equipped and well-kept milk-room, provisions for thoroughly sterilizing all utensils, intelligent people in charge, and cleanly methods throughout. There are a number of persons—thanks to the training received at the various dairy schools—who make an honest effort to place on the market milk obtained under such conditions, but by far the majority are ignorant or wilfully indifferent to hygienic requirements, and therefore matters of this kind should never be left to the individual, but the principles which ought to be carried out should be embodied in effective laws, and accepted and executed in a practical sense. Honorable men will not object to laws placing dairies, the herds, and the milk market under strict sanitary control, and as many of the most serious dangers are the result of ignorance, rather than of intentional negligence, the difficulties will be materially lessened by proper education and trade competition. It is highly desirable that some uniform legislation, preferably a national pure-food law, be enacted to regulate the inspec-

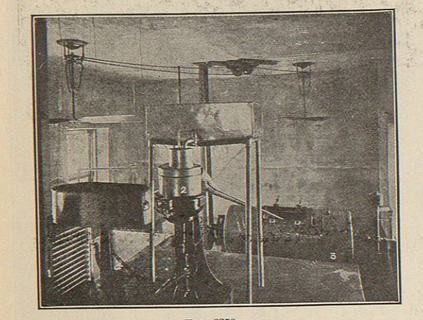

FIG. 3358.

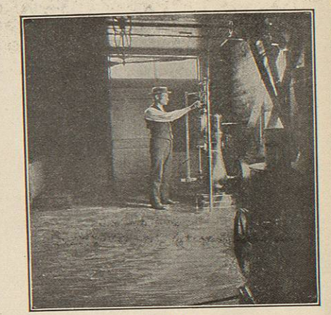

FIG. 3359.

FIGS. 3358 AND 3359.—Separating, Pasteurizing, and Cooling Department at Senator Stewart's Farm near Washington, D. C. 1, Cooler; 2, separator; 3, pasteurizer.

tion of dairy farms, etc., for, as it is now, milk consumed in New York City, for example, may be produced in a number of States over which, of course, the local authorities have no jurisdiction. A compulsory inspection of the dairy herds will be a source of ultimate profit to the owner, as the presence of tuberculosis or other communicable diseases endangers his entire herd, and great losses can be prevented by the extermination or isolation of the first case. The farmer will also find it to his advantage if he is obliged to house his cattle in spacious, well-ventilated and lighted stables (at least six hundred cubic feet of air space and nine feet window space for each animal, with good cemented floors, proper drainage, clean hay, straw, or shavings for bedding, and a standard ration.

The Feed and Care of Cows.—The animals should not be allowed to feed upon pastures with stagnant water or noxious weeds such as meadow saffron, henbane, Jamestown weed or stinkweed, poppies, mustard, carrot tops, milkweed, poison oak, sumach, skunk cabbage, and other euphorbiaceous and ranunculaceous plants, nor upon the swill or products from distilleries, breweries, glucose factories, etc. The use of turnips, kohlrabies, rutabagas, carrots, mangels, and the leaves of all kinds of root crops are also objectionable.

An abundance of wholesome pasture in season with hay and meal fodder should be allowed. At some of the "milk-cure institutes" in Germany each cow is allowed daily 10 pounds of meadow hay, 17 pounds of clover hay, 6 pounds of hulled barley meal, and 4 pounds of wheat flour. The United States Department of Agriculture recommends the following:

Adjustment of Ration to Milk Yield.—In making allowance for the difference in milk yield of different cows, a uniform basal ration can be fed to all the cows, and the amount of the richer grain mixture varied to suit the demands. For example, a basal ration might be made up of 25 pounds of corn silage, 8 pounds of rowen hay, and 3 pounds each of cornmeal and wheat bran, which would supply 1.43 pounds of protein and a fuel value of 23,712 calories. To this could be added a richer grain mixture composed of two parts of gluten meal and one part of cotton-seed meal, the amount of this being varied according to the milk yield of the cow. Two pounds of this mixture would bring the ration up to 1.97 pounds of protein and 26,999 calories, which would meet the requirements of cows giving from 12 to 15 pounds of milk a day, while 4 pounds would bring it up to 2.50 pounds of protein and 30,286 calories of heat, suitable for the cows giving from 20 to 25 pounds of milk, and so on, 5 or 6 pounds of the grain mixture being fed to the heavier milkers.

