cheese, but only in the uniformity and quickness of ripening. This slimy whey has been used extensively in Holland, and its use has been increasing rapidly in the last fifteen years. It was a practical application of bacteriology to cheesemaking by a method discovered before it was known that bacteria had any special relation to the matter. It should be stated, however, that in spite of all investigations, at the present time the exact relation of bacteria to the ripening of the Edam cheese is unknown.

Somewhat more is known concerning the relation of micro-organisms to the manufacture and ripening of soft cheeses and semi-soft cheeses. Among the former class are the Limburger, the Camembert, and the Brie types, and among the latter the Roquefort and Gorgonzola. These types of cheese are very popular abroad, and they represent quite a different kind of ripening from that of the better known hard sorts. They represent also, in general, a type of fancy cheese, which has a smaller market than that of the hard cheeses, and which commands a higher price. In the last five years considerable information has been discovered concerning these cheeses. As would be expected by any one who knows the great difference between them, it has been found that they are not ripened by similar agents or under similar conditions. It may be stated, in general, that some of them owe their distinctive characteristic, primarily, to the growth of molds.

This is true of the Roquefort and Gorgonzola, and the English Stilton cheeses. Others of this class owe their characteristics to a combination of a development of molds and bacteria-growing in connection with each other in certain peculiar relations. This is true of the Camembert and the Brie type; others, again, appear to be ripened primarily by the action of bacteria or allied low types of organisms, among which may be placed the Limburger. In these types of cheese the course of the ripening has been so thoroughly studied, and is so well known, that there is no doubt that the primary agents are micro-organisms.

As a practical result of these discoveries the manufacture of soft cheeses is becoming more and more of a scientific process. Up to within a few years their production has not been understood, and it was known that certain types would not be produced equally well in different localities. Many vain attempts have been made to manufacture in the United States some of the soft cheeses common in Europe. The failures have been attributed to all sorts of conditions; but it now seems to be in a large degree due to the fact that the proper micro-organisms are not found in American dairies. At the present time, these organisms are being introduced from their proper localities, and there is beginning in this country, as well as in Europe, a scientific manufacture of the soft cheeses. This industry has not, as yet, been in existence long enough to have demonstrated its possibility as a financial success. It has, however, been shown beyond peradventure that it is perfectly possible to manufacture the soft cheeses in the United States as well as in Europe, using the types of milk, the types of cow, and the climate of this country, and obtaining products identical with and indistinguishable from the best products in Europe, provided the proper micro-organisms can be introduced into the cheese in the proper way.

There seems to be little doubt that future development along these lines will show the possibility and feasibility of an expansion of an industry in America which shall place upon our markets a series of American brands of fancy cheese, and which shall open a new outlet for the dairy products of our farms. Up to the present time, these processes, involving as they do bacteriological knowledge and experience, are too difficult to be undertaken by the average farmer. Beyond much doubt they will in the future extend until the American dairy industry has a possibility of utilizing and developing a large market for the delicate, fancy cheeses so common in Europe. This possibility is dependent solely upon the success with which our bacteriologists can devise practical and feasible methods of handling the desired types of organisms.

From this brief summary it will be seen that there is no phase of the dairy industry that has not been modified and revolutionized by bacterial discoveries. The methods of cooling milk for churning and keeping it, the methods of buttermaking, and now the method of cheesemaking, have all been more or less modified, and some of them totally changed within the last twenty years as a result of the rapid expansion of the knowledge associated with milk bacteria. There has rarely been a more rapid and complete change in any industry than that which has occurred in dairying in the last two decades.

THE DRY DISTILLATION OF BEECH WOOD.

THE proverb "all is fish that comes to my net" does not apply in principle (with the necessary alterations) to the charcoal and wood distillate manufacture. There is wood and wood. Hard wood, for instance—and especially beech and poplar—can be considered as composed practically of only cellulose and water; and the distillates may be considered as only products of the disintegration of the cellulose by the heat; whereas pine and similar soft woods contain, in addition to the cellulose and water, great quantities of turpentine, which is a solution of rosin in terpene. Further, there is less cellulose per cubic foot in the soft wood than in the hard.

Steaming soft wood drives out the water, with it the volatile turpentine; and the rosin is melted out. After this has taken place, the process is about the same as with hard wood; namely, the cellulose is dis-

integrated by dry distillation; except that the rosin that was at first melted out yields rosin oil. It is desirable to recover the turpentine before this period of dry distillation, to prevent any undistilled rosin from going over into the tar. If this be done, there will be some compensation for the lighter yield of charcoal, lime acetate, and wood spirit, as compared with that from hard wood. That is, the object is to get (1) a turpentine free from rosin oil, and (2) a tar free from rosin.

