Making the Test.

Sampling the Milk. Every precaution should be taken to have the sample represent as nearly as possible the whole lot of milk from which it is taken. Milk fresh from the cow, while still warm, and before the cream has separated in a layer, may be thoroughly mixed by pouring three or four times from one vessel to another. Samples taken at once from milk mixed in this way are the most satisfactory of any. Milk that has stood until a layer of cream has formed should be poured more times, until the cream is thoroughly broken up and the whole appears homogeneous. No clots of cream should appear upon the surface when the milk is left quiet for a moment. With proper care any milk that has not coagulated or that has not been exposed to the air until the surface of the cream has become dried, may be mixed so that a representative sample may be taken. Milk should not be poured more times than is necessary, as continual mixing in this way is liable to churn the cream, forming little granules of butter that quickly rise to the surface. When this occurs it is impossible to obtain a fair sample. Milk is sometimes churned by being transported long distances in vessels that are not full. When this occurs it is useless to make an examination.

It is impracticable to sample a large amount of sour milk, but a small sample of a pint to a quart may be thoroughly mixed by adding five per cent. of strong ammonia water which will dissolve the curd and permit a uniform mixture being made. When ammonia is added the final results should be increased by five per cent. Samples from sour milk are, however, never as satisfactory as those taken when the milk is in a proper condition.

Measuring the Milk. When the milk has been sufficiently mixed, the milk pipette is filled by placing its lower end in the milk and sucking at the upper end until the milk rises above the mark on the stem; then remove the pipette from the mouth and quickly close the tube at the upper end by firmly pressing the end of the index finger upon it to prevent access of air; so long as this is done the milk cannot
flow from the pipette. Holding the pipette in a perpendicular position, with the mark on a level with the eye, carefully relieve the pressure on the finger so as to admit air slowly to the space above the milk. When the upper surface of the milk coincides with the mark upon the stem, the pressure should be renewed to stop the flow of milk. Next, place the point of the pipette in the mouth of one of the test bottles, held in a slightly inclined position so that the milk will flow down the side of the tube leaving a space for the air to escape without clogging the neck, and remove the finger allowing the milk to flow into the bottle. After waiting a short time for the pipette to drain, blow into the upper end to expel the milk held by capillary attraction in the point. If the pipette is not dry when used, it should be filled with the milk to be tested, and this thrown away before taking the test sample. If several samples of the same milk are taken for comparison, the milk should be poured once from one vessel to another after each sample is measured. Neglect of this precaution may make a perceptible difference in the results, through the separation of cream, especially when the milk examined is rich.

Persons who have had no experience in the use of a pipette will do well to practice a short time by measuring water into a test bottle before attempting to make an analysis. The manipulation is easily acquired, and with a little practice milk may be measured nearly as rapidly with a pipette as with a graduate, and with much greater accuracy.

Adding the Acid.—When the milk has been measured into the test bottles the necessary amount of sulphuric acid may be added immediately, or the bottles may be left for a day or two without materially changing the results; samples that have remained in the test bottles more than a week have given the same amount of fat as samples tested immediately after being measured. If the milk has become coagulated, the curd should be broken up by shaking the test bottle before the acid is added.

The volume of commercial sulphuric acid required for a test is approximately the same as that of the milk, 17.5 c. c. for the ordinary test. If too little acid is added, the casein
is not all held in solution throughout the test, and an imperfect separation of the fat results. If too much acid is used, the fat itself is attacked. The acid need not be measured with great accuracy, any quantity between 17 c. c. and 18 c. c. will answer the purpose.

Great care must be taken in handling the acid to avoid getting any of it upon the skin or clothing, as it is very corrosive. If by accident any is spilled upon the hands or clothes, it should be washed off immediately, using plenty of water. A prompt application of ammonia water to clothing upon which acid is spilled may prevent the destruction of the fabric, and restore the color.

When all of the samples of milk to be tested are measured ready for the test, the acid measure is filled to the 17.5 c. c. mark with sulphuric acid, and from this it is carefully poured into a test bottle, containing milk, that is held in a slightly inclined position for reasons given in directions for measuring the milk. The acid being much heavier than milk sinks directly to the bottom of the test bottle without mixing with the milk that floats upon it. The acid and milk should be thoroughly mixed together by gently shaking with a rotary motion. At first there is a precipitation of curd from the milk, but this rapidly dissolves. There is a large amount of heat evolved by the chemical action, and the solution, at first nearly colorless, soon changes to a very dark brown, owing to the charring of the milk sugar and perhaps some other constituents of the milk.