The water supply should be pure and closely guarded against pollution. In the absence of a spring, a deep-driven well should be preferred. While it is true that at the majority of dairy farms wells and privies are dangerous neighbors, the agency of flies in carrying infection should not be underrated, and points to the necessity of prompt disinfection; an effort should also be made to get rid of the flies by prompt disposal of the horse manure in which they breed, the abandonment of open privies and surface pollution, removal of garbage, and other fly-breeding matter. The animal should be groomed, and the teats and udders washed with sterilized water before milking; this is of importance, as the presence of fecal bacteria in milk is next in danger to disease germs.

Milking and Care of Milk.—The requirements of cleanliness apply with equal force to the milkmen, their person and clothing, and they should be required to keep their finger-nails clean from dirt and make a careful toilet before milking. The milking should be done in a dust-free atmosphere, preferably in a special room with cemented floors, previously sprinkled in order to reduce the number of germs to a minimum. It is impossible to secure bacterial purity of the milk when the milking is done in a stable with a hayloft above. The best results observed by the writer were obtained at a dairy supplied with one-story frame stables, cemented floors, well

lighted and ventilated by windows and Ridge ventilators, and where the animals after grooming were taken into a similarly constructed room for milking. Attention has already been called to the necessity of absolute cleanliness of the utensils and bottles, which can be accomplished with a weak solution of boiling soda water, subsequently rinsed in sterilized water. Before bottling, the milk must be rapidly cooled to a temperature of 40° F. and delivered to the consumer at a temperature not exceeding 50° F.

Sickness among Milkers and Employees.—All persons engaged in handling the milk should be free from disease. No family ever thinks of employing or keeping a cook afflicted with a communicable disease, and yet not the slightest restriction is placed upon, nor a question asked about, the persons who handle our milk supply, which we know affords an excellent culture medium for disease germs. After the recital of numerous epidemics and milk-borne diseases, we need hardly insist upon the necessity of compulsory notification of all infectious diseases, and that the milk should not be permitted to leave a farm, dairy, or milk-shop during the existence of any of these diseases among the inmates or employees, nor should the latter be permitted to reside in or visit infected premises while engaged in the milk traffic, without permission from the Health Department. The farmer or retailer should, in fact, be prepared by previous instructions to guard the milk supply from these sources of danger and call upon the authorities for an immediate inspection. To prevent great loss incident to these restrictions, they may be modified so as to utilize the milk after proper sterilization under the direction of the Health Department. The retailer should be duly registered and be required to furnish the health office with a list of customers. These lists should be arranged on the "index card system," so that the simultaneous occurrence of infectious diseases in a number of families supplied by the same milkman may be promptly discovered and the mischief checked.

There is nothing strained in these requirements, as good and sufficient reasons have been adduced, and by their enforcement we may hope to obtain such a standard of milk as will not only effect a decided reduction in infantile mortality, but will render the dissemination of infectious diseases through the milk supply a matter of history only. Until this is accomplished, we should patronize only such dealers as sell "certified milk," or subject the milk in pint bottles to pasteurization at a temperature of 155° F. for thirty minutes, and after cooling keep it on ice; this will not make bad milk good, but it will at least destroy its infectiousness.

George Martin Kober.

MILK SICKNESS.—The early settlers in the Middle West, or the region between the Alleghany Mountains and the Mississippi River north of Georgia and Alabama, suffered in their own persons and in their cattle from a severe and often fatal malady, called by the term which heads this paragraph. In cattle the affection was called "trembles," but its relation to the "milk sickness" of man was so close as to leave no doubt in the minds of either the physicians or the laity of those times that the two were one and the same disease.

In animals the first symptom noted was marked apathy; the animal stood apart from the herd, motionless with drooping head, and persistently refused to graze. Later a general tremor came on, its appearance being hastened by forced exercise of the animal, there was extreme thirst in most cases, and constipation was pronounced. Soon the animal lay down, respirations became less and less frequent, the extremities grew cold, the eyes glassy, and death usually occurred at the end of eight or ten days.

