between different stocks. The average ratios of the content of sulphite in the scalded strips to that in the scalding liquors are given; they do not change with the concentration of sulphite in the scalding liquor.

To incorporate sulphite in strips during steam scalding the raw strips were dipped in a solution of sodium sulphite or metabisulphite before spreading on trays preparatory to scalding. Under laboratory conditions 0·15 per cent. Na_2SO_3 was a suit-

able concentration for the dip liquor, and gave dry strips containing sulphite equivalent to about 100 p.p.m. of SO_2.

Change in Weight during Water Scalding

During scalding, water was either gained or lost by the strips. Whether scalding was carried out in weak sulphite solution or in water this change varied from a loss of about 10 per cent. to a gain of up to 8 per cent. of the weight of the washed strips. The magnitude and direction of the change in weight appear to be controlled by the storage history of the stock of potatoes.

A loss of starch and other soluble material also occurred during scalding. In single scalds with about equal amounts of potato and water the amount of soluble material in the scalding liquor at the end of scalding varied from 0·74 per cent. to 1·3 per cent. of the weight of the raw strips or about 3·5 per cent. to 7 per cent. of the dry matter of the raw strips. The amount of this loss depended on (1) the efficiency of cutting the strips (absence of ragged surfaces and uniformity of cross-section); (2) the duration of the scald, for any slight overscalding led to disintegration of some of the strips; (3) the stock of potatoes, whether floury or waxy; and (4) the storage history of the potatoes. Thus a wide range in the amounts lost during scalding is to be expected.

Serial scalding—*i.e.*, repeated scalding of vegetables in the same liquor—is recommended (Allen *et al.*) on the grounds that it results in a product with a higher proportion of the initial dry matter, a higher retention of ascorbic acid and a better flavour. The increase in yield of dried product is only large, however, when using vegetables with a high content of soluble solids and not with potato, in which nearly all the dry matter is starch and cellulose and the proportion of water-soluble matter is low (0·5-1·0 per cent. of the fresh weight). Liquors in which potato strips were serially scalded did not normally attain more than 2-2½ per cent. of soluble matter, of which a considerable proportion was soluble starch. Since the average loss in single scalds varied from 3-7 per cent. of the dry weight of potato, the gain in yield resulting from serial scalding could not have been more than this and was liable to be less, owing to a failure to achieve equilibrium between scalded material and scald liquor. The gain in nutritive value from serial scalding is, however, greater than these figures suggest, since there is a larger gain in soluble constituents such as salts and vitamins than of less soluble constituents such as starch and proteins. In serial scalds in which an increase in the yield of dried potato should have been apparent, some experiments have shown an increase in yield whilst others have shown no change. This presumably depended on sampling errors which, with potato, were greater than the effect of serial scalding.

Cooling strips by immersion in cold water after either steam or water scalding is said to prevent mushiness and to improve culinary quality by removing gelatinised starch. This practice was found to be unnecessary in the present series of experiments and is undesirable, as it leads to further losses of soluble constituents. In one experiment, scalded strips of potato were immersed in cold

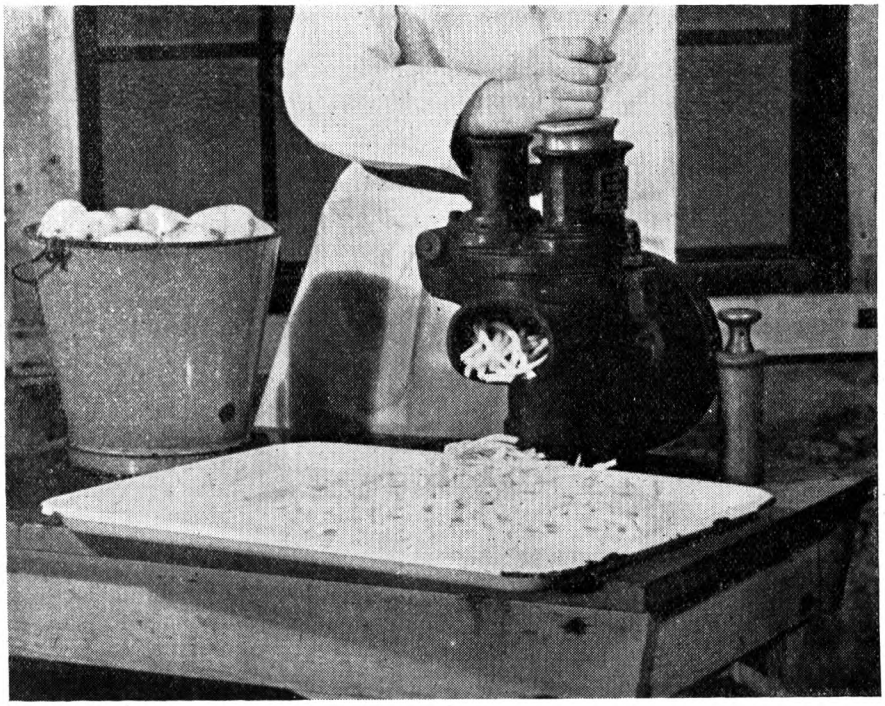
TABLE 2

THE CONCENTRATION OF SULPHITE, EXPRESSED AS p.p.m. SO_2, IN SCALDED AND IN DRIED POTATO STRIPS AND IN THE SCALDING LIQUOR

Variety.	*Wt. of Scalded Strips / Wt. of Dried Strips*		*Approx. Con. of Na_2SO_3 in Initial Scalding Soln.* 0·0	0·012	0·025	0·037	0·05	0·1	*g./100 ml.*
Doon Star ..	5·1	Scalded strips	0	30	45	60	80	160	p.p.m. SO_2
		Scalding liquor	0	60	120	165	205	445	,, ,,
		Dried strips	15	55	120	200	270	625	,, ,,
King Edward ..	4·3	Scalded strips	5	30	35	60	80	—	,, ,,
		Scalding liquor	0	70	135	180	250	480	,, ,,
		Dried strips	15	50	95	135	205	650	,, ,,
Majestic	5·3	Scalded strips	15	22	30	67	138		,, ,,
		Scalding liquor	10	55	100	225	—		,, ,,
		Dried strips	25	35	80	245	525		,, ,,
King Edward ..	5·7	Scalded strips	15		40	100			,, ,,
		Scalding liquor	15		120	—			,, ,,
		Dried strips	0		145	335			,, ,,
Majestic	5·5	Scalded strips	—		30		60	120	,, ,,
		Scalding liquor	—		105		205	380	,, ,,
		Dried strips	0		70		175	525	,, ,,
Average		SO_2 in scalded strips / SO_2 in scalding liquor		0·44	0·31	0·33	0·34	0·35	
Average		SO_2 in dried strips / SO_2 in scalded strips		1·6	2·7	2·9	3·1	4·0	

Top picture.—The peeled and trimmed potatoes are cut into strips.

Bottom picture. — The potato strips are scalded in boiling water.



water for 3 minutes and lost 4 per cent. of their dry matter.

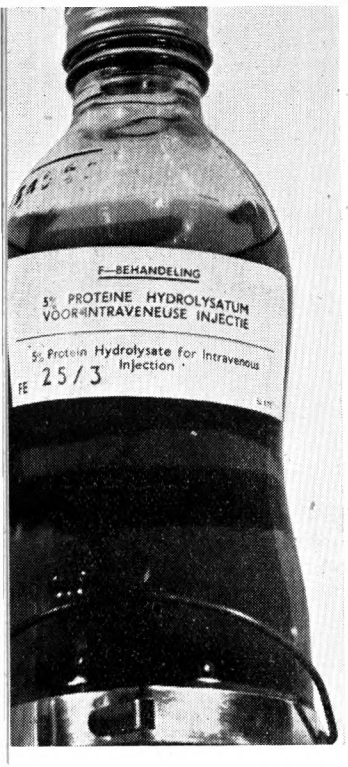
Change in Weight during Steam Scalding

When potato strips were steam scalded after dipping in sulphite solution the ratio of the weight of scalded strips to the weight of raw strips varied between 0·91 and 1·07, with an average of 1·00 (ten experiments). For parallel samples which were water scalded the range was 0·86-1·04, and the average 0·97. The individual figures were tolerably consistent, and there is little doubt that this small difference in ratio was significant.

The loss of soluble matter during steam scalding was less than for single water scalds of strips of potato. The soluble matter in the liquor that dripped from potato strips during steam scalding was in three experiments equal to 0·05, 0·08 and 0·09 per cent. of the raw weight or about 0·4-0·5 per cent. of the dry weight of the strips. This percentage loss was too small to be detected, owing to sampling errors, in experiments in which only the weights of dried raw and dried scalded strips were measured. In experiments in which the dry matter of steam- and water-scalded strips could be compared, that of the steam-scalded strips was, on the average, greater than that of the water-scalded by about 0·9 per cent. of the raw weight or 4·5 per cent. of the dry weight; this difference in yield was similar in magnitude to the loss found to take place into the scalding liquor during water-scalding—*i.e.*, 0·7-1·3 per cent. of the fresh weight—and indicated a very slight loss during steam scalding of potato strips.

(To be continued)

NOTE.—The references in the text will be published at the end of this series.



"F" Food

The possibility of using hydrolysates of protein in the treatment of human beings was not appreciated until just before the outbreak of war. The author of this article is one of the scientists concerned with "F" Food and presents the story of its development.

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A COLLECTION of the initials used during the past six years to denote various objects or incidents connected with the war would reveal some curious and unexpected items, and one can well imagine historians of the distant future being puzzled by such specimens as PLUTO, UXB, FIDO, and IBSEN. One of the most recent additions to this dictionary of *noms de guerre* is the letter "F." This stands for famine treatment.

"F" food is not a new conception, and was first thought of over thirty years ago. The possibility of using hydrolysates of protein in the treatment of human beings appears not to have been appreciated, however, until just before the outbreak of war, and it was only in 1939 that the first trials were made.

It is very doubtful if the idea of using "F" food for relieving cases of starvation was present in the minds of the original research workers concerned, or whether it even occurred to them that extreme starvation would possibly be encountered in this enlightened era. Nevertheless, it remains true that the stimulus for the further development of "F" food came, as in so many other instances, from the unfortunate necessities of war.

