KANSAS STATE AGRICULTURAL COLLEGE.

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DAIRY DEPARTMENT.

Dairy Farming.

O. E. REED.

ADVANTAGES OF DAIRYING.

A farm used for dairy purposes does not need to lose in fertility, but can gain, and may be used for dairying almost indefinitely. On a well-managed dairy farm practically all the feed grown is marketed through the cow. Concentrated protein feeding-stuffs, such as bran and oil meal, are usually purchased to balance the ration, These feeds contain a high percentage of fertilizing ingredients, and the manure from the cows consuming such feeds is very rich in plant food.

The first method of farming practiced in a newly settled country is grain farming. This is continued until the land becomes high priced and the fertility of the soil is decreased, when dairying usually comes into practice. In grain farming, the land is cropped year after year, and these crops are sold off the land. In live-stock or dairy farming, the crops are harvested and fed to the animals, and the income is obtained by selling the animals or their products.

Selling grain and other crops from the farm means selling soil fertility or plant food. No soil can grow crops year after year without sooner or later reaching the point where this depletion is felt. When animals and milk products are sold from the farm only a small portion of the plant food of the entire crop is sold. The greatest part of the plant food is left behind in the form of barnyard manure, and this may be returned to the soil. This is very clear when we compare the

amount of plant food that is sold in milk and dairy products with that contained in the ordinary farm crops, as shown in the following table:

1 ton of butter contains 50 cents' worth of plant food.
1 ton of milk contains $2.09 worth of plant food.
1 ton of wheat contains $7.75 worth of plant food.
1 ton of oats contains $7.26 worth of plant food.
1 ton of corn contains $6.75 worth of plant food.
1 ton of clover hay contains $9.07 worth of plant food.
1 ton of alfalfa contains $9.50 worth of plant food.

In some of the eastern states of the United States land became so unproductive, as a result of grain farming, that the owners abandoned their farms. During the more recent years

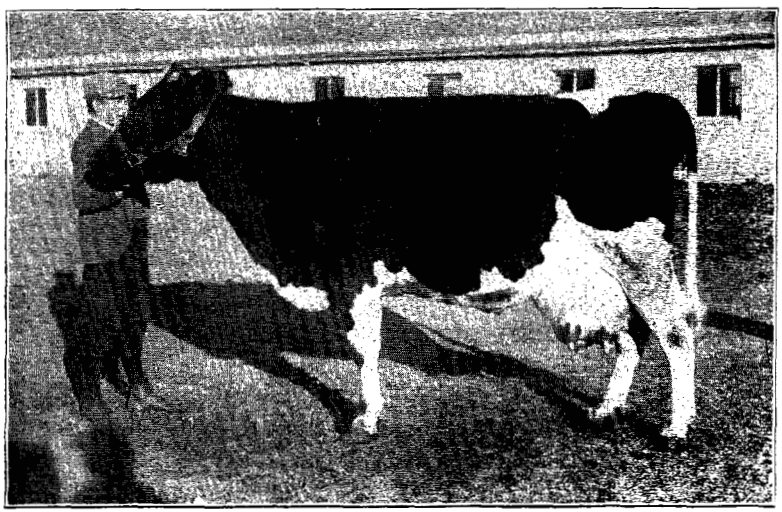

PLATE No. 1.—Maid Henry, Holstein cow, owned by the Kansas State Agricultural College. Record for one year, 19,600 pounds of milk, 887 pounds of butter.

attention has been directed to these farms, and some of them are now yielding large crops. This change from an unproductive to a productive state has been brought about largely through the use of the dairy cow. On these farms hay and concentrated feeds have been purchased and fed, and in this way the fertility of other soils has been and is now being used to build them up. These same conditions exist in other countries. Much of Europe has gone through this period of soil depletion, and has taken up dairying, until now in Germany, Denmark and Holland, where cows are handled extensively, the land is producing larger crops than it did thirty years ago.

In many parts of Kansas the soil contains a sufficient quantity of plant food, but it is so devoid of humus, or vegetable matter, that the plant food is not available. Soil lacking in vegetable matter will not retain water and packs and bakes after rains. Such a soil is called a poor soil. By rotation of crops, by marketing the crops grown through dairy cows or other live stock, and by using the manure, it is possible to add humus to the soil and thus to render it more productive.

The dairy cow is an economical producer of human food. No other animal can produce the same quantity of digestible food as economically as can the cow. The following table shows the comparative production of food of a cow and of a steer:

A Dairy Cow vs. a Steer as a Producer of Human Food.

	Yearly production of Maid Henry.	Prime steer,* weight 1250 lbs.
Proteids	686 lbs. solids.	172
Fat	716 " "	332
Sugar	932 " "	...
Ash	137 " "	43
Total	2,471	547

Maid Henry produced nearly five times as much total solids as did this prime two-year-old steer. The total solids produced by the cow are all edible, while the total solids of the carcass include the entire body, a great deal of which can not be used for food.

Because of this economy of production, the cow is adapted to high-priced lands and can utilize high-priced feed to advantage. That dairying is adapted to the high-priced land is shown by illustrations from European countries. Land on the Island of Jersey, which is the home of the Jersey cow, rents for from $50 to $80 per acre. Land in Holland is valued at $1000 per acre, and the chief agricultural pursuit is caring for and handling the Holstein cow and her products.

Dairying furnishes immediate and constant returns. A man with small capital can invest his money in a dairy cow and soon begin to realize on his investment. The prices of milk and butter fat are never subject to any great fluctuations, but are more steady and uniform than the price of many other commodities.

* University of Missouri.

Keeping dairy cows on the farm furnishes employment the year round and in many sections this enables one to get the better class of farm labor. The best farm hands prefer to work during the entire year, and they can usually find work around the dairy.

THE DAIRY HERD.

The first essential for profitable dairying is good cows. The profitable dairy cow is one that will make the maximum production on the minimum quantity of food. The most profit can be made from special-purpose dairy cattle. A