In man the symptoms were very similar. There was complete anorexia, nausea and vomiting were frequent, and constipation was absolute. The urine was clear and limpid, but reduced in amount despite the large quantities of water taken to quench the intolerable thirst. The pulse was weak and compressible; the temperature was usually below normal, but in exceptional cases might rise to 99° or 100° F.; there were never any chills, and the headache ushering in malarial and typhoid fevers was conspicuously absent.

Milk sickness was a very grave malady, and recovery seems to have been the exception, though not impossible. There was no specific treatment, but the best results were obtained by judicious stimulation and careful nursing.

As the disease is no longer recognized—whether because it has become extinct or because better diagnostic methods have corrected our nosology, it is difficult to say—it is impossible to determine what its true nature was. Indeed, many observers to-day question whether there really ever was a morbid entity such as that described under this name. In Volume V. of the first edition of this work Dr. William M. Beach, a pioneer physician in Central Ohio who had had a wide experience with "milk sickness," contributed an article on the disease, and to this we should refer readers who desire to learn more of the facts than are here detailed. This brief abstract of Dr. Beach's article is inserted in this place for purely historical reasons, the disappearance of the disease having rendered a more extensive treatment of the subject unnecessary.—[Abstract of article by *William M. Beach.*]

MILK, SUGAR OF.—SACCHARUM LACTIS. "($C_{12}H_{22}O_{11}+H_2O$). A peculiar, crystalline sugar, obtained from the whey of cow's milk by evaporation, and purified by recrystallization" (U. S. P.). Sugar of milk crystallizes in four-sided rhombic prisms. These are usually collected upon sticks or strings hung in the concentrated solution; thus are formed long rolls, three or four inches in diameter, the crystals densely massed and tapering to a point at the axis of the roll. Much of the sugar, however, is crystallized in pans and comes in fragments of large cakes, two or three inches in thickness. The following is the official description:

"White, hard, crystalline masses, yielding a white powder feeling gritty on the tongue, odorless, and having a faintly sweet taste. Permanent in the air.

"Soluble in about six parts of water at 15° C. (59° F.), and in one part of boiling water; insoluble in alcohol, ether, or chloroform.

"The aqueous solution of sugar of milk is neutral to litmus paper.

"On adding to a few cubic centimetres of a hot, saturated aqueous solution of sugar of milk an equal volume of sodium hydrate T. S., and gently warming, the liquid will turn yellow and brownish-red. On the further addition of a few drops of copper sulphate T. S., a brick-red precipitate will appear.

"If about 1 gm. of powdered sugar of milk be sprinkled upon about 5 c.c. of cold sulphuric acid contained in a flat-bottomed capsule, the acid may acquire a greenish or reddish but no brown or brownish-black color within half an hour (absence of *cane sugar*)."

The aqueous solution differs from that of ordinary sugar in being thin and not in the form of a syrup.

The very numerous uses of milk sugar in the pharmacy, in connection with other substances, as an excipient, makes it unusually important that it be kept fresh and pure. Its delicate and extensive use in the preparation of artificial milk for infants renders this caution still more important. The substance has no special physiological action, and its use in milk preparations will be found described under *Milk.*

Henry H. Rusby.

MILLBORO SPRINGS.—Bath County, Virginia.

POST-OFFICE.—Millboro. Hotel and sanitarium.

ACCESS.—Viâ Chesapeake and Ohio Railroad to Millboro Depot, thence by carriage two miles to springs. The hotel is situated on a gently sloping eminence about two thousand feet above the level of the sea. The situation commands a fine vista of green fields, fertile valleys, lofty forest-capped hills, and in the distance the towering summits of the Alleghanies. The climate here is of the usual dry, bracing character of the Virginia

mountain region. The hotel is a comfortable, well-kept establishment, having a capacity of one hundred guests. Lawn tennis, croquet, bowling, riding, and driving are among the amusements offered. The Wallawhatoola River, half a mile distant, furnishes excellent bass fishing. There are several mineral springs here, the most important being the Sulphur and the Alkaline Springs. The following analysis of the former was made in 1891 by G. B. M. Zerr, chemist, of Staunton, Va.:

SULPHUR SPRING (MILLBORO'S SPRINGS).

