FOOD MANUFACTURE

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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.

Electronic Dehydration of Food

AN electronic dehydration method has been developed by the Federal Telephone and Radio Corporation, Newark, New Jersey, some information on which is given in an article by Vernon W. Sherman in *Electrical Communication*, the journal of the International Telephone and Telegraph Corporation, New York. The process makes possible the removal of 99 per cent. of the moisture content from a compressed vegetable block. The aim has been to decrease the amount of moisture usually left in the dried product by the conventional methods.

Dehydration is carried on after the vegetables have been compressed into a small block 6 ins. by 3 ins. by $\frac{3}{4}$ in. This is an unprecedented method, all other processes requiring exposure of as much of the vegetable surface as possible.

Extensive studies have shown that the length of time vegetables may be kept in good condition increases very greatly as the moisture content approaches 1 per cent. The author states that the exact method of dehydration cannot be disclosed at present; briefly, it consists of 80 per cent. of the moisture being removed by conventional methods, leaving the vegetables pliable, but without formation of "case-hardening".

The vegetables are then compressed into bricks and the remaining moisture is removed electronically, after which they are ready to be wrapped in paper, wax coated, packed, and shipped. The whole procedure is well adapted to automatic straight-line production. Laboratory results show that 1 lb. of water may be removed electronically with less than 1 kw. of energy, a figure which is economically good in comparison with other methods.

In addition to vegetables, dried whole milk has had its moisture content reduced electronically from 2 per cent. to 1 per cent. This appears to be a small difference, but it makes it possible to ship dried whole milk without danger of its butter fat content becoming rancid.

Apart from the importance of this electronic dehydration achievement (states the author), the results of which are especially timely in connection with the transportation of food abroad, the process represents another of the many outgrowths of fundamental research and development in industry.

Better Bread

Britain is to have better bread. The Ministry of Food has appointed a "flying squad" of five experts who will investigate complaints about bread and advise bakers how to make the perfect national loaf. They will turn out in answer to urgent calls from any part of the country just as a police car turns out to investigate a crime. If a complaint is received, or if a baker is puzzled because his bread does not turn out well, an expert will go to the baker, examine the ovens, correct the temperature if necessary, and finally test the loaf. He will not leave until the baker is confident that his bread in future will be up to standard. "And the standard", a Ministry official told our correspondent, "is the finest loaf that Britain's best bakers can bake."

Ice Cream Definition

The Ministry of Food contemplates amending the Ice Cream (Prohibition of Manufacture and Sales) Order so as to incorporate a definition of ice cream. The current Order merely states that "ice cream includes water ices". The decision not to insert a definition of the banned products was taken on the advice of the Ministry's Legal Department.

Administration of the Order has shown that whenever a case is heard in court under its provisions the first question asked by the defence is: "What is ice cream?" or "What is a water ice?" and in the present absence of any legal definition different magistrates may accept very divergent views of what these products really are.

Shortly after the Clerkenwell "test" case the Ministry seems to have formed the view that a definition of ice cream and water ice is desirable, and the following definition was suggested to the Ice Cream Association: "The term ice cream or water ice shall comprise any confection sold in a frozen or semi-frozen condition—*i.e.*, at a temperature below 32° F.—but shall exclude frozen or semi-frozen fruits and vegetables."

Manufacturers declare that such a definition is useless. If a summons were brought under such a definition the defence would ask: "What is a confection?" and the position would be just as unsatisfactory as it is to-day.

To define ice cream is not a difficult matter, but such a definition would be totally inadequate for purposes of a Prohibition Order. The Ministry needs a definition that will embrace ice cream, water ices, and all the wide range of chilled and semi-frozen products that the Ministry wishes to keep off the market. That is a much more difficult matter. So far the Ministry has not sought the assistance of the industry, but manufacturers have told the Department why the suggested definition quoted above is inadequate.

Vitamin Nomenclature

In a recent article in *Science* (97, 57-60, 1943) Burk and Winzler have proposed the use of the term "vitamer" to describe a group of substances the members of which can act to overcome a specific vitamin deficiency. According to this definition several forms of vitamin D are vitamin D vitamers, vitamin K_1 and vitamin K_2 are vitamin K vitamers, etc. Whereas isomers are chemical compounds with a given molecular formula, vitamers are chemical compounds with a specific vitamin activity and usually possess different molecular formulæ. Compounds which are vitamers thus become vitameric towards each other. Other new terms are advanced for forms of biotin and related compounds, based chiefly on their biochemical significance.

Several new terms for vitamins—*e.g.*, niacin and menadione, have come into recent prominence and the nomenclature is growing rapidly. In *Nutritional Observatory*, 3, 33-34 (1942) was a discussion of relevant neonyms, such as "vitagen" and "vitazyme." Following a critical study of vitamin terminology a number of these proposed designations may possibly find acceptance.

Nutritive Value of Wheat Germ Protein

In an account of their experiments on the nutritive value of wheat germ protein (*Cereal Chemistry*, xx, 2, 141), E. L. Hove and C. G. Harrel state that they believe that their results are the first data indicating its high biological value as determined by the Osborne Mendel rat-growth method, as well as its equality to casein in supplementing poor-protein diets.

With protein level of from 9·3 per cent. to 11·7 per cent. of the basal ration the biological values of certain animal proteins fed at a 10 per cent. level were: commercial casein, 2·30; dry skim milk, 2·85; boiled dry egg white, 2·58.

Wheat germ and casein proteins are equally effective as supplements to poor-protein diets. Rations in which the "average American diet, plant sources" furnished 7·5 per cent. protein and either wheat germ or casein furnished the remaining 2·5 per cent. showed total biological values of 2·00 and 2·06 respectively. Similarly, at 6·7 per cent. protein from the "average American diet" and 3·3 per cent. protein from wheat germ or casein, the biological values of the total proteins were 2·12 and 2·28 respectively.

At higher protein levels wheat germ as the sole protein in the diet promotes growth in young rats equal to that obtained on higher levels of casein, skim milk powder, or dry beef muscle.

It is suggested that wheat germ can be utilised in the human dietary and in non-ruminant animal feeds as a supplemental protein of high biological value.

Vitamin C in Cereals and Legumes

Stating that he had not seen any similar reference in the literature on the ascorbic acid content of dry cereals and legumes, M. N. Rudra, of the Department of Medical Chemistry, Prince of Wales Medical College, Patna, describes in a letter to *Nature* (**152**, 3846, 78), some experiments on the biological assay of ascorbic acid. He found that guinea pigs kept on a scorbutic diet did not cease to grow and show depletion even after three weeks. This unusual behaviour was ultimately traced to the ascorbic acid of the cereals and legumes in the diet. The ascorbic acid contents, estimated by titration with 2:6-dichlorophenol indophenol, of the materials, were as follows: Bengal grain (ground and roasted), 10·31 mg./gm.; oatmeal (whole), 13·97 mg./gm.; and wheat flour, 5·30 mg./gm. These values were subsequently substantiated by biological assay. Young growing guinea pigs were kept on a diet of casein, ground Bengal grain, oatmeal, cod liver oil and salts; when the total consumption of food by each animal corresponded to an average intake of about 1 mg. ascorbic acid per animal per day, they showed a growth response of 14 gms. (mean growth-rate) per animal per week over a three-week test period.

Fruit Diseases Investigation

Mr. R. V. Harris, plant pathologist, East Malling Fruit Research Station, Kent, has been seconded to Scotland to undertake an investigation into raspberry diseases, which have created a critical situation in the fruit-growing industry north of the border. At a meeting of raspberry growers in Blairgowrie, Perthshire, recently Mr. William Nairn, chairman of the local branch of the National Farmers' Union, said that steps should have been taken years ago, because they had now reached the stage when the principal varieties of raspberries were failing rapidly, and disease was so rampant that the industry was in a critical state.

Mr. Harris addressed the meeting on raspberry diseases, and made suggestions to the growers about methods that might be employed in the meantime to maintain existing stocks and prevent them losing further in cropping capacity. They should be sure to plant canes that were reasonably healthy and likely to give vigorous growth. Stating that growers were spreading the diseases themselves by using canes from affected plantations, he said they had to give up the idea that their fruiting plantations could be regarded as nurseries. A virus carried in the Lloyd George variety was believed to be responsible for "leaf curl" disease recently discovered to have widely and seriously attacked the Norfolk Giant variety. He advised that Lloyd George and Norfolk Giant varieties be kept well apart.

Shark-Liver Oil

An account of the chemical properties of shark-liver oil is given in *Revista de Agricultura Industria Comercio de Puerto Rico* (1934, **34**, 2, p. 205). It is stated that typical specimens of two local species of ground shark yield an average of three gallons of oil, the specific gravity of which ranges from 0·9 to 0·86 owing to the presence of varying amounts of the highly unsaturated hydrocarbon squalene. Chemically squalene ($C_{30}H_{50}$) can be considered a polymer of isoprene to which two atoms of hydrogen are added. Experiments at the School of Tropical Medicine with oil from Puerto Rico sharks showed a vitamin A content of 13,000 to 14,000 Sherman units per gm. Average cod-liver oil runs from 800 to 1,000 units. Vitamin D, on the other hand, was low (50 units per gm.) compared with cod-liver oil (200 units per gm.)

Milk Shake Syrups

Chemists employed by leading manufacturers are largely responsible for the introduction of standard milk shake syrups. The matter was first investigated at a joint meeting of the Soft Drinks (Wartime) Association and representatives of the syrup manufacturers, following which the chemists of some of the manufacturers submitted formulæ to the Association. These have been considered by the Committee of the Association, and the Association is now prepared to consider applications from firms to manufacture milk shake syrups conforming to the following standard:

	Per 10 Gallons of Syrup.
Sugar	7½ lbs.
Saccharin	1¼ ozs.
Citric acid	5 ozs.

The addition of benzoic acid preservative is permitted to the extent allowed under the Public Health Regulations.

Flavour is restricted to the following range of four—namely, lemon, orange, raspberry and vanilla. Quantity and quality must be sufficient to justify the description of the product and to produce a satisfactorily flavoured drink.

The quantity of syrup that any manufacturer will be permitted to make is restricted to that produced during 1941-42; and the gallonage of non-producing firms—*i.e.*, firms that have been "concentrated"—will be shared *pro rata* among producing firms. Prices of these standard syrups will for the present be the same as for non-fruit cordials, but this arrangement may be modified at some future date.

Manufacturers of standard milk shake syrups must become members of the Soft Drinks (Wartime) Association but will be excluded from the provisions of the concentration and compensation scheme.

Limit for Fluorine in Certain Foods

The recent incidence of comparatively large quantities of fluorine in foodstuffs containing acid phosphates and the possible danger to public health which may arise from the ingestion of such fluorine has had the consideration of the Public Analysts' Committee of the Society of Public Analysts and other Analytical Chemists. The Council has authorised the publication of provisional standards pending any official regulations by the Ministry of Health. These standards are as follows:

The proportion of fluorine, however combined, should not exceed—

in acid phosphates	...	200 parts per million
in baking powder	...	70 ,, ,, ,,
in golden raising powder		50 ,, ,, ,,
in self-raising flour, cake mixtures and like compositions	...	5 ,, ,, ,,

It is recommended that, pending further information or official regulation, no action should be taken under the Food and Drugs Act where these quantities are not exceeded.

Fluorescence as an Indication of Quality in Dried Eggs

It has already been shown by J. A. Pearce and collaborators (in papers in the *Canadian Journal of Research*, Sect. D, 1942 and 1943) that the fluorescence of a potassium chloride extract of defatted dried egg powder had a close inverse correlation with the quality of the powder. A further study by Pearce in the same *Journal*, Vol. 21 D, 1943, pp. 97-107, deals with the behaviour and nature of the fluorescing substances from a practical point of view. It was found that fluorescence increased in defatted dried egg powders during storage, and also in separately dried yolk and white. A portion of the fluorescent material was soluble in fat solvents, and especially in alcohols. Ethanol may destroy some of the fluorescent substance.

The results indicate that fluorescent materials arise from lytic changes in the proteins, that there is more than one fluorescing substance, and that some of these materials contribute to the increased fluorescence which is associated with decrease in quality. Indirect evidence indicates that proteose and peptone constituents are partly responsible for fluorescence. The nature of the deterioration is partial hydrolysis; amino acids do not fluoresce. A preliminary study was made of the effects of a few enzymes, and of some strains of micro-organisms, on the formation of fluorescent materials. The work is being continued in the Division of Applied Biology, National Research Laboratories, Ottawa.

Visual Method for Vitamin B_1 Assay

In the estimation of vitamin B_1 by oxidation to thiochrome it has usually been considered essential to keep the volumes of all reagents constant for both standard and unknown solutions, because there is an appreciable partition of thiochrome between the aqueous and *iso*butyl alcohol layers. Using independent methods, C. W. Herd, L. M. Mundy, and H. N. Ridgard have attempted to determine this partition and have recorded their results in a paper published in *The Analyst*, 68, 807, 174. The conclusion arrived at is that the extent of the partition of thiochrome between aqueous and *iso*butyl alcohol layers used in the various methods has been found to be generally of the order of 5 with wide variations mainly occasioned by the concentration of salts in the aqueous layer. It will be seen, therefore, that it is most important to treat standard and unknown solutions in precisely the same manner or, alternatively, to ensure complete extraction of thiochrome in every instance. Neglect of this could lead to an error as great as 25 per cent.

Food and National Character

There has been much discourse and many writings on the education of the enemy after the war. Perhaps the dieticians could help? In *Hudibras* a couplet goes

. . . and fat black puddings, proper food
For warriors who delight in blood.

Maybe the deprivation of one of the favourite foods of the Teutons might modify their warlike proclivities. The Italians have shown that macaroni, spaghetti and demulcent olive oil engender a not-too-ferocious attitude

Salad and eggs and lighter fare
Tune the Italian spark's guitar,
And, if I take Dan Congreve right,
Pudding and beef make Britons fight,

sang Prior. Sydney Smith, in a letter dated September 30, 1837, wrote: ". . . I am convinced that . . . character, talents, virtues and qualities are powerfully affected by beef, mutton, pie-crust and rich soups."

The average Briton's attitude is expressed in the words of the old song, "We don't want to fight But, by Jingo, if we do . . ." Perhaps the "two veg.", the Yorkshire pudding, the jam-bestrewed sweet have a dulcifying or neutralising influence on the roast meats, and produce that subtle blending of the lion and the lamb which has produced much puzzlement in our enemies and once gave us the sobriquet "perfidious Albion".

One day, perchance, among the many new societies which will be formed, there will be a Society for the Modification of National Character by Dietetics.

The Effect of Handling Cans

GEORGE W. BLACKWOOD.

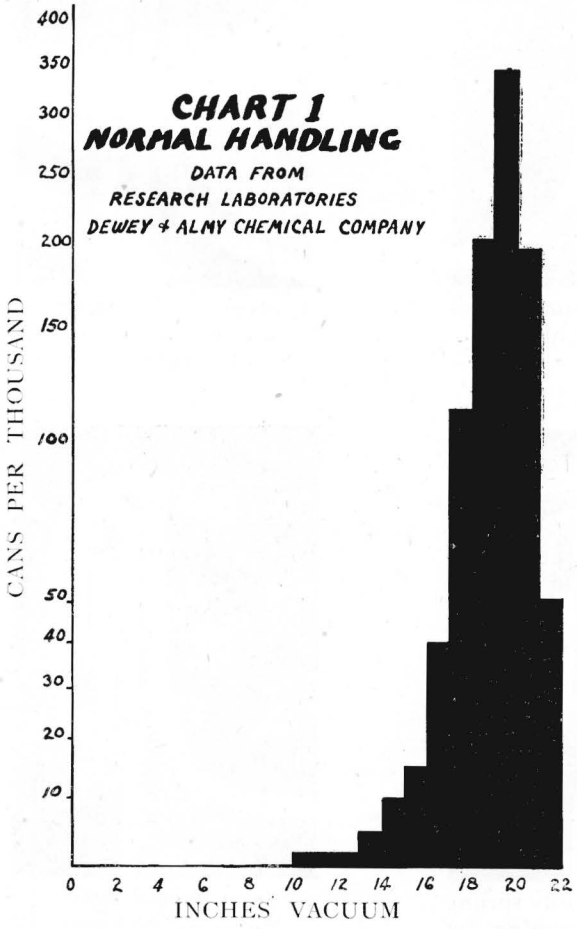
Dewey and Almy Chemical Company, Cambridge, Mass.

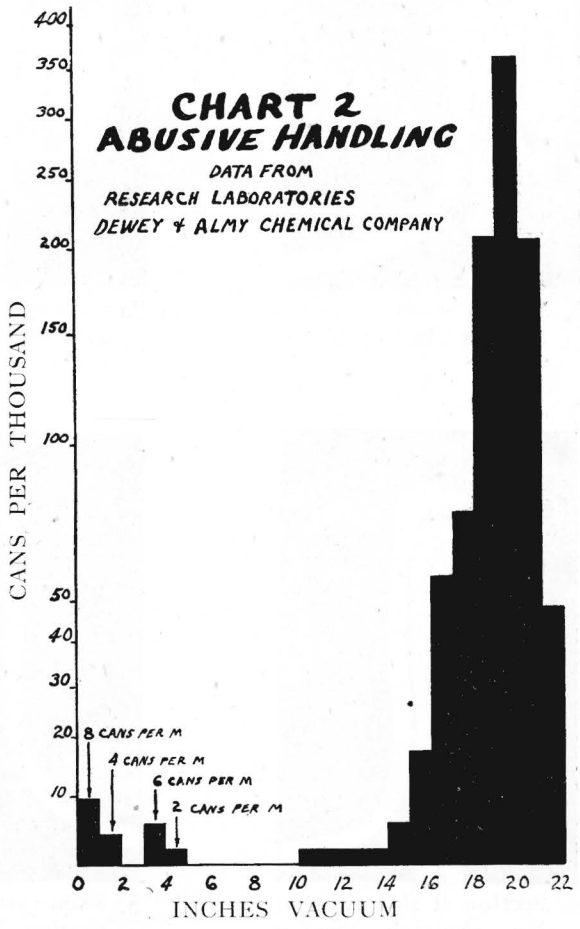
IN OUR continuous study of the efficiency of sealing compounds we have been forced to adopt types of standard can abuse which duplicate the worst possible handling conditions that might be encountered in actual operation. Our field experience with new compounds over a period of years has confirmed the close correlation which exists between these laboratory findings and actual plant situations.

In the present emergency, where conservation of both container and content is so vital to our national life, it seems that the results of our observations point out certain types of can handling that are likely to lead to waste. While not qualified to pose as an authority on handling techniques, I believe an account of our experience may be useful. In showing some of the results that come from improper handling, perhaps I may contribute to a better understanding of some little recognised factors and thus help in overcoming loss through waste. Most canners, when they appreciate the dangers involved, are, of course, best fitted to make the necessary adjustments in the handling procedures to correct possible abuses.

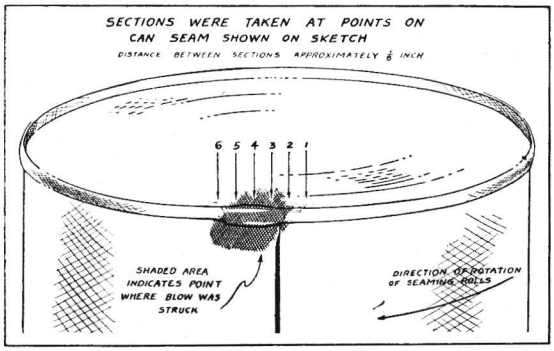
First, what does happen when a rolling can is brought to an abrupt stop by hitting another can or has to make a sudden change of direction? As a pedant would say, "When an irresistible force meets an immovable object," something has to give.

We are concerned here with a special type of injury to the seams which results from this kind of bumping. Let us compare the results illustrated in Charts 1 and 2. From these one can see that the relative number of cans holding a vacuum of less than 10 inches may be arbitrarily taken as a measure of the results of improper can handling. In securing the data for these charts the cans were filled, seamed and processed in one lot to give a fair test. As the cans issued from the double seamer, one-half were placed in one retort crate and the other half in a second retort crate. Great care





Vacuum charts showing loss of vacuum in cans subjected to abuse conditions. Note in Chart 2 that twenty cans per thousand have leaked.

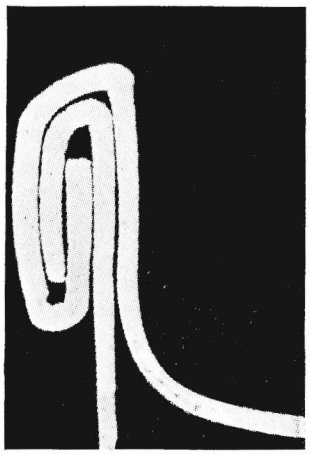


Sketch showing location of the six sections illustrated in the photo-micrographs shown below.

was taken to alternate every other can to each crate, so that there would be a truly representative grouping.

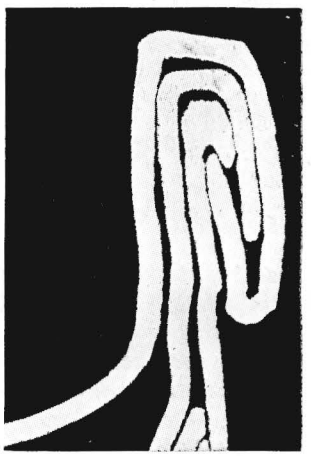
Both crates were then processed at the same time, but after processing the cans listed in Chart 1 received only normal handling care, whereas those shown in Chart 2 were subjected to an abuse apparatus designed to produce the types of abuse encountered in commercial cannery operations. Obviously, the abuse produced by this piece of apparatus is far more severe than would normally be encountered, but the abuses are of the same type and therefore an indication of what happens in some plants. After the cans had been stored for a period of fourteen days the vacua were taken to determine the number of cans per thousand at each given vacuum.