The Amino Acids

It is common knowledge that the proteins of the diet are not used as such, but are first broken down to their constituent amino acids, which, after being absorbed from the intestine, recombine in an almost bewildering variety of ways to form other proteins essential to the proper functioning of the body. There are twenty-two naturally occurring amino acids, and by various permutations and combinations of these, it is obviously possible to build up a vast number of different proteins. This is the reason why the different members of this particular group of substances can display such wide variations in chemical and biological properties. Proteins, for example, are the main constituent of structures so diverse in function as muscle fibres, hair, enzymes, and antibodies. Yet the formation of all these structures requires the same fundamental building materials, amino acids. Normally, these are provided by the food and, in general, the more varied the diet, the more likely is it to contain all the amino acids essential for the formation of these various proteins. Although nearly all the proteins occurring in foodstuffs contain at least a little of each one of the known amino acids, some contain such small amounts that, if this protein forms a main article of diet, deficiency of one or other amino acid may occur. This may not matter, but if one or more of the so-called essential amino acids, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine, is lacking, growth may not occur at the normal rate, or disturbances of nitrogen metabolism may ensue. It is very important, therefore, that the diet should not only be adequate in protein, but also in the right kinds of protein, containing together sufficient of the essential amino acids to satisfy the body's requirements.

Early Experiments

Proteins then are normally broken down by the body, liberating amino acids, which are absorbed from the intestine during digestion, and it is not unreasonable to suppose, therefore, that the administration of amino acids, by mouth or otherwise, would be as effective as feeding proteins. This was demonstrated by Henriques and Andersen (1913), who injected into goats a solution of amino acids prepared by hydrolysis of goats' flesh, and observed that nitrogen equilibrium could be maintained in this way. In work on protein requirements the amount of nitrogen ingested in the food and the amount excreted by the body are estimated, and if the two values thus obtained are equal, the body is said to be in nitrogen equilibrium. If the nitrogen intake is greater or less than the nitrogen output the body is said to be in a state of positive or negative nitrogen balance respectively. For many years these early experiments appear to have been forgotten, but within the last decade suggestions have

been made from time to time for administering amino acids in the same way to humans. The first reports of work of this kind were given by Elman and Weiner (1939), who showed that an acid hydrolysate of casein, fortified with tryptophan and supplemented with additional methionine or cystine, could be utilised effectively by patients. Soon afterwards, Cox and Mueller (1939) showed that an enzymic hydrolysate of casein maintained nitrogen balance and promoted growth. Since that time large numbers of cases have been treated with protein hydrolysates, given either orally or by injection, and these preparations constitute the "F" food recently sent to Holland for the treatment of the starving population.

Casein—the Raw Material

Casein is the protein mainly used in the preparation of these hydrolysates because it is available commercially, and because it contains all the essential amino acids in substantial amounts. This is not surprising when it is borne in mind that casein is the protein intended by Nature to be used for feeding the young mammals, where it is obviously important that all the amino acids for growth should be present in optimal amounts. It should be added in parenthesis, however, that the casein from cow's milk is not necessarily the perfect protein for feeding the young of other mammals, for caseins from different species of animals vary slightly in composition.

Acid and Alkali Hydrolysates

In preparing hydrolysates of casein there is a choice of agents that can be used to break down the protein, but unfortunately all suffer from one disadvantage or another. Acids, though capable of breaking down the protein completely to its constituent amino acids, destroy the tryptophan, without which a positive nitrogen balance cannot be maintained, and it is therefore necessary with hydrolysates of this type to make good this loss by addition of tryptophan, usually prepared synthetically. Acid hydrolysates fortified with tryptophan were made by Corbould, Clark, and McKechnie (1939), whilst Altshuler, Hensel, and Sayhun (1940) used a similar preparation to which cystine had also been added. White and Elman (1942) attempted to reduce the loss of tryptophan by using a more dilute acid and a shorter time for hydrolysis; such hydrolysates are not satisfactory, however, for intravenous use. Hydrolysis with alkali does not destroy trytophan, but it does destroy methionine and cystine and, in addition, converts the constituent amino acids, which are all optically active, into their racemic or optically inactive forms. As the non-natural optically active forms generally do not appear to be of any value as sources of protein in the body, this means that the biological value of such alkali hydrolysates may not be more than half that of the original casein. In spite of this, a combination of an acid with an alkali hydrolysate has been used, with the object of making good the deficiencies of the acid hydrolysate by means of the alkali hydrolysate and vice versa. Sayhun (1941) did not obtain very satisfactory results, however, and Madden *et al.* (1942) found it necessary to supplement even such hydrolysates with tryptophan and cystine.

Enzymic Hydrolysates

Enzymic hydrolysates have been investigated very intensively. They suffer from the disadvantage that the protein is not broken down completely; though this is not a serious disadvantage for hydrolysates intended to be taken by mouth, it does give rise to trouble in hydrolysates intended to be given intravenously. It is well known that foreign proteins cannot be injected into an animal, as they give rise to reactions, known as anaphylactic shock, which may be serious or even fatal. Protein breakdown products may also give rise to reactions, more or less serious, depending mainly on the extent to which the protein has been converted into the simple amino acids. Where the breakdown is complete, the material can safely be injected; little trouble is to be anticipated when hydrolysis has proceeded to the stage at which only amino acids and di- and tri-peptides are present. Such extensive hydrolysis, of casein in particular, can only be achieved with difficulty, but meat is hydrolysed more readily by proteolytic enzymes, and some of the "F" food was made by enzymic digestion of meat. Another disadvantage of protein hydrolysates made by digestion with enzymes is that most of the hydrolyses (though not all) are conducted by incubation at 37° C., the optimal temperature for bacterial growth. The presence of developing bacteria at any stage of the process may result in the introduction of bacterial "pyrogens," substances that remain behind after the death of the micro-organisms and cause a rise in body temperature when such solutions are injected. On the other hand, digestion with enzymes has the great advantage that none of the essential amino acids is destroyed.

Types of Enzymes

Several different enzymes have been used, and a combination of two or more may give better results than one enzyme alone. A papain digest was used by Madden *et al.* (1942), and a hydrolysate prepared by digestion first with papain and then with trypsin was used by Beattie *et al.* (1944). A papain digest of meat was used with partial success in the Bengal famine (Narayanan and Krishnan, 1944; Krishnan, Narayanan and Sankaran, 1944). The best results appear to have been obtained with a

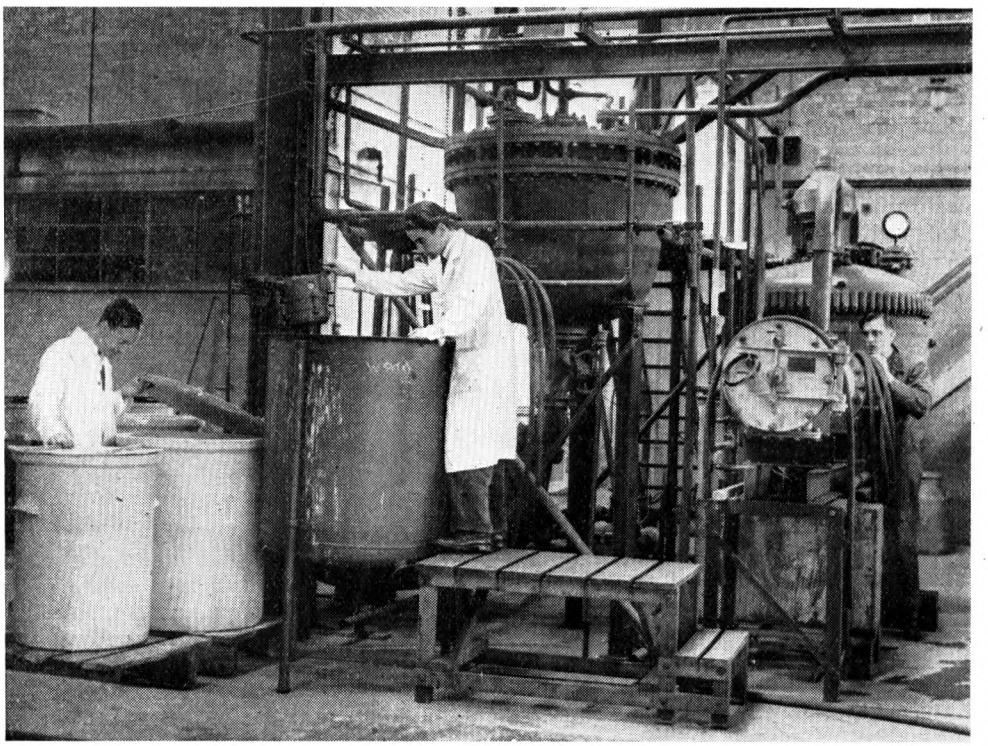
hydrolysate prepared by prolonged digestion with fresh pig pancreas, as first described by Mueller *et al.* (1940). A preparation of this type has been available in the U.S.A. for some time under the name "Amigen"; it contains about 60 per cent. of amino nitrogen. This appears to be the maximum degree of hydrolysis that can be attained with enzymic digestion. A similar preparation is obtained when casein is incubated with the enzymes of pancreas, "pancreatin."

Publication of their results by American workers created considerable interest in this country, and the possibility of using protein hydrolysates for administration to war casualties, in which considerable loss of protein had occurred, was studied by a Committee of the Medical Research Council set up in 1943. Several manufacturers were invited to supply protein hydrolysates for the investigation, but the problem proved to be far more difficult than had been anticipated. Four of the companies, Crookes Laboratories, Ashe Laboratories, Genatosan, Ltd., and the Herts Pharmaceutical Co., Ltd., concentrated almost exclusively on hydrolysates made by enzymic digestion, investigating various enzymes or combinations of enzymes, whilst my own company concerned itself mainly with the preparation of an acid hydrolysate fortified with synthetic tryptophan. Our own work had, in fact, been begun, at the suggestion of my colleague, Dr. B. A. Hems, in 1938, before the publication of Elman and Weiner's paper, and a few results had already been obtained before the outbreak of war. Owing to the necessity of providing important drugs formerly made in Germany, the work had to be put on one side, but when it became clear that protein hydrolysates might be of value in medical problems arising out of the war, we returned to the problem. The most pressing need was for a satisfactory synthesis of tryptophan, and this problem was attacked by a team of workers led by Dr. Hems. The results of their work have been published (Elks, Elliott, and Hems, 1944) and an economic method is now available for adding tryptophan, equivalent to 1 per cent. of the total amino acids, to acid digests of casein.