ONE UNITED STATES GALLON CONTAINS:

Solids.	Grains.
Sodium hydrosulphate	3.34
Calcium sulphate	1.55
Potassium sulphate	.11
Sodium bicarbonate	4.27
Magnesium bicarbonate	1.65
Calcium bicarbonate	.54
Iron bicarbonate	Trace.
Alumina	.26
Sodium silicate	.89
Sodium chloride	.47
Aluminum phosphate	Trace.
Organic matter	.35
Total	13.43
Gases.	**Cu. in.**
Sulphureted hydrogen	1.08
Carbonic acid	6.94

This is an excellent water of the alkaline sulpho-carbonated variety. It possesses antacid, tonic, and mild diuretic properties, and will be found useful in the class of cases to which such waters are applicable. The alkaline spring was analyzed by Dr. Zerr in 1895. It is somewhat milder than the sulphur spring, but is also a very useful water in acid dyspepsia, enfeebled states of the digestion, etc. *James K. Crook.*

MINERAL ACIDS, TOXICOLOGY OF. See *Acids, etc.*

MINERAL ALKALIES, TOXICOLOGY OF.—The alkaline carbonates and hydrates of potassium and sodium act as corrosive poisons.

Potassium carbonate is a white, crystalline salt, alkaline and deliquescent. It dissolves readily in water, its solution effervescing readily on the addition of acids. It is used in commerce under the names of pearl ash and salt of tartar.

The pure sodium carbonate is crystalline, colorless, odorless, and transparent. It has a sharp, alkaline taste and an alkaline reaction. On exposure to dry air the crystals effloresce and fall into a white, opaque powder. This compound is met with in commerce as washing soda or sal soda and is much used in the household for cleaning purposes.

Both these carbonates are much less poisonous than the hydrates of the same elements and they are of no great interest to the toxicologist. Their poisonous dose is large and their effect like that of the hydrates though much less intense.

The hydrates of both sodium and potassium are found in commerce in the form of irregular lumps, a more or less fine powder, or in the form of sticks, yellowish-white or pure white in color, crystalline, and bitter. All forms of these hydrates absorb moisture readily to such an extent as to become liquid. They dissolve in water very quickly with the evolution of great heat, producing if pure a clear liquid. A solution of each containing about five per cent. of the hydrate is official in the United States Pharmacopœia.

In strong solution the hydrates act energetically on cotton or woollen fibre and on animal or vegetable tissues in general, causing them to soften and disintegrate. On metals also they act corrosively and so insoluble a material as glass is after a time affected by them.

Poisoning by these substances is the result of accident or from suicidal intent, their sharp and biting taste serving to protect from their homicidal administration.

The first sensation on taking either the solid compounds or their concentrated solution into the mouth is a most intense burning and biting pain. In case any of the material is swallowed this sensation extends throughout the œsophagus and stomach. Vomiting generally follows, the materials ejected being frothy in character, brown, tinged with blood or streaked with mucus, and strongly alkaline in reaction and soapy to the touch. Sometimes there is purging. The abdomen in the region of the stomach is extremely tender to the touch, and the act of vomiting causes excruciating pain. The surface of the body is cold and covered with perspiration; the pulse is quick but feeble.

In some fatal cases death follows within three hours, the patient dying from shock; but more often life is prolonged sometimes for months, death finally ensuing from starvation or from perforation of the stomach or the œsophagus and subsequent inflammation.

Forty grains of the hydrate have been known to cause death, though one-half ounce is usually regarded as the poisonous dose.

Treatment in cases of poisoning by the fixed alkalies consists in the administration of dilute acids like vinegar or lemon juice to neutralize the alkali, and afterward oily or mucilaginous drinks to cover the raw surfaces. No attempt should be made to use the stomach pump on account of the softened condition of the tissues.

