The solution was now diluted to the required strength and completed with the exception of the neutralization of the solution by boric acid. This was accomplished by adding the boric acid in small portions until the solution was just neutralized. An aqueous suspension of phenolphthalein was used as indicator. When the solution was just neutralized, 2 grammes more of boric acid was added to each liter of the finished solution. The reason for this excess acid is to take care of the small amount of sodium hydroxide liberated when the solution comes in contact with the tissues. If more than 4 grammes of boric acid in excess of neutralization are present in each liter of the solution it will prove irritating. I found that 2 grammes of boric acid in excess worked satisfactorily.

During the months of November and December of 1918, twenty-five gallons of this solution were used each day. It proved to be, by far, the best solution in use for the sterilization of wounds.

When the solution was prepared according to the above modifications not a single complaint was registered by the patients, and the results were most encouraging, which was proven by the bacterial counts taken every other morning as wound controls.

Whether other hospitals experienced this same difficulty I am not able to state, but the fact is, the Army formula with the poor quality of bleaching powder received was absolutely worthless and if it had been continued would have resulted in a much greater loss of life than was actually experienced.

ABSTRACT OF DISCUSSION.

H. A. B. Dunning called attention to the very satisfactory method of preparing Dakin's solution by passing chlorine gas into a solution of sodium carbonate and bicarbonate, then standardizing carefully by the usual iodometric method, and testing for alkalinity with the newer sensitive indicators, as well as observing the phenolphthalein flash.

Ivor Griffith stated that the wane of the popularity of the solution could be ascribed to the fact that the organic chlorine compounds, such as dichloramine-T and chloramine-T, replaced it in some conditions, and also that civil practice, other than in hospitals, did not allow of its proper use.

CONCENTRATED MILK PRODUCTS.*

BY J. W. ENGLAND.

CONDENSED MILK.

Condensed milk is an evaporated milk representing about two and a half times its volume of fresh milk and containing about 40 percent by weight of cane sugar. It is of thick syrupy consistency and very sweet taste, and is marketed in cans. Commercially, it is made by dissolving cane sugar in fresh milk by a warming pan, after which it is drawn into the vacuum pan, where it is condensed at a temperature of 120° to 130° F. until the volume of liquid is 40 percent or less of the original volume; if the milk be overheated, the albumin will be coagulated and the sugar caramelized. After condensation, the milk is drawn off into cooling cans and constantly stirred in a sanitary room and atmosphere for two or three hours until a temperature of 70° F. is reached, when it is quickly canned and sealed.

* Read before annual meeting of Pennsylvania Pharmaceutical Association, held June, 1920.

Some of the more modern canners of milk sterilize the cans with dry heat before filling them, but the cans are cooled *in vacuo* before being filled, otherwise the milk congeals. If the milk condensed be acid, a certain amount of invert sugar (dextrose and levulose) is formed. Some manufacturers use invert sugar in place of cane sugar (U. S. D. 20 Edt., 1498), because invert sugar has a less sweet taste than cane sugar and is less liable to cause sugar of milk to crystallize in the can.

According to Food Inspection Decision No. 170 (U. S. Department of Agriculture, March 31, 1917), condensed milk must be the product of the evaporation of whole, fresh, clean cow's milk and must contain at least 8 percent milk fat and not less than 28 percent total milk solids.

Condensed milk is not sterile and may contain pathogenic organisms; it is preserved against decomposition by its high percentage of sugar, which, also, prevents freezing during transportation. So long as the can is unopened, condensed milk will keep under favorable conditions for a year or two, but after several months it becomes darker in color and thicker; when the cans are opened, if kept in a cool and sanitary place, it will keep for several days.

Condensed milk was the first form of canned milk put on the market. "The early French inventors along this line, dating back over a hundred years, are said to have been called forth by Napoleon's efforts to obtain a milk that could be transported for the use of his armies. It is interesting to note that canning milk first became a successful enterprise because of the urgency in this country of feeding the soldiers of the North in the Civil War." ("Condensed Milk and Milk Powder." Otto F. Hunziker. Published by the author, Lafayette, Ind., 1914.)

During the recent World War, the demand for condensed milk was enormous. Mr. Charles E. Hires, of Philadelphia, one of the leading manufacturers of condensed milk in the country, writes me as follows:

"Following the thought expressed by you yesterday relative to the production of condensed milk in the United States, it gives me pleasure to enclose herewith the data of same:

"I do not have an accurate record of the amounts produced in 1914 and 1915, but the amounts exported were as follows:

Year.	Pounds.
1914	22,850,904
1915	75,689,584

"The amounts manufactured and exported were as follows:

Year.	Pounds.	Pounds.	Per centage exported.
1916	992,364,000	219,686,127	22
1917	1,333,787,000	428,575,213	32
1918	1,675,934,000	551,139,754	33
1919	2,030,958,000	852,865,414	42

"The number of cases of condensed and evaporated milks manufactured were as follows:

Year.			Year.		
1916	Condensed	5,931,000	1918	Condensed	10,188,000
	Evaporated	14,474,000		Evaporated	22,998,000
1917	Condensed	7,482,000	1919	Condensed	13,441,000
	Evaporated	19,618,000		Evaporated	25,720,000

"I believe these figures to be reliable. The data was compiled by the National Canners' Association of Washington, D. C."