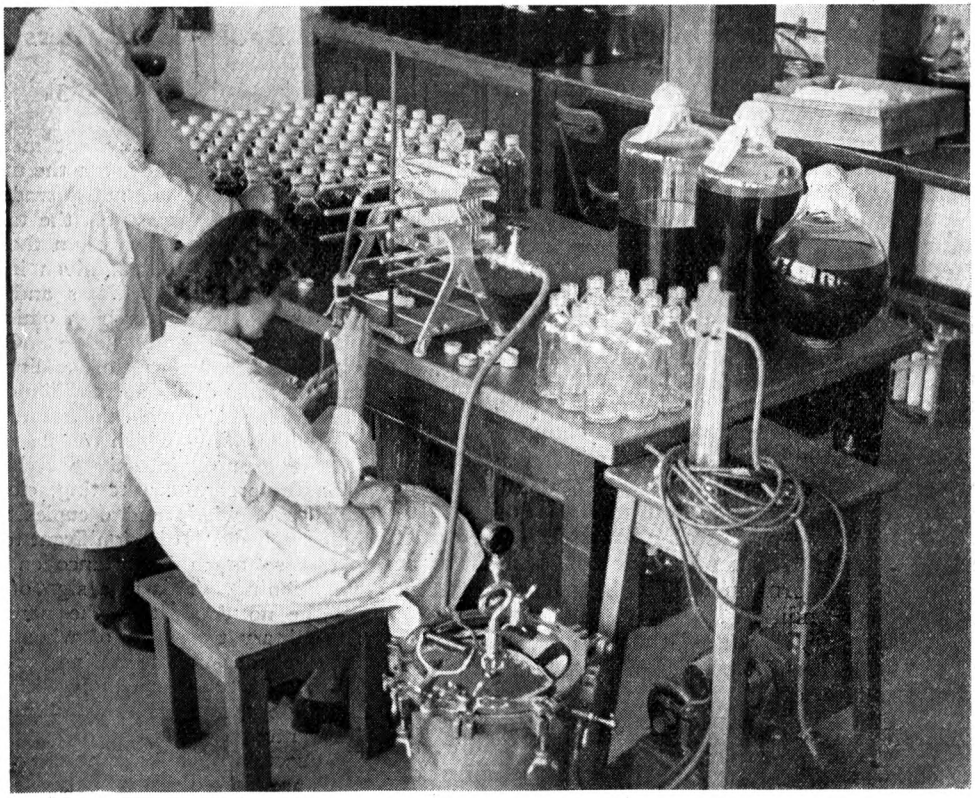
Preliminary Tests

Preliminary tests with a 10 per cent. solution of this fortified hydrolysate gave very successful results, with no serious reactions on injection. Consequently, when early this year information reached London that a proportion of the Dutch population was suffering from extreme starvation, the Medical Research Council's Committee were in a position to promise a supply of casein hydrolysate, the acid digest being provided for intravenous, and the enzyme digest for oral, administration.

In collaboration with the Ministry of Supply and the Ministry of Food, suitable packs were devised. One unit contained tins of casein hydrolysate for oral use in powder form together with tins of glucose, milk powder, and vitamin supplements, whilst another unit contained sterile solutions of



Plant used in preparing an acid digest of casein for intravenous injection.



Filling the casein hydrolysate solution into serum bottles for despatch to Holland.

casein hydrolysate for intravenous use, dried blood plasma, and glucose and vitamin supplements, together with tubes for administering the solutions intravenously. These were transported to the Continent by air before the invasion of Western Holland began, so that there need be no delay in treating the civilian population.

Production Problems

The effort required to provide and pack these materials at short notice can only be appreciated by those who took part in it. It involved a rapid expansion of production, necessitating generally the erection of additional plant and, for the injectable solution, the provision of facilities for pyrogen testing on a scale not previously envisaged, for each batch of material had to be tested on rabbits, and any that produced a rise of more than 0·6° C. had to be rejected. Nevertheless, the material was made available in ample time for the treatment of the most severe cases.

So far any detailed account of the value of "F" food is not available, and it is possible that the material has not come up to expectations. Indeed, the most recent reports indicate that the degree of malnutrition was less severe than had been anticipated, and very few people appear to have been in so advanced a stage of starvation that they would not respond to ordinary food or at any rate to a milk diet. If this is so, then the casein hydrolysate prepared in readiness for the emergency will not have been required and other methods of assessing its value will have to be sought.

In the meantime, however, another and more serious situation had developed, following the overrunning of German concentration camps. The degree of starvation encountered in these places was infinitely worse than that in Holland. Immediately after their release, it was impossible to do more than give the prisoners what was immediately available, but within two weeks of the liberation of the camp at Belsen a small team of workers under Dr. Janet Vaughan was engaged in treating some of the starvation cases with casein hydrolysate. The results were not encouraging, as the conditions under which the hydrolysates had to be given were so unfavourable that it was almost impossible to administer them properly. The prisoners believed that the by vein and nasal tube administrations, for example, were merely forms of torture, and, as they did not understand English, it was impossible to explain to them the reasons for the treatment.

Uses for Hydrolysates

"F" food cannot therefore be claimed to have been particularly successful in the treatment of starvation, but this is no reason for assuming that protein hydrolysates are of no value in other conditions; indeed, there is already abundant evidence to the contrary. In any event, it should be remem-

bered that protein hydrolysates were not originally intended for the treatment of starvation. Protein hydrolysates have been given with considerable success in cases where serious loss of protein has occurred—for example, in severe hæmorrhage, extensive wounding, and serious burns. They have also been shown to be of value for the pre- and post-operative treatment of surgical cases, and in the treatment of a variety of pathological conditions. They have been used, for example, to improve the nutritional state in cases of carcinoma, intestinal obstruction, hyperthyroidism, hypothyroidism, nephritis, ulcerative colitis, and cirrhosis of the liver. They have also been given intravenously in cases where absorption is defective following gastric resection, cholecystectomy or gastroenterostomy, in the treatment of infants with chronic diarrhœa, vomiting and dehydration and in the feeding of premature babies. The list of applications for protein hydrolysates is thus already a long one, but it will doubtless be further increased as more is learnt about their absorption and utilisation in different pathological conditions.

In conclusion, it should be emphasised that many problems relating to both the production and the administration of protein hydrolysates remain to be solved—for example, the preparation of an enzymic hydrolysate that can safely be injected requires further investigation—and the elimination of the unpleasant taste of most casein hydrolysates is a matter of considerable importance if they are to find a more extended application. Finally, it is desirable to improve the technique of administration so that a more satisfactory response is obtained without increasing the risk of thrombosis or causing unpleasant reactions.

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Two Books for Millers

(*Continued from page* 283)

Lockwood's menu may not meet with the complete approval of everybody, but the meal is there and even if the *hors d'œuvres* masquerades as a savoury little harm is done; but surely the tables on Food Values and Equivalents taken from the Ministry of Agriculture's Bulletin No. 48, given in Chapter 7, and the full text of the Fertilisers and Feeding Stuffs Act, 1926, could well have been omitted or relegated to a place among the Appendices. Of a very meaty book possibly Chapters 27-30, dealing with the manufacture of finished products, balanced rations, and compressed foods, provide the most food for thought.

Flour Milling, which contains thirty-eight chapters, is also grouped into three sections. The first deals with the preliminary testing, cleaning treatment, and storage of wheat and occupies 220 pages or roughly half the book. It is significant to note that the author places so much importance on wheat cleaning and conditioning. This is a sign of the times and there can be no doubt that the necessity for the correct preliminary treatment of wheat to bring it into the right condition for milling cannot be stressed too much. Part 2 deals chiefly with the processes of flour milling but also includes chapters on Speciality Flours, the control of pests and of temperature and humidity. This section occupies some 180 pages, and if some sections are treated rather sketchily, they are at least suggestive, and the discussion on the manufacture of high vitamin flour brings the book right up to date. In this connexion, however, the reader might get the impression (page 413) that the realisation of the concentration of vitamin B_1 in the scutellum was the prime discovery of the Cereals Research Station of the Ministry of Food. While no one wishes to deprecate the excellent work carried out in this direction at St. Albans, it should be remembered that pioneer work on the location of the vitamins in the wheat berry and the most economical way of extracting them was done in Canada and resulted in the well-known Canada Approved Flour, and the researches of such workers as Jackson, Doherty, Malone, and Whiteside deserve honourable mention in this field. As in *Provender Milling*, so in *Flour Milling*, the sequence may seem rather inconsequent and one wonders why a longitudinal section of a wheat grain should be displayed on page 31, but we have to wait for the cross-section of the grain on page 268. One feels too, that if the chemistry of wheat had to be dealt with in a book essentially devoted to flour milling, it should receive far more attention than is given in pages 269-270 of this book. This section seems to have been treated on the scratch system and reduced to an almost invisible minimum!

Mr. Lockwood's two books fully come up to the high standard of other books that have emerged from the walls of Henry Simon, Limited, such as Sir E. Simon's *Physical Science of Flour Milling* and J. H. Scott's *Flour Milling Processes*. The books are produced in a particularly handsome manner for wartime.

T. H. FAIRBROTHER.

Trade News

Food Manufacturers' Federation, Inc.

At the thirty-second annual general meeting of the Food Manufacturers' Federation, which was held recently, Lieut.-Col. C. V. Jones, C.B.E., was re-elected President.

Colonel Jones is deputy chairman of Messrs. Foster Clark, Ltd., managing director of Associated Biscuit Manufacturers, Ltd., deputy chairman of Peek Frean and Co., Ltd., chairman and managing director of Suchard Chocolate, Ltd., and director of the Eagle Star Insurance Co. (Maidstone Board).