The Usual European Method.—Starting with 100 cubic meters = 3,531.5 cubic feet or 27.6 cords of beech wood, weighing 40,000 kg. = 88,000 lb. avoirdupois, there are obtained 115,000 kg. = 25,300 lb. av. of charcoal, 20,599 kg. = 45,300 lb. av. of raw wood vinegar and tar, and 8,000 kg. = 17,600 lb. av. of gas. The tar is let settle from the vinegar, and there are then obtained 18,500 kg. = 40,700 lb. av. of crude wood vinegar and 20,000 kg. = 44,000 lb. av. of crude tar. The crude vinegar is distilled and the vapors passed through milk of lime; the crude tar is freed from water by distillation and yields

- (a) 400 kg. = 880 lb. av. of crude wood vinegar (which is sent to that obtained in the first place);
- (b) 1,320 kg. = 2,904 lb. av. water-free tar; and
- (c) 80 kg. = 176 lb. av. of light oil, which requires refining.

The two batches of crude vinegar yield together (g) 6 to 10 per cent of retort deposits and 1,800 = 1,980 lb. av. of water-free tar;

- (h) 12,000 kg. = 26,400 lb. av. of 20 per cent lime acetate lye;
- (i) 5,000 kg. = 11,000 lb. av. of 10 per cent crude wood spirit;
- (j) 5,400 kg. = 11,800 lb. av. of steam.

The lime acetate lye is evaporated to 5,000 kg. = 11,000 lb. av., yielding (k) 7,000 kg. = 15,400 lb. av. steam and (l) 5,000 kg. = 11,000 lb. av. of 50 per cent lime acetate.

This latter is then dried by combustion gases, and yields (m) 2,500 kg. = 5,500 lb. av. of steam and (n) 2,500 kg. of gray acetate of lime.

The 40 per cent crude wood spirit is rectified and yields (o) 660 kg. = 1,452 lb. av. of 82 per cent raw spirit.

The American Method.—The American process of distilling hard wood differs from the foregoing as follows: 100 cubic meters = 3,531.5 cubic feet or 27.6 cords of air-dried beech wood, weighing 800 kg. = 1,760 lb. av., are distilled, and deliver (as with the ordinary European process) 11,500 kg. = 25,300 lb. av. of charcoal, 21,500 kg. = 47,300 lb. av. of mixed crude wood vinegar and tar, and 8,000 kg. = 17,600 lb. av. of gases. The vinegar and tar are separated by standing, and yield as before 18,500 kg. = 40,700 lb. av. of crude wood vinegar and 2,000 kg. = 4,400 lb. av. of crude tar.

But from this on the process is somewhat different; as from the 4,400 pounds of crude tar are distilled 400 kg. = 880 lb. av. vinegar, 1,520 kg. = 3,344 lb. av. water-free tar, and 80 kg. = 176 lb. av. of light oils. The 1,520 kg. = 3,344 lb. av. of crude vinegar resulting from the distillation of the crude tar is, after being added to the 18,500 kg. = 40,700 lb. av. of vinegar, distilled, in order to free it from tar; the result being

- (1) 17,100 kg. distilled wood vinegar.
- (2) 1,200 to 1,800 kg. = 2,640 to 3,960 lb. av. of water-free tar.

This latter, being allowed to settle, yields— (3) 17,100 kg. = 37,620 lb. av. of oil-free distilled wood vinegar and

- (4) A quantity of oils.
- The wood vinegar is neutralized with 4,000 kg. = 8,800 lb. of milk of lime; the result being—

- (5) 21,100 kg. = 46,420 lb. av. of lime acetate lye; which by simple distillation is disintegrated into—
- (6) 4,000 kg. = 8,800 lb. av. of 15 per cent wood spirit; and
- (7) 17,100 kg. = 37,620 lb. av. of lime acetate lye.

The wood spirit is rectified and produces— (8) 1,400 kg. = 3,080 lb. av. of 42 volume per cent wood spirit, and

- (9) 2,000 kg. = 4,400 lb. av. of water and oils.
- The lime acetate lye is filtered and evaporated by steam to—
- (10) 12,100 kg. = 26,620 lb. av. of steam and
- (11) 5,000 kg. = 11,000 lb. av. of 50 per cent gray lime acetate.

This latter is by means of combustion gases further evaporated, yielding—

- (12) 2,500 kg. = 5,500 lb. av. of steam and
- (13) 2,500 kg. = 5,500 lb. av. of bone-dry gray lime acetate.

There are required by the old European process 43,040 kg. = 94,688 lb. av. of steam and 9,360 kg. = 20,592 lb. av. of charcoal; by the present American system, 57,240 kg. = 125,928 lb. av. of steam and 11,154 kg. = 24,539 lb. av. of charcoal.

The New European Process.—By the new process, as commenced in Europe, the following shows the course of the materials and the results therefrom:

100 cubic meters = 3,531.5 cubic feet or 27.6 cords of beech wood delivered by dry distillation.

- (A) 11,500 kg. = 25,300 lb. av. of charcoal.
- (B) 17,100 kg. = 37,620 lb. av. of clear wood vinegar.
- (C) 3,320 kg. = 7,304 lb. av. of water-free tar.
- (D) 80 kg. = 176 lb. av. of light oils.
- (E) 8,000 kg. = 17,600 lb. av. of gases.

The clear wood vinegar is neutralized with milk of lime, then deprived of its spirit by distillation; yielding—

(F) Crude wood spirit of 80 to 90 per cent, and

(G) An alcohol-free solution of acetate of lime.

This latter being evaporated and dried as in the other process, yields gray acetate of lime of 80 to 82 per cent strength.

There are required 12,400 kg. = 27,280 lb. av. of steam and 6,000 kg. = 13,200 lb. av. of coal.

Fuel Consumption.—By this process, instead of there being used 186 kg. = 409 lb. av. of coal (80 kg. = 176 pounds under the retorts and 106 kg. = 233 lb. av. under the boilers) per cubic meter of wood, there are needed only 120 kg. = 264 lb. av.; of which 89 kg. = 196 lb. av. are used under the retorts, and 31 kg. = 68 lb. av. under the boilers; or a saving of coal of 35 per cent.

One of the principal advantages of the new system is the employment of much larger retorts, holding from 10 to 25 cubic meters = 353 to 883 cubic feet, or 2.77 to 6.43 cords, instead of as formerly 1.2 to 1.5 cubic meters = 42.4 to 53.0 cubic feet = 0.331 to 0.414 cord each.

GREEK EYESIGHT.

By DR. CHARLES W. SUPER.

THE Greeks looked upon the external world with emotions very different from the moderns. Let us inquire what means they possessed, if any, for strengthening the sight or aiding defective vision. The problem has been a good deal discussed. Those who believe that some sort of apparatus corresponding to modern eye-glasses has been in use from almost time immemorial rely chiefly upon inference, since hardly any direct evidence is forthcoming. It is held by some investigators that the very large number of seal rings and seal cylinders, both intaglios and cameos, dating from the remotest times found in the Babylonian tombs, must be accepted as proof positive that the art of cutting the hardest precious and other stones was a regular business in that part of the world, and that this could not have been carried on without some kind of magnifying lenses. That work of this sort could be performed only by persons of exceptionally keen eyesight is beyond question: the inference drawn from modern experience is logical. Yet in the absence of objects which might reasonably be expected to be forthcoming, we are constrained to render the verdict "not proven." So far as we have direct testimony, it is all adverse, if the expression be admissible. It is generally held that the first mention of magnifying glasses is found in an Arab writer of the eleventh century. Roger Bacon speaks of glasses that correct refraction. The epitaph of a certain Salvinus Armatus in Florence names him as the inventor of spectacles, although it is also said of the monk Alexander of Spina, that he made use of eyeglasses. In the year 1488 makers of spectacles are mentioned in Nuremberg. There is a passage in Scott's "Quentin Durward" that represents Lord Crawford with spectacles on his nose, and the remark is added that the invention was recent. That artificial aids to sight are modern is also rendered probable from the lack of a word inherited from antiquity to designate the apparatus. The English word "spectacle" is still used in a sense that differs but little from its Latin parent: it is something to look at, a stage-play, then the theater itself. But the earliest English "spectacle" is used for spy-glass. It is thence probable that our plural "spectacles" originally meant a pair of spy-glasses, a sort of anticipated binocular. The French *spectacle* still has its original Latin meaning, the form of the word being but slightly changed. On the other hand, in the German and Scandinavian languages, *Spektakel* is equivalent to what we call a "rumpus." But *Brille* (spectacles) is from beryllus, the Latin name of a transparent stone. The French *besicles* also point to beryl. *Bericle* is an earlier form of *besicle* for "besiculum," a little beryl. In some of the French dialects the first syllable *ber-* is still preserved, but the Parisian word for spectacles is *besicles*, in which the original *r* has been changed to *s*, according to a phonetic law traceable in other words also. The Spaniards, Italians, and Russians have each a native word to designate this article of common use. —Popular Science Monthly.

New and exceptional minerals from Ceylon have recently been exhibited at the Royal Society. These were found during the course of the Mineral Survey of Ceylon now in progress in connection with the Imperial Institute, where the composition of these materials is being investigated. (a) Zirkelite. A rare mineral containing the oxides of titanium and zirconium together with variable proportions of other oxides. Three varieties are shown: (1) containing 20 per cent of thorium and 1 per cent of uranium oxide; (2) containing 8 per cent of thorium and from 2 to 5 per cent of uranium oxide; (3) containing traces of thorium and 15 per cent of uranium oxide. The crystals, which belong to the hexagonal system, differ also in specific gravity. An account of these varieties of zirkelite will shortly be communicated to the Royal Society. In exhibiting variation in the proportions of thorium and uranium the zirkelite of Ceylon shows the same peculiarities as thorianite. (b) Baddeleyite. Notable as a definitely crystalline form of this mineral. Some crystals exhibit twinning, others are untwinned. The mineral is essentially oxide of zirconium. (c) Thorite. Notable as an anhydrous form of the mineral with the high specific gravity of 6. Essentially a silicate of thorium, containing 74 per cent of thorium. (d) Monazite. Consists mainly of phosphates of the cerium metals, notable in containing variable and unusually high percentages of thorium. The three specimens shown contain 10, 15, and 28 per cent of thorium respectively.