"Milk," an exceedingly informative pamphlet, issued by the U. S. Department of Labor, Children's Bureau, No. 35, 1918, written by Dr. Dorothy Reed Mendenhall, and from which considerable data in this article have been taken, gives the following average percentage composition of condensed milk.

AVERAGE COMPOSITION OF CONDENSED MILK (HUNZIKER).

Fat	9.0
Protein	8.5
Milk sugar	13.3
Cane sugar	40.9
Ash	1.8
Water	26.5
	100.0

One of the best known brands of condensed milk, can marked "net weight 15 ounces," has upon its label the following statement: "By adding 1 part of water to 1 part of the contents of this can, a resulting milk product will be obtained which will not be below the legal standard for whole milk." Presumably, *parts by volume* are meant—not parts by weight. On examining this condensed milk, I found it had a specific gravity of about 1.26 and one tablespoonful (rounded) weighed about 350 grains. (The tablespoon is the usual form of measurement for the smaller dilutions.) Therefore, one tablespoonful of the condensed milk mixed with one tablespoonful of water represents, practically, 60 percent by weight of condensed milk; with 6 tablespoonfuls of water represents 20 percent by weight; with 12 tablespoonfuls of water represents 11 percent by weight; with 18 tablespoonfuls of water represents 8 percent by weight. With these factors the percentages of the food elements in the different dilutions when measured by the tablespoon can be readily ascertained.

But the tablespoon "heaps" when filled with condensed milk, measuring more than 240 minims (as with water). Hence, one fluidounce of condensed milk (S. G. 1.26) weighs about 575 grains and mixed with an equal volume of water represents, practically, 56 percent by weight of condensed milk, with 6 fluidounces of water, represents 17 percent by weight, with 12 fluidounces of water represents 9.5 percent by weight, and with 18 fluidounces of water represents 6.5 percent by weight.

In making condensed milk dilutions for infant feeding, the graduated measure should be used instead of the tablespoon; it is much more accurate.

Condensed milk is often useful for the feeding of infants, but it has its limitations. It "is advisable for temporary use during attacks of indigestion, for infants with feeble digestion, especially in summer, for very young infants during the first two or three months, or among the very poor when the cow's milk which is available is still more objectionable" (Holt), and also, for undernourished infants where the use of a rapidly assimilable body-fuel like sugar is indicated. In traveling, it is the most convenient as well as the safest food to use. It is usually diluted six times or more with water. But condensed-milk-dilutions are illy-balanced physiologically, containing low percentages of fat and protein and a high content of sugar, and hence, even if prepared under the best possible conditions, "should not be used as a permanent food when good fresh cow's milk can be obtained" (Holt).

The composition of human milk averages fat 3.5 percent, protein 1.5 percent, and sugar 7 percent; cow's milk averages fat 4 percent, protein 3.5 percent, and sugar 4.50 percent. The U. S. (Federal) minimum standard for cow's milk is fat 3.5 percent, non-fatty solids 8.5 percent (U. S. D. 20th Edt. 1918, 1498).

EVAPORATED MILKS.

Evaporated milk, formerly mis-named evaporated cream, is an evaporated milk representing from two to two and a half times its volume of fresh milk and containing no cane sugar. It is an unsweetened condensed milk. It has the consistency of thin cream and is much less sweet than condensed milk. It is sold in cans and in many large cities is delivered fresh daily in bulk.

Commercially, it is made by evaporating fresh milk *in vacuo* until the volume of liquid is from 40 to 50 percent of the original volume, "placing it in cans and then sterilizing the contents by subjecting the cans to steam under pressure." The temperature must be "high enough and maintained long enough to insure absolutely sterility to the product and to give the milk sufficient body to prevent the separation of the butter fat in subsequent transportation and storage." ("Milk," U. S. Department of Labor, Bulletin Publication No. 35, 1918.)

The Federal regulations require that evaporated milk must be made from whole, fresh, clean cow's milk and must contain at least 7.8 percent fat and not less than 25.5 percent total milk solids (Food Inspection Decision No. 158, U. S. Department of Agriculture, April 2, 1915). It will be noted that the standard required for milk solids in evaporated milk is nearly the same as that for condensed milk.

Evaporated milk is, or should be, absolutely sterile and will keep almost indefinitely so long as the can is unopened; once opened, however, it rapidly decomposes (but does not become at first like condensed milk—it putrefies); it should be kept well iced and used in a day or two.