During the war, Colonel Jones has been chairman of advisory committees to the Ministry of Food. He is on the executive, grand council, and Empire committee of the Federation of British Industries, and is chairman of their Concentration of Production Committee.

New British Insecticide

A new British insecticide with a wide range of uses is being developed by the I.C.I. It is named gammexane and is the gamma isomer of benzene hexachloride, or 666 for short. Besides being deadly against locusts, a preliminary field experiment against wireworm has raised high hopes. It is highly toxic to lice, fleas, and flies. The yellow fever mosquito and the grain weevil are among the other pests for which 666 may also be toxic.

Electrical Recorders for Heat Control

We have received from Elliott Brothers (London), Ltd., a copy of a completely revised edition of a booklet with the latest developments of electrical recorders for heat economy and control measurements—*e.g.*, temperature, humidity, gas analysis, etc. A new type is included, the "S" type or small recorder, which is smaller and cheaper than the standard "L" types.

British Society of Associated Filter Manufacturers

The growth of the filtration industry has been considerable during the war, and because of its probable increase in importance in the post-war era it is proposed to form a British Society of Associated Filter Manufacturers. It is hoped that the Society will act as a medium for negotiation with Government departments and other bodies and also deal with matters of general technical interest. As filtration covers so many diverse fields it has been thought advisable to sub-divide the Society into sections which will handle their own particular problems.

A temporary organising committee has drawn up a draft constitution which was submitted to the inaugural meeting of the Society on July 6, 1945.

Electric Vibrators

A new leaflet issued by E. P. Allam and Co., Ltd., describes their Trillor Electric Vibrators, devised to eliminate choking and to maintain a steady flow of material in hoppers, feeders, chutes, conveyors, etc. These vibrators prevent materials from clogging and keep them flowing freely.

Flexible Bearings

A self-contained and complete reference book for every application of flexible bearings, anti-vibration mountings, and flexible couplings, has recently been produced by Silentbloc, Ltd. The data made available should be of value in the engineering drawing office as well as to the engineering buyer.

Mobile Canneries

It is reported that nearly 1,000 mobile canneries will be operating this summer, bottling and canning fruit on the spot. These units, loaded on vans, will operate in the orchards themselves.

New Floating Factory

The first of three modern floating whale factories, built to the order of C. E. Salvesen and Co., Ltd., Leith, was launched on June 11 from the Middlesbrough yard of the Furness Shipbuilding Co., Ltd. This vessel, the *Southern Venturer*, will go into service immediately on completion, and is expected, with her sister ships, to play a big part in restoring stocks of oil and fats.

The vessel includes plant for the extraction and production of liver oil and the dehydration of whale meat. The wireless installation enables constant communication with the whale catchers, and there is also apparatus for direct communication with the mainland.

Aluminium Development

At an inaugural luncheon recently given by the President (Hon. Geoffrey Cunliffe) and the council of the newly formed Aluminium Development Association, the President said that the new association intended to carry out propaganda, but that this would be directed not simply to the sale of aluminium. It was a common fault to say you have plenty of something, and therefore must use it for everything. Aluminium should be used only where it ought to be used. There were three main platforms for the new association. One was to develop by practical means, and not merely by old-fashioned sales talk. Secondly, the association would encourage research, which after all is the basis of all industrial development and achievement. Thirdly, propaganda and advertising would be used in what it is hoped would be an intelligent manner.

Betro Reports Progress

Each week sees fresh additions to the ranks of the recently formed British Export Trade Research Organization. Expressions of overseas opinion now being received by the Organization reveal a great deal of satisfaction that British

industry intends to analyse the precise requirements of the Empire and foreign consumer. The words of a Norwegian importer may well be quoted: "The Germans," he told a Betro official, "made extensive use of market research, and, in fact, seemed to know more about our countrymen's requirements then we ourselves; I am glad that our British friends are adopting a scientific method of market investigation."

In addition to a list of 98 elected founder members, Betro announces for the first time that a further 98 firms, representing a great variety of industries, have applied for ordinary membership. Among firms which recently applied for founder membership are Cow and Gate, Ltd., and Schweppes, Ltd.

Among the ordinary members are the British Drug Houses, Ltd., the British Thomson-Houston Co., Ltd., Crompton Parkinson, Ltd., Industrial Publicity Service, Ltd., Mather and Platt, Ltd., the Oilcakes and Oilseeds Trading Co., Ltd., and Rose Brothers (Gainsborough), Ltd.

Far East Food Packs

Special ration packs have been prepared for our forces fighting against the Japanese. These will allow each man from 4,200 to 4,360 calories a day, compared with the 2,900 allowed to civilians.

Brigadier C. E. R. Ince, Deputy Director of Supplies of the Quartermaster-General's branch of the War Office, made this announcement recently. The quality is ahead of anything hitherto experienced by our armies.

Nothing is dehydrated because of the water difficulties and the time taken to reconstitute dehydrated food.

The 24-hour ration pack comprises three meals, separately packed in hermetically sealed tins of aluminium—for breakfast, a midday snack, and supper. There are meat and egg for breakfast and meat and ham for supper, and with each of these meals go a packet of five British cigarettes and a book of matches.

For breakfast, too, there is a block of oatmeal for porridge, and a tea, milk, and sugar powder; for midday, a fruit bar and lemon powder for a drink, and a meat-flavoured biscuit.

OBITER DICTA

● Never before have growers been so much inclined for organisation.—*Mr. E. M. Bear writing in "The Fruitgrower."*

● Dehydrated potatoes are entirely satisfactory—quite good to eat—and I am told they will be ready for sale shortly.—*A Hall Green resident.*

● Colonel Llewellin should, I think, have introduced his corned beef not with an apology but with a flourish, as of one who brings gifts from the gods.—*"The Yorkshire Post."*

● Whole potatoes in tins weren't so bad—main trouble was there weren't enough—but as for dehydrated potatoes, well, most of the words I could use about them are unprintable.—*Soldier serving in Italy.*

● We've tried dehydrated vegetables on the Forces all through the war years, but they just won't have them. So it's not much use trying them on the housewife.—*A member of the canning industry.*

● If every Women's Institute in Britain had a dehydrating plant the country as a whole would save the cost of installation in reduced imports in a very short time.—*Mr. John Langdon-Davies.*

● When oatmeal is exported from Scotland to England and other foreign countries, will the Minister see that proper instructions are sent with it and try to see that English people do not add sugar to their porridge?—*Mr. G. Mathers, M.P.*

● The Russians laughed when I told them that everyone in Britain received the same rations of food. In Russia the people's food ration depended upon their utility as individuals. I prefer the British method.—*Lord Bruntisfield.*

● The best thing that could happen is that the elastic should break and that there should be a distribution of fish without any pretence of a zoning scheme.—*Mr. J. H. Muirhead, presiding at the annual conference of the National Federation of Fish Friers, Ltd.*

● Canning has become such a scientific process, that even the people who feared they would get ptomaine poisoning in bygone days and would not have dreamed of touching canned foods, accept them gladly today.—*An ex-director of the Wholesale Co-operative Society.*

A 4-oz. cooker issued to every man and of a size which can be slipped into a pocket of his battle-dress will make the individual soldier a self-supporting unit for 24 hours.

The Pacific "compo" pack for six men represents a great advance on the 14-day "compo" pack issued for European operations.

Weight has been limited to 40 lb. The weight carried by one bearer coupled with the shape of the pack allows six cases to be packed on a mule.

Air Leakage in Boiler Plants

Leakage of cold air into boiler plant settings, with consequent efficiency loss, takes place not only through cracks and crevices in the brickwork but also, in "Lancashire," "Economic," or other cylindrical boilers, at certain definite points. Examples are where the boiler shell is in contact with the exterior brickwork and where the side flue dampers project, and also, on the same lines, through the holes at the top of the economiser, through which the chains pass to operate the scrapers. Very often 10 per cent. of the fuel bill, or even more, is lost by cold air leakage.

In this connexion, two devices are made by Power House Components, Ltd.: an economiser chain hole air excluder and an airtight damper cover.

The latter comprises a casing of thin seamless mild steel plating, fixed over the top of each side flue, being bolted, using two bolts only, to a cast-iron base forming the top of the damper outlet on the boiler brickwork. The side flue damper is therefore raised and lowered inside a completely airtight steel casing through the top of which the wire rope passes through a small hole, resulting in almost complete elimination of every trace of air leakage.

Hydroponics

From time to time, states the *B. & G. Review*, efforts are made to introduce some form of soilless culture into commercial practice, but such attempts are not usually very successful. Now,

however, after five years' work on the subject, Professor R. H. Stoughton, of Reading University, thinks the sub-irrigation method may have commercial possibilities in the future.

Three methods have been tried by Professor Stoughton, of which sub-irrigation is one, the other two being ordinary liquid culture and sand culture. The plants used were tomatoes.

The main advantage of soil-less culture lies in the saving of labour and time. One man can look after everything in several houses—that is, four or five times as much as under normal glasshouse cultivation. There is also complete control over water supply and food. In addition, the method gives freedom from soil-borne disease. Disadvantages are, firstly, the cost of installation, and, secondly, the work required in the frequent testing of the food solution. Crop yields are no higher than those from soil growth, the yield of the experimental tomato plant being between 6½ lb. to 8 lb. of fruit per plant.

Society of Chemical Industry

The sixty-fourth annual meeting of the Society of Chemical Industry was held at the Royal Institution, London, on July 13. After the usual business, including the election of Officers and Members of Council for 1945-1946, had been transacted, Prof. Eric K. Rideal, M.A., F.R.S., delivered his Presidential Address, "Chemistry and Our Society."

Members and guests then proceeded to the Savoy Hotel for luncheon, at the end of which the President made a short speech and presented Dr. Stephen Miall and Mr. T. F. Burton, who are retiring, with tokens of appreciation of their long service with the Society.

In the afternoon, the Society's medal, which is conferred biannually, was presented to the Rt. Hon. Viscount Leverhulme, who gave an address on "Research in Prospect and Retrospect."

The afternoon session was concluded by tea in the Long Library of the Royal Institution, at which the President and Mrs. Rideal received members and guests.

Personalia

Mr. N. Clarke, B.Sc., A.Inst.P.