Upon standing a short time the fat begins to collect upon the surface, not in a clear layer, but having at first, the appearance of a dirty cream. The separation of fat by gravity alone is not complete even when the bottles are left standing for several hours; with the centrifuge, however, a perfect separation is accomplished in a few minutes.

*Whirling the Bottles.* The test bottles containing the mixture of milk and acid may be placed in the machine directly after the acid is added, or they may stand several hours without harm. An even number of bottles should be whirled at the same time, and they should be placed in the wheel in pairs opposite to each other, so that the equilibrium
of the apparatus will not be disturbed. When all of the test bottles are placed in the apparatus, the cover is placed upon the copper jacket, and the machine is turned either by hand or by power at such a rate that the wheel carrying the bottles will make from 600 to 800 revolutions per minute, and this motion must be kept up for six or seven minutes. If this wheel is less than about twenty inches in diameter the speed should be greater, or else the whirling should be continued for a longer time.

When the bottles are placed in the machine directly after the acid is added, the separation may be affected without any extra heat, as that caused by the chemical action is sufficient to keep the fat liquid. If the bottles have stood after the acid is added until the contents are cooled below 100° F., the water in the tank should be warmed to about 200° F. before putting the bottles in the machine. The bottles should not be kept heated in the machine as high as the boiling point of water while the separation is being effected. The proper degree of heat may be obtained by lighting the burner or kerosine stove under the jacket when the machine is started; so much water having been poured into the jacket as will be just heated to boiling when the whirling is finished. In this way hot water is always available for filling the tubes at the proper time. In creameries, heat can be most easily supplied by steam connection with the boiler. If the machine is stopped after about six minutes, a layer of fat will be found upon the upper surface of the liquid in the tubes. This fat will not usually be clear; this however, will make no difference in the result, as the subsequent treatment will clarify it.

As soon as the bottles have been sufficiently whirled, they should be filled to the neck with hot water. This is most conveniently done by placing a vessel containing boiling water above the machine, and by means of a syphion, made from a small rubber tube with a glass tip, run the water directly into the bottles without removing them from the wheel. The flow of water can be perfectly controlled by a pinch-cock upon the rubber tube. If only a few tests are to be made, the bottles may be easily filled with a pipette, or by
pouring from a graduate. The cover should then be re-
placed and the machine turned for one or two minutes,
after which more hot water is added, filling the tube to about
the seven per cent. mark. The fat will slowly rise into the
graduated tube, losing its cloudy appearance as it passes
through the hot water. When all of the bottles are filled,
the cover is put upon the tank, and the machine again
turned for a short time. During this time the water in the
tank should be kept hot, either by placing a lamp or kero-
sene stove beneath it, or by pouring in a quantity of boiling
hot water before starting the machine. If the fat in some
of the tubes still has a cloudy appearance, the cover should
be placed upon the tank and heat applied for a few min-
utes, when the fat should become clear and in condition to
be measured. The clearing may be hastened by whirling
the tubes while hot. When the bottles are allowed to cool
off to a point where the fat will crystallize and then warmed
again, the fat will usually be much clearer than before, but
as this does not materially change the volume of fat it is
considered unnecessary. Even a slight cloudy appearance
does no harm.

Measuring the Fat. The fat when measured should be
warm enough to flow readily, so that the line between the
acid liquid and the column of fat will quickly assume a hori-
izontal position when the bottle is removed from the ma-
chine. Any temperature between 110° F. and 150° F. will
answer, but the higher temperature is to be preferred. The
slight difference in the volume of fat due to this difference
in temperature is not sufficient to materially affect results.
A difference in temperature of 40° F. will make less than
one-tenth per cent. difference in milk containing five per
cent. of fat. To measure the fat, take a bottle from its
socket, and holding it in a perpendicular position with the
scale, on a level with the eye, observe the divisions which
mark the highest and lowest limits of the fat. The differ-
eence between these gives the per cent. of fat directly. The
reading can easily be taken to half divisions or to one-tenth
per cent.

If the column of fat is less than about one division, as will