In answer to the query as to why the vacua run as low as 10 inches in Chart 1, we can only say that this amount of variation is considered normal and follows

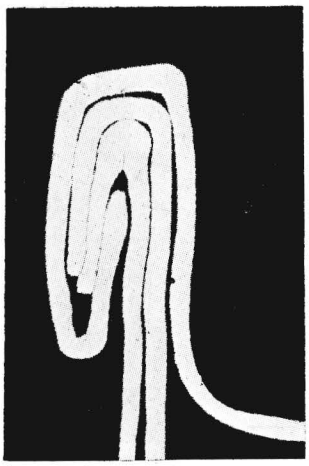


1. Normal seam as rolled, not disturbed by blow.

2. Seam badly sprung and deformed by blow.



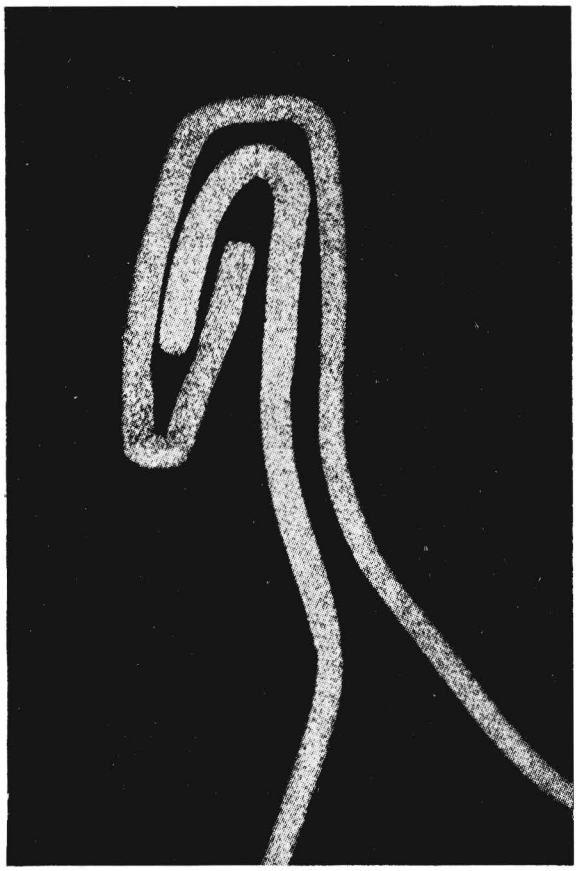
3. Section at side seam lap at centre of blow showing flattening.



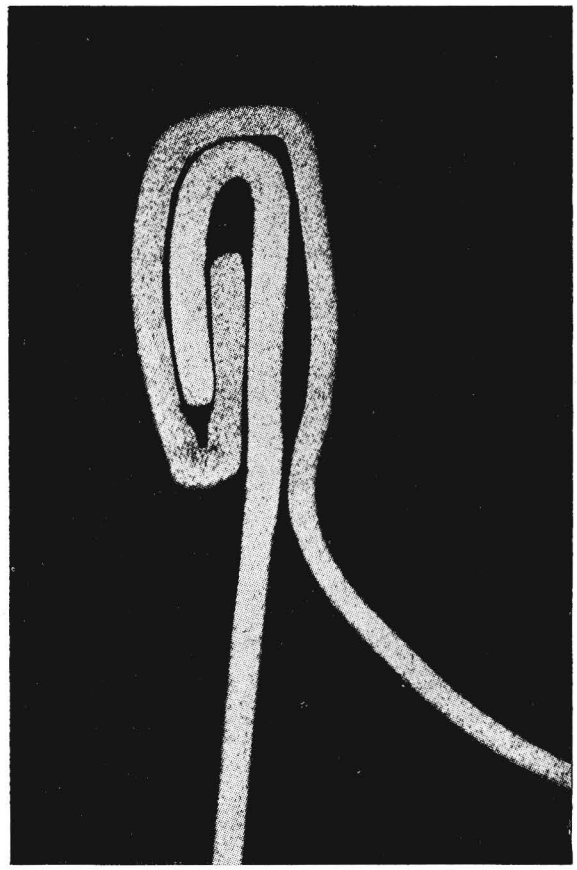
4. Section at side seam at lap showing prying open of seam at the lip.

5. Seam very badly sprung causing loosening of seam and bulging of countersink.

6. Seam normal again, undisturbed by blow.



A. Cross-section of seam where blow was just below seam. Seam sprung open and body hook shortened.



B. Cross-section of seam where blow was on seam. Seam body deformed and countersink buckled inward.

the theoretical frequency curve when the effect of the variables listed below is considered. These variables are :

(*a*) The amount of liquid that splashes out of the can in the sealing operation.

(*b*) The extent that air in the headspace becomes heated by the hot brine and is expelled in the short interval that elapses from the time the cover is put on and the seam is completed.

(*c*) Minor variations in the temperature of the brine.

(*d*) Stiffness of tinplate in the ends.

Chart 2 differs only in the matter of the handling after processing. It will be noticed that there are many cans below the 10-inch vacuum, and a considerable number actually at 0 inch.

In further study as to the cause of the leakage, photomicrographs of cross-sections of abused cans were taken at the point of abuse on the seam. It is surprising to note the extent to which these blows have tended to open up the seam. In the case of Photomicrograph A, the blow was below the seam, yet you will see that the seam has sprung open and the body hook has been pulled down, which has caused it to pry open the seam.

Photomicrograph B shows the effect of a bump on the seam. While the results are not so strikingly apparent, the seam has been badly deformed, and it will be noted that the countersink has been buckled inward. Although this type of distortion does not appear to be serious, our findings show that it produces at least as many leakers.

The Seam at the Lap

Further study was undertaken to see what happens to the seam at the lap, which is quite generally acknowledged as the most vulnerable part of the seam. A can which had received a blow at this point was examined by sections taken not only at the point of the blow, but also on both sides of it, as indicated in Sketch 3. You will note from photomicrographs taken at points indicated on Sketch 3 that the seam is uninjured at a point less than $\frac{3}{8}$ inch from the dent; the seam is quite normal and well locked. As the pictures approach the dent itself the varying degrees of injury are apparent. Photomicrograph 5 shows the point of greatest injury, which is located just past the lap of the side seam, where there is always a tendency for the seaming roll to jump a bit.

It seems to me that this collection of facts has special significance to canners and packers to-day. It shows beyond a reasonable doubt the *potential* dangers that lurk in every handling operation. True, the good old tin can is a pretty sturdy container. Better seams and closer control of seaming are common to-day, and im-

proved sealing compounds have been designed to give extra factors of safety for to-day's high-speed work. But it should be remembered that we are at war. We must conserve and save, prevent damage both to container and to contents. Now more than ever before we must be vigilant in our care in handling canned foods.

As a detached observer I should like to suggest several places that it seems to me bring about the type of abuse illustrated here.

(1) Gravity conveyors may cause bad abuse unless equipped with power-driven belts over the cans to control the downward speed.

(2) Vertical twisters used for lowering cans by gravity or for changing the direction of the cans impart a severe kind of abuse because they combine a hammer blow with a twisting motion, causing the cans to be dented at the vulnerable points directly on and under the double seams.

(3) Bar elevators, though useful in obtaining positive spacing, may cause bad denting of the cans if they fall squarely on the bars rather than in between them.

(4) Hand filling of retort baskets is often unnecessarily abusive. This all too common practice of allowing cans to fall directly from the double seamer into the retort basket may cause damage.

(5) Inclined belt pocket conveyors, frequently used to feed cans to coolers, often allow the cans to fall out of their pockets and roll back on each other.

(6) Mechanical unscramblers are a well-known source of damage.

(7) The dumping of whole crateloads of hot cans from the retort on to a cooling conveyor produces much the same kind of abuse as the mechanical unscrambler.

These are but a few of the obvious sources of damage. In the national interest I can only urge that every canner take the time to study his equipment installation anew and make the necessary adjustments that will prevent avoidable abuse.

With acknowledgments to "The Canner".

Casein in the Food Industries

M. SCHOFIELD, M.A., B.Sc., A.I.C.

CASEIN, known from ancient times in a crude form as cheese, appeared forty or fifty years ago as an article of commerce either partially or entirely purified from lactose and butter fat. As a phosphoprotein in milk in the form of calcium caseinate, it is an invaluable constituent of food preparations and of patent foods—a fact rather lost sight of with all the attention closely focused on casein plastics, casein adhesives and other "chemical" applications. It may be precipitated from milk by natural souring to give "lactic casein"; by addition of rennet; by the action of a mineral acid (or acetic acid in some cases where food products are the aim); or by an electrical process which commerce has not yet adopted. There is also the production of casein from soya beans which concerns more the plastics and adhesives industries.

Gradually the manufacture of casein has become a more efficient process with *p*H control and improved methods of drying the curd. The method of utilising lactic acid bacilli depends on the fact that when approximately 1 per cent. of the acid has accumulated, curdling to a soft jelly takes place. The warm gel is then drained from the whey, washed until the wash water runs clear, and dried on trays or in a tunnel drier. This process, together with the use of rennet or of acetic acid, attracted the attention of manufacturers of food products, rather than the preparation of casein by the use of mineral acid with the necessity of thorough washing of a bulky precipitate. In the rennet method the greater the degree of acidity of the milk and the nearer the temperature is to 106° F. the less the proportion of rennet required for curdling. As an example of common practice, 0·025 per cent. rennet is used at 98° F. to effect an almost complete precipitation of the casein as compared with complete precipitation at 106° F. with 2½ ozs. rennet per 100 gallons milk. Milk which has not been boiled and which is not alkaline is employed, since rennet only works in the presence of soluble calcium salts. The whey in both the lactic and rennet methods may be used for the precipitation of a second batch of milk.

Acid Caseins

In the preparation of acid caseins dilute hydrochloric or acetic acid at 94° F. and working at the isoelectric point of 4·7 *p*H is common, the curd being washed with water of this *p*H value. One hundred lbs. of milk usually gives 7 lbs. moist curd, this on drying yielding 2 lbs. casein. Plants for the above operations vary from wooden vats to copper or enamelled iron pans, the vessels being fitted with stirring gear and open and closed steam heating. The skim milk is sent from the separators at 95° F. to the curdling vats, where it is agitated with the dilute acid. After settling, the curd is separated by siphoning off the whey, allowed to drain, and then churned with repeated amounts of cold water before filtering off in press or centrifuge. The damp gel is next broken up and spread on wooden frames in drying rooms at temperatures from 80° to 180° F. Among new suggestions for improving the product may be mentioned the spray drying of soluble alkaline caseins when intended for ice cream manufacture; the grinding of the wet curd followed by spray drying; and the addition of pectin extract before addition of rennet in order to ensure a smooth non-bitter casein.

Electrical Curdling and Soya Bean Casein

Electrical curdling and the preparation of soya bean casein complete the possibilities of manufacture. In the former operation milk at 120° F. is used with a porous cell placed in the centre containing dilute milk. When a current is passed, the soluble phosphates and salts are electrolysed between the anode in the milk and the cathode in the porous cell, the phosphoric acid

liberated causing the precipitation of casein while the liquid in the porous cell becomes correspondingly alkaline. Two points to be noted in passing are the high cost of anodes, since these must be of platinum, and the neglect of phosphoric acid used directly for precipitation of casein.

Soya bean casein may also be prepared in wooden vats during the extraction with dilute soda solution of the oil-free soya residues. The beans are crushed and pressed to remove the oil and then further treated with a mixed solvent, traces of which must be removed before the alkaline extraction process. Dilute hydrochloric acid is then used to precipitate the casein from the alkaline liquid, a thorough washing being as essential as in the preparation of acid casein from milk.

Properties of Casein

Casein is insoluble in water, soluble in strong acids (a property of no importance) and in solutions of sodium carbonate (2¾ per cent.), sodium bicarbonate (3½ per cent.), ammonia (2½ per cent.) and caustic soda (1¾ per cent.), as well as in lime, borax and other less important alkaline solutions. When dry it will keep indefinitely, but is liable to decomposition when moist.

The purest form is known only to bacteriology, Hammarsten's casein which came from Germany being snow-white, odourless, and yielding no ash on incineration.

For ensuring prolonged keeping properties, butter fat and lactose impurities may be removed by stirring with sodium bicarbonate solution followed by steaming and re-precipitation with a dilute acid. The solubility of alkaline caseins is an invaluable property where the special food industries are concerned since the caseinates show excellent keeping qualities, while the purity and digestibility are other essentials in products which were guaranteed a market by vegetarians as well as invalids anxious to substitute such protein foods for meat.

With regard to the comparison of biological values of various proteins, the work of T. B. Osborne and L. B. Mendel (*Zeit. Physiol. Chem.*, 1912, p. 307) showed that casein is superior in promoting growth, while other workers have reported its superiority to egg white; its high proportion of phosphorus assimilable by the body; and the invaluable amino-acids like tryptophan, glutamic acid, alanine, tyrosine, arginine and cystine formed by hydrolysis and of the kind used for nourishment. With such invaluable properties it is not surprising that casein has been the essential constituent of a number of patent foods as well as of preparations like egg substitutes, baking powders, etc.

Dried skim milk, now so much in evidence, is an example of a casein food in which no separation or concentration of casein has been carried out. Next comes Eulaktol, a mixed preparation in which the fat globules from milk evaporated under vacuum are surrounded by an albuminous coating for preservation against rancidity, the resulting powder containing 46·3 per cent. fat and 14·3 per cent. carbohydrates. An example of high carbohydrate content in a food for children and dyspeptics was the German product, Guttman's Nutrient Milk Flour, in which skim milk casein was compounded with carbohydrates like a gluten-free oatmeal plus flavouring bodies. Sanatogen is a white, insoluble casein readily assimilable, free from lactose and fat and incorporating 5 per cent. sodium glycerophosphate, while Sanagen also included this proportion of glycerophosphate and, with up to 78 per cent. proteins, was on the market for diabetics.

Alkali Caseinates

Examples of products which took advantage of the solubility of alkali caseinates are Dr. Reigel's milk protein or "Milk Albumin", in which the curd is prepared by precipitation with ethylsulphuric acid, whereby, it is claimed, the casein is free from ash constituents and of very small acid content; Nutrose, a soda compound; Plasmon (formerly Caseon), a coarse, cream-coloured powder with high assimilability, since it is a soda compound of casein together with some fat and lactose; and Eucasein, a preparation comprising an ammonia-casein. Such preparations have appeared on the market from 1898, when Lactarine containing 78 per cent. casein plus mineral matter and some fat was introduced. The only example of the incorporation of phosphoric acid as distinct from glycerophosphate appears to have been Galactogen, a preparation marketed at 1s. 10d. per lb. and comprising over 70 per cent. casein with 3·5 per cent. fat and up to 2·5 per cent. phosphoric acid. Vi-Casein and Laitproto are examples of products prepared in this country, the casein for Laitproto being precipitated by acetic acid.

Incorporation with Other Food Products

Apart from products in which casein is the major constituent there are a number of instances of incorporation for improving food commodities. Thus casein entered into malted milk when Horlick discovered the method of combining the whole of milk with malt extract and some wheat carbohydrate so as to bring the enzymic action of the malt into an invaluable food. Here, again, the protective coating of gluten serves to maintain the fat globules free from rancidity, while the milk is pasteurised in the process and the diastatic property of the malt-wheat mash brought into full use. In bread-making, milk substitutes have been made from alkaline casein solutions precipitated by some suitable acidic body like the acid citrate described by Dunham (Brit. Pat. 180,018). Bakers have also found use for "casein phosphate" prepared from a monocalcium acid phosphate syrup free from sulphuric acid and a casein precipitated by acid and freed from lactose and soluble matter. A second stable, non-hygroscopic preparation included casein and phosphoric acid, which was used in baking after mixing with sodium bicarbonate. Sodium caseinate has been added to cocoas to yield a soluble, readily-assimilable product, while casein was to be recommended as constituent of egg substitutes, either as prepared casein or simply as milk powder, in order to include valuable protein and avoid the condemnation which such commodities have met with. In ice cream, skim milk has long been used, although either casein or sodium caseinate has been recommended for keeping properties and for improving the body and texture. Thus U.S. Patent 1,424,602 introduces casein as "filler", the swelling of the casein being ensured by inclusion of pepsin. As examples of the variety of uses found for casein may be mentioned its use as clarifier of wines; as binding material and improver of moisture content in sausage meat; as constituent of oleomargarine, so that this will give the "foam test" for butter; and in soup tablets and concentrates.

Milk Production as a National Problem

COWS' MILK has outstanding properties in two distinct and contrasting directions. It is not only considered to be our most important "body-building" or "protective" foodstuff, but at the same time may become, in the absence of adequate bacteriological control, a potent agent for the spread of disease. For these and other reasons, the farmer, transport official, retailer, dietician, medical officer and consumer have all separate, and sometimes conflicting, interests in milk production. At a joint meeting of the Nutrition Society and the Food Group of the Society of Chemical Industry, which was held recently in London, experts interested in milk from different angles were brought together. A valuable exchange of views led to a clearer conception of the progress which must be made in the milk industry in the near future, and how it may best be achieved.

Organisation of the Dairy Industry

According to Mr. J. L. Davies, milk is produced in this country on about 150,000 farms, which employ 300,000 workers. Another 150,000 workers are engaged in the distribution of milk, or in the manufacture of milk products. Assets probably amount to £400,000,000. One man, backed by £750 capital, produces on an average 7 gallons of milk per day. The average number of cows per herd is 16, but there is great variation in different parts of the country. Thus large herds are usual in Berkshire, small herds in Devon. About 85 per cent. of all herds produce milk for sale, and the average yield is 500 to 550 gallons per cow per year. In herds which are kept mainly for the purpose of dairy farming, the yield per cow is slightly greater at 600 to 650 gallons per year, and those enlightened farmers who practise milk recording are rewarded with 700 to 750 gallons.

Rising Consumption

These figures for production must be considered in relation to the rapidly rising consumption, which recently has been much increased by propaganda, and by the National Scheme by which 80 per cent. of eligible mothers and young children avail themselves of the privilege of free or cheap milk. Thus in 1933 the consumption was 0·37 pint per person per day, in 1942 the level had risen to 0·57 pint, and in May, 1943, a new record of 0·65 pint was attained. Under present conditions consumption must be approaching the limit of production, with little margin for diversion to cheese or manufactured products. In order to reach a goal of 0·75 pint per head per day, which is considered by most dieticians to be a modest estimate of the optimum daily ration, a substantial rise in the milk yield is obviously necessary. Contributions towards increased production may be sought in the first place by increasing the efficiency of lactation in the 2½ million cows already available in this country. Thus substantial losses in milk output could be eliminated by the eradication of diseases such as mastitis, contagious abortion and temporary sterility, which, according to Dr. W. R. Wooldridge, afflict 25, 10 and 30 per cent. of the bovine population respectively, and are responsible for average deficits of 12, 25 and 23 per cent. in the yields of the diseased animals.

Management of Herds

There is also much room for improvement in the management of herds, particularly those containing only a few cows. Buildings are often inadequate, or are without water or electricity. About one-third of the existing farms require modernisation, at an estimated cost of about £100 millions. In many herds milk production could be increased by the replacement of inferior animals by breeding stock from pedigree strains specially suitable for the dairy, but this procedure must obviously take considerable time to complete. Labour conditions also require standardisation and improvement. Some small-scale farmers have too few cows to keep them fully occupied; in larger herds men may be worked to excess in handling too many animals without adequate facilities. Professor H. D. Kay has emphasised the need for vocational training in dairy work.

One Million more Cows

Authorities differ as to the increase in production which could be effected under these headings. It is clear, however, that in order to reach the desired level of consumption of 0·75 pint of fresh milk daily, with an appropriate margin for seasonal variation and diversion to manufactured products we must increase our cow population by at least one million. This increase must inevitably be slow, and might reasonably be accomplished within ten years. The urgent need for numerical increase is considered by some to afford an argument against the disposal of existing cows with poor milk yield, since a contribution of 400 gallons yearly is better than none at all.

Opinions are also highly divergent as to the degree of economic efficiency prevailing in the milk industry under present conditions. Professor Ashby considers that a cost of 2s. per gallon for producing a commodity which is mainly water is grossly excessive, and suggests that in order to reduce the cost to a reasonable level it will be necessary to nationalise not only the milk industry but also the land which it occupies.

The Food Value of Milk

Professor Kay has commented on the strange anomaly that, whereas the farmer often takes pains to ensure that his fodder shall have the greatest possible nutritional value, any fluid containing at least 3·5 per cent. of fat which is extracted from the udder of the cow is legally considered to be of uniform value as a foodstuff for humans. The experiments of Dr. S. K. Kon, and others, have shown that this conception is far from the truth, since the food value of milk may vary widely according to the breed and condition of the cow, season, and particularly the nature of the diet. Thus the milk of Jersey cows is richer in fat and carotene than that of most other breeds. In all breeds vitamin A and carotene reach their lowest level in late winter, and rise with dramatic suddenness when the cows are

allowed access to fresh green pasture. Carrots, silage, dried herbage and other fodder rich in carotene may be used to prevent or moderate the fall of carotene and vitamin A in the milk during winter. The antirachitic value of the milk is raised when the animal is exposed to summer sunshine, and may be artificially enhanced by feeding the cow with cocoa shells or irradiated yeast. The richness of the milk in riboflavin also depends in part on its presence in the diet, but this factor appears also to be synthesised by bacteria in the intestines. Vitamins B_1 and C are unaffected by diet.