Mr. N. Clarke, B.Sc., A.Inst.P., has been appointed Assistant Secretary of the Institute of Physics.

Mr. A. G. Marsden's C.B.E.

Among those honoured with the C.B.E. in the King's Birthday Honours List was Mr. A. G. Marsden, Director of Transport of the Ministry of Food. Mr. Marsden is associated with the firm of Cadbury Bros., Bournville.

Mr. R. H. Brand

Mr. Robert H. Brand has been appointed chairman of the British Supply Council in Washington in succession to Sir Ben Smith. Mr. Brand will continue as head of the British Treasury delegation in Washington.

Mr. R. H. Brand was appointed by the Chancellor of the Exchequer as representative of the Treasury in the U.S. in May, 1944, in succession to the late Sir Frederick Phillips. The Minister of Food released him for that purpose from his post of head of the British Food Mission and from the British membership of the Combined Food Board which he held for three years. He is 66, and held important positions in the banking world in the City, being managing director of Lazard Bros. and on the board of Lloyds Bank.

The Royal Sanitary Institute

At a recent meeting of the Council of the Royal Sanitary Institute Mr. David M. Watson, B.Sc., M.Inst.C.E., was elected as chairman of the Council to take office on October 1, 1945.

Mr. A. Robertson

The death has occurred of Mr. Alexander Robertson, Balgonie, Paisley, who was for many years a managing director for the Paisley factory of James Robertson and Sons, Ltd., the well-known preserve manufacturers. He was the son of Mr. James Robertson, who was a founder of the business.

Mr. S. R. Mansfield

To Mr. S. R. Mansfield, director of Polak and Schwarz (Eng.), Ltd., we send our congratulations on his silver wedding. Some seventy people attended a reception on July 3 at the Connaught Rooms to celebrate the event.

Mr. T. J. Stewart

Mr. T. J. Stewart, A.M.I.W., late of B.T.H., has been appointed technical representative for Stanelco Products for the Birmingham area. His address is: Temple Courts, Temple Row, Birmingham, 2.

A.B.C.M.—Return of General Manager

Mr. J. Davidson Pratt, general manager of the Association of British Chemical Manufacturers, has been released by the Minister of Supply, with effect from June 1, 1945, from the appointment of Controller, Chemical Defence Development, which he has held since May, 1940, to resume the former duties with the A.B.C.M. and its affiliated associations.

Mr. F. J. Beeton

Mr. F. J. Beeton, who for eight years has been manager of the canning factory of British Fruit, at Faversham, has now been appointed a director of the firm. Prior to coming to the factory at Lady Dane, Mr. Beeton had been with the parent company at Wisbech, where he served his apprenticeship.

The firm is going in for the "quick freezing" of fruits and vegetables which involves considerable additions to buildings and plant.

Mr. H. Warren

Mr. H. Warren has been appointed Managing Director of the B.T.H. Co., Ltd. He is 53 years of age, and came from Bristol University to the B.T.H. Company (in the testing department) in 1911. He was appointed to the engineering staff in 1913.

During the war Mr. Warren has directed a large volume of special research, development, and engineering work executed by the B.T.H. Company for H.M. Government.

The Institute of Physics

At the annual general meeting of the Institute of Physics held on Monday, June 4, 1945, the following were elected to take office on October 1, 1945: *President:* Sir Frank Smith; *Vice-President:* Prof. A. M. Tyndall; *Honorary Treasurer:* Major C. E. S. Phillips; *Honorary Secretary:* Prof. J. A. Crowther; *Ordinary Members of the Board:* Dr. B. P. Dudding, Mr. A. J. Maddock, Prof. W. Sucksmith, and Dr. C. Sykes.

Sodium Pectate

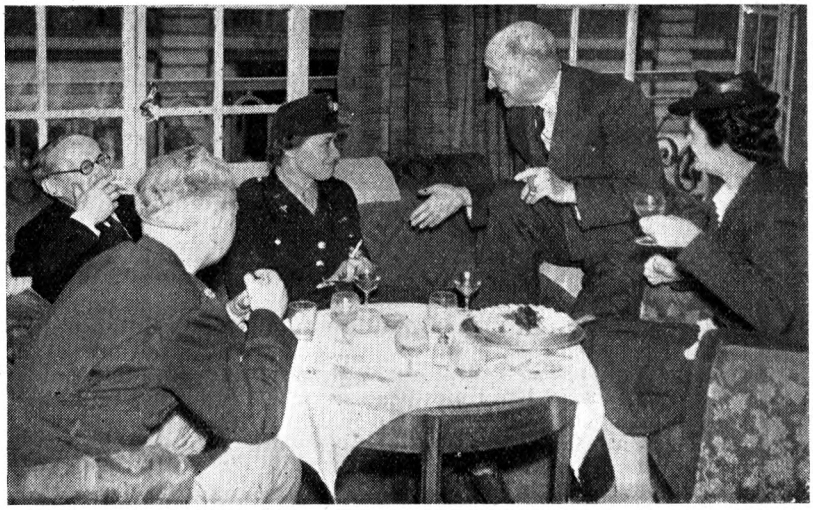
The shortage of natural gums for use as jelling agents and emulsifiers has created a need for other materials to fulfil these purposes. Messrs. May and Baker, Ltd., have advised us of the availability of sodium pectate, which should be of considerable interest to manufacturers requiring a new product with these properties. It is an effective stabilising, suspending, and gelatinising agent, more powerful than gums, gelatine, and cellulose derivatives, and is in the form of a cream-coloured powder, soluble in water, giving colloidal, slightly alkaline solutions of viscosity depending upon the concentration, the *p*H, and the amount of other salts present.

Dilute solutions may be jelled by addition of mineral or organic acids or of metallic salts such as those of calcium or magnesium, and in this respect sodium pectate behaves in an analogous manner to sodium alginate, being jelled irreversibly by slurry of calcium citrate. The gels are compatible with large amounts of other organic substances, such as sugar, dissolved in the aqueous medium.

Suggested uses are: As a thickening agent in syrups, essences, emulsions, and sauces; a binding agent in pastes and tablets; an auxiliary emulsifier in oil emulsions and salad creams; a jelling agent in the manufacture of jams and table jellies; and a clarifying agent for malt liquors and fruit juices.

Change of Address

M. Hamburger and Sons notify that their address is now: Ceylon House, Eastcheap, London, E.C. 3. Telephone: Mansion House 4139.



Sir Francis Joseph chatting during the luncheon given to the delegates on their return from America. Lord Horder is on the left.

CATERERS LUNCH TOGETHER

The suggestion that a number of employers in Britain and the United States should get together and work out a scheme to enable their staffs to join in a two-way Atlantic traffic and to study each other's methods was made by Sir Francis Joseph, Bart., K.B.E., D.L., President of the National Society of Caterers to Industry at a lunch given to the society's delegation on its return from a two-months' tour of catering establishments in the U.S.A.

Mr. Harold L. Gardner, chairman of the society and leader of the delegation, made comparisons between catering in Britain and America.

Asking himself why catering on the Santa Fé railroad, race tracks, and other places was obviously so much better done than in this country, he thought an important part of the answer was that it was not based on short term, rigid written contracts, in which each side tried to extract the last penny from the other or to cheesepare on the job.

Mr. Gardner was particularly interested in the financial aspect of industrial catering. The money lost by managements need not have been lost if the facilities had been planned and operated from the start by caterers who knew their business. He had reason to suppose that about 90 per cent. of our own industrial canteens as well as some other large-scale catering operations do not pay their way and that a widespread and thorough overhaul of industrial catering is necessary.

Speaking of equipment, he said that the Americans were years ahead of us in the use of refrigeration, quick freezing, air conditioning, ventilation, sound insulation, electric power, labour-saving machinery, and modern materials, such as plastic, glass for building construction, aluminium alloys, and stainless steel. One incidental result is that the American manufacturers of catering equipment are in a favourable position to develop post-war export markets.

Mr. Gardner hoped that British catering equipment manufacturers would be free at the earliest possible moment from official control and restrictions which have held them back during the war. He said that this was the Government's responsibility, and he hoped that the Catering Wages Commission, the Board of Trade, and the Ministry of Works would look to it without delay.

Lord Horder, vice-president of the society, expressed his appreciation of the work that the delegation had done. He hoped that as a result of the visit, progress would be made in British catering.

Companies

Associated Biscuit Mfrs.

At the twenty-fourth Annual General Meeting of the Associated Biscuit Manufacturers, Ltd., Mr. C. Eric Palmer, D.L., J.P., the chairman, said: The revenue of the company for the twelve months ended March 31, 1945, was £65,065, as compared with £60,032 in the previous year. With the carry-forward from the 1944 accounts—namely, £34,952—there is a total of £100,017. From this amount has to be deducted the Preference dividend to date—namely, £19,500—and the payment on January 1, 1945, of an interim dividend on the Ordinary shares of 2 per cent., less tax (£14,001), leaving a balance available for dividend of £66,516. The directors now recommend that a final dividend of 4 per cent., less tax, should be paid on the Ordinary shares of the company, absorbing £28,002, and that the sum of £38,514 should be carried forward to next account.

The combined reserves of the subsidiaries—Huntley and Palmers, Ltd., and Peek Frean and Co., Ltd.—as stated on their balance sheets at December 31, 1944, amounted to £700,000, whereas the undistributed profits of the company and its subsidiaries at the date of their balance sheets after providing for the dividends payable on the Ordinary shares for the period under review amounted to £212,746, making a total of reserves and undistributed profits of £912,746.

The combined profits of Huntley and Palmers, Ltd., and Peek Frean and Co., Ltd., before charging N.D.C. and E.P.T. for the year ended December 31, 1944, show an increase of £121,367, as compared with the previous year, which has been almost entirely absorbed by taxation.

Virol

An explanation of the sharp rise from £16,992 to £24,315 in the net profit after taxation of Virol announced in the preliminary figures is given by Lord Luke in his statement accompanying the accounts for the year to March 31 last. Gross profit before charging advertising, salaries, E.P.T., etc., rose by £11,839 to £141,774, but this increase would normally have been offset by E.P.T. A favourable adjustment in the profits standard has, however, permitted the rise in net profits. This allows the transference of £5,000 to reserve at the same time as the addition of a cash bonus of 2½ per cent. to the previous year's dividend of 10 per cent. on the Ordinary shares. The balance sheet shows little change.