Chemical Age (June, 1920, 188) states that: "As a matter of more than passing interest it should be noted that evaporated milk, part or full skimmed, modified with foreign fat or vegetable oils, has been used in increasing quantities as a substitute for true evaporated milk for home consumption. While but 12,000 pounds were tinned in 1916, more than 62,000,000 pounds of the case goods were manufactured in 1919, as shown by the following table. In 1916, the production of the

PRODUCTION (IN POUNDS) OF EVAPORATED MILK (PART OR FULL SKIMMED) MODIFIED WITH FOREIGN FAT IN THE UNITED STATES, 1916–1919.

Year.	Case.	Bulk.	Total.	Increase over previous year. Percent.
1916	12,000	14,134,712	14,146,712	...
1917	18,504	17,487,064	17,505,568	24
1918	41,033,855	7,591,182	48,625,037	178
1919	62,262,221	2,748,120	65,010,341	34

substitute compared with the production of true evaporated milk, case goods, was negligible, while the production had increased to over 5 percent by the close of 1919."

"Milk" (1918, 20) gives the following average percentage composition of evaporated milk:

AVERAGE COMPOSITION OF EVAPORATED MILK (HUNZIKER).

Fat	8.3
Protein	7.5
Milk sugar	9.7
Ash	1.5
Water	73.0
	100.0

Dr. D. R. Mendenhall states:

"From the feeding experiments recently conducted on animals it does not seem probable that either of the vitamines so far determined is injured by the high temperature. By diluting with equal parts of sterile water, evaporated milk can be reconstituted, approximately, as ordinary milk; also, it can be of great use in the general nutrition of the household and it certainly has a more tenable place in the feeding of infants and young children, when fresh milk cannot be obtained, than condensed milk. We must recognize the facts that it will freeze and is, therefore, not suitable for transportation in cold weather; that it must be carefully handled after opening the can, if it is to remain a sterile food and one fit to give an infant; and that even though condensed to one-half to two-fifths of its original bulk, it is still bulky to transport. Also, all condensed milk is relatively high in price as compared with grade A raw milk. * * * * All these reasons make evaporated milk far from the ideal substitute for fresh milk."

Dr. L. Emmett Holt (Diseases of Infancy and Children, 1916, 159) states that:

"Evaporated milk requires the same modification (for infant feeding) as ordinary cow's milk. For routine use, it should be diluted with from eight to twelve parts of water and sugar added. * * * * It is a sterile cooked milk. Some children thrive upon it who cannot so well digest either raw milk of the same percentage composition or even freshly pasteurized milk. It should not be continued as the sole food when good fresh cow's milk can be obtained."

One of the best known brands of evaporated milk, can marked "net weight 1 pound," has upon its label the following statement: "By adding one part of water to one part of the contents of this can, a resulting milk product will be obtained which will not be below the legal standard for whole milk. Presumably, *parts by volume* are meant, not parts by weight.

On examining this evaporated milk, I found that it had a specific gravity of about 1.07, and one tablespoonful weighed about 256 grains. Therefore, one tablespoonful of the evaporated milk mixed with one tablespoonful of water represents, practically, 53 percent by weight of evaporated milk; with 6 tablespoonfuls of water represents, practically, 15.75 percent by weight of the evaporated milk; with 12 tablespoonfuls of water represents 8.5 percent by weight; with 18 tablespoonfuls of water represents 6 percent by weight.

With these factors, the actual percentages of the food elements in the different dilutions measured by tablespoonfuls can be readily ascertained.

Evaporated milk does not "heap" on the tablespoon like condensed milk and, therefore, does not bulk so large. One fluidounce of evaporated milk (S. G. 1.07) weighs about 488 grains and mixed with an equal volume of water represents, practically, 51.7 percent by weight of evaporated milk, with 6 fluidounces of water it represents 15 percent by weight, with 12 fluidounces of water represents 8 percent by weight, with 18 fluidounces of water it represents 5.5 percent by weight.

In making evaporated milk dilutions for infant feeding, the graduated measure should be used instead of the tablespoon; it is more accurate.

DRIED MILKS.

Dried milk is milk deprived of its water, or the milk solids, and represents about eight times its weight of milk. It is a yellow, fluffy powder that is readily miscible with water, forming a milk-like liquid having a cooked milk taste. Dried half-cream milk is similar, but is made of milk from which one-half the cream has been removed, and is a light yellow, fluffy powder. Dried skim milk is made from skim milk and is a yellowish white, granular powder.