Standardisation of Quality

Treatment of milk subsequent to its secretion by the cow may also considerably influence its nutritive value. Thus the antirachitic activity may be much improved by artificial ultra-violet irradiation, a procedure which is widely adopted commercially in America. On the other hand, the practice of leaving milk in ordinary glass bottles on doorsteps must be condemned as causing a serious loss of vitamin C, which takes place through the agency of riboflavin as a photochemical activator. Fortunately pasteurisation has little effect, except for a slight lowering of the vitamin C content. While a comprehensive scheme for the establishment of legal minima for all important nutrients in milk would obviously involve considerable administrative difficulties the ultimate desirability of such standardisation cannot be denied.

Manufactured Products

The effects of properly conducted manufacturing processes on the nutritive value of milk are relatively slight. Generally speaking, the differences to be expected between any fresh milk and the same milk after processing are trifling when compared with the variation between winter and summer milk from the same herd. The fat soluble vitamins A and D survive drying processes without loss. In spray drying some 20 per cent. of vitamin C, 10 per cent. of vitamin B_1 and 5 per cent. of the biological value of the protein are lost. With roller drying, which gives a less readily soluble product, the losses are similar, except that the fall in vitamin C is increased to 30 per cent. Equally small reductions in nutritive value occur in condensed milk, both sweetened and unsweetened. In any of the above processes, however, serious losses, particularly in vitamin C, will be incurred if the manufacturer is so unwary as to admit traces of copper by the use of vessels or plant constructed from this metal. Since in skimmed milk almost all the original content of vitamins A and D has been removed with the fat, processed forms of this material must inevitably be deficient in these vitamins. They are nevertheless perfectly wholesome and valuable articles of diet, provided the missing vitamins are supplied in some other form.

Cleanliness in Milk

There have been several schools of thought on this vital question. In the opinion of some people quantity has appeared to be more important than quality. Children given plenty of milk, even if it is dirty, may be expected to thrive in a general way and thereby become resistant to the diseases whose germs are admittedly carried in the milk. Natural milk is held to be superior to pasteurised milk in nutritive value, and some of its protagonists go so far as to argue that moderate contamination with bacteria may actually be an advantage, conferring active immunity against infection in later life. Others have recognised the very real danger of dirty milk, which may give rise not only to intestinal tuberculosis, but also to typhoid, undulant fever, and scarlet fever. Schemes have therefore been elaborated for the elimination of infected cows, and for milking and transporting milk under sterile conditions. The "clean milk" crusade, initiated some twenty-five years ago by the late Dr. Stenhouse Williams, has borne fruit in those progressive herds which produce milk which is certified to be free from tubercular infection. While supplies of such safe milk fulfil a valuable *rôle* in the nutrition of infants and young children, the quantities produced are not adequate to meet the requirements of the whole population, and any further disposal of infected cows would cause a serious, if temporary check in progress towards the goal of increased production. For this reason many experts agree that the only practical procedure is to sterilise by heat treatment all milk except that coming from certified herds. Since in "pooling" milk it is usually necessary to include contributions from infected herds, it is imperative that all "pooled" milk should be treated in this way.

Pasteurisation of Milk

According to Dr. A. T. R. Mattick, the destruction of bacteria in milk to be used for human consumption may be effected in two ways. In the "holding" method the milk is heated in bulk to 145° F., and is kept at this temperature for 30 minutes. In the "high temperature" method the milk is passed through a heater, controlled by a thermostat, which heats the milk to 162° F. for only 15 seconds. Milk to be used for feeding calves or other farm stock may be freed from *Brucellus abortus* and other pathogenic organisms by injecting steam, since dilution is not an important factor. A convenient test for the efficiency of sterilisation has been devised by Professor H. D. Kay. The treated milk is tested by a chemical method for the enzyme phosphatase, which is present in fresh milk but is destroyed at a slightly higher temperature than that necessary for the destruction of bacteria. If no enzyme is present it then can safely be concluded that all bacteria have been killed.

Considered scientific and medical opinion is now wholeheartedly in favour of the compulsory pasteurisation of all uncertified milk. The only real disadvantage may be slight change in flavour, which is noticeable only to sensitive palates. The slight loss of vitamin C is insignificant, since even fresh milk is but a poor source of the vitamin. The objection, which has been raised by some advocates of "natural" milk, that pasteurised milk will not readily go sour, and hence without outward sign may harbour dangerous bacteria which have gained access since the heat treatment, has little scientific justification. It is indeed true that more prolonged heating than that used in ordinary pasteurisation produces "sterilised" milk, which will not go sour even on prolonged standing, but the improved stability may be counted as an improvement, and advanced bacterial contamination will be announced by putrefaction as in many other foodstuffs. Finally, the hypothesis that light infection with bovine tubercle in the child may be beneficial in conferring

immunity against the human tubercle in the adult is pure supposition, unsupported by scientific evidence.

Spontaneous T.B. Inoculation

As Professor G. S. Wilson points out, the incidence of pulmonary tuberculosis in European countries is lowest where the incidence of juvenile non-pulmonary tuberculosis is also lowest, or in other words those countries where the supposed spontaneous " inoculation " has been least frequent. To reduce the matter to absurdity we may consider, with Dr. N. S. Barron, our reply to a family doctor approaching us in the following terms :

> I have here a vaccine, which I want to try on your baby. It may confer immunity from pulmonary tuberculosis, although we have no real evidence for this. On the other hand, it may kill him, but in this country we only lose 1,500 to 2,000 children annually in this way.

In spite of disapproval on the part of unqualified critics, therefore, pasteurisation allows us to start on the problem of producing more milk, and at the same time safe milk, without the preliminary handicap of having to dispense with a large number of infected cows. In recognising this principle as a basis for its forthcoming important reforms in the milk industry, the Ministry of Food has the endorsement of many members both of the Nutrition Society and of the Food Group.

Fuel Economy

ANY USEFUL information which can bring about fuel economy at the present time is serving a double purpose—not only does the purchaser of the fuel get a bigger dividend on his investment, but the national interest is also served. It is therefore necessary to give all publications dealing with fuel economy and all articles in journals which deal with that topic very careful thought so that no useful idea is missed.

The compilers of the 1943 edition of the well-known year-book* on the steam boiler have obviously set out to improve on their 1942 effort, which was generally acclaimed by people in the power plant industry to be of considerable use as a reference book.

The collecting and indexing of so much of the catalogue type of information relating to the various types and designs of boilers, of boiler-house accessories and instruments, particularly with regard to recent improvements in Europe (necessarily somewhat scanty) and U.S.A. has been well done. The result is that the most up-to-date information on boiler-house plant is presented in one volume which will not occupy undue space on the engineer's desk. Particularly welcome is the matter devoted to pulverised fuel systems, which doubtless will develop rapidly under post-war conditions.

The four-and-a-half pages devoted to the discussion of the pros and cons of different types of mechanical stoker do not sufficiently emphasise the fact that while a first-rate fireman can be almost as efficient as a good mechanical stoker supplied with the type of fuel for which it is designed, these men are not easy to find, even in normal times, while at the present time the inspection of a large number of boiler plants working under wartime conditions leaves the impression that 95 per cent. of hand-fired jobs do not work as efficiently as a properly installed and fuelled mechanical stoker.

Automatic Control

The different ingenious automatic systems of boiler-house control that have been put forward have been thoroughly dealt with, and the reviewer's only comment is that it is advisable to point out that, no matter what automatic form of control is installed on a boiler plant, without the fairly constant attention of someone who really knows something about combustion, there is a definite chance of the control being a failure. As an instance, the present reviewer recently surveyed a power plant where a very useful automatic control system had been installed, but none of the operating staff knew anything about combustion, and at the time of the survey their CO_2 recorder showed the percentage of CO_2 in the flue-gases, at the side flue of their Lancashire boiler, to be only 7·5 per cent., showing excessive air supply, and inefficient burning of coal.

Dealing with steam pipes and appliances, Chapter 20 will prove particularly useful to the works engineer who has not had much experience of arranging steam pipe lines, and works owners who are contemplating considerable rearrangement of their pipe lines should seriously consider putting a copy of this book into the hands of the works engineer and thus avoid many possible pitfalls. The section dealing with steam traps, too, has been well handled, and would be profitably read by those concerned.

Lagging of Steam Pipes

It is noted that very little attention has been paid to the importance of the proper lagging of steam pipes and steam vessels, which can effect considerable savings. As an instance of what can be done in that direction, a recent visit paid to a fruit preserving factory resulted in the following recommendations being made :

(*a*) Much bare steam pipe to be covered.
(*b*) Many steam jacketed pans to be covered.
(*c*) Bad air leaks about the flues to be prevented.
(*d*) Firebars to be shortened.
(*e*) Better use to be made of exhaust steam which was being sent to the atmosphere.

The result of these recommendations being carried out has been a 37 per cent. drop in fuel consumption, and the recovery of the capital outlay in less than six months.

Some chapters giving practical tips to the works engineer would considerably enhance the value of the book. Such information might be usefully utilised by the process man, who may not necessarily be a steam engineer.

The production of this book is excellent and the illustrations clear.

H. C. A.

* *The Steam Boiler Yearbook and Manual.* Edited by Sydney D. Scorer, A.M.I.Mech.E., M.I.Mar.S. Pp. 522. 30s.

Food Production by Micro-Organisms

Part II

FAT PRODUCTION

H. T. FAWNS, M.Sc., F.I.C.

THE ANIMAL organism has been known to convert carbohydrate to fat ever since Laws and Gilbert carried out their feeding experiment on pigs in 1852. The chemical mechanism of this transformation has attracted the attention of many biochemists since that date, and several theories have been advanced to account for it, pigs, geese and dogs being largely employed as the experimental animals. Observations concerning a similar process in the case of micro-organisms followed the early experiments with vertebrates.

Fat obtained from yeasts was studied by Naegeli and Loew (1878),[1] Gerard (1895), Hinsberg and Roos (1903, 1904), and Sedlmayer (1903). Fat production by moulds was observed by Browne[2] in 1906 with *Citromyces* (*Penicillium*), and a number of other mould species have been studied more recently.

Since micro-organisms can be grown on culture media of known composition, and aliquot portions withdrawn any time during incubation, they have proved useful material for studying the mechanism of the carbohydrate-fat transformation, and this method of approach may help to throw light on the corresponding changes in the vertebrates. The experimental work up to 1935 has been well reviewed by Smedley-MacLean.[3]

The oxidation of 1 gram of fat gives rise to 9·3 calories and 1 gram of carbohydrate to approximately 4·1 calories; hence the conversion of carbohydrate to fat is an economical way of storing potential energy, since every gram of reserve food material deposited in depot tissue as fat has more than twice the calorific value of a gram laid down as carbohydrate—*e.g.*, glycogen—or as protein (4·1 calories per gram). This no doubt accounts for fat formation being such a widespread natural phenomenon from the vertebrates downwards. The oil in vegetable seeds is another aspect of the same subject as it pertains to the plant kingdom.

The production of protein from carbohydrate and ammonium salts by yeasts has been discussed in an earlier article (FOOD MANUFACTURE, June, 1943), and the rapidity of the conversion was shown to make the process especially suitable for quick production of protein in time of war when normal supplies may prove inadequate. It has been, and is being, used under those conditions. The same applies even more emphatically to the use of micro-organisms as a source of fat. Prescott and Dunn[4] point out that only under conditions of national emergency would one ordinarily attempt to produce fat from micro-organisms on a technical scale, since the normal demands of a country are more economically met by domestic production from animals and higher plants or by importations. The last war provided the stimulus for large-scale production of fat from micro-organisms in Germany, and further information has accumulated on the subject during the intervening years.

Both yeasts and yeast-like organisms and also moulds have been successfully employed for converting carbohydrate waste into fat, but so far as the author is aware bacteria have not been employed for this purpose.

Synthesis of Fat by Yeasts

Small amounts of fat are synthesised by yeasts under normal circumstances, the amount extractable being dependent on the treatment of the yeast prior to analysis. Certain variations in the cultural conditions will greatly increase the yield. The following are the main requirements:

(1) Thorough aeration of the medium.
(2) The addition of phosphates (Na_2HPO_4 and KH_2PO_4) to the medium.
(3) A high concentration of carbohydrate—*i.e.*, high C/N ratio.
(4) The addition to the medium of *small* amounts (0·5 to 0·6 per cent.) of either ethyl alcohol or sodium acetate.

Treatment of Yeast Prior to Analysis

The amount of fat normally present in yeast has been generally accepted as 1 to 5 per cent. of the dry weight. Actually the amount obtained varies with the treatment of the yeast, since the intact cells are resistant to extraction by ether. Smedley-MacLean overcame this difficulty by boiling the yeast for 2 hours with normal HCl, filtering and washing. The acid-extracted yeast was then dried overnight at room temperature, after which the fat was extracted with ether in a Soxhlet apparatus in the usual manner. This treatment rendered the cells permeable to ether without causing appreciable hydrolysis of the fat. She further considers that a good deal of the fat is held in combination with protein or carbohydrate, these complexes being broken down by the pre-treatment with acid. Naegeli and Loew[1] had previously used concentrated HCl, but their results have been criticised on the grounds that such drastic treatment caused hydrolysis of the fat, and also that the resultant material was unsuitable for extraction with ether.

Naegeli and Loew[1] found that a yeast grown on a sugar solution without aeration contained 5 per cent. of fat, but that aeration for the same period raised the fat content to 12·5 per cent. Smedley-MacLean[5] incubated pressed yeast for 44 hours in glucose solution and found that aeration increased the fat content from 6 to 11·6 per cent. The same yeast, extracted without the pre-treatment with HCl, gave only 3 per cent.

When yeast was suspended in water and aerated with a current of oxygen, about two-thirds of the carbohydrate and one-seventh of the protein disappeared, but the fat content showed increases of 50 to 100 per cent. This was not observed in the unaerated control nor when oxygen was replaced by hydrogen (Smedley-MacLean and Hoffert[6]). They concluded, therefore,

that oxygen plays a definite rôle in the conversion of carbohydrate to fat, and the effect is not merely due to mechanical removal of CO_2 from the cultures. Not only did aeration increase the fat percentage, but also the yield of yeast, so that, looked at from the point of view of fat production, aeration is of primary importance.

Rôle of Phosphates

The importance of phosphate in alcoholic fermentation by yeast and the formation of hexose-phosphates as intermediates having already been shown by the earlier work of Harden and Young[7] and of Robison,[8] the question naturally arose as to the part played by phosphates in the carbohydrate-fat conversion. Smedley-MacLean and Hoffert,[6] investigating this point, found that additions of alkaline phosphate increased the yield of fat if the culture was aerated, but had little effect in unaerated controls. Further, the amount of phosphate taken up was proportional to the concentration of sugar in the medium. Increases in carbohydrate laid down as glycogen were also observed under certain conditions. Their experiments tend to show that intermediate formation of hexose-phosphate is concerned with the deposition of both glycogen and fat (Smedley-MacLean and Hoffert[9]). Table 1, taken from their paper, shows the order of results obtained. 12·5 grams of yeast were grown in 1 litre of 4 per cent. glucose solution and aerated. Yeasts were analysed at intervals, as shown in the table, protein, carbohydrate and fat being recorded. One set of cultures received alkaline phosphates (0·3692 gram Na_2HPO_4 and 0·0286 gram KH_2PO_4 per 100 c.c.), the second set received none.

Most of the fat was deposited in the first 24 hours, and after 46 hours the 4 per cent. glucose media had been reduced to 1 per cent. Thereafter fat formation was slow unless the glucose in the medium was renewed.

The Carbohydrate Substrate

Growth of yeast in sucrose, maltose, glucose and fructose solutions, varying in strength from 0·5 to 5·0 per cent. in each case, was studied by Smedley-MacLean and Hoffert,[6] both oxygenated and unoxygenated. Lactose was found to be unattacked by yeast. Five per cent. solutions were found to give optimum results, the amount of fat stored by the yeast increasing with the concentration of the sugar, the relative effectiveness of the sugars being fructose, glucose, sucrose, maltose, in descending order, for aerated solutions. Maltose, although least effective for promoting deposition of fat, was by far the most effective in causing storage of carbohydrate.

The Source of Nitrogen

Ammonium salts, peptone, or the nitrogen present in wort form the usual source of nitrogen, but in Smedley-MacLean's experiments growth was conducted for the most part on nitrogen-free media for the short duration of these experiments; thus the carbohydrate-fat conversion was not complicated by the introduction of a protein factor, the N-metabolism of the yeasts being endogenous. Naegeli and Loew[1] recommend a medium rich in carbohydrate and low in nitrogen.

Non-Carbohydrate Substrates

Lindner and Ungar[10] showed that fat was deposited in the cells of brewery yeast and also in the yeast-like organism *Endomyces vernalis* when exposed to alcohol vapour. Halden[11] showed a similar effect by growing yeast on agar exposed to alcohol vapour. The following 2- and 3-carbon compounds were used by Smedley-MacLean and Hoffert[12] as substrates for yeast, and the increases in carbohydrate and fat recorded: Ethyl alcohol, acetaldehyde, glycol, glycollic aldehyde, acetone, glycerol, aldol; together with the sodium salts of the following acids: acetic, glycollic, glyoxylic, oxalic, lactic, pyruvic, butyric, β-hydroxybutyric, and acetoacetic. Of these, only ethyl alcohol and sodium acetate proved effective in causing fat deposition, more especially the latter. Sodium lactate and pyruvate were also utilised if the culture was vigorously shaken. The addition of sodium sulphite diminished the storage of fat in alcohol and acetate, but had little effect when added to a hexose medium.

As has previously been stated, if yeast be suspended.

TABLE 1

EFFECT OF PHOSPHATE

Analysis of yeast incubated in 4 per cent. glucose expressed in grams per 12·5 grams yeast used as inoculum.

	(a) *Without phosphate.*			(b) *With phosphate.*			
Time (hours).	*Protein.*	*Carbo-hydrate.*	*Fat.*	*Protein.*	*Carbo-hydrate.*	*Fat.*	*P(mg.).*
Original—I	1·30	1·03	0·075	1·34	0·82	0·091	65·4
12...	1·25	1·24	0·342	1·30	1·08	0·496	78·2
24...	1·22	1·25	0·514	1·15	1·36	0·665	82·0
36...	1·24	1·09	0·602	1·19	1·26	1·047	101·1
Original—II	1·30	1·00	0·056	1·24	1·43	0·052	66·5
24...	—	1·18	0·436	1·19	1·14	0·656	107·5
48...	1·19	1·14	0·454	1·15	1·21	0·669	112·9
72...	1·20	1·07	0·542	1·17	1·16	0·911	125·2

in water and aerated, some of the stored carbohydrate is converted into fat. MacLeod and Smedley-MacLean showed that this was increased if water was substituted by N/14 solutions of metallic acetates (see Table 2). They conclude from their analyses that some of this fat was formed from acetate and not from reserve carbohydrate. On the other hand, the addition of these acetates to hexose solutions diminished the amount of fat normally deposited, this effect being most noticeable in the case of the calcium or magnesium salts. The amount of fat deposited in acetate solutions was not increased by the addition of phosphates.

TABLE 2

AVERAGE INCREASE IN FAT CONTENT IN VARIOUS SOLUTIONS

Solution.	*Per Cent. Increase in Fat Content.*
Water	41
Potassium acetate	180
Sodium acetate	160
Magnesium acetate	118
Calcium acetate	100

Synthesis of Fat by *Endomyces vernalis*

According to Ramsbottom,[14] *Endomyces vernalis* was used by the Russians to produce fat from carbohydrate during the last war, Nadson and Konokotine[15] being the investigators responsible. It was originally found in the slime fluxes of birch and hornbeam and was known as " fat-yeast ". The production of fat by this organism as well as others was extensively studied by Lindner[16] at about the same time in the *Institut für Gärungsgewerbe* in Berlin (see also Prescott and Dunn[4]).

Nadson and Konokotine found that the organism contained practically no fat when growing in its filamentous form, but that fat formation occurred when the hyphæ broke up to form so-called *oïdiæ*, which germinated to produce yeast cells. The organism grew as a mat or skin over the surface of the liquid medium. Their cultures were grown for various periods at 10° to 15° C., inactivated by heating to 70° C., and the total yeast crop, protein and fat (obtained by ether extraction), were estimated after drying *in vacuo*. Germination in beer wort of gravity 8·1° Balling for 8 days gave a yeast crop containing 25 per cent. protein and 28 per cent. fat. Equally good or even superior results were obtained by growing the organism either on molasses containing 0·5 per cent. ammonium sulphate or on a mixture of 1 part molasses, 1 part urine and 1 part water.

Unmarketable potatoes can equally be used as a nutrient substrate for *Endomyces vernalis*. Nadson and Konokotine showed that when potatoes were sterilised at 120° C. and inoculated with it the fat content rose from 0·52 to 7·31 per cent. in 10 days. The organism grew as a thick yellow pellicle over the surface.

Lindner recognises two phases in the growth of the organism—an initial " growth phase " of from 2 to 3 days, followed by a phase of " fat generation " lasting 6 to 8 days. For the former an abundance of nitrogen relative to carbohydrate is required—*i.e.*, a low C/N ratio—but for the latter a carbohydrate-rich diet is required. According to this authority, the optimum temperature is 15° to 20° C., but lower temperatures may be used. Aeration is essential and fat formation was found to be increased by the presence of alcohol vapour. Potassium chloride, potassium phosphate and magnesium sulphate may be used as salts, and ammonium sulphate, yeast-water, urine (or synthetic urea), molasses slop, etc., as a cheap source of nitrogen. Molasses, sulphite liquor, cellulose waste or glucose obtained by acid hydrolysis of wood were all assimilated as sources of carbon.