Weston Foods

Weston Foods has declared an Ordinary dividend of 15 per cent., less tax, in respect of the year to June 30 next, compared with 10 per cent. for each of the five preceding years. All the issued £900,000 Ordinary capital is owned by Allied Bakeries, and Mr. W. Garfield Weston is chairman of both companies. Weston Foods also has in issue £750,000 6 per cent. Cumulative Preference £1 shares, quoted at 26s. 6d.

The directors of Weston Foods also announce that "the subsidiary companies have achieved satisfactory trading results in respect of their year to March 31, 1945, and it is anticipated that the profits for the year to June 30, 1945, will show a moderate expansion; it is, however, too early yet to make any reliable estimate of the profits for the year."

United Molasses Company, Ltd.

At the nineteenth Annual General Meeting of the United Molasses Company, Ltd., the chairman, Mr. F. K. Kielberg, said that stockholders would welcome a brief statement from him in reference to the claim made in a recent White Paper that "industrial and power alcohol can now be produced and is, in fact, being produced in this and certain other countries by other than distillation processes and from material other than molasses, and that in some fields of economic manufacture alcohol itself may be superseded by other materials."

This statement had evidently led some financial writers and some stockholders to fear that molasses is likely to be superseded as a raw material in the production of industrial alcohol. It was clearly impossible in an age of intense industrial and scientific research to forecast the economic and industrial changes which the future may have in store, but personally he saw no reason whatsoever for thinking that available supplies of molasses would not continue to find a ready market as a raw material in the production of industrial alcohol, yeast, and cattle food, to mention only the three most important of the pre-war outlets.

The present world demand for industrial alcohol was far in excess of the maximum quantity that could be produced from molasses, even if all available supplies of molasses were used for that one purpose only, and he looked upon the production of alcohol from other materials not as a threat to the continued use of molasses, but as a necessary complementary source of supply.

Significance of Food Distribution

Speaking at the fiftieth Ordinary General Meeting of the Home and Colonial Stores, Ltd., the chairman, Sir George Schuster, said that there was much talk on one side of the State taking over business undertakings and on the other of the dangers of "Big Business." They were not, however, greatly disturbed by this sort of talk; in fact, they felt confident about their position, provided that they concentrated on doing their job as well as it could be done, thus being enabled to convince the consuming public that they were performing a valuable national service in distributing food of first-class quality as economically as possible. The public should be able to appreciate the facts about distribution, and he therefore welcomed the Government's apparent intention to carry out a regular census of distribution. On the other hand, he was much concerned to see that, in the special Income Tax Bill introduced this year, the Chancellor of the Exchequer had discriminated between the business of distribution and so-called "productive" industry, and had given the former much less favourable treatment in the matter of depreciation allowances. Such discrimination implies a complete failure to appreciate the significance of distribution and should be corrected. Wasteful or costly processes of distribution must tend to raise costs of living, and, as a result, both to depress living standards and also to weaken the competitive power of British industry and agriculture.

Hovis Dividend

Hovis is maintaining the second interim Ordinary dividend at 10 per cent., making 20 per cent., less tax, for the year to March 31 last—the same annual rate as for the preceding nine years. Issued capital is £544,780 in £1 shares—150,000 6 per cent. Cumulative Preference (quoted at 31s. 3d.) and 394,780 Ordinary (standing at £5 15/16).

Apollinaris and Presta, Ltd.

At the forty-eighth Ordinary General Meeting of Apollinaris and Presta, Ltd., it was announced that the gross revenue received from the trade in soft drinks and sparkling Buxton water had decreased by £1,544, but this was more than accounted for by the loss to the trading subsidiary of the interest on their surplus funds which were transferred to the company towards the end of 1943, with the result that the interest received direct from investments had increased by £2,263, the total revenue being £754 up. On the other side, expenses showed an increase of £475. The net profit of £24,939 enabled payment of 4 per cent. on the debenture stock to be made on July 2 last.

C. and E. Morton Acquired by Beechams

Beechams Pills has acquired control of C. and E. Morton, the preserved provision manufacturers. It has purchased the privately held 225,000 £1 8 per cent. Cumulative Preferred Ordinary at 8s. each and 450,000 10s. Ordinary at 4s. each, making the total consideration £180,000.

An official statement says:

"The policy of the Beecham Group for the past few years has been to broaden the base of the company's business and not limit it to the medicinal field. During the past few months it has acquired a number of businesses producing and marketing proprietary foods; and the purchase of the Morton business, with its factories and agencies all over the world, gives Beechams the opportunity of gaining not only unlimited expansion in the food market, but also export channels for selling the other products which the Beecham Group has to offer."

Overseas Items

Canned Rattlesnake

Ross Allen, Florida herpetologist, has bought the property at Arcadia, Fla., where George K. End operated a rattlesnake meat canning business until his death last year. Mr. Allen, it is reported, will build a modern canning plant there.

New Food Agreement

The British Ministry of Food and the Canadian Department of Agriculture have reached a new food agreement under which Britain will purchase at least £2,328,888 (10,500,000 dollars) worth of the 1945 Canadian vegetable crop.

The British purchases will include the following minimums: 746,700 bushels of dried white beans; 4,375 long tons of dehydrated potatoes; 2,250 long tons of dehydrated cabbage, carrots, and turnips and beet.—*Reuter.*

South African Dehydrated Food Industry

Six factories conducted by private enterprise have come into operation since dehydration was started in the Union on a commercial basis in November, 1942, it was stated by Mr. Droesti, officer in charge of the Union's dehydration and cold storage control. So far, the Union has supplied about 1,000 tons of dehydrated products to the British Admiralty, a quantity which equals about 20,000 tons of fresh vegetables.

Although three of the six factories had to close down temporarily owing to a seasonal shortage of vegetables, Mr. Droesti stated that the Union plants would make every effort to meet requirements of the British Admiralty.—*Reuter's Trade Service.*

Australian Food Production at Capacity

Australia has reached the limit of her food-producing capacity, a spokesman of the Commonwealth Food Control declared recently. Unless there is a complete break in the drought over the whole country, Australia will not be able to fulfil her added responsibilities.

The spokesman gave the following information regarding the food situation: Production of cereals has been halved by the drought; last year's meat production was 1,035,000 tons compared with a pre-war average of 850,000 tons, but this year's output does not exceed 900,000 tons; last year's egg production amounted to 90 million dozen, compared with the peace-time 56 million; about 2 million cases of canned vegetables were recently produced for the British forces in Burma; production of dried fruits last year was about 100,000 tons compared with the pre-war total of 85,000, but this year's output is not more than 70,000 tons.—*Reuter.*

Australian Canning Trade

After the war, big increases in the Australian export trade and domestic consumption of canned goods are expected. In 1932, Australians were eating an average of only 3·8 lb. of canned fruit a head; by 1939 this had risen to 9·2 lb. a head. In 1932, Americans were consuming as much as 10·25 lb. a head, while by 1939 the amount consumed was up to 16·06 lb. a head, almost double the Australian consumption per head. Most marked difference in consumption levels between the two countries is in canned vegetables. It has been estimated that the average consumption in Australia of canned vegetables was 2 lb. a head in 1938-39, compared with 22 lb. a head in America.

This has a considerable interest for (among others) manufacturers of cans; and it raises a query whether the pre-war plans for a tinplate industry in Australia will be revived. Meanwhile, the food front efforts of some of the enterprising concerns of the Commonwealth are achieving notable results. A batch of 1,534,420 tins of canned carrots was produced at the factory of Mumzone Products, Ltd., St. Peter's, South Australia, under a recent defence contract.

Some 18 million carrots were used in fulfilling the order, which took only twelve weeks to complete. Believed to be an Australian record on a single production line, highest daily output was 27,018 cans. Four girls topped and tailed an average of 76,000 carrots a day each. South Australian production of fruit and vegetables is on such a scale as to warrant the belief that the State will play a major part in any post-war expansion in the canning trade.

Combining Dehydrated and Regular Product

Meat processors who have had an opportunity of examining some of the Army's new canned products in which meats are combined with dehydrated vegetables or fruits, or in which regular meat and dehydrated meat are mated, believe that the technique may have considerable value in producing high-quality civilian canned meats and perhaps improved sausage and loaf products after the war.

In such combinations the excess moisture freed from some types of meat in processing is absorbed in reconstituting the dehydrated food or meat used with it, so that the end product is not watery or gelatinous, but contains throughout the proper

proportion of moisture for attractive appearance and palatability.

Dehydrated and regular meat have been combined in making canned loaf; ham and dehydrated sweet potatoes and pork and dehydrated apples have also been used together successfully.

Employing this idea, the sausage manufacturer, as well as the meat canner, should be able to develop some unusual combination specialities and loaves. Moreover, by combining dehydrated with regular meat, it might be possible to eliminate some of the greasiness inherent in some types of sausage, improve texture, and ensure a more shapely end product after baking or other processing. There would also seem to be some possibility that dehydrated meat might be valuable in adjusting the protein to water ratio in sausage or loaf manufacture.—*National Provisioner.*

Food from Sawdust

A process for manufacturing foodstuff from sawdust and waste wood has been offered to the Allies by a German scientist, a Nobel Chemistry Prize winner, Friederich Bergius. After experiments, he said, his products were passed on to the German army and used for daily diet, mainly in soups and hashes.

According to Bergius, two factories were producing 800 tons monthly of yeast, which equals in protein value the meat ration for 1,700,000 people under the German rationing system.

With the process he offered the factories and machinery which have been producing this artificial food for the German army and people since 1938.

"Protein from wood yeast," said Bergius, "is the same as protein from meat or cheese, and the best raw material for it is bamboo, which grows between Venice and Trieste."

News from the Ministries

Bread Subsidy

The Ministry of Food, pending its further investigation of costings figures, has made a temporary increase in the bread subsidy payable to bakers in England and Wales on the first 10 sacks of weekly production as from April 29. While this operates, 8s. per sack will be payable on the first 10 sacks of weekly production and 6s. 9d. on all appropriate production in excess of 10 sacks per week.