Post-mortem examination in cases of sudden death from the action of alkalies shows corrosion of greater or less intensity and extent, depending on the strength of the solution swallowed and the time during which it acted on the tissues. Usually the mouth is found white, or intensely red or brown, its mucous membrane loosened in shreds. The tongue is swollen and reddened; the œsophagus much inflamed, and its lining membrane softened so as to be readily detached from the tissues below, sometimes in shreds, in a few instances as a complete cast. The lungs are sometimes found inflamed and gray or deep brown in spots where the alkali drawn into them has come in contact with the tissue. The stomach is reddened and its mucous coat loosened. The blood-vessels of the stomach are congested and the blood in them is dark-brown in color. The intestines are usually normal, but sometimes show marked signs of inflammation. In case of death after a considerable interval the chief characteristic is the severe constriction or scarred appearance of the œsophagus or the stomach. In one case reported the opening into the stomach hardly admitted a probe. The œsophagus has been found much distended above its constricted portion, the constriction appearing hardened and considerably scarred. Perforation has also been noted on post-mortem examination.

In case of a chemical investigation of the stomach contents in poisoning by mineral alkalies these materials are usually found acid in reaction, either from the antidotes administered during life or because the normal acids of the stomach juices have neutralized so much of the alkali as remains in the body. The investigation is further complicated by the fact that the salts of both potassium and sodium are normal to the tissues and exist in nearly all foods. The vomit, at an early stage of a case of this kind, is therefore the most satisfactory material for an investigation. Whatever the material it may be best extracted from the organic matter by dialyzing and then concentrating the liquid so obtained. If this liquid is alkaline, titration by decinormal sulphuric acid is advisable, as this gives a measure of the amount of alkali still existing. If the extract is acid, or in any case after neutralizing, add an excess of sulphuric acid, evaporate to dryness, and incinerate. The residue is then treated with hot water and filtered. The sulphuric acid is removed by barium chloride and the barium sulphate filtered out. The chlorides formed are treated with milk of lime for some time and then filtered. The filtrate is saturated with carbon dioxide, boiled, and the precipitate, if any, filtered out. The filtrate is evaporated to dryness after the addition of sulphuric acid and the ignited residue weighed. Whatever the salts in the original solution

this residue consists of sodium and potassium sulphate. After weighing, the residue is dissolved in water, platinum chloride solution is added in excess, and the mixture is evaporated to dryness on the water-bath. The residue is treated with eighty-per-cent. alcohol and the insoluble potassio-platinic chloride filtered out, and after thorough washing with alcohol it is dried and weighed. The weight of the platinum salt multiplied by 0.2309 represents the weight of caustic potash. The difference between the potash, calculated to sulphate, and the weight of the mixed residue of sulphates represents the sodium sulphate. *Herbert M. Hill.*

MINERAL HILL SPRINGS.—Grainger County, Tennessee.

POST-OFFICE.—Bean's Station. Hotel and sanitarium.

These springs are located in the Bean's Station Valley, near the foot of Clinch Mountain, ten miles from Morristown. The peculiar arrangement of the valleys, hills, and mountains gives rise to a cool, refreshing air current, always passing from north to south in the morning and from south to north in the afternoon. We are informed by Dr. W. J. Heacker, of Bean's Station, that as many as twelve varieties of mineral water are found near the hotel, among which are mentioned red, white, and black sulphur chalybeate, Epsom, and alum waters. No analyses appear to have been made. The accommodations of this resort appear to have been largely extended and improved. It is stated that many varieties of ills are benefited by the genial climate and a free use of the waters. *James K. Crook.*

MINERAL SPRINGS AND WATERS.—Geologically, all the waters which issue from the earth might be designated as mineral, but in the common acceptation the term refers only to those waters which are used for internal or external medical purposes in virtue of their chemical contents, or on account of their natural temperature. Such waters have been employed in the healing art through all ages from the earliest dawn of history to the present day. Like many other medicinal agents, mineral waters in former times, before their proper constitution was understood, were superstitiously invested with powers which we now know they never could have possessed. Some of the ancient notions regarding their healing virtues are still retained by credulous or ignorant persons, and this fact is duly utilized by enterprising promoters of certain springs to their own commercial advantage, but not to the benefit of enlightened and progressive therapeutics. Aside from disappointing the expectations of invalids, the absurd claims published in their circulars by unscrupulous proprietors of mineral springs have served to prejudice the minds of medical men, some of whom in our own country ignore this subject altogether, and are content to leave the whole matter of mineral hydrotherapeutics in the hands of persons having nothing more than a commercial interest in its extension. In Europe, however, these agents are justly regarded as a valuable addition to the armamentarium medicorum, and a study of their uses is held as an essential part of materia medica and therapeutics. The students of all the chief universities are instructed in their rational uses, and the status of mineral waters is altogether dignified and satisfactory. Even on this side of the Atlantic there are evidences that the regular profession is awakening to a proper appreciation of the potential value of these remedial adjuncts, which in our own fair land are found in greater profusion and variety than anywhere else on the globe. A spirit of scientific inquiry and investigation is superseding the lethargy and indifference of American practitioners. Many of our spas are already provided with properly equipped sanatoria and bath-houses, and the writer learns from a recent visit to some of our well-known mineral spring resorts that an increasing number of the valetudinarian visitors are taking the waters under medical supervision.