Some micro-photographs of cells of *Endomyces vernalis* and other organisms, showing the fat globules in them, are given in Lindner's original paper.[15] He stresses the importance of microscopic examination of the organism and suitable staining methods as a rapid means of following the extent of fat formation.

This paper also gives the history of fat production by *Endomyces vernalis* in Germany. The most successful large-scale method was the " pan process ", in which the organisms grew as a mat on top of pans, containing a shallow layer of the nutrient liquid, 1 to 2 cm. in depth. The nutrient solution could be run off and replaced without destroying the " mat " of organism on the surface, and similarly the " mat " could be washed with water to clear it of media prior to its collection and treatment for fat recovery. By arranging the pans in tiers, one above the other, up to twenty of them in one column, a large saving of factory floor-space was effected, enabling a very large surface area of mycelium to be grown within the confines of one building. The pans were made of " magnalium ", a magnesium-aluminium alloy, but in order to conserve metal other materials were also tried, including a kind of linoleum composition spread out on wire frames. Lindner suggests that the organism could be grown on textile surfaces, a series of " towels " hanging vertically, and the nutrient solution sprayed on it. As much as 42 per cent. of fat could sometimes be extracted from the " mat " of growth, expressed in terms of dry-weight percentage.

More recently Stampa,[17] in reviewing the whole subject of micro-biological production of fat, gives the average dry-weight yield of fat from *Endomyces vernalis* as 25 per cent. The fat obtained was mostly neutral glycerides and said to resemble olive- or rape-seed oil.

Fat recovery was effected by grinding the organism with sand and extracting with ether, by rupturing the cells with warm, dilute HCl, or by allowing the cells to autolise at 50° C. for 2 to 3 days. Spoilage of the cultures by air-borne infection and the high labour costs in running the process were the two main difficulties encountered.

Introduction of Oöspora (Oïdium)

In 1026 an organism of the group Oöspora (Oïdium) was isolated by Chaston Chapman from a sewer blocked by its growth (Ramsbottom[14]). Cultured on laboratory medium, it produced a film in 2 days which contained 50 per cent. of protein and 10 per cent. of fat. The flavour and odour of the film resembled cream cheese. Organisms of this group appear to yield a far larger amount of fat than is the case with *Endomyces vernalis*. Thus Stampa[17] quotes values as high as 50 per cent. for *Oïdium lactis*. This particular organism grows readily on whey and other dairy by-products as well as glucose-containing liquids that occur as residues from fruit-canning industries, or on a mixture of both.

It has the advantage of being more resistant to infection by other organisms; in fact, Fredholm[18] obtained a more rapid and higher production of fat when the organism grew symbiotically with lactic acid-producing bacteria in milk serum. Stampa's article has already been reviewed in this journal.[19]

Fink Haehn and Hoerburger[1, 20] grew *Oïdium lactis* in whey to which were added 2 grams of ammonium sulphate, 1 gram primary potassium phosphate and 0·5 gram of magnesium sulphate for each 2-litre batch of medium. Incubation was carried out up to 16 days in Jena flasks. During this period the initial *p*H rose from 5·0 to 8·1, and maximum fat production was attained in 6 days, being 22·5 per cent. of the dry weight (as crude fat). The optimum temperature was found to be 25° to 30° C. In terms of carbohydrate consumed the fat obtained represented a conversion of from 12·5 to 14·34 per cent.

Geffers,[21] working with *Oöspora wallroth* and culture medium containing pure lactose, reported fat yields as high as 50 per cent. of the dry weight.

Fat Production in the Penicillium Group

The early analyses by Browne[2] in 1906 on *Citromyces* (*Penicillium*) showed that the dried mycelium contained 27·5 per cent. of fat. The organism was found growing as a scum on the surfaces of molasses waste in a sugar factory.

Barber[22] grew a green species of *Penicillium* on solutions of sucrose, glucose, xylose or glycerol. He made the important observation that the same type of fat was produced irrespective of the carbon substrate. Pearson and Raper,[23] working with *Aspergillus niger* and *Rhizopus nigricans*, showed (by determinations of Iodine Number) that the degree of unsaturation of the fat increased as the incubation temperature was lowered, and *vice versa*.

More recently a series of investigations in America by May, Lockwood and their associates[24, 25, 26] have thrown much light on the amount and nature of the fat produced by *Penicillia* and other moulds, the particular organism which has attracted most attention being *P. javanicum* van Beijma, because of the unusually heavy mycelial mat produced, as well as its high lipoid content.

Ward *et al.*[25] extracted the crude fat by ether from sixty-one different mould species—thirty-nine *Penicillia* and twenty-two *Aspergilli*. Out of these, ten contained over 15 per cent. fat and six over 20 per cent. The organisms concerned are set out in Table 3, quoted from Prescott and Dunn.[4] It will be observed that nine out of the ten are *Penicillia*.

Penicillium javanicum van Beijma has been extensively studied by Lockwood *et al.*[26] and the chemical and physical properties of the fat determined by Ward and Jamieson.[24] The mould was grown for 12 days at 30° C. at *p*H 4 to 5 in 75 c.c. of media placed in 200-c.c. Erlenmeyer flasks. The media contained NH_4NO_3—2·25 grams, KH_2PO_4—0·3 gram, and $MgSO_4.7H_2O$—0·25 gram per litre. Glucose as source of carbon was varied from 20 to 50 per cent. Maximum fat content (41·5 per cent. dry weight) was obtained at 40 per cent. level as against 29·0 per cent. at 20 per cent. level. On the other hand, a larger mat was obtained at 20 than at 40 per cent. level—*e.g.*, 2·52 grams compared with 1·96 grams, to quote a typical experiment. Increasing the sugar level to 50 per cent. lowered both the fat content and the mat weight. Xylose, galactose, maltose, sucrose glycerol, starch and dextrin all served as sources of carbon, and traces of the following ions increased the mycelial growth and fat content: chromic, columbic, ferric, molybdic and tungstic. Nitrates, preferably as ammonium nitrate, were a favourable source of nitrogen.

In Italy, Garoglio and Ciferri, in experiments quoted by Stampa,[17] obtained an average of 18·52 per cent. fat (dry weight) from 135 cultures of *P. javanicum*, using a somewhat similar medium containing 22 grams glucose per litre and incubation periods rising to 60 days at 25° to 30° C.

Under similar circumstances various species of *mucor* were also tested by them. One of these, *Mucor racemosus*, yielded 25·4 per cent. fat, and these authors seem to consider *Mucoraceæ* superior to *Penicillia* as fat producers, but the amount of mycelium obtainable

TABLE 3

MOULDS CONTAINING MORE THAN 15 PER CENT. OF CRUDE FAT

Mould.	*Crude Fat in Dry Mycelium (per cent.)*
Penicillium bialowiezense	17·0
P. citrinum Thom...	18·1
P. hirsutum Dierckx	18·4
P. soppi Zal	20·2
P. javanicum van Beijma	22·2
P. roqueforti Thom	22·9
P. oxalicum	24·4
P. piscarum Westling	26-28
P. flavocinerium Biourge	28·5
Aspergillus flavus Thom and Church ...	16·0

TABLE 4

PHYSICAL AND CHEMICAL PROPERTIES OF OIL FROM P. JAVANICUM

	Ward.	*Garoglio.*
Specific gravity at 25° C. ...	0·9145	0·9200
Melting point	15° C.	12° C.
Solidification point	6-7° C.	2-3° C.
Refractive index	1·468	1·472
Iodine number	78-88	66·06* 78†
Saponification value	181-183	190-191
Saturated fatty acids (per cent.)	30·8-34·6	34-35
Unsaturated fatty acids (per cent.)	60·8-62	62
Unsaponifiable matter (per cent.)	2·0	1·4
Melting point of saturated fatty acids	52·5° C.	—
Mean m.w. of saturated fatty acids	272	273
Acetyl value	10·7	—
Reichert-Meissel number ...	0·3	—
Free fatty acid as oleic acid (per cent.)	—	16·92

* Oxidised type. † Unoxidised type.

is less. Unfortunately, further details concerning this group are difficult to find.

Nature of the Fat Obtained

Endomyces vernalis.—Stampa gives the following details: "The extracted substance was a reddish oil containing 6 to 8 per cent. of free fatty acid and easily refined. The yields calculated in relation to the sugar consumed were 12 per cent. with molasses and 18 per cent. with waste sulphite water. . . ." In the case of Lindner's "pan process" the fat obtained was nearly all neutral glycerides.

Oïdium lactis.—Fredholm reports this as soft and yellow in colour, containing 42·8 per cent. saturated acids, 42·2 per cent. oleic acid, 11·8 per cent. linoleic acid and 0·12 per cent. linolenic acid.

The fat which appears to have received most attention is that of *P. javanicum* van Beijma. Details of the chemical and physical properties of this fat are given by Ward and Jamieson[24] and by Garoglio and Ciferri, and their results are set out side by side in Table 4, quoted from Stampa's review.[17]

Stampa places this oil in the category of a semi-drying oil, pointing out that it can be used for technical, as well as edible, purposes.

This same author claims that cultures of these fat-forming fungi could be improved by hybridisation, since a uniting of the spores of different yeasts has now been achieved, resulting in hybrid species of higher performance. Winge and Lausten[27] crossed *Saccharomyces ellipsoidus* with *S. validus,* grown in 9 per cent. sugar solutions. The hybrid converted 72·2 per cent. of sugar into fat, compared with 63·9 per cent. for *S. ellipsoidus* and 57·7 per per cent. with *S. validus.* Apart from this, the hybrid possessed greater vegetative vitality than either parent. This new development appears to open up considerable possibilities, since hybridisation might also be carried out to confer resistance against infection by contaminating organisms.

One of the main difficulties in the biological synthesis of fats is the need for inoculating a large surface relative to culture volume.[19] This involves much hand labour and was one of the main drawbacks to Lindner's original "pan process", but Stampa[17] suggests that mechanical means could be found to overcome this defect, and, since the organism can grow for the most part on waste carbohydrate material, he considers that a combination of improved type-cultures and mechanisation might well make the biological synthesis of fats an economical undertaking in normal circumstances as well as a wartime expedient.

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The Case for a Nutrition Council

JOHN YUDKIN, M.A., Ph.D., M.B., F.I.C.
(Dunn Nutritional Laboratory)

SIR JOHN ORR has spoken of a food policy based on human needs. It would appear axiomatic that the production and distribution of food should be thus founded upon a knowledge of the nutritional needs of the people. For this to obtain, we must be in a position to answer three questions:

(1) What are the nutritional needs of the people?

(2) Can the food necessary to satisfy these needs be produced?

(3) Are the people obtaining the food necessary to satisfy these needs?

It will become evident, after we have discussed the methods which have to be used in order to answer these three questions, that they are closely interrelated, and that their solution can only be undertaken by a single representative body of nutritionists and allied workers, a body which is, in fact, a Nutrition Council. First, then, let us consider how these questions are to be answered.

Determination of Nutritional Needs

Human nutritional needs are determined by three types of investigation—(*a*) animal research, (*b*) research on human subjects in the laboratory, and (*c*) survey work in the field.

(*a*) Work with laboratory animals has given, and is still giving, information about the existence of hitherto unknown nutrients, the mode of action of specific nutrients and the effects of deficiency in animals. This last has frequently served as a useful guide to the possible effects of deficiency in humans.

(*b*) By such studies it is possible to determine the requirements of specific nutrients either by metabolic "balance" experiments or by examining the effects of graded amounts of the nutrient in producing or preventing signs of deficiency. An example of the former is the determination of the requirement of calcium; of the latter, the determination of the requirement of vitamin A.

(*c*) By dietary surveys it is possible to determine fairly accurately the amount of each of the dietary essentials consumed by individuals; by nutritional surveys, it is possible to determine, by looking for signs of early deficiency of some of these essentials, whether the individuals are receiving adequate amounts. Although this method has so far never been used, careful dietary and nutritional field studies, conducted on the same subjects, would produce valuable information regarding the requirements of at least some of the dietary components.

Food Production

The food consumed in Britain is partly home-produced and partly imported, and it is clear that important economic factors are concerned in both. While it may be debatable to what extent the nutritionist should assume executive authority in such matters, there is no doubt that decisions affecting either the home production or the importation of food must sooner or later be his concern. With imports, one can at least hope that economists will be guided to some extent by the advice of nutritionists, particularly if they speak with the general broad knowledge and experience of a Nutrition Council. As regards home production, the nutritionist has a more direct claim for consultation.

Improvement in food production in Britain may be quantitative and qualitative. The question of increased quantity by the use of appropriate fertilisers, pest control and similar measures is chiefly one for the practical farmer, although here too the nutritionist is naturally interested. But he is more directly concerned with improvements in quality. At the moment, the bias in food production is almost entirely economic; food is considered as a marketable commodity rather than a product supplying vital human needs. It is possible, by appropriate methods, vastly to affect the nutritive quality of milk, wheat and probably many other foods, but unless such methods are of economic benefit to the producer they will not be adopted. If appropriate measures were taken by the administration to encourage the production of foods of higher nutritional value, even though immediate economic considerations alone would not appear to justify such a step, nutritional research would without doubt be able to find methods of effecting improvements in quality which are as yet unknown.

The balance between imported and home-produced food will be affected, as we have suggested, by many economic factors and, in wartime, by difficulties of transport. But by considering mainly the nutritional needs of the people, it should be possible to balance them so that these needs are met.

Questions such as seasonal variation in food supplies must also be considered, so that, for example, home-produced foods which supply essential nutrients and which may be in short supply at certain seasons, can perhaps by made up by imported foods.

Food and the People

Even if an adequate amount of appropriate food were produced and imported there are several stages between it and its consumption by the people.

The ease with which foods, both within Britain and from overseas, can be transported and stored will affect its availability to the whole country or to parts of it. Nutritional research has played an important part in solving problems of this nature, the most important recently being the method of dehydration. The guiding principle which has been adopted in working out the technical processes of dehydration has been that of obtaining a product of the highest possible nutritional value. The dried foods, which have been known in some cases for centuries, would perhaps have adequately solved the question of transport and storage, but the great deterioration of nutritive quality entailed by the ordinary drying processes has rightly been considered sufficient to warrant the considerable effort necessary to produce "dried" foods of a high nutritional standard.

Unless the people have the financial means necessary to purchase an adequate diet, the mere presence of the food in the shops will clearly not of itself produce optimal nutrition. A continual check on the purchasing power of the people is necessary, and this entails budgetary surveys of the type conducted by the Ministry of Labour in 1938. A great step towards ensuring that the more important foods are within the means of at least the majority of the people has been taken by the administration since the war; this has been done by the control of prices, which have sometimes entailed financial subsidies to the producers.

Although the " main single cause of malnutrition is poverty " (League of Nations Nutrition Committee), there is no doubt that an improved knowledge of food values would result in a better standard of nutrition. Campaigns such as that organised to popularise national wheatmeal bread could overcome a great deal of prejudice and false statements by interested parties, which have often led to a gross mis-spending of the inadequate money available in many families. A sensible plan of education in nutritional matters would result in an increase in the knowledge of food values without creating a nation of food-faddists.

In order to help in educating the public, it is necessary to have a body of trained nutritionists. At the present moment there is nothing apart from qualifications in dietetics which would allow the public to differentiate between the well-qualified nutritionist and the food quack. One would like to see more university posts in nutrition and the institution of courses in the subject leading to a diploma or similar university qualification.

Cooking and other methods of food preparation may effect great changes in the nutritive quality of foods. It is important not only that studies of these effects should continue, but also that the results of such studies and the methods which are found to be best be made known.

Gaps between Food Supply and the People

Let us suppose that we are able to answer satisfactorily the three questions postulated above, so that we can say that we know what are the nutritional needs of the people, that the food is available to satisfy these needs and that the people are in a position to obtain the food. Can we then be certain that the food policy does in fact entirely meet the nutritional needs of the people? A consideration of the assumptions made in answering the questions show that in fact we cannot be certain of the adequacy of the food policy without a continuous check. For example, we are not yet in a position to say with certainty exactly what is the requirement, for an individual, of each one of the essential nutrients. Nor is it sufficient, even for those nutrients whose requirements we know fairly accurately, to say that if the total amount of that nutrient available in the country divided by the total population provides more than enough to meet the requirements, then the requirements are in fact met for every individual.

In order to see whether the people are getting a diet which, in our present state of knowledge, appears to be adequate, it is essential to conduct continually budgetary, dietary and nutritional surveys, especially in those groups such as women factory workers and adolescents in which the possibility of an inadequate diet is most likely. The budgetary surveys will determine, in relation to current food prices, whether the means are available to purchase an adequate diet. The dietary surveys will determine what actually is being consumed; the relation between the results of these two surveys will incidentally be of great value to those in charge of food education. Nutritional surveys will, with modern methods of assessment of nutritional status, be able to detect quite early signs of malnutrition, and will provide in conjunction with the dietary data a useful check on our standards for the requirements of the nutritive elements.

The gaps between the supply of food and its consumption by the people, which will be revealed by these studies, can be filled by an alteration of food policy so as to make available an adequate supply of food, by a campaign to educate the people to make the best use of the food which is available, by extending the regulation of food prices or otherwise increasing the purchasing power of the poorer sections of the people, and by supplying if necessary concentrates of synthetic nutrients. This last is now being done, for example, in the fortification of bread with calcium, and again the nutritionist will be concerned in studying the efficacy of such fortification and the possible effect of the added nutrient on the other nutrients in the bread.

Problems for a Nutrition Council

Of the many specific nutritional problems which await urgent attention, in addition to the general problems outlined above, two might be mentioned here. These are the possible nutritional factors concerned, on the one hand, in the rise in tuberculosis and, on the other hand, in causing absenteeism in factory workers. That malnutrition may play a part in lowering the resistance to tuberculosis is well known, and, indeed, in the recent report of the Medical Research Council it is suggested as one of the possible causes of the wartime rise in the incidence of disease. But so far no systematic investigation has been carried out to test this, so that the rôle of malnutrition in the pathogenesis of tuberculosis is still problematical.

With regard to absenteeism there are several reasons why malnutrition may possibly be concerned. In the first place, women workers, the number of whom has increased greatly since the war, are often anæmic, and, indeed, some workers have found recently an increase in anæmia in certain localities. A low level of hæmoglobin may quite easily be imagined to cause a degree of ill-health or " off-colourness " sufficient to prevent a woman from attending work. Secondly, many young women are working away from home, and are living on a most unsatisfactory diet; often their midday meal consists of buns and tea and often, too, their evening meal at their lodgings is far from ideal. Thirdly, the symptoms which recent workers have reported in many factory workers, and which some have called " nervous debility ", resemble quite closely the symptoms of early deficiency of some of the vitamins—lack of concentration, excessive lassitude and fatiguability, irritability and general feeling of malaise. And in all instances, even if the worker is not prevented from going to his work, he may well be doing less and with greater effort than if he were in perfect health. Once more, it is at present impossible to say to what extent malnutrition is really affecting the efficiency and health of the worker, but there would seem to be a good case for

beginning, and for continuing periodically, investigations to determine whether malnutrition plays a part in this problem.

Existing Bodies Concerned with Nutrition

It has been stated by the Minister of Health that existing arrangements already secure the main purposes of a Nutrition Council. The Minister then cited some of the organisations which are directly interested in nutritional problems. The more important of these, including some which the Minister omitted, are :

The Ministries of Health, of Food, of Labour and National Service and of Information.
The Board of Education.
The Privy Council and its sub-departments (Medical Research Council, Agricultural Research Council, Food Investigation Board of the Department of Scientific and Industrial Research).
Admiralty, War Office, Air Ministry.
Many Universities and Colleges.
Many voluntary organisations such as the Children's Nutritional Council.

It is exactly because there are these numerous organisations to whom nutritional problems present themselves that it is essential that some unifying body be set up which can co-ordinate the work of those departments actively engaged in nutritional research and inform authoritatively those departments whose main function is to apply the results of such research.

Many of the questions which concern the nutritionist are general scientific problems which apply equally well to all nations. There is no reason to believe that, for example, the requirements of calcium or of vitamin B_1 are any different in an Englishman or a Chinese, an American or a Russian. We can expect, too, that the effect of vitamin A in improving dark adaptation are as true in Britain as in the Middle East. There is already an increasing tendency to avoid duplication of what we may call fundamental research of this nature between workers in the different armed forces. May we not therefore hope that such problems shall be investigated with closer liaison between workers of different countries? May we not expect that, by the formation of a Nutrition Council in each country, an International body shall be formed which would be in touch with, if it did not actively direct, problems of this sort throughout the world?

Furthermore, if the nutritionist expects—and rightly expects—that nutritional considerations as well as economic should guide the food policy of his country, it is clear that, in so far as part of the food is imported, his recommendations must affect the policy of food production abroad. Logically, then, the food policies of all nations should be considered together, and an International Nutrition Council should be the body to supply the nutritional information available or to take steps to obtain the information if it is not available. The feeding of the peoples of the world is being actively considered at the present time, and it is at the present time that the nutritional worker should make an effort to ensure that the administrators are sufficiently aware of the importance of food in the health and lives of the people as well as of its importance as an economic commodity.

Finally, it should be emphasised that no claim is made that malnutrition is the root of all evil nor that the formation of a Nutrition Council will provide a universal panacea. But it is claimed that, if we really intend to achieve freedom from want, the first essential is to devise a food policy which provides for the nutritional needs of the people. To do this adequately requires the existence of a body composed of nutritionists both in the laboratory and in the clinic, of chemists and biochemists, of statisticians and dieticians and of agriculturists and veterinarians. This body, the Nutrition Council, would be in the hands of men of broad knowledge and wide interests, who would not despise the social implications of their work nor refuse to acknowledge these implications by labelling them " political ". It would be in touch with economists and would aim at making contact, with all speed, with similar organisations in other lands, in order to hasten the day when malnutrition is as rare and as startling as the bubonic plague.