Fats for Priority Supplies of Flour Confectionery

The Ministry of Food announces that, in view of the present supply position of fats, the amount of fats available under the Ministry's priority scheme for the manufacture of flour confectionery for industrial canteens and other priority establishments will be reduced by 12½ per cent. as from July 22.

Christmas Puddings

The Minister of Food has made an Order (S.R. & O. No. 758 of 1945), which came into force on June 20, 1945, amending the maximum prices for Christmas puddings sold in non-returnable basins, as shown in the Schedule to S.R. & O., 1943, No. 1318, which authorises certain persons to manufacture and pre-pack Christmas puddings subject to the conditions set out in the General Licence.

The Amending Order maintains the provision that Christmas puddings in non-returnable basins may be sold at a higher price than those in other containers, but the maximum prices for puddings in such non-returnable basins are increased by 2d. per lb. as compared with the prices previously prescribed.

War Factories Change-Over

The Board of Trade has allocated another 34 Government factories for civilian production, making, with the 19 announced in March, a total of 53. The total of the factory space now allocated exceeds 15,600,000 square feet. There is about three times this amount of factory space still to be allocated in bulk, as well as a large number of smaller premises.

The 34 factories will, when they are in full swing on civilian production, employ approximately 150,000 workpeople. It does not follow, of course, that they will always be the same workpeople or the same type of workpeople who have been employed on the war-time work of the factories. Some of the allocations have been made in advance of the time when the change-over to civilian use can be made. All the factories are leased. It is the Government's policy not to sell them.

Resignation

Mr. Willam Wallace, Joint Director of the Cocoa, Chocolate, and Sugar Confectionery Division, found it necessary on personal grounds to relinquish his appointment on June 30, 1945. From July 1 this Division has been under the sole direction of Mr. Eric D. Mackintosh, who at present holds the directorship jointly with Mr. Wallace.

Mr. Stanley G. Hillyer

Mr. Stanley G. Hillyer, O.B.E., F.C.A., who has been Director of Costings to the Ministry of Food since the outbreak of war, September 3, 1939, relinquished his appointment as from June 30, 1945.

The Minister, Colonel Llewellin, has accepted his resignation with regret and expressed his appreciation of Mr. Hillyer's services to the Ministry.

Pork Sausages and Pork Sausage Meat

The Minister of Food has made an Order (S.R. & O., 1945, No. 798) amending the Meat Products, Canned Soup and Canned Meat (Control and Maximum Prices) Order, 1944, providing for the use of at least 80 per cent. instead of 90 per cent. pork in the meat content of pork sausages and pork sausage meat including pork slicing sausage, but without alteration of the total weight of meat prescribed. The Order is in force from July 5, 1945.

Urgent Building Requirements

The Ministry of Food desires to estimate the amount of constructional work costing not less than £2,000 at 1939 prices urgently needed by bakers.

Bakers in urgent need of building work to the value of £2,000 or more should apply for a form at once to: The Director for Bread and Flour Confectionery, Ministry of Food, Bryn Euryn, Dinerth Road, Colwyn Bay, Denbighshire.

Those who gave particulars in response to the enquiry made last January need not repeat them.

Nuts

The Minister of Food has made a new Nuts Order (S.R. & O. No. 757 of 1945) which came into force on July 1, 1945. It is a consolidating Order which revokes and in substance repeats the provisions of previous Orders and of the General Licence dealing with nuts. The only change effected by the Order is to increase the maximum prices for Barcelona, Turkey points, and other similar kernels, for sweet almonds and for desiccated coconut.

Iodinated Protein

Experiments have been in progress with a substance known as "iodinated protein" and have shown that, if this is fed to milking cows at a particular short stage of the lactation, it stimulates the udder and temporarily increases the milk yield. In the later stages of the work a large-scale trial was carried out in which many farmers took part.

While this trial confirmed previous research work, a general review of the position made it clear that the use of the substance as an aid to milk production could not, in the light of present knowledge, be recommended.

The full effects of feeding iodinated protein to milking cows have not yet been ascertained, and further trials are being considered. In the meantime the use of this product would not be in the interests of milk production or of milk producers, and the Ministry of Agriculture and the Department of Agriculture for Scotland do not intend that it shall be made generally available.

British Mission

It has been arranged that a small party shall visit America this summer to study the design, layout, and construction of farm buildings there, in order that the fullest information should be made available to farmers, landowners, architects, and builders in this country. The party will consist of:

The Earl of Portsmouth, landowner and farmer, and member of the Hampshire War Agricultural Executive Committee.

Mr. F. Ward, farmer from Shropshire.

Mr. J. Mackie, farmer from Kincardineshire.

Mr. A. Thorpe, F.R.I.B.A., Architect to the Ministry of Agriculture and Fisheries.

Mr. P. J. Moss, of the Ministry of Agriculture and Fisheries, Secretary of Farm Buildings Committee.

The mission will report to the Agricultural Ministers on their return.

Directorship of Fish Division

It was announced on January 15 that Mr. F. S. Anderson would continue to act as Director of Fish Supplies while undertaking the work of a Principal Assistant Secretary, and that he would be assisted in the Fish Division by Mr. J. A. Peacock, Director of Egg Supplies. Pressure of work in the Eggs Division has made it impossible to continue this arrangement.

Mr. J. P. Van de Bergh has been appointed Director of Fish Supplies. He retains his existing appointments as Director of Margarine and Director of Dehydration.

Plums Pre-emption

It is not proposed to exercise during the coming season the power of pre-emption contained in the Plums Order, 1945. Growers are therefore free to make contracts with preservers, but all sales to licensed preservers must be made at the fixed price and under the conditions laid down in Part 3 of the First Schedule to the Plums Order, S.R. & O., 1945, No. 785.

Dried Fruit for Bakers

For the period of eight weeks beginning on July 22, the permits for dried fruit issued to the bakery trade will be honoured at 10 per cent. of their face value, instead of the 70 per cent. normally applied. The additional quantity thus represented will be allocated solely in the form of pitted dates.

Divisional and Local Organisation

The Minister of Food has decided to dispense with the remaining posts of Chief Divisional Food Officer appointed for special duties in the main military command areas in England and Wales in the year 1941. Following this decision:

(*a*) Sir Thomas G. Jones, K.B.E., and Sir W. Oliphant MacArthur, C.B.E., have submitted their resignations with effect from June 30, 1945, and July 31, 1945, respectively. Both resignations have been accepted.

(*b*) The Chief Divisional Food Office at Chester consequently closed on June 30, and that at York on July 31, 1945.

(*c*) Rear-Admiral Sir Arthur F. Strickland, K.C.B., O.B.E., relinquished his appointment as Chief Divisional Food Officer on July 31, 1945, but will continue to serve as Divisional Food Officer, South-Western Division.

Sir Angus Watson, J.P., intimated his desire to retire from the Ministry on June 30, 1945, and his resignation of the post of Divisional Food Officer, Northern Division, has accordingly been accepted. Mr. W. S. Rainbow, who has served in the Northern Division since the outbreak of war and as Deputy Divisional Food Officer since 1941, will succeed Sir Angus Watson as Divisional Food Officer with effect from July 1, 1945.

The Minister wishes to place on record his appreciation of the very valuable services which have been rendered to the Ministry by Sir Thomas Jones, Sir Oliphant MacArthur, and Sir Angus Watson, all of whom have given great help both to the present and previous Ministries of Food.

Sausage Casings

The Ministry of Food has agreed with the associations representing the sausage casing trade for the existing agreement on the maximum prices of hog casings to be extended to cover sheep and beef casings. The new agreement came into force on July 1.

Spray-Dried Whole Egg

Until further notice, supplies of spray-dried whole egg for the bakery and food manufacturing trades will be reduced from the present rate of 130 per cent. to the datum year basis of 100 per cent. Supplies required to meet any form of priority permit will be released as additional to datum year entitlements.

Plums Order, 1945

The Minister of Food has made an Order replacing the Plums (Maximum Prices) Order, 1944. This Order came into force on July 8, 1945. Until then the Plums (Maximum Prices) Order, 1944, remained in force.

The group classification for plums and Price Areas is the same as last year. Transport restrictions are renewed except that the prohibition on transporting damsons from Northern Ireland to Great Britain is retained.

The maximum commission payable on a sale to a licensed preserver has been increased from 20s. to 30s. per ton. Growers are required to keep records of weekly pickings of pre-empted plums. Licences issued under the 1944 Order will remain valid under this Order.

Prices have been increased for Groups 1 and 4. For Groups 2 and 3 the prices remain the same except for a small upward adjustment in the growers' price for Group 2 plums in Area 3. The Groups correspond to those enumerated in the Plums (Maximum Prices) Order, 1944.

Ancillary Materials for the Fish Trades

Changes in the arrangements for buying machinery will be made soon, individual licences to machinery manufacturers being replaced by bulk licences, and a new procedure will shortly be adopted in dealing with post-war building projects.

Full information on both these subjects has been circulated to the various associations of the fish processing and distributive trades, and their members are asked to send to the Fish Division, Ministry of Food, Carlton Hotel, London, S.W. 1, separate statements of their building and machinery requirements during the coming year.

Information and Advice

Butter Flavour and Coconut Essence

B.119. *An enquirer asks for some information regarding the manufacture of butter flavour and coconut essence.* (Lancs.)

There are a large number of formulæ for butter flavouring and the following indications may serve as a basis for experiment. The main ingredient is diacetyl, to this is added small quantities of butyl acetate and butyrates, ethyl butyrate and acetate. Also triacetin to the extent of about 20 per cent.

A formula for coconut essence from the nuts themselves is as follows :

10 lb. of the rasped nuts are macerated with 30 lb. proof spirit and stirred frequently for ten days. 20 lb. of the liquor are removed. To the residue is added 50 lb. of water, 12 dr. ethyl pelargonate and 1½ oz. amyl formate and distilled, collecting the first 10 lb. of distillate which is mixed with the 20 lb. of extract liquor first removed to give a final yield of 30 lb. If required, most of the alcohol can be removed by distillation, preferably *in vacuo*, the aqueous residue extracted with ether, and the ether removed to yield the concentrated essence.