The writer is convinced by his own continued observations that American medical men of to-day are far better acquainted with the chemical composition and therapeutical possibilities of our own mineral waters than they were fifteen or twenty years ago. The alert Yankee will not forever allow the fruitful fields which surround him to lie fallow and undeveloped. The veil of ignorance and superstition which has shrouded the medicinal operation of mineral waters having been brushed aside, the plain fact is revealed that these substances exert their physiological action and therapeutical effects precisely as do other internal remedial agents. It is known to all that a mineral water containing the sulphate of soda or magnesia will act on the bowels. A bicarbonated alkaline water will quickly remove the symptoms of acid dyspepsia, while it requires no argument to show that a potent chalybeate will influence the manifestations of anæmia, at least as readily as will one of the artificial preparations of iron. These are examples of what we know about the therapeutics of mineral waters. But we have not yet learned why a very few grains of sulphated, magnesic, or sodic salt will give a laxative influence to a natural mineral water, and that the physiological effects of arsenic can be readily secured by the daily imbibition of a water containing far less than the usual pharmaceutical dosage. Nor are we at present able to explain why we cannot gain these same effects by artificially adding these substances to ordinary potable water. The progressive practitioner, however, while desirous of further light regarding these matters, will not deprive his patient of the advantage of knowledge well attested by clinical experience while awaiting an exact explanation of the *modus operandi* of his remedial agents. We are equally ignorant as to the precise action of a majority of our most highly prized artificial preparations.

Certain European mineral springs were known to be useful in the treatment of syphilis and its sequelæ many years before a chemical analysis showed them to possess a minute quantity of the iodides of potassium and sodium. Similarly, quinine was known to be useful in malarial affections a very long time before it was learned that malaria was a specific infectious disease, and that quinine was destructive of its pathogenic microbe. We are often obliged to avail ourselves of empirical knowledge until the scrutinizing eye of the experimental chemist or physiologist supplies us with rational explanations.

With the possible exception of the sulphated-saline group, mineral waters find their chief application in chronic diseases. The very fact of the ease with which they may be introduced into the system gives them a vast advantage in many obstinate and long-continued affections in which the gamut of pharmaceutical remedies has been run and the stomach of the weary patient rebels at more drugs. Waters have a very much better influence when consumed at their original source at the spa than when used from bottles, demijohns, etc., in the city. At the spring the patient has the added advantages of a change of scenery, surroundings, climate and food, and a temporary absence from the worries and cares of home and business. Many a long-standing and well-nigh hopeless case of chronic rheumatism, anæmia, dyspepsia, or hepatic disorder has been restored to a state of perfect or comparative good health by a timely sojourn at a proper mineral spring resort. There are numerous excellent commercial mineral waters which may be used advantageously at home, but the effects obtained cannot compare with those derived at the fountain-head.

The employment of baths or the external use of water belongs more properly to the domain of general hydrotherapeutics (*vide* p. 788, Vol. IV.). In this place we can only briefly refer to the action of mineral waters on the economy through the medium of the skin and to balneological procedures employed at mineral springs. The time was when special virtues were attributed to the external application of water the temperature of which had been raised by the interior heat of the earth. More advanced reasoning, however, has led to the conclusion that terrestrial heat imparts no more value to water as a bathing medium than heat secured through the art of