Abstract of a memorandum issued by the Parliamentary and Scientific Committee.

Correspondence

Free German Institute

TO THE EDITOR OF FOOD MANUFACTURE

SIR,—As patrons and others interested in the aims and objects of the Free German Institute we wish to draw your attention to the valuable work being carried on there by a body of exiled anti-Nazi German scholars and to appeal for support of its enlightening activities.

The Institute is affiliated to the Free German League of Culture, which has among its patrons Thomas Mann and Prof. Albert Einstein. The Institute has set itself the task of upholding and developing the traditions of German science and learning which are now destroyed or falsified by the Nazis, and of contributing towards an interchange of knowledge between German scientists in exile and scientists of the United Nations.

By the work of its research groups on German philosophy, arts, literature, theatre, music, education, history and sociology, law, and the sciences, which it is hoped will be published and which would provide factual material for discussions on these questions; by language classes and lecture courses for British students in conjunction with British Universities and by a series of lectures by Allied scientists, good progress has been made.

As the Institute does not receive any grants it has to rely entirely on contributions from refugees themselves and financial assistance given by British scientists and interested persons.

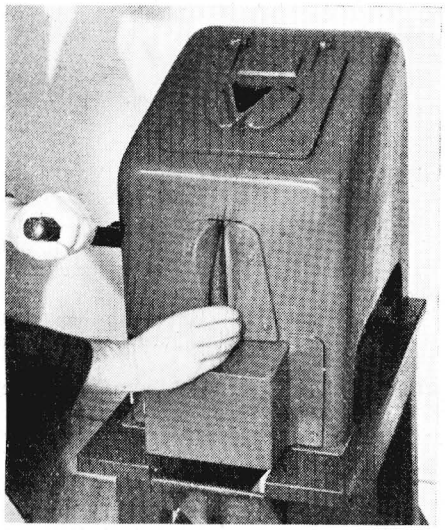
The undersigned appeal, therefore, to all those sympathetic towards the work of the Institute to send a helpful contribution to the Secretary, Free German Institute of Science and Learning, 16, Buckland Crescent, London, N.W. 3.

Yours, etc.,

S. CHAPMAN, G. D. H. COLE, G. P. GOOCH, RICHARD GREGORY, JULIAN HUXLEY, S. SUSAN ISAACS, F. G. KENYON, H. LASKI, H. LEVY, J. R. MARRACK, JOHN ORR, R. PASCAL, G. THOMSON.

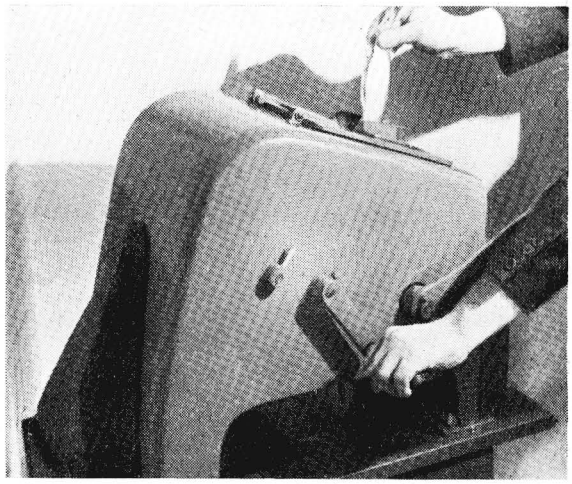
A Herring Boning Machine

Mr. Tom Johnston, M.P., stated recently that if an efficient herring boner could be produced, he visualised the sale of a hundred thousand. Mr. Johnston was presumably referring to a simple hand gadget which would be used in the kitchen, but it would be better if the objectionable operation of boning were performed in the fishmonger's shop. A small machine for heading, splitting, gutting and boning herring is described on this page.



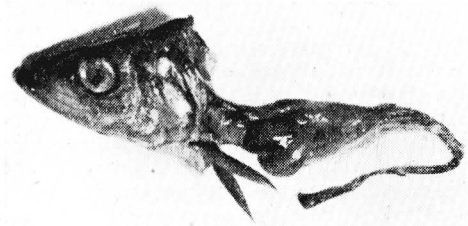
Beheading, splitting and gutting

The process is completed in two operations. The herring is first grasped in the right hand and the head inserted downwards in a slot in front of the machine. With the right hand still grasping the herring, the left hand pulls a lever on the side of the machine, which beheads, splits and guts.

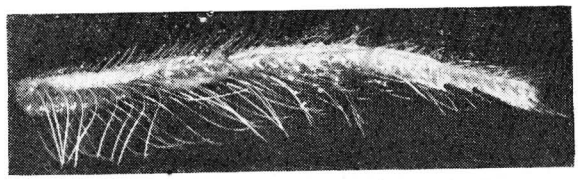


The bone is removed

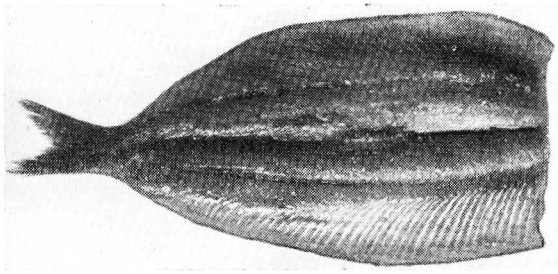
The herring is then dropped into a slot in the top of the machine and the left hand rotates a handle. The fillet immediately drops out of the chute while the bone slips down into a tray underneath the machine; the head and gut having already dropped into the same tray. A trickle of water running through the machine enables the fish to slide easily and keeps the machine clean internally.



Head and guts drop into tray



The bones join head and guts



The finished fillet

Flavour and Food

R. W. MONCRIEFF, B.Sc.

FLAVOUR is a complex sensation. It comprises taste, odour, roughness or smoothness, hotness or coldness and pungency or blandness. The factor which has the greatest influence is odour. If odour is lacking, then the food loses its flavour and becomes chiefly bitter, sweet, sour or saline. People suffering from loss of smell lose also what they call their "sense of taste", but which is really the odour component of the flavour. Taste remains, but only the ghost of flavour. Meats taste the same, wines merely slightly sweet or sour. It is probably legitimate to include "roughness or smoothness" as a flavour factor. Roughness may quite destroy the appreciation of an otherwise attractive food. One recalls lumpy porridge or a gritty chocolate. Hotness may be sensed either as the result of applying food at a high temperature—say, 45° to 55° C.—to the mouth or by tasting ginger or another "hot" spice. Similarly, coldness may be due to a change in temperature or to tasting peppermint, which has a cooling taste.

Owing to the greater volatility of the odorous components, warm or hot food or beverages have more flavour than cold. After eating or drinking cold food or liquids the sensation of flavour is experienced chiefly on breathing out, after the odorous constituents have been warmed in the mouth and throat and are consequently more volatile and more easily detected by the nose.

Apart from the æsthetic enjoyment derived from flavour in food, the flavour performs useful biological work in stimulating the flow of salivary and digestive juices. We all know how the mouth waters on perceiving the smell of a delicacy and how the appetite sharpens when we smell the breakfast bacon. Smell starts a series of reflex processes in motion. Certain fishes will not feed unless they can smell the food, even though they are hungry (or at least starved) and suitable food is where they can see it. The appearance of the pigment (at the same time as the sense of smell, we believe) in young animals at weaning-time also illustrates the importance of smell in the selection of food.

Water

The first requirement of our alimentary system is water, and we rightly attach importance to its purity. It should be odourless and tasteless. A stale odour is often the accompaniment of bacterial infection.

The concentration of dissolved carbon dioxide in water affects its taste. Distilled water has no carbon dioxide and is flat and insipid. It may be said to have an alkaline taste. The water in our nasal passages contains carbon dioxide in solution, and this water is the standard to which we refer other substances for odour. It is therefore correct to regard distilled water as sapid and incorrect to apply the adjective "insipid" to it, although in colloquial use it is used more to indicate an alkaline taste than a complete absence of taste. These remarks apply equally whether the alkaline taste is considered as a true taste or as a manifestation of the common chemical sense. Hard water, which contains more carbon dioxide, has a distinct taste.

The cause of an earthy taste in water is generally the presence of the common ray-fungus *Actinomyces*, which comes from the soil. The taste is persistent but can be removed by adsorption on carbon, clay, chalk, etc. Such water may also give an earthy taint to the flesh of fish inhabiting it.

Non-Alcoholic Beverages

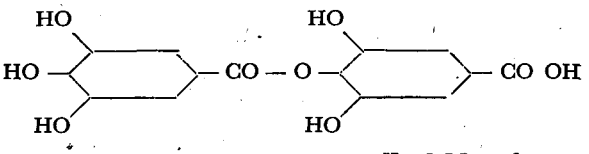
New milk has only a mild, sweet taste and faint odour. The smell of sour milk is not due to lactic acid, which is odourless, but to the presence of small quantities of volatile fatty acids—*e.g.*, butyric.

The food given to the cows has a considerable influence on the flavour of milk. The betaines in sugar-beet residues may give it an unpleasant taste, while another source of trouble is vetch seeds, which contain bitter principles which impart their taste and odour to the milk. Experiments have been made to see if this danger can be avoided by steam distilling the vetch grains to remove the bitter principles, but without much success.

Tea was originally used medicinally as a nerve stimulant. It appears to have been used in China for at least 4,500 years. Its use in Europe dates from 1517. It consists of the leaves of *Thea chinensis* and *Thea assamica*, which are dried and then fermented until they have a fragrant odour. An essential oil has been extracted from tea and is pale yellow with an intense penetrating odour of tea. This is quite a separate body from tea-seed oil obtained from the seeds, an oil which has for some purposes replaced olive oil.

Tea may be flavoured by the addition of fragrant flowers. Those of the navel orange are sometimes used and owe their effect largely to the trace of indole which they introduce. It has in fact been suggested that the quality of such orange flowers present could be determined by the amount of indole present and that the aroma of the tea could be related to its indole content.

About 45 to 50 per cent. of ordinary tea is water-soluble. When it is infused for drinking, the aim should be to dissolve as much as possible of the aromatic essential oil and the caffeine which give the pleasant flavour and stimulating effect without dissolving the tannin, which has an astringent taste and renders objectionable tea which has been standing some time. Most of the caffeine and essential oil are dissolved out in five minutes, so that the optimum pleasant effects are then obtained, and to leave the liquor in contact with the tea-leaves longer impairs the quality of the beverage. Normally tea contains about 3 per cent. caffeine and 13 per cent. tannin. The tannin, which is remarkable for its astringent taste and peculiar odour, is a phenol derivative with the constitution



The milk which is usually added to the tea has the good property of precipitating the tannin, so minimising its astringent taste and deleterious effects.

In other countries different flavours are appreciated. In the East a weak infusion without milk or sugar is favoured; in Russia lemon-juice is added; in Germany rum and cinnamon; and in Spain lemon-verbena.

The odorous principles of oil of tea which are responsible for the aroma of the beverage have been the subject of intensive research in Japan. A very large number of compounds have been identified, particularly alcohols—*e.g.*, butyl, isoamyl, hexyl, octyl, benzyl and phenyl ethyl alcohols and geraniol.

Coffee consists of seeds from the berries of the evergreen shrub *Caffea arabica* indigenous to Abyssinia and Arabia. The seeds or beans are dried and then roasted in order to destroy the tough, fibrous nature of the bean and to develop the aroma. If under-roasted, the flavour is not fully developed, but if taken too far an unpleasant empyreumatic odour appears which renders nauseous the subsequent infusion. During roasting there is a loss in weight of about 16 per cent., of which about half is moisture, the other half consisting of volatile products from the fats and sugars as well as some caffeine; thus some portion of the pleasantly flavoured oils is lost to the final infusion. It is clear why the flavour of infused coffee is only a shadow of the exquisite aroma of roasting coffee. In order to minimise the loss of essential oil, the beans should not be ground until required for infusion.

Cocoa has a less sophisticated odour than tea or coffee. The beans are fermented, as this changes their taste from bitter to an agreeable aromatic flavour. Such fermented beans are suitable for chocolate making. Unfermented beans are too bitter for chocolate, and if used for cocoa a large quantity of sugar must be added. After fermentation the beans are normally dried and roasted. This brings out the flavour, but, as in coffee roasting, some of the volatile oil is lost.

Theobromine or dimethylxanthine is the alkaloid in cocoa (caffeine is trimethyl xanthine). About half of the husked bean is composed of cocoa-butter, a fat with a pleasant taste and chocolate odour which consists chiefly of the glycerides of stearic, palmitic, oleic and arachidic acids.

Alcoholic Beverages

Alcohol cannot be tasted in low concentrations, and even in fairly high concentrations it has only a rather faint, sweet taste. Neither is its odour remarkable; it is not pronounced, just pleasant and spirituous or ethereal. It is therefore surprising that alcohol should be such an indispensable constituent of so many of our drinks. It may be said that the stimulating and intoxicating effect is the attraction, but there are few people who would be attracted by a pure aqueous solution of absolute alcohol. The odour of the alcohol perceived mostly after the vapours have been warmed in the throat enhances and blends with the odours of the esters, giving an attractive *ensemble*. As is well known, raw spirits contain fusel oil, which consists chiefly of isoamyl and active amyl alcohols as well as small quantities of many other alcohols such as propyl and isobutyl. These alcohols have disagreeable odours and impair the flavour of the beverage, which, since they are very harmful to the body, is just as well. Consequently the spirits are kept for long periods during which these alcohols are converted into harmless and pleasantly odorous esters.

The alcohol content of beer is usually less than 5 per cent. The alcohol cannot be tasted, although the vapours are odorous. Flavouring is necessary, and hops are used. If the hops are added and boiled with the wort in making beer, much of the essential oil which contains the odorous constituents of the hop steam distils off and is lost. Accordingly it is now more usual to extract the oil from the hops separately and add the oil either to the finished beer or at a late stage of its manufacture. The essential oil of hops contains myrcene, linaloöl and linalyl isononoate. Many attempts have been made to concentrate beer so that it could be transported cheaply and then watered down, but these have been unsuccessful, as they have resulted in loss of aroma and destruction of the palate or flavour of the beer.

Wines contain more alcohol, but not usually above 10 per cent., except in fortified wines, where distilled alcohol is added. Light wines such as sauternes, hocks, clarets and burgundies are not fortified, but ports and sherries may be so. In these cases the alcohol content is high enough to have a distinct taste effect, while naturally the odour effect is enhanced. However, the bouquet of the wine is determined principally by the esters it contains. These vary according to the district from which the wine comes, the year according as the crop is good or poor, and the age since esterification will have proceeded during maturing. The best length of maturing time varies with the wine—perhaps 40 years for port and 12 to 15 years for champagnes. The temperature at which the wine matures should be between 53° and 58° F. Champagne is often chilled before drinking, but if the temperature is taken below 50° F. much of its fragrant bouquet and pleasant vinous flavour is lost. If wine is too warm the odour of the alcohol interferes unduly with that of the esters and the fineness of the bouquet is lost.

Wine will readily take up other odours, and it is necessary to exclude these from places of storage. The relation between the *p*H value and the taste of wine was investigated by Crisci (*Ann. chim. applicata*, **20**, 566-83, 1930). A low *p*H value gave the wine a sour taste, but other factors exerted an influence, notably the undissociated organic acids and the presence of sugar, glycerol, alcohol and tannin. Crisci pointed out that if a wine is diluted with water its *p*H value may not be greatly affected, but the taste will change. Glucose may be added to " improve " wines.

Brandy is the distillate obtained from fermented grape-juice. It is colourless when new, but takes its yellow-brown colour and some tannin from the oak casks in which it is stored. Inferior or new brandy has a fiery taste and earthy bouquet, but if aged and matured it has a sweet, mellow, ethereal flavour. The bouquet is due to esters, mainly ethyl pelargonate, but also acetic, butyric and valeric esters as well as traces of terpenes. Liqueur brandy, which should be in the region of fifty years old, is drunk from thin convex glasses so that the warmth of the hand increases the volatility, and the vaporous particles are partly restricted from escaping by the narrow lip of the glass,

(*Continued on page* 346)

Fruit Products Research

THE annual report of the Agricultural and Horticultural Research Station at Long Ashton for 1942 recently published records of a very active year on the part of the research workers on fruit and vegetable culture; plant pathology; cider and fruit products; and agriculture.

Cider and Fruit Products

In the cider and fruit products section the following papers are to be found:

The treatment of apple pomace prior to drying for subsequent pectin extraction, by V. L. S. Charley, L. F. Burroughs, Margaret E. Kieser and Joan Steedman.

Apple pomace silage. Report on experiments conducted in 1941, by V. L. S. Charley, A. W. Ling and E. L .Smith.

The development of acidity in carrot juice and treacle and the nature of the acid products, by A. Pollard.

Production of black currant syrup. (*a*) Utilisation of pomace residues. (*b*) Production of syrups with high ascorbic acid contents, by V. L. S. Charley, Margaret E. Kieser, and Joan Steedman.

The cold SO_2 method of plum preservation. A large experimental trial in Kent, by V. L. S. Charley, Margaret E. Kieser and A. Pollard.

A note on the production of a concentrated syrup from table beet, by V. L. S. Charley, Margaret E. Kieser and A. Pollard.

Experiments on the domestic extraction of sugar from sugar beet, by Alice Crang and D. Pearce Jones.

A comparison of the ascorbic acid content of stored peas, beans and parsley, dried by various domestic methods, by Alice Crang, M. Jones, D. Pearce Jones and M. Sturdy.

Treatment of Apple Pomace for Pectin Extraction

A paper by V. L. S. Charley, L. F. Burroughs, Margaret E. Kieser and Joan Steedman deals with the treatment of apple pomace prior to drying for subsequent pectin extraction. For over thirty years some proportion of the residues from the cider presses has been dried and utilised for the extraction of pectin. During that time the production of pectin from English apples did not show any very large increases until the present war, probably on account of the fact that considerable quantities of dried apple pomace and powdered citrus pectin were imported from America and Canada. The need to limit imports created a new situation in 1940, and efforts were made to ensure that the maximum possible quantities of home-produced wet pomace should be dried and extracted. The paper describes the difficulties which were encountered and the series of experiments which were devised and carried out in the last two months of 1942. The authors explain that the scheme was simple in nature and was intended merely as a means of obtaining some information as quickly as possible in order that it could be utilised during the 1943-4 season. The experiments themselves have indicated certain points which must be examined in more detail and the results given in the paper must be regarded merely as a progress report.

The different matters examined were as follows:

(1) Effect of length of time of the drying process on jelly strength of dried pomace.

(2) Changes in jelly strength of untreated pomace over a period of several days.

(3) Effect on jelly strength of keeping wet pomace as a heap of disintegrated material or as a compact stack of press-cakes as they came from the cloths.

(4) Effect on adding SO_2 to the pomace, either in form of 6 per cent. liquor or solid potassium bisulphite.

These points are examined in detail in the paper, and the authors summarise their findings thus:

1. The effect of delaying the drying of wet apple pomace on the setting quality of the extracted pectin for the formation of sugar-acid-pectin jellies has been examined.

In samples stored in sacks there was no tendency for the jelly strength to fall to a noticeable extent as the moisture content in the dried pomace was reduced from 22·23 to 2·20 per cent., but the extra period of heating of the last portion of the pomace showed a large loss. The experiment shows that pomace can be dried and maintained with a wide variety of moisture contents without causing any considerable differences of jelly strength over a period of two months.

2. Very considerable losses occurred when wet, twice-pressed pomace was stored either in slab or disintegrated form during a period of six days, approximately half the loss having occurred during the first day's storage.

3. Treatment of the pomace with 1,500 p.p.m. SO_2 had a noticeable effect in retarding losses in jelly strength, especially in the first three days' storage.

4. A suggestion is advanced that as the losses in jelly strength occurring during the storage of the wet pomace were very variable, other factors, such as the variety and the condition of the fruit prior to milling, may also have an important bearing on the quality of the pomace.

Cold SO_2 Method of Plum Preservation

A description of a large experimental trial of the cold SO_2 method of plum preservation is given by V. L. S. Charley, L. F. Burroughs and A. Pollard.

During the early summer of 1942 it was anticipated that difficulties would be encountered in disposing of the large crop of plums maturing in Kent. Consequently arrangements were made by the Ministry of Food to extend the pulping facilities in the county and the co-operation of the Long Ashton Research Station was sought with regard to the technical supervision of a large-scale experimental scheme for preservation of plums by the Long Ashton cold process. The paper contains general technical details, which indicate that, provided that sound strong vessels are available, the cold process gives satisfactory results on a large scale.

The preserving vessels, linings, lids, methods of sealing the lids and filling the tanks are described. The

strength of the SO_2 solution and also the losses of SO_2 which occur are discussed.

Jam-making tests on the preserved plums were made in November, 1942, and the conclusions come to by the authors are:

1. The Long Ashton cold process was satisfactorily applied to 398 tons of plums and, apart from 11½ tons that were lost by fermentation, no other losses occurred.

2. Plums taken from tanks that commenced to leak in February and April, 1943, were still in perfectly sound condition.

This paper will be of great interest to those concerned with the SO_2 method of preserving fruit.

Black Currant Syrup

Various aspects of the process of preparing black currant syrup have been examined by V. L. S. Charley, Margaret E. Kieser and Joan Steedman, with a view to obtaining the most efficient extraction of ascorbic acid (A.A.) from the fruit, and its retention in the final product. The question whether the black currant syrup could be produced in a more concentrated form with the object of saving space in transport and storage has also been considered. The question of concentration also arose in connexion with the use of canned black currant pulp for syrup production. Canning resulted in the dilution of the product with 10 to 20 per cent. of water, and in certain cases, where varietal or seasonal factors were involved, the A.A. content of the expressed juice fell so far below that of a normal fresh juice that the required amount of A.A. could not be achieved in the syrup without some form of concentration.

Some attention was given to these points during the 1942 fruit season. Although storage results for only six months have so far been obtained, these are included in order that the results may be available for the 1943 season.

Under "Utilisation of Pomace Residues", the effect of volume, temperature, and aeration of the extracting water has been investigated, also the effect of the length of time of extraction.

With regard to the production of syrups with high ascorbic acid content, experiments are described on the preparation of concentrated syrups from (*a*) canned black currants, (*b*) fresh black currant pomace and fresh black currants.

1. As a result of the experiments described, the optimum conditions for the extraction of the residual ascorbic acid from once or twice pressed black currant pomace have been determined.

2. The production of syrups with high vitamin C content from the concentrated, fresh black currant juice is described and the stability of the products over a six-month period is given.

Acidity in Carrot Juice and Treacle

In the winter of 1941-42 the production of carrot treacle was carried out on a commercial scale under the supervision of the Fruit Products Section and on behalf of the National Vegetable Marketing Company. During the course of the work the problem of acid formation in carrot treacle arose more acutely. On one occasion, when it was necessary to hold a large batch of juice over a period of days, it was found that the resulting treacle developed masses of rapidly growing crystals on cooling and within six hours the treacle had set into a sticky, plastic mass. The sugar content was 28·4 per cent., which is very low, and the fruit acid content 2·3 per cent., which is exceptionally high. Yet the juice had not shown any signs of active alcoholic fermentation.

It therefore appeared that carrot juice, on being kept in a non-sterile condition, could undergo a type of fermentation in which sugar was converted into acid; and that if this process had occurred to any appreciable extent, the treacle made from the juice would become semi-solid and lose its fluidity. This occurred in the commercial production wherever carrot juice was held over between expression and concentration for more than 24 to 36 hours, though in some cases the results were only slightly noticeable. The free acidities of such treacles varied from about 1·0 per cent. in those slightly affected, to over 2 per cent. in the more serious cases.

A paper, "The Development of Acidity in Carrot Juice and Treacle and the Nature of the Acid Products", by A. Pollard, describes the investigations which were carried out in order to follow the actual changes taking place in carrot juice when the naturally occurring yeast and bacteria develop in it.

The nature of the acid material was sought. Although it has been shown that the treacle produced from fermented carrot juice possesses a high acidity, the amount of free acid present gives no indication of the amount of total acid produced by the fermentation process, as a considerable amount of acid has been found present as neutral salts, and this is not estimated by the usual titration with alkali. For example, one very acid treacle had a titratable acidity corresponding to 35 c.c. of normal acid per 100 grams, but the total acid present, both free and in a combined state, was equivalent to 88 c.c. of normal acid per 100 grams. The treacle was found to have a high ash value, the total ash of this particular treacle being 6·54 per cent. (water soluble ash 5·41 per cent); this would, therefore, account for the neutralisation of a considerable amount of the acid. The presence of nitrogenous compounds such as amino acids would also have a neutralising effect. That such compounds were present is indicated by the values for dialysable nitrogen (0·48 per cent.) and for amino nitrogen (0·2 per cent).

An analysis of the acids present in the treacle was carried out, using as a starting material the mixture of acids obtained by ether extraction of the treacle after acidification to *p*H 1 with sulphuric acid. The titration curve of the extracted acids suggested that the chief constituent of the mixture was a mono-basic acid with a *p*K of about 3·7. Subsequent analysis confirmed this, for the acid present in the greatest amount was found to be lactic acid (*p*K 3·8). The composition of the acid mixture was as follows:

Composition of Acid Mixture.

	Per cent. of Total.
Lactic acid	67·0
Volatile acids	14·7
Succinic acid	7·2 (approx.)
Malic acid	0·8
Oxalic acid	1·0
	90·7

Extraction of Sugar from Sugar Beet

In a paper by Alice Crang and D. Pearce Jones, experiments on the domestic extraction of sugar from sugar beet, the authors state that the increased knowledge of the value of the sugar beet crop and the strict rationing of sugar have encouraged a number of people to grow beet in gardens or allotments for private use. This has been officially discouraged, as it was realised that the extraction processes in use were only suited to the production of sugar on a commercial scale. However, the demand for a domestic method of extraction has been so great that experiments were carried out to see whether a palatable syrup could be extracted in the home at all economically, or whether alternative methods of utilising the beet as a sweetening agent could be suggested.

Summarising their results, the authors say that:

1. In experiments on the use of domestic methods of extraction of sugar from sugar beet, it was found that a satisfactory proportion of the sugar could be extracted, but the process is tedious and wasteful of fuel.

2. If the extract is not clarified, or only clarified with precipitated chalk before concentration, the flavour of the product is rather unpleasant. This flavour is not noticeable when the syrup is used in chutneys.

3. Clarification with charcoal and diatomaceous earth is more complicated than with precipitated chalk, but the process could be carried out domestically with care. A dark coloured syrup is obtained which could be used instead of treacle for many purposes.

4. Drying the roots cannot be recommended as a method of utilising the beet domestically.

5. The use of minced sugar beet in chutney cannot be recommended, but the sugar beet syrup may well replace sugar in chutneys.

Flavour and Food

(*Continued from page* 343)

so that the warm, odorous vapours which collect in the glass may be inhaled.

Rum is distilled from the sugar cane, and its flavour is due to esters of high molecular weight acids.

Whisky is distilled from fermented barley. Gin is similar to whisky, but flavoured with juniper.

Liqueurs are prepared by adding various flavouring ingredients to spirit and distilling, and in some cases essential oils may afterwards be added to the distillate.

Caraway seeds provide the flavour of kümmel; peppermint, balm and cinnamon, that of crème de menthe; cloves, nutmegs, cinnamon, balm, angelica, etc., that of benedictine.

Bread

The pleasant odour of new bread is due to the presence of furfuraldehyde. The aromatic principle in rye bread is a derivative of furfuraldehyde. Biacetyl, the odorous constituent of butter, is also present in bread in small quantities and may contribute to its flavour. White bread which has been deprived of its bran, middlings and germ by modern milling methods has very little taste. Wholemeal bread, on the other hand, has a pleasant nutty taste. The wheat germ which is available under the name "Bemax" has the same nutty flavour much more pronounced. Since the wheat germ contains the valuable vitamin B, thiamine or aneurin, it is clear that it is more beneficial to eat the pleasantly flavoured wholemeal than the tasteless refined product. People who eat white bread ignore the promptings of the tongue.

Fruits

The pleasant flavours of fruits are due to the esters and acids they contain. In addition the attractive odour of the oils in the rind, especially of the citrus fruits, is outstanding.

Unripe fruits contain a good deal of starch, and as the fruit ripens this starch is gradually changed into sugar, so that in ripe fruit there is no starch but a lot of sugar. Most of the sugar is fructose or lævulose and the remainder usually either glucose or sucrose (cane-sugar). Hence the increase in the sweet taste as the fruit ripens. All fruits have a water content of about 80 per cent.

Apples, for instance, are 80 per cent. water, and when ripe contain about 14 per cent. sugars and about 0·7 per cent. malic acid, which gives the tart flavour. The peel is dietetically the most valuable part of the apple and contains most of the ascorbic acid present. Cider apples contain more tannin than others and have an astringency which detracts from their flavour for eating. On cutting and exposing to the air they rapidly turn brown. Apart from the sweetness due to the sugars and the tartness due to the malic acid, the flavour or aroma of apples depends on esters. It can be imitated by isoamyl isovalerate.

Apricots and tomatoes are useful sources of carotene. Most of the other fruits are poor in this substance. The flavour of apricots can be imitated by a mixture of isoamyl butyrate and isoamyl alcohol.

The flavour of oranges is due to these alcohols and to esters as well as to the essential oil, which is chiefly concentrated in the rind. The bitter principle of the navel orange was identified by Higby (*J. Am. Chem. Soc.*, **60,** 3013-18, 1918) as isolimonin, a substance which had been earlier found in orange seeds. It occurs in the section covering of the fruit as a non-bitter water-soluble substance, but when the tissues are ruptured it is converted by the juice to the intensely bitter form. Feist and Schulte (*Ber.* 69B, 1322-3, 1936) isolated from lemon seeds an optically active "citrolimonin" which may be the same bitter constituent as is found in orange-pips. Lemons and grape-fruit (shaddock) are similar.

Grapes are 80 per cent. water and have a sugar content of 17 per cent. Their acidity is due to tartaric acid and to potassium hydrogen tartrate.

The flavour of the pineapple is imitated with ethyl butyrate, the pear with propyl acetate, and the jargonelle pear with amyl acetate.

The ratio of sugar to acid in a fruit largely determines its flavour. The wild strawberry has a ratio of 2 sugar to 1 acid, the cultivated American strawberry a ratio of 4 : 1, and the English cultivated berry a ratio of 9 : 1. In the cultivated raspberry, which is noticeably tarter than the cultivated strawberry, the ratio is about 3 : 1. Essential oils contribute to the flavour of both these fruits. The flavour of strawberries may be imitated by a mixture of 2 parts of ethyl acetate and 1 part of amyl acetate.

(*To be continued*)

The Making of Cakes

BOOKS of recipes have their use and must be popular, otherwise the word " Beeton " could not be so well known as it is. New recipe books on many specialised subjects such as the cooking of potatoes, tomato dishes, etc., are being published. The British cook, whether industrial or domestic, suffers (if that is the right word) from *embarras de richesse* so far as recipes are concerned, and yet British cooking still receives reproaches not only from foreigners but also from such august native critics as Lord Horder and others.

The Function of Recipes

The presentation of a recipe for any article of food presupposes a knowledge of the materials which go towards its making not universally possessed by the reader.

The method employed by the authors of a book* on cake-making, the second edition of which has just been published, is to be highly commended. In their preface to the first edition they stated that it had been their aim to give such data as would enable the reader to obtain a good working knowledge of the material and processes they were employing in daily practice. Emphasis is again laid upon the necessity for the production of articles of the highest degree of uniformity and quality; consequently special attention is devoted to the methods used for evaluating raw materials and for the technical control of processes. Also, it is shown how the various methods of preparation of the raw materials may influence the finished product.

The authors thus repudiate the intention of preparing a mere recipe book and claim rather to have dealt with " fundamentals ", the knowledge of which will enable the reader to build up his own recipes. In presenting summaries of standard recipes, they intend these as a guide to the student.

Raw Materials and Processes

As in the first edition, the present one is roughly divided into two parts. The first sixteen chapters deal with the study of raw materials—that is, with flour, water, milk, eggs, fats, sugars, baking powders, flavourings, spices, colouring matters, nuts and fruits. The rest of the book is concerned with cake-making processes, the baking of confectionery goods, the preparation of icings, fondants, etc., and the different types of equipment used.

The section on flour still suffers to a slight extent from the lack of more details regarding the types of flour used, and of the methods which the confectioner might employ to decide for himself whether the flour he was using was of the right strength, and more about gluten and the methods of washing it might have been given .

Wartime Conditions

The authors have not ignored wartime conditions, the special commodities arising from them and the modifications of procedure necessary for their preparation. They realise that a wartime recipe book would appeal to many, but point out that supplies of commodities and their availability so change from month to month that no fixed recipes can be used.

The necessity for these changing conditions is not overlooked, and the reader is given a good idea how to confront them.

New chapters on chocolate, jams and jellies, and the development of " high-ratio " cakes and wartime confectionery problems have been included.

A minor criticism of the chapter on chocolate is that its history and manufacture might have been omitted in a practical handbook. It cannot be satisfactorily covered in four pages and, in this reviewer's opinion, references to the standard works on the subject would have been sufficient. However, in general, the authors have not succumbed to the temptation of " padding ".

High-Ratio Cakes

The formula for a good quality bakery-made cake used in the 1930's is given, and it is stated that " this type of cake had a good appearance, good volume, and handled, cut and packed easily and well; the only trouble was that it did not sell." That was in the U.S.A. What was wanted was to offer the housewife a cake " like Mother makes 'em ". This was the start of the very important development of high-ratio cakes. About 1933, special shortening and special flours had become available as the result of research in the laboratory and test bakery.

The door to the undeveloped market of home baking had been unlocked and the new cakes, properly merchandised, were instantly successful in capturing a large part of this market for the baking trade. Over five years the increase in business was estimated at 40 per cent., a very substantial one that could not have been made were it not for the development of the special flours and fat which made the new formulæ possible.

Development in Great Britain

Those interested in this new type of cake in Great Britain were not willing to go ahead with its promotion without finding out what measure of consumer acceptance could be expected. It was realised that British and American tastes differed considerably, and it was necessary to determine what modifications of the new type cake were necessary to make it acceptable to the British taste. The result of a series of consumer surveys was that 63 per cent. preferred the new cake and 37 per cent. preferred good quality Madeira; these results were quite different from those found in America. Investigational work was therefore conducted in order to remedy certain obvious faults. For example, the cake was too wet, whereas in America the problem of prevention of stales is very acute. The result of the changes resulting from further research was very marked, and a satisfactory cake was eventually obtained.

The ingredients which made possible the production of high-ratio cakes were specially processed shortening and cake flours.

* *Cake Making.* By Edmund B. Bennion, M.Sc.Tech.(Vict.), F.I.C., and James Stewart. 2nd edition. Pp. 264. 21s.

The special nature of the shortenings, now well known to the baking trade, was in their improved emulsifying properties. The main object in the development of high-ratio formulæ was to be able to incorporate successfully into the cake extra enriching ingredients such as sugar, eggs, and fat. This can be done with high-emulsifying shortening. Other advantages resulting from the new shortening are described in the section devoted to the subject.

Some Present-Day Problems

A special chapter is devoted to wartime confectionery problems. As the war went on the reserve stocks of sugar which many confectioners normally had became depleted, and a search had to be made not only for sugar substitutes, but those for eggs, dairy cream, milk and jams.

With regard to sugar and sweetening products, it is apparent that there is nothing very much to be done but to reduce the sugar, as syrups, fondants, honey, glucose, invert sugar and jams are now in short supply.

Fats

The most difficult problem is fat substitution. Less fat in baked goods means lowering the quality and food value of the products. In short paste it is possible to use less than the normal 7 or 8 ozs. of fat per lb. of flour by a slight change in the recipe. Potato flour, mashed potatoes, cornflour or rice flour can be utilised to reduce the gluten content of the flour by using 2 ozs. or more of either per lb of flour. The fat can be reduced to 4 ozs. per lb. of flour, but ½ oz. baking powder per lb. of flour should be used to shorten the paste. The moisture content would require to be increased from 5 to 6 ozs. per lb. of flour. The use of soya flour is mentioned.

Some useful tips are given on the handling of dried whole eggs and milk substitutes.

Cakes with Carrot Powder and Mashed Potatoes

The authors have investigated the possibility of using dried carrot powder in the manufacture of cakes, and their final dictum is that " the carrot powder gives the crumb of the cakes a nice egg-yellow colour, so that they appear very rich in eggs ".

Apparently some very good cakes can be made by adding a certain proportion of mashed potatoes to the mix, and the authors give a recipe for a good quality Madeira cake in which the flour saved amounts to as much as 12½ per cent.

Stress has here been laid more on the new matter contained in this new edition, as the general scheme of the work is already known to the majority of flour confectioners.

The book has some useful illustrations and has an adequate index.

Advice on Fertilisers

A SMALL book* has just been published which will be useful to farmers and to those who compound or manufacture fertilisers. The book is essentially technical, and contains chapters on farmyard manure, nitrogenous fertilisers, phosphate manures, and in other sections suggests the correct manuring for particular crops.

A large section is devoted to very useful tables of conversion factors, mixing tables, rules for calculating mixtures and tables of weights and volume equivalents. This notebook should be a useful stand-by for practical farmers.

* *The Manure Note Book,* by J. S. Remington. 3s. 6d. net.

Licensing of Biscuit Manufacturers

THE Biscuits (Licensing and Control) Order, 1941, originally provided that biscuit manufacturers who produce more than 12 tons of biscuits per year should hold a licence granted by or on behalf of the Minister of Food, and this provision was subsequently amended to require all persons or firms engaged in the manufacture of biscuits to hold a licence.

In order primarily to secure uniformity in the Ministry's policy on the granting and revoking of licences it has become necessary to revoke the existing Order and its amendment and to replace them, with certain modifications, by a new Order which came into force on September 10, 1943.

The new Order will be known as the Biscuits (Licensing and Control) Order, 1943, and maintains the provision that no person shall manufacture biscuits in the course of any undertaking by way of trade or business except under and in accordance with the terms of a licence granted by or on behalf of the Minister.

It further provides that 14 days' notice shall be given of the intention to discontinue the manufacture of biscuits, for the transfer of undertakings from one person to another, as well as for the keeping of such records as may be necessary to secure the efficient working of the licensing system.

The definition of " biscuits " has been slightly amended to conform with the Cereal Fillers (Control and Maximum Prices) Order, 1943, and now reads as follows:

> " Biscuits includes shortbread of an individual weight not exceeding 2 oz., Petit Fours and similar products, wafers, rusks (other than rusks of a description commonly used as a filler in the manufacture of articles of food containing meat or fish), crispbreads, oatcakes, matzos, broken biscuits and biscuits wholly or partially covered with chocolate, but does not include medicinal biscuits (other than diabetic biscuits) or biscuits of a description used only for feeding animals.

Catering establishments and institutions are not, as such, subject to the Order, unless they are also carrying on an undertaking for the manufacture of biscuits.

News from the Industry

Technical Tallows and Greases

The Minister of Food announced that an amendment has been made to the Technical Tallows and Greases (Home Melt) (Maximum Prices) Order, 1941, as amended. On and after August 29, 1943, the maximum prices of all tallows and greases scheduled in the Order were advanced by £12 10s. per ton.

* * *

Age of National Flour

"National" and "M" flour milled on and after August 29, 1943, and packed in weights of 112 lbs. and over, will be clearly marked with the date of the Monday of the week in which the flour was manufactured.

The Ministry of Food will issue periodical Press notices, advising bakers of major alterations in the characteristics of national flour such as may be occasioned by a substantial alteration in the percentage of home-grown wheat or other diluent grains in the grist. These notices, when co-related to the dating system, should assist bakers in adjusting their process to suit changes in the character of the flour.

* * *

Changes in National Flour

From August 30, the proportion of home-grown wheat used in the grists for national flour in England and Wales was increased, especially in the south and west. In other areas the grists employed will be very similar to those which were being used at the end of June.

In Scotland there will be no change in the proportion of home-grown wheat, while in Northern Ireland the changes in the grist will be slight.

It is not anticipated that the present usage of new season's wheats will cause any significant change in flour quality in the majority of areas at once, but the general tendency will be towards softer flour from now onwards.

On September 6 the admixture of imported flour was fixed at the rate of 7½ per cent. instead of 10 per cent. as hitherto.

Breadcrumbs and Stuffings

On and after October 31 it will become an offence to sell prepacked rusk or crumbs made wholly from bread, biscuit or other baked cereal product. On and from the same date it will only be permissible to sell cereal filler mixtures, stuffings and similar products if these have been manufactured under the terms of a licence issued under S.R. & O. 856/1943. Manufacturers to whom licences have been granted have been requested to make statements to this effect on their invoices.

* * *

Advice for Bakers

The Ministry of Food has appointed a number of advisers, who are practical bakers, to give help and advice to those bakers who are not getting the best results from National flour and who are experiencing difficulty, from time to time, in handling it.

The services of these advisers will be available to the baking industry in England and Wales. Any baker who would like to make use of this service should write to: The Director of Bakeries, Bakery Division, Bryn Euryn, Colwyn Bay, giving as full information as possible of the problem to be considered. The necessary arrangements will then be made.

* * *

Essences Containing Spirits

The Ministry of Food having authorised increases in the prices of essences to meet the additional duty on spirits of 20s. per proof gallon, W. J. Bush and Co., Ltd., announced on August 10 that from that date they were compelled to advance the prices of all essences containing spirit in accordance with the schedule issued by the Ministry of Food, which is based on the spirit strength of each essence.

The increases will vary from 6d. to 2s. 6d. per lb. for most essences and those of a very high spirit content up to 4s. per lb.

Purchases of Argentine Meat

The Ministry of Food has completed with the representatives of the Argentine Republic the purchase of the exportable surplus of Argentine meat for the two years ending September 30, 1944.

This covers the past season during which shipments have been proceeding in anticipation of the settlement of terms.

The Ministry of Food has made this purchase on behalf of the United Nations; it includes frozen, canned and dried meats. The supplies will be allocated in accordance with the recommendations of the Combined Food Board; as usual, however, the frozen and dried meat will be shipped mainly to the United Kingdom.

* * *

Saving Transport of Sausages

In view of the need to relieve both road and rail transport and reduce so far as possible the risks to perishable goods now passing over long distances, the Ministry of Food have asked the Food Manufacturers' Federation as a matter of urgency to arrange as between manufacturers of sausages, meat pies, and other open-pack meat products, for voluntary interchanges of customers or other equally suitable arrangements for deliveries from the nearest possible point, cutting out long hauls and cross hauls.

It is important that any manufacturer who is willing to assist the national effort by making arrangements on these lines should give particulars to the Food Manufacturers Federation Inc., 25-28, Buckingham Gate, London, S.W.1, and obtain their acknowledgment before proceeding, in order that the Federation may be in a position to record the exchange, and satisfy the Ministry that, under the new arrangements, all pre-war customers will continue to receive their proper share of supplies. This record will be the basis on which the issue of the necessary adjusted alloeations of meat will be authorised.

Dehydration Plant for Belfast

The establishment of a factory in Northern Ireland for the dehydration of vegetables is planned by Imperial Chemical Industries Ltd., states the *Northern Whig*.

The factory, which it is hoped to have in operation next year, will handle potatoes, cabbages, and other vegetables and its output is expected to be several hundred tons a month.

The Ministry of Agriculture will make arrangements for the growth of the necessary extra vegetables in Northern Ireland.

* * *

Food Dehydration

The prospects of establishing a dehydration industry in Southern Rhodesia have advanced a step as the result of a visit to the colony by an Anglo-American Dehydration Mission.

The Mission considers there is a future for this industry, especially if the Colony concentrates on the production of secondary foods, such as onions, for use in other foods.

The Mission was impressed with the preparatory work already done in Southern Rhodesia and advised that steps be taken to control the general development of the dehydration industry, which requires a considerable amount of technical knowledge and constant technical supervision. The value of dehydrated citrus was stressed, and the Mission emphasised that cattle feed and waste citrus constituted a very real field for exploitation.

The Minister of Agriculture, Captain F. E. Harris, stated that if it was found that the dehydration industry could be successfully developed on national lines the Government would use its influence to obtain the machinery and also the necessary manpower.

* * *

Coal Commission

The Minister of Fuel and Power announces that Mr. P. G. Hyslop, M.I.M.E., has ceased to be a member of the Coal Commission on the expiry of his term of office, and Lt.-Colonel J. A. S. Ritson, D.S.O., O.B.E., M.C., T.D., B.Sc., has been appointed a part-time member of the Commission to fill the vacancy.

Egg Products Distributing Co.

To act as agents for the Minister of Food in the purchase, sale and distribution of egg products, the Egg Products Distributing Association has been registered as a company limited by guarantee without share capital. The original number of members is 100, ordinary members being liable for £20 and each special member for 1s.

The first members of the management committee are: E. Brown, director of Eastmans; C. W. Cousins, St. Albans, produce broker; D. V. House, C.A., Stanmore; V. H. Liddell, director of Ch. Goldrei Foucard and Son; A. Milroy, director of Milroy Chemical Company; A. R. Pegler, manager, J. Lyons and Co.; L. G. Scott, departmental manager, Arnhold Trading Company; S. F. Welti, Caterham, merchant; M. Zausmer, director of S. Behr and Mathew, Ltd.

The secretary is Mr. John Carter and the registered office is at Aldenham Grove, Radlett, Herts.

* * *

U.S. Food Director Resigns

Mr. James Lecron, Director of the Food Division in the office of Mr. Nelson Rockefeller, Co-ordinator of Inter-American Affairs, has resigned because of what he terms "interference, obstruction, delay and unintelligent dictation" by State Department officials, especially in the Division of Economic Operations, reports Reuter.

In his letter of resignation Mr. Lecron wrote: "After the strong and unanimous declarations at the United Nations Food Conference, I had thought that perhaps these State Department officials would encourage the efforts of this office in its co-operative work with other American Republics to stimulate an improvement in the living standards of their people.

"But State Department officials hampered us in almost every possible way without due regard for the will of Congress or the official commitments of the department."

Mr. Lecron's action follows President Roosevelt's recent order that officials wishing to criticise Government policy publicly should resign.

Ministry of Fuel and Power

The provisions of the Fuel and Lighting Registration and Distribution Orders, which provide the machinery for regulating coal supplies to controlled premises, has been replaced by a new consolidating Order, the Coal Distribution Order, 1943, which came into force on September 1.

In the main, the existing provisions have been retained with minor modifications, but attention is drawn to the following points:

The Order sets out in detail the procedure applicable to appeals to the Ministry's regional controllers and regional coal officers against decisions given by local fuel overseers.

The Order prohibits, except as may be authorised by licence or for resale, the keeping or storage at any controlled premises of coal which has not been lawfully acquired for actual consumption in those premises.

The definition of controlled premises has been revised and now covers (1) all non-industrial premises (which includes houses, shops, hotels, offices, etc.), and (2) all industrial premises which in the year ended June 30, 1943, consumed not more than 100 tons of coal. Coal for this purpose includes coke, anthracite, and manufactured fuels of which coal, coke or anthracite is the principal constituent.

A brief statement of the main changes from the existing provisions is being printed with the Order, of which copies will shortly be available from H.M. Stationery Office (price 6d. net) or through any bookseller.

* * *

See It Out!

Heavy snow had hardly melted from the grass. A smoker filled his pipe, lit it and tossed the match over his shoulder. Who would have thought that under such conditions there was danger of fire? But there was—two acres of grass and 5,000 young trees went up in smoke. If that can happen in winter, how much easier may fires be caused in summer and early autumn. When throwing away matches, cigarette ends or hot ash from a pipe, grind under the heel all chances of a fire.

War Damage Act, 1943 (Part II)

The Board of Trade have, with the approval of the Treasury, decided that, in respect of the six months beginning October 1, 1943, and ending March 31, 1944, the rate of premium payable under any policy issued under the Business Scheme shall be at the rate of 5s. per cent.

* * *

Award to Crosse and Blackwell, U.S.A.

The award of the Army/Navy (E) went recently to the Crosse and Blackwell Company, Baltimore.

About 80 per cent. of that company's production of marmalades, jellies and tomato products has been going to the armed forces. Marmalade output has increased 1,200 per cent. at the Crosse and Blackwell plant during the last year.

The award is the fourth to be made to a canning or preserving plant and its workers, and the first to a Maryland canner.

* * *

Kitchen Waste (No. 4) Order (Scotland)

Under the Kitchen Waste (No. 4) Order (Statutory Rules and Orders, 1943, No. 1200) which came into force on August 23, 1943, no person dealing in or processing kitchen waste may separate any part of the waste except under a licence granted by the Minister of Supply. This prohibition does not apply to a person using kitchen waste for feeding livestock under his control.

The new Order extends the Kitchen Waste (Maximum Prices) (No. 1) Order.

Kitchen waste means broken or waste foodstuffs, including table, kitchen or vegetable refuse, scraps or waste, but does not include waste material composed wholly of bones, fat, fish or fish refuse, or of any waste from slaughterhouses, knackers' yards or bakehouses, or of flour sweepings, sack shakings or waste produced in the manufacture as a trade or business of food or foodstuffs except at catering establishments and institutions licensed through a Food Control Committee.

Food Quality

One of a consignment of parcels sent out by the North Row packing centre was addressed to an Allied prisoner in Germany, who could not, however, be traced. After many travels the parcel was sent back by the Germans via Geneva.

By the time it reached Britain again the package had been away for over a year—a severe test of the keeping qualities of its contents.

The British Food Manufacturers' Research Association, after examining the margarine, cheese, bacon, tins of meat, condensed milk, as well as carrots and oatmeal, pronounced all the products fit for consumption. The only article affected was the cheese, which with a slightly bitter flavour, "would be objected to by some people and not by others."

The tins of damson jam and marmalade, analysed by a different laboratory, were found also to be in excellent condition.

* * *

Fuel Economy

In factory heating plant, overheating, even by 1°, means waste of fuel. This waste can be prevented, not by hand regulation of valves, but by automatic heat control.

The saving effected with such control will satisfy the criterion of essentiality laid down to justify the installation on the grounds of fuel economy. In addition (1) the fuel ration will go farther, (2) an even factory and office temperature will provide healthy working conditions and reduce "sick leave."

The Sarco system of heat control is simply applied to different types of heating systems. Screwing the valve and strainer into the pipeline and fixing the thermostat in position is the only work entailed. No electric wiring and compressed air or water supply pipes are required.

Similar considerations apply to process work and hot-water supply. An uncontrolled supply of steam to a boiling process can result in a steam wastage of anything up to 98 per cent. after heating up. Water supplied for showers or washing at 5° F. above a comfortable temperature wastes 7½ per cent. of the fuel.

Australian Food Output

The Australian Food Executive has asked the War Cabinet to release sufficient manpower to enable a large-scale increase in Australian food production, particularly of meat, dairy produce, poultry, eggs, and vegetables, to meet the increasing civilian and United Kingdom needs.

Mr. W. J. Scully, Minister of Commerce and Agriculture, said recently: "We shall be called upon to play a very big part in feeding the peoples of the occupied countries as they become liberated.

"In addition, we will be called upon more and more to feed the armed forces based in this country."—*Reuter.*

* * *

Commodity Trades Federation

The Hide Shippers and Agents Association and the Liverpool Corn Trade Association were elected members at the eighth council meeting of the British Federation of Commodity and Allied Trade Associations held in London on August 19. The first informal meeting of interested associations took place a year ago, on August 12, 1942, and the membership of the Federation now numbers 30.

* * *

Menus by Phone

The telephone administration of the town of Zurich has had an excellent idea, learns Reuter's Trade Service from Zurich. In order to help housewives who are finding it more and more difficult to exercise their skill, hampered as they are by rations, the Zurich telephone service has arranged to give a daily menu over the phone. This is the first service of its kind, not only in Switzerland, but also in Europe.

The menu is accompanied by a commentary giving useful hints as to quantities, methods of preparation and times of cooking.

* * *

"Oil Cocktails"

Food specialists in Gambia have invented an "oil cocktail". Made from ground-nut oil and red palm oil mixed in the ratio of five parts to one, the "cocktail" is rich in vitamins A and D.

Cadbury Brothers

Mr. Egbert Cadbury, Mr. M. Tatham, Mr. W. M. Hood and Mr. W. N. Hallett have joined the board as managing directors.

* * *

J. S. Fry and Sons

Mr. R. R. Sly, Mr. A. Whittaker and Mr. D. W. Collier have recently been appointed as managing directors.

* * *

A. Boake, Roberts and Co., Ltd.

Mr. E. J. Boake and Mr. F. M. Roberts are retiring from the position of managing directors of A. Boake, Roberts and Co., Ltd. Mr. F. G. Pentecost has been appointed managing director and Mr. E. E. Boake assistant managing director.

Mr. E. J. Boake and Mr. F. M. Roberts will continue as chairman and vice-chairman respectively.

* * *

Golden Block, Ltd.

Mr. Lewis A. May has been elected chairman of Golden Block, Ltd., margarine manufacturers, which office he will hold in addition to that of managing director, in place of Mr. Alfred P. Harrison, who has been forced to retire from the board owing to the excessive calls on his time and attention, resulting from his widespread interests in shipping and coal.

Mr. Lewis A. May has been a director of the company from its inception, and its managing director for a number of years.

Saving Oil Cake

Recent trials at the National Institute for Research in Dairying, carried out with the co-operation of milk-recording herds, point the way to a means of saving cattle cake in the feeding of dairy cows. Experiments have shown that the protein equivalent for the production of 10 lb. of milk with 3·7 per cent. of fat can be reduced from 0·6 lb. to 0·42 lb. without lowering the food value of the milk or the yield of the cow. Less oil cake, however, means more of cereal or other carbohydrate foods, since the necessary 2½ lb. of starch equivalent per gallon of milk must be maintained.

Returns from Vinegar Manufacturers

The attention of manufacturers and bottlers of vinegar of any description is drawn to the requirement under Article 2 of the Manufactured and Prepacked Foods (Control) Order, 1942, to render a return in the form specified in the Fifth Schedule to that Order.

Manufacturers and bottlers of vinegar who have submitted such a return are infringing the provisions of that Order if they continue to manufacture or prepack vinegar without having rendered the required return.

It is intended in the near future to prescribe appointed days for the purpose of bringing the Order fully into force in relation to vinegar. Apart from the question of infringement of the Order where manufacturers and bottlers have failed to render the required return, the Ministry may find it impossible to complete the enquiries necessary for the issue of licences before the appointed days and such manufacturers may therefore find themselves severely prejudiced when the Order is brought fully into force.

The necessary forms for making the return are obtainable from the Central Licensing Control, "Brooklands", Brackley Avenue, Colwyn Bay.

* * *

Food Production in the U.S.A.

It is stated by Mr. Roy F. Hendrickson, Deputy Administrator and Food Distributor of U.S. War Food Administration, that the production of food in the U.S.A. in 1942 reached record figures. As compared with 1935-39 averages, there were the following notable increases: Meat, 5,500 million lbs.; chicken and turkey, 800 million lbs.; lard, 800 million lbs.; canned fruit and juices, 1,000 million lbs.; dried beans, 4 million bags.

Production in 1943 is expected to show even higher figures.

Comparing the supply of food for civilian consumption in 1943 with the 1935-39 situation, there will be less fish, butter, canned and dried fruit, canned vegetables, dried beans and sugar, but more poultry, eggs, milk, total fats and oils, fresh citrus fruits and canned juices.

U.K.C.C.'s Turkish Agent

Lord Carlisle, one of the most popular trade ambassadors that Britain has ever sent to Turkey, is shortly returning to London after two and a half years as U.K.C.C. representative in Turkey.

Lord Carlisle had a part in buying up Turkish products for Britain, helping Britain's war supply needs and at the same time preventing such goods going to Germany, to the extent of about £10,000,000.

These products included crude copper, mohair, foodstuffs, silk for parachutes and sheepskins for Army coats.

During the same period Turkey imported from the sterling area the same amount of goods, including £5,000,000 worth of cereals to tide over the bad harvest of 1941-42.

* * *

Heavy Casualties Inflicted on the Enemy

Pest destruction in Huntingdonshire during the last three months has yielded a "bag" of 11,000 rats, nearly 900 sparrows, more than 2,000 sparrows' eggs, 18,000 butterflies, 2,500 jackdaws and 4,000 eggs, 1,265 magpies and nearly 6,000 eggs.

* * *

Pest Control Undertakings

In accordance with the provisions of the Infestation Order, 1943, every firm or person engaged in the manufacture or preparation of, or servicing with, substances or articles used for the control of rodent, insect and other pests will, on and after a day yet to be appointed by special Order, require a licence from the Minister of Food.

Requests for forms of application to obtain such a licence can be made now to the Director of Infestation Control, Ministry of Food, University College, Gower Street, London, W.C. 1.

* * *

Change of Title

Chocroll, Ltd., advise that from August 16, 1943, the title of their company has been changed to "The Croydon Chemical Company, Ltd."

Soya Beans in Uganda

Uganda is considering growing increased quantities of soya beans. The beans will be used for local consumption and military requirements, so that more groundnuts may be released for export.

* * *

Pyrethrum Seed

At the request of the United States, 2,000 lbs. of pyrethrum seed is being sent from East Africa by air to Brazil, and more will follow. Pyrethrum as an insecticide is needed in increasing quantities for war purposes.

* * *

Indian Fruit Canning

An up-to-date canning factory started recently "somewhere in India" is already producing 300 tons of canned fruit this year.

The first to be organised on such a large scale, the new factory, which is at present concentrating on plums, peaches, pears and apricots, available in large quantities in the vicinity, is likely to be the nucleus of a major industry after the war.—*Reuter.*

* * *

Scots Fruit Canning Plans

Middlemen in the fruit trade in Scotland may be cut out before the end of the war, and Scottish canning factories are likely to be established as soon as possible.

Mr. T. L. Blackwood, New Cumnock, chairman of the Scottish Committee of the British Growers' Union, after a meeting of the committee in Glasgow recently, said that discussions on these points had found the support of members.

* * *

Britain-Uruguay Meat Talks

The Government of Uruguay is now considering an agreement with Britain regarding the sale of the exportable surplus of Uruguayan meat until October, 1944, according to Señor José Serrato, Uruguayan Minister for Foreign Affairs.

The agreement was being studied by the board of directors of the National Packing Plant, he added. A similar Anglo-Argentine agreement has been announced.—*Reuter.*

OBITER DICTA

● I would suggest that our food faddists turn their attention to sugar and give bread a rest.—*Mr. J. Gordon Hay, writing in "Milling".*

● To-day eating bacon is like eating board. I suggest that the Ministry do something to improve it.—*The Lord Mayor of Liverpool (Alderman R. Duncan French).*

● Whilst spam has had much favourable publicity, it should not be forgotten that it is not a common noun, but a manufacturer's brand name.—*"World's Press News."*

● I am constantly having small shopkeepers in my court for offences against the rationing regulations. Do they never read their trade journals?—*A Magistrate at a Midland Police Court.*

● There is too great a difference in the price paid to fishermen and the price of fish in the shop.—*Major Duncan M'Callum, M.P., in a letter to Lord Woolton and the Secretary of State for Scotland.*

● Would not our member be better employed heckling Lord Woolton over the retail price, seeing the fisherman, even at 70s., is getting for East Coast herrings about three times the normal price?—*Letter to "Aberdeen Press and Journal".*

● When you listen to the Kitchen Front broadcasts you are, in fact, obtaining free expert medical advice.—*Sir Thomas G. Jones, Chief Divisional Food Officer of the North-Western Midlands and Wales Food Area.*

● I sells peppermints on Sunday because they takes them to church to eat, and it keeps them awake during the sermon; but chocolates, that's different. If you want them you must come on week-days.—*Old Lady Owner of Small Sweet Shop.*

● Our home-produced food and materials, however, fall far short of our requirements and the balance must be obtained from oversea and paid for by exports. The question of what we can afford, therefore, depends mainly on the extent to which we can reinstate and expand our export trade.—*Mr. Frank T. Wheen, writing in "The Times".*

New Variety of Sugar Cane

A new variety of sugar cane, known as B. 34104, is, according to the British West Indies Central Sugar Cane Breeding Station, regarded as probably the best juice cane of the West Indies.

* * *

"Sugared Flour"

Included in the research work on additional sources of sugar, which is being carried out by the Institute for Confectionery under the People's Commissariat for the Food Industry, is the valuable work by Sokolovsky, Doctor of Technical Science, on the use of flour as a source of sugar. By means of "sugared flour" produced by his method, Moscow factories alone already produce an additional quantity of 750,000 kilograms of confectionery products per month. The taste and nutritive value of these products are hardly different from those made with ordinary sugar.—*Soviet Monitor.*

* * *

Soya Meal Approved

Scottish food manufacturers have now passed a satisfactory verdict on "soya grit", the new substance prepared by the M.O.F. for inclusion as a filler in food preparation and particularly for sausage type food. Thirty Glasgow firms who experimented with samples of the grit given out by a distributor state that the results were excellent and "highly palatable and meaty".

As one of the world's chief manufacturing and consumption centres for sausage foods, Glasgow has been particularly interested in this development.

As there are many other types of products manufactured in this market—of which haggis and black, white and red puddings are examples—there would appear to be a growing field for the inclusion of soya meal or grit, and manufacturers of these and other canned or skinned foods are watching the present position with great interest.

Actually soya manufacture has been an industry on the Clyde for many years, there being the Soya Bean Factory on the Clyde, where the process of oil extraction from the soya bean was carried on.

Coffee for U.S. Forces

Half of the Brazil coffee crop has been offered as a gift to the United States armed forces. This was revealed by Señor J. P. Filho Salcado, Brazilian Air Minister, recently returned to Brazil after seeing President Roosevelt in Washington.

* * *

Canadian Bacon

In the years 1935 to 1939 only 25 per cent. of the total imports of bacon into the United Kingdom was supplied by Empire countries, principally Canada. With supplies cut off from Europe Canada stepped into the breach, and by the third year of the war Britain looked to Canada to supply 75 per cent. of the total required. In the fourth year of the war Canada's responsibilities had increased to 80 per cent. of the total quantity needed to maintain the bacon ration of 4 ounces per person per week.

* * *

Argentina Bans Maize Exports

Maize exports have been prohibited according to a Government decree issued in Buenos Aires. This decree points out that stocks are very low and indispensable for home needs.

The grain board, as an exception, will consider contracts pending with official organisations in other countries and is authorised to fulfil them if necessary.

The export of oil processed from maize is also prohibited.—*Reuter.*

* * *

Eire Canned Beef for Britain

Eire is to send Britain 22,500,000 lbs. of canned beef, worth over £1,250,000, between now and March 1 next. The first consignment will be sent almost immediately.

The export of canned meat to Britain from Eire was discontinued at the end of March last.

The managing director of one of the ten firms engaged in the export trade said recently: "Eire has an unusually good supply of the type of beef suitable for the trade."

Food Yeast

A new food yeast, tasting like rump steak, is being produced by a firm of Saint Louis brewers and sold to the U.S. Army and the Lease-Lend Administration. The new food is a brownish powder, said to be twice as rich in protein as meat.—*Reuter.*

* * *

Oyster Shortage

Oysters would have been in season at the end of August in normal times, but supplies are acutely short, and even though the season started late in September, it may not last until the normal closing, which is April 30.

Oyster beds have not been restocked since war began. Two severe winters, those of 1940-41 and 1941-42, brought a high percentage of mortality to the beds. Stocks are lower than they have ever been in the memory of the oldest Whitstable dealer.

* * *

Increased U.S. Soya Production

The U.S. War Food Administration has announced that U.S. production of soya beans has expanded from 46 million bushels to an estimated 200 million bushels in 1943.

Peoples in liberated areas may receive almost 744 million lbs. out of the 1,350 million lbs. expected to be available for the period July 1, 1943, to June 20, 1944. The Allies will get about 240 million lbs.

* * *

Dried Oranges Plant

An Anglo-American mission of three leading food experts, who are at present touring dehydrating plants and canning factories in Palestine, saw an installation for dehydration of oranges at the Jewish Agency Agricultural Research Station in Rehoboth, which may play an important part in utilising the Palestine citrus crop in post-war times, says A.P.

The mission, which had conversations with military and other authorities in Jerusalem, next visit Syria, where the dehydration of vegetables will be the main study.

Paper Rope

Up to now mechanical binders for harvesting have been made of hemp. In Sweden, owing to the war, imports of this raw material have now entirely ceased. For the 1942 harvest paper rope has been used on a very large scale, and the new product has been more and more improved. For this year's harvest it will be necesary to rely almost entirely on paper rope, of which satisfactory stocks now exist.

* * *

South Africa to Grow Olives

Olives are soon to be planted in South Africa in an attempt to meet the wartime emergency caused by the cutting off of oil supplies from Mediterranean countries. Parts of South Africa, which have a climate similar to that of the Mediterranean regions, are considered by experts to be suitable for this purpose.—*Reuter.*

* * *

Gum Guaiac as Food Preservative

Gum guaiac is being used extensively in the preservation of considerable quantities of food for the armed forces in the U.S.A. The juice, which prevents fats from becoming rancid or from losing their palatability, is used in meats, but it will also be used with dehydrated fruits and vegetables. Paper wrapping of fatty foods will also be impregnated with guaiac juice to prevent the fats from soaking through.

* * *

New Varieties of Oats in U.S.A.

Success with recently developed disease-resistant varieties of oats in some of the important oat areas is reported from America. Stem and crown (leaf) rusts and some other diseases have been made relatively harmless where the right varieties are grown.

This year in Iowa, the biggest oat-growing State, 75 per cent. of the acreage was sown to resistant varieties; in Wisconsin, 50 per cent.; and in Illinois about 30 per cent. They were also widely distributed in Minnesota, the double-resistant varieties being grown in this state where diseases have been most troublesome.

Corn Merchants Alliance

The Corn and Agricultural Merchants (Wartime) Company, registered August 21, is to have 5,000 original members. The company is to effect economies in manpower and transport in the corn trade, and if thought fit to prepare a voluntary scheme for providing compensation for members adversely affected by the silencing or restriction of their businesses, and to enter into agreements with the Board of Inland Revenue, Board of Trade and other Government Departments.

The management is vested in a Central Board, and there are to be divisional committees for the Northern, North-Eastern, North-Midland, Eastern I, Eastern II, London, South-Eastern, Southern, South-Western, South Wales, Midland, North Wales, North-West, Northern Scotland, Western Scotland and Eastern Scotland areas.

* * *

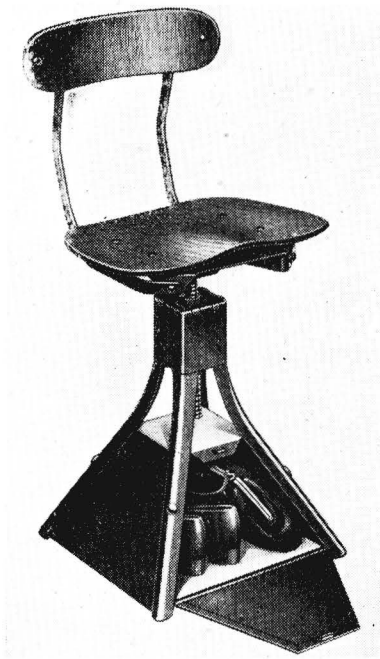
Container Recovery Service

Over 600,000 used fibreboard cases are collected weekly by Container Recovery Service for re-use in industry. This non-profit-making organisation, a specialised branch of S.P.D., Ltd., was set up two months after the outbreak of war in order to ensure the continued re-use of margarine and soap containers. S.P.D., Ltd., is one of the largest transport firms in the country, and although it is a subsidiary company of Lever Brothers and Unilever, Ltd., its Container Recovery Service has been extended to render assistance to a larger number of other firms and a variety of trades. Manufacturers participating in the C.R.S. scheme mark their containers with a C.R.S. emblem. By this means the wholesalers and retailers can easily tell that these items must be put on one side for collection.

Containers for cod liver oil, orange juice and other vitamin products distributed through Welfare Centres are included in this recovery system. Wood boxes, sacks and iron drums also come under the collection scheme, which has proved invaluable in prolonging the life of these articles and thus ensuring minimum use of packing materials in short supply.

Protecting Workers' Property

Personal compartments now built into all "Evertaut" stools and chairs are specially designed to hold the worker's handbag, shoes, and other private belongings during working hours. They can be securely locked, and the fact that the worker can be sure that his or her belongings are safe from loss or "unauthorised borrowing" is very important. They merit the attention of all firms engaged in war work.



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Women in Canning Industry

In their employment office Heinz are demonstrating some of the packs the troops receive. Women are invited to examine them, and if they feel they can assist in this vital war work, hours of employment can be arranged to suit individuals.

* * *

Assistance for Grapefruit Industry

The U.K. Government is to give financial assistance for the grapefruit industry in British Honduras, which has been badly hit by the war, and the provision of $10,000 for this purpose has been approved.

South Africa's Food Production

South Africa's representation at the recent United Nations' Food Conference at Hot Springs, Virginia, is an indication that she is prepared to contribute her due share in any post-war scheme that may be devised for feeding the occupied countries.

The Industrial Development Corporation, which is financed by the Union Government, has agreed to establish factories for the production of balanced ration feeding-stuffs at strategic points in different parts of the country.

The corporation's two-year-old subsidiary company, National Foods, known as "Nasfeed," is now manufacturing as many as 15 different types of balanced foodstuffs for livestock from ingredients which it procures both in the Union, in neighbouring African States and elsewhere.

* * *

Temperature Regulators

Two newly issuued pamphlets by the Cambridge Instrument Company describe improved forms of compact, self-contained and inexpensive regulators for automatically controlling the temperature of various processes, at any desired point between the limits of −20° C. and +600° C., and −10° F. and +1,100° F. One of these instruments, named the Cambridge Thermometer Regulator, is a general purpose instrument adapted to the control of moulding platens, oil baths, small ovens, and the like, and incorporates a self-contained switch capable of making and breaking an electric current up to 20 amperes A.C. or D.C. at any voltage up to 250. The main contacts are arranged to open circuit in the event of any interruption in the supply or any fault in the interval wiring, thus preventing damage to the process through overheating.

The second new instrument, called the Cambridge Gas Regulator, is similar in design, but is arranged to control gas-heated apparatus by operating either a low-pressure or a high-pressure relay valve.

Numbers of these regulators have already been employed in bread baking and similar applications in the food industry.

COMPANIES

Danish Bacon Company

Under current conditions the title of the Danish Bacon Company is something of a misnomer, but bacon, whatever its source, is still the leading product of the business. Its distributing organisation has proved valuable and has dovetailed perfectly into the structure built up by the Ministry of Food. The scale of operations is substantial and has further expanded, judged by the increase in trading profit for the past year, from £171,700 to £218,900. Net profits have risen from £141,000 to £168,500, but the improvement is partly offset by the increase in tax provisions from £109,200 to £123,400, of which £94,200 is for E.P.T.

The company is again limiting the dividend on the £208,855 Ordinary capital to 5 per cent. This absorbs £5,200 net and a like distribution on the £200,000 Preference £5,000 net. The latter shares of £1 each are a rather nominal market at 17s. 6d.-20s. The company has the option of redeeming the Preference at 21s. between 1951 and 1999 and has already built up a redemption fund of £64,300, including £11,500 appropriated from the past year's profits Apart from £8,300 for the staff pension fund surplus profits of £15,000 are set aside for various reserves. The finances are maintained in good shape.—*Financial Times.*

* * *

The Imperial Cold Storage and Supply Co.

The annual general meeting of the shareholders of the Imperial Cold Storage and Supply Co., Ltd., was held in Cape Town on June 30.

The following is an extract from the statement made by the chairman, Mr. J. G. van der Horst, who presided

The turnover of the company, its branches and subsidiaries, showed a big advance upon the previous year—£13,670,646 against £9,343,332. One branch and two subsidiaries showed decreases, but all other branches and subsidiaries contributed to the increase. The proportion that meat forms of the total turnover was slightly increased in the year—37·4 per cent. against 36·1 per cent.

Our creameries increased their production of butter during the year, the percentage of the total production in the Union and South-West Africa being 38·4. Our proportion of the total output of the Union is much lower in cheese than in butter. In 1942 it was 12·7 per cent., but the production of the whole Union for the year showed an increase of 41·7 per cent., and our increase for the year was therefore considerable.

The larger part of the company's earnings again went in taxation. The total for the company and the subsidiaries was £434,740, and the amount left, after providing for this taxation, was £222,696, representing 1·7 per cent. on the turnover.

The balance available from the year was £240,917 16s. 8d., which, added to the amount from the previous year, gives an amount of £433,069 8s. 6d. to the credit of profit and loss account.

The accounts and reports were approved.

* * *

United Molasses Company, Ltd.

The seventeenth annual general meeting of the United Molasses Company, Ltd., was held on August 27.

The following is an extract from the statement by the chairman, Mr. F. K. Kielberg, circulated with the report and accounts:

Stockholders will appreciate the reasons why a detailed survey of the activities of the company and its subsidiaries cannot be given.

In the United Kingdom the company continues, in respect of all dealings in molasses, to act as agents for the Ministry of Supply, and the whole of the company's fleet remains under Government requisition.

The 1942 earnings of the United Molasses group were £829,165 compared with £882,383 for the preceding year. Less was required for British taxation provision, and net profit is only £24,034 smaller at £349,321. Dividends and cash distribution are maintained, and £100,000 is again placed to general reserve, raising it to £1,200,000. The consolidated balance-sheet shows an excess of current assets over current liabilities of £5,045,000, an increase of £1,933,000 compared with the figure at December 31, 1941.

The 20 per cent. dividend on the ordinary stock is again well covered. In addition to the dividend stockholders again receive a cash bonus of 2½ per cent. not subject to tax, from the capital reserve.

Shipping losses this year have been only a fraction of those suffered during the same period last year.

* * *

British Oil and Cake

A member of the Unilever group, the British Oil and Cake Mills, continues to work under the control of the Ministry of Food, and again the annual accounts show that operations have been less profitable. A year ago the Ordinary stockholders, who are Lever Bros. and Unilever, and who, incidentally, have undertaken to assume liability for E.P.T., had their dividend reduced from 9 per cent. to 5 per cent., a difference of £140,000 gross. This time earnings are barely sufficient to cover preferential dividends and nothing is paid on the equity. The controlling company therefore loses a further £175,000 gross of income from that source. By the repayment of close on £600,000 debenture stock at the end of last year the capital is now unencumbered. The financial position is very strong.—*Financial Times.*

* * *

Davies Bottled Fruits

The liquidator of Davies Bottled Fruits (in voluntary liquidation) announces a second distribution of assets at the rate of 1s. 9d. per share, payable forthwith.

A resolution to wind up voluntarily was passed early in January last following the sale of the property and assets (except debtors and cash) to Wm. P. Hartley (the preserve manufacturing company) for £84,000. Issued capital was £60,555 in 5s. shares.

Information and Advice

Poisoning from Duck Eggs

8,876. *Required, information on the danger incurred by eating unsterilised duck eggs. Any evidence as to the proportion of duck eggs infected and of the number of cases annually of infection caused by eating duck eggs. Is there any evidence that hen eggs ever contain* B. enteritidis *or any allied bacteria, and have cases of serious illness ever been traced to the eating of hen eggs?* (Herts.)

There are few statistics published on human infection by ducks and their eggs, and during the war no figures have been issued by the Ministry of Health.

Ducks are naturally dirty feeders wherever they are reared or kept—water or no water. They have been known to gobble up young rats or mice, frogs, etc. Rats and mice are well-known carriers of *B. typhimurium* (same organism as *B. aertrycke* in man, and is the most commonly isolated food poisoning organism in Great Britain), and also *B. enteritidis*. Ducks, by nature, in their wanderings are liable to pick up infected material, offal, etc., on the farm, in the stables, pigsties, cowsheds, etc. There is no reason why the infection should not be passed on from the duck's egg to the duckling. In this way a person may buy infected duck eggs and breed infected ducks—a possibility which cannot be overlooked.

As far as can be ascertained there have been no recorded cases of chickens and their eggs becoming infected in nature by members of the Salmonella group of organisms. Any illness caused by the consumption of hen eggs are usually cases of food allergy, which is fairly common among young children.

Chickens are liable to a fatal illness caused by the consumption of food containing the toxin of *B. botulinus* (called "Limberneck"), and fairly common in the U.S.A.

The following is an extract from Elliot B. Dewberry's book, *Food Poisoning*:

"The infection of ducks and their eggs by Salmonella strains, including *B. aertrycke* and *B. enteritidis*, is not uncommon. The importance of the duck's egg as conveying Salmonella infection was brought into prominence by Scott (1930, 1932, 1933), Clarenburg and Dornickx (1932), Lovell (1932), Seligmann (1935), Hohn and Hermann (1935), Jansen (1936). Scott (1933) suggested that the eggs are probably infected during their formation in the oviduct, but the bacilli may gain access through the intact shell. In his paper on the subject (1930) he mentions several outbreaks, including a typical one which occurred at Darlington in 1927. A 'trifle' was consumed by 10 out of a party of 12 persons. All the 10 were seriously ill, owing to an aertrycke infection, while the two who had no trifle but had shared in all the other food, remained well. The cream of the trifle had been prepared by whipping the white of duck eggs.

Beller and Reinhard (1934), who examined 1,500 duck eggs from 34 farms in Germany, found that about 1 per cent. contained Salmonella organisms.

The Chief Medical Officer of the Ministry of Health, in his annual reports for 1926, 1929, 1933 and 1938, drew attention to the strong circumstantial evidence incriminating insufficiently cooked duck eggs as the cause of severe and fatal food poisoning, and the possibility that many cases of gastro-enteritis, in which the hypothesis of alimentary infection appears impossible, since the single sufferer has consumed only food and drink shared with impunity by others, may be explained by the ingestion of a Salmonella-infected egg. 'Fried, lightly boiled, in creams, custards or mayonnaise, and most of all in the raw form, as egg-flips, etc., duck eggs are capable at all seasons of the year of producing severe gastro-enteritis and fatal septicæmia.'

With regard to the prevention of illness from the consumption of infected duck eggs (three cases of which occurred in 1937), there appears to be no practicable method of preventing with certainty the occurrence of Salmonella infection in ducks, though their exclusion from access to human or animal excreta doubtless would diminish its frequency. Cooking the eggs thoroughly is the only real safeguard.

It is interesting to note that in Germany a law was passed which prescribed that all such eggs offered for sale must be indelibly stamped 'Duck eggs. Boil.' All receptacles in which these eggs are kept for sale must bear the following notice: 'Duck Eggs. To be boiled for at least 8 minutes or thoroughly baked.' In addition, the following notice must be displayed near ducks' eggs where they are offered for sale: 'In order to prevent injury to health, duck eggs should not be consumed raw or lightly cooked, nor used in the preparation of puddings, mayonnaise, scrambled eggs, fried eggs, pancakes, etc.'

The above preventive measures might be instituted with advantage in this country."

Information Supplied

8,805. *Information on making of diabetic jams.* (Kent.)

8,808. *Information on Quick Freezing Dehydration.* (Warwick.)

8,816. *Details regarding edible and non-edible gelatine, its uses and how to judge it, etc. Books on the subject.* (Lancs.)

8,818. *Information concerning pickling cucumbers.* (Cumb.)

8,820. *Suppliers of potato flour and dehydrated potatoes.* (Middlesex.)

8,825. *Details of the drying of fruits and vegetables.* (Berks.)

8,830. *List of books covering the food industry and the manufacture of food, particularly from the engineer's standpoint. Also bibliography on zinc in food.* (Northants.)

Information Required

8,874. *Names and addresses of manufacturers of the Bentall Grinder.* (London.)

8,877. *Names and addresses of manufacturers or bulk suppliers of starch substitutes.* (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.).

Abstracts of Recent Specifications

Improvements in or Relating to the Means for an Improved Method of Sterilisation in what are known as High Pressure Sterilisers

The advantages of sterilisation and disinfection of goods by so-called high-pressure steam or vapour, in contra-distinction to media at atmospheric or low pressure, are now well recognised, and the present invention has for its object to provide an improved construction of sterilising apparatus wherein steam, and where necessary a drying agent, flows through goods packed in a container arranged within an enclosing chamber so that the steam or drying agent is compelled to pass through the goods.

For this purpose sterilising apparatus, according to the present invention, comprises a container within which goods are packed, provided with an outlet, the container being removably arranged within an enclosing chamber having an outlet, the connection of which with the outlet of the container being established and interrupted automatically in the act of inserting and removing the container, or the connection of the outlets of the container and chamber may be effected by moving a member associated with one or other of the outlets axially relatively to the other outlet.

Sterilising apparatus, according to the invention, may be variously constructed, the steam or other agent being admitted to the container from the chamber or directly from a suitable supply source.

Simplification of loading and unloading of containers into and out of a surrounding chamber may be achieved and fuller advantage taken of the maximum capacity of the chamber, by substituting for the individual drums a single drum or container of such a size as to occupy substantially the full cross-sectional area of the inside of the chamber, running the whole length of the chamber and having dividing partitions to form the number of compartments required, which can be individually opened and closed. Steam or hot air is admitted to the drum through a duct at one extreme end thereof and is allowed to escape only through another duct at the other extreme end after passing through the goods and openings in the partitions in the drum. The inlet connection may also be made and interrupted automatically in the act of inserting and removing the drum.

550,192. Hugh Emile Colman Collins, James Michael Hodges, and Manlove, Alliott and Co., Ltd.

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.

550,736. FOSTER WHEELER, LTD.: Controlling the temperature of superheated steam or other vapour.

550,747. SANDELL, B. H. R.: Electrically heated boiling, cooking, and like apparatus.

550,810. AKTIEBOLAGET SVENSKA FLAKTFABRIKEN: Rotary drying drums.

550,920. SPOONER, W. W.: Treatment of food by heat transference.

550,933. CROWN CORK AND SEAL CO., INC.: Coating machines, particularly for coating containers or cans.

550,979. TEAGLE, W. T.: Machines for planting potatoes. Cognate Applications, 5481 and 7020.

550,992. BOYLE, F., and MCCONVILLE, E.: Treatment of root crops for production of substitute foodstuffs and beverages.

551,057. GARDNER, H. W.: Distributor for agricultural and horticultural fertilisers.

551,151. BETTS AND CO., LTD., DUNN, E. STATHER, and MENHENEOTT, F. M.: Collapsible tubes.

551,164. DEWEY AND ALMY, LTD. (Dewey and Almy Chemical Co. and Container Corporation of America): Vapour-proof storage and shipping cartons or containers.

551,177. ENGLISH ELECTRIC CO., LTD., and LANDERS, M. A. B.: Temperature-responsive device.

551,247. MILES, DRUCE AND CO., LTD., and EARNEY, J. E.: Methods of and means for securing lids on containers.

551,271. CONTINENTAL CAN CO., INC.: Apparatus for hermetically closing containers for food.

551,377. LACOSTE, L.: Watertight closures for boxes and analogous closures.

551,393. EVANS, T.: Brushes or wipers for the rolls of tinning apparatus.

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.).

REFENA.—619,663. Preparations of wheat flour (none containing lard) for use in making bread, cakes and the like. **Wheta, Ltd.,** 1-5, Calvin Street, Belfast, N. Ireland; Manufacturers.

FINAVITE.—620,324. Cooking fats. **Merseyside Food Products, Ltd.,** 51, North John Street, Liverpool; Manufacturers.

MAVARA.—620,874. Tea, coffee and cocoa. **Nathan Pursell McGavin,** and **Colin McKenzie McGavin,** trading as **McGavin and Sclanders,** 9, York Street, Glasgow, C. 2; Merchants.

DELICAF.—621,661. Coffee preparations for use in making beverages. **Atomised Food Products, Ltd.,** Bessemer Road, Welwyn Garden City, Herts; Manufacturers.

SPREGG.—621,774. Powdered eggs and preparations of powdered eggs, for use as food or as ingredients in food. **S. Zwick and Sons, Ltd.,** London Bridge House, 2, Tooley Street, London, S.E. 1; Frozen Egg Importers.

CONRICE.—622,275. Rice for food. **Rice Conversion, Ltd.,** 14 and 19, Leadenhall Street, London, E.C. 3; Merchants.

New Companies

J. and T. Peters, Limited. (378632.) To take over the bus. of hay, straw, corn and potato mchts. and farmers cd. on at Glazebury, Swinton, Houghton Green Croft, and elsewhere, as "J. and T. Peters". Nom. cap.: £30,000 in £1 shares. Permt. dirs.: F. Peters, 342, Warrington Road, Glazebury, nr. Manchester; T. Peters, Dukinfield House, Glazebury, nr. Manchester.

Polyplastics, Limited. (378636.) To carry on bus. of manfrs. of and dlrs. in plastic materials and goods, etc. Nom. cap.: £3,000 in £1 shares. Dirs.: S. Avery, Little Clare, Barton Lane, Barton-on-Sea; A. Korach, 4, Eton Avenue, N.W. 3.

L.T.C. Company (Oxford), Limited. (378651.) Becket Street, Oxford. To carry on bus. of canteen proprs., caterers, etc. Nom. cap.: £2,000 in £1 shares. Dirs.: A. London, 5, Donington Road, Oxford; P. L. T. Tolley, 13, East Avenue, Oxford; C. B. Collier, 15, Addison Crescent, Oxford.

County Farms, Limited. (378704.) To carry on bus. of farmers, etc. Nom. cap.: £100 in £1 shares. Dirs.: To be apptd. by subs. Subs.: W. Bunning, 2, Longdown Lane North, Ewell, Surrey; J. W. Terry, 3, Abbey Road, Selsdon, Surrey.