Wheat Milling

B.147. *Required information regarding the total quantity of wheat milled annually in this country, and also comparable figures for oats milled in Scotland and oats milled in England.* (Lincs.)

We are informed that the total quantity of wheat milled in Great Britain is between 35,000,000 and 40,000,000 quarters of 480 lb. annually. The home production is between 7,000,000 and 10,000,000 quarters of 504 lb. We have no figures giving the quantities of oats milled in Scotland and England, but are informed that Scotland produced some 8,000,000 tons of oats last year.

According to Broomfield's *Corn Trade Review* just before the war, England produced between 8,000,000 and 9,000,000 quarters of 320 lb., and Scotland nearly 5,000,000 quarters of 320 lb.

The imports for all Great Britain were about 2,000,000 quarters of 320 lb., but probably most of that was for animal feeding.

Information Supplied

B. 128. *Details of manufacturing confectioners and canned food manufacturers in South Africa.* (Essex.)

B. 140. *Manufacturers of a machine for recording specific gravity.* (Lancs.)

B. 142. *Information regarding processes for the production of starch from wheat flour.* (Staffs.)

B. 143. *Information regarding standard specifications for the hardness of lacquer on black plate goods supplied to the Services.* (Lancs.)

B. 145. *Names and addresses of suppliers of plant for refining olive oil.* (Syria.)

B. 146. *Information concerning the dilution of whiskey, gin, and rum during the war.* (Dorset.)

B. 150. *Names and addresses of manufacturers of horseradish cleaning machinery.* (Warwicks.)

B. 151. *Names and addresses of manufacturers of tinplates and lacquered tinplates, rubber bands, and lacquers and lacquering plant.* (Egypt.)

B. 152. *Names and addresses of manufacturers of food machinery.* (Palestine.)

B.163. *Names and addresses of firms supplying machines for peeling onions and also manufacturers of metal taps and filters for use with vinegar.* (Worcs.)

B.164. *Particulars of engineering firms specialising in the manufacture of presses suitable for the production of 2-oz. brickettes of gravy salt.* (Newcastle-on-Tyne.)

B.165. *Recipes for ice cream.* (Worcs.)

B.166. *Information regarding suppliers of uncooked potato flour.* (Kent.)

B.171. *Courses of study for chemical qualification.* (London.)

B.172. *Manufacturers of the plant used in "A New Canning System" described in* FOOD MANUFACTURE, *May,* 1945. (Lancs.)

B.173. *Particulars of recipes, methods of manufacture, and machinery for sauces, mayonnaise, etc.* (Australia.)

B.174. *Suppliers of a green dye for peas.* (London.)

B.176. *Names and addresses of patent holders or manufacturers of the various types of quick freezing apparatus.* (Suffolk.)

B.177. *Particulars of firms specialising in the manufacture of modern machinery for the processing and canning of tomatoes and fruit pulps.* (Lancs.)

B.179. *Names and addresses of firms making macaroni machinery.* (Africa.)

B.182. *Details of the relative food values of rice (polished and unpolished) and semolina.* (Warwicks.)

B.183. *Full particulars required of the projection refractometer illustrated in* FOOD MANUFACTURE, *April,* 1945. (South Africa.)

B.187. *Names and addresses of English firms producing fully automatic butter and/or margarine packing machinery.* (London.)

B.188. *Formulæ for high-class quality ice cream powders.* (Lancs.)

B.189. *Names and addresses of firms supplying machinery for* (a) *the mixing ingredients of a self-raising flour and* (b) *the filling of the flour into various size packets* (1 *lb.,* 2 *lb., and* 3½ *lb. size), the minimum output to be five tons per week.* (Ireland.)

B.195. *Recipes for jelly crystals and lemonade crystals.* (Scotland.)

Information Required

B.246. *Required the address of the proprietors of Frigidex.* (London.)

Recent Patents

These particulars of new patents of interest to readers have been selected from the "Official Journal of Patents," and are published by permission of the Controller of H.M. Stationery Office. The journal can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

Specifications Published

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, at the uniform price of 1s. each.

568,007. UNIPEKTIN AKT.-GES.: Method and apparatus for the conservation of fruit juices and vegetable juices.

568,026. BAMFORD, C. J., and BAMFORD, H. V.: Potato-planting machines.

568,086. POINTON, J. E., and BAKER PERKINS, LTD.: Dough-kneading pans.

568,093. KNOCH, H., and DRYFOOD, LTD.: Manufacture of extruded food preparations.

568,094. KNOCH, H., and DRYFOOD, LTD.: Manufacture of extruded food preparations.

568,114. RICE, G.: Jar for use in the production of pure cultures such as mushroom spawn.

568,172. FURLONG, J. J.: Machine for filling cans and like containers with potatoes and the like.

568,214. AKTIEBOLAGET, G. AREHNS MEKANISKA VERKSTAD: Machine for dressing fish.

568,250. VICKERS, H.: Method of preparing meat or fish packed in sealed containers.

568,261. KENYON, J., SILBERSTEIN, V., and ATTARI, H.: Production of gelatine and glue from hides and other collagen or ossein-containing materials.

568,329. AVELING-BARFORD, LTD., and WILCOCK, C. M.: Rotary mixing and agitating and analogous machines.

568,354. FLETCHER AND CO., LTD., G., and MURRAY, C. W.: Vacuum pans, evaporators, digesters, and like apparatus.

568,474. TRACY, J. W.: Pastry cutter with rotating disc cutters.

568,487. MELVIN AND GILLESPIE, LTD., and HALL, W. A.: Bakers' ovens.

568,771. NORDENSKJOLD, T., and HOLMQUIST, K. S.: Process and apparatus for treatment of masses containing chocolate.

568,798. MEYER, J.: Machines for peeling potatoes and the like.

568,891. DEHN, F. B. (Mills Novelty Co.): Ice cream hardening and dispensing cabinet.

568,892. FREEMAN, W. S.: Closures for containers.

568,897. GRIFFITHS, E. E., and GRIFFITHS, J. E.: Thermostatic means for regulating the heat supply to liquid heating apparatus.

569,023. SKRINE, H. H., and DRING, LTD., J.: Collapsible boxes, cartons, or baskets made of cardboard or like materials.

569,124. NOWAKOWSKI, M. K.: Tea infuser.

569,139. AVELING-BARFORD, LTD., and WILCOCK, C. M.: Charging of batch mixing and agitating machines.

569,176. RICHTER, E. W.: Method and a machine for lining the inside of tins with pastry.

569,180. AINSWORTH, A.: Ovens through which articles to be heat-treated are continuously passed.

569,205. HOBBS, E. W.: Cooling apparatus.

Abstracts of Recent Specifications

Improvements in Apparatus for Irradiating Foodstuffs by Ultra-Violet Rays

This invention relates to apparatus for irradiating foodstuffs by ultra-violet rays to improve their anti-rachitic properties, and the invention has for its object to provide improved construction.

There is provided a tubular shield adapted to be placed and supported intermediate the discharge end of the lamp and an opening in the container for holding the material to be treated.

The tubular shield may be detachably mounted on the lamp and one end of the tubular shield may be provided with a gallery adapted to surround the lamp casing, means being provided for attaching the shield to the lamp.

Further, the base of the gallery may be provided with one or more openings for air.

Within the gallery and arranged in spaced relationship over the opening or openings a baffle plate may be provided so as to prevent the rays from the lamp passing through the opening or openings.

The shield may be of tapering form with the larger end adjacent the lamp and the smaller end adjacent an opening in the foodstuff container.

The lamp may be suspended by counter-balanced means, so that it can be raised together with the shield to allow the foodstuff container to be moved in and out of position.

561,858. Ernest Harding.

Trade Marks

The list of trade marks of interest to readers has been selected from the "Official Trade Marks Journal" and is published by permission of the Controller of H.M. Stationery Office. The journal can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

POM-ANZ.—627,283. Flour, bread, and biscuits (other than biscuits for animals). **Herbert Bernard Tidmarsh Collins,** 32, Wendover Court, Finchley Road, London, N.W. 2; Merchant.

LAKESIDE.—631,061. Sauces. **Lakeland Food Industries, Ltd.,** Solway Estate, Maryport, Cumberland; Merchants and Manufacturers.

SANTOSSIE.—631,347. Tea. **Thomas Clarke and Company (Tea Dealers), Ltd.,** 2, Saint George's Lane, London, E.C. 3; Merchants.

BUSCO.—631,401. Flour, cereals prepared for food for human use, bakers' confectionery, baking powder, cake powder, sponge powder, pudding powders. **Effie Holden,** trading as **E. Holden and Sons,** 114, Tynemouth Road, Heaton, Newcastle-upon-Tyne, 6; Manufacturer.

MILLER'S PRIDE.—631,542. Self-raising flour. **J. H. Meachin and Company, Ltd.,** Raven Flour Mills, 289, Stockport Road, Longsight, Manchester, 13; Manufacturers.

New Companies

Hertford Refrigeration Co., Limited. (390427.) 80, Mackenzie Road, Holloway, N. 7. Nom. cap.: £1,000 in £1 shares. Perm. gov. dirs.: C. M. Grant, 76, Gt. Queen Street, Dartford.

Atmospheric Control, Limited. (390457.) 41, John Dalton Street, Manchester 2. To carry on bus. of makers of air-conditioning and dust-removing appliances, etc. Nom. cap.: £10,000 in £1 shares. Dirs.: C. V. Ward, 43, Corbar Road, Mile End, Stockport, Ches.; E. R. Lewis, 1, Lisburn Lane, Gt. Moor, Stockport, Ches.

Gunns (Mineral Waters), Limited. (390495.) 9, East Street, Okehampton, Devon. To take over bus. of mineral water manufacturers and distributors carried on at 9, East Street, Okehampton, as "S. P. Gunn and Sons." Nom. cap.: £5,000 in £1 shares. Dirs.: G. P. Gunn, 9, East Street, Okehampton; W. A. Gunn, Glengairn Villas, Station Road, Okehampton.

Taken from the Daily Register, compiled by Jordan and Sons, Limited, Company Registration Agents, 116, Chancery Lane, London, W.C. 2.