Commercially, according to "Milk" (1918, 21), milk powder is made by one of the following processes: (1) By feeding the milk in a thin stream over two steam-heated cylinders or drums, about one-eighth inch apart, revolving in opposite directions. The milk exposed to the heat of the cylinders dries as a thin film and comes off the revolving cylinder as a sheet, which is easily crushed into a fine powder. The cylinders which are some 60 inches long and 24 inches in diameter, are charged with steam under two or three atmospheres of pressure causing the heating surfaces to have a temperature of about 250° to 280° F. This process, known as the Just patent in the United States and as the Just-Hatmaker patent in England, is said to have been the invention of J. R. Hatmaker, of London; (2) by pasteurizing milk and then condensing in the vacuum pan, at a low temperature (130° F.) to about one-fourth its bulk, after which the condensed product is forced under high pressure through minute openings in a metal disk into a hot air chamber. The atomized liquid surrounded by a current of hot air instantly dries and falls to the bottom of the chamber as a snowy powder, the moisture rising as a cloud of steam. The mixture of the liquid and air in the evaporating chamber is stated to be about 180° F. The method was developed in France and is called there and in England the Bevenot de Neveu process. In this country it is known as the Merrell-Gere process; (3) by condensing milk to approximate dryness in a vacuum pan equipped with a mechanical stirrer.

The Federal regulations (Food Inspection Decision No. 170, U. S. Department of Agriculture, March 31, 1917) require that dried milk must contain "not less than 26 percent milk fat and not more than 5 percent of moisture." There are no Federal standards, apparently, for dried half-cream milk and dried skim milk, except that the latter "shall not contain more than 5 percent of moisture."

Dried milk and dried half-cream milk are sterile and in sealed cans keep almost indefinitely. Exposed to air, warmth and moisture, however, they slowly become rancid; dried skim milk, however, with its low content of fat, remains unchanged longer. The dried milks should be stored in a cool and dry place.

Eric Pritchard (Medical Press and Circular, Vol. 97, Feb. 25, 1914, 192–195) gives the following as the average percentage composition of the dried milks:

	Casein.	Albumin.	Sugar.	Fat.	Calories per oz.
1. Dried milk.....	24.50	1.94	38.92	28.00	146
2. Dried half-cream milk.....	30.58	2.42	39.70	15.10	119
3. Dried skim milk.....	31.40	2.49	55.00	1.00	104

The dried milks are now made upon a very large scale and find different uses according to kind. They are used in manufacturing confectionery, such as milk chocolate, baked food products and ice cream, etc., and should find a ready application for soda fountains and in the household. Their utility in traveling is

obvious. They possess many advantages—sterility, stability, convenience and cheapness.

Dried half-cream milk is used for infant feeding, more especially in France and England, being similar in such application to evaporated milk. Two ounces by weight mixed with sufficient hot (not boiling) water to make 1 pint, gives a liquid that, except for deficiency in fat, approximates the composition of cow's milk, as follows: Fat 1.5 to 2 percent, protein 4 percent, sugar 5 percent. Dried whole milk mixtures are used, also, for infant feeding, especially for infants over six months of age.

Dried skim milk is used in making bread, rolls, muffins, cakes, custards, creamed soups, sauces, cocoa and chocolate; if richer products be wished, the dried milk or dried half-cream milk is employed.

MANUFACTURING BY THE RETAILER AND ITS RELATION TO PHARMACOPOEIAL REVISION.*

BY F. W. NITARDY.

Much criticism is voiced at times against the pharmacist of to-day because he does not, as of old, make the pharmaceuticals required by him. There are exceptions, to be sure, but in general even the best of our pharmacists as a rule do not do much manufacturing, and because of this, even such radical statements as, "the average pharmacist is lazy," have been made. It has been said that unless the pharmacist makes his own preparations, he is neither availing himself of the knowledge that is his, nor practicing his art to the extent that he should, and that he is largely a dealer in merchandise, restricting pharmaceutical practice to the filling of prescriptions.

At a recent meeting where the revision of the U. S. P. was the subject of discussion, the simplification of the official processes was advocated by one of the speakers as a means of interesting the retailer in manufacturing and rescuing pharmaceutical practice from its present trend.

The object of this paper is to discuss and analyze this situation with the purpose of determining if it represents a condition detrimental to pharmacy and what, if any, change of policy should be attempted in the coming U. S. P.

To reach an unbiased opinion, let us first determine the mission of pharmacy. Broadly speaking, it is to furnish those things which the physician requires in the treatment as well as the prevention of disease. We may also include those things which the public requires in treating itself, even though we may not always believe in the wisdom of this habit. The practice of pharmacy, then, includes the gathering or production of medicinal substances, their selection, preparation, standardization, elaboration, and final compounding for use by physician and public. Whether or not, and how well pharmacy fulfills its mission would, of course, be measured by the efficiency of its service and the reliability, uniformity, and quality of the products it offers, and its progress by the improvement noted in any or all of these factors.

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* Read before Section on Practical Pharmacy and Dispensing, A. Ph. A., City of Washington meeting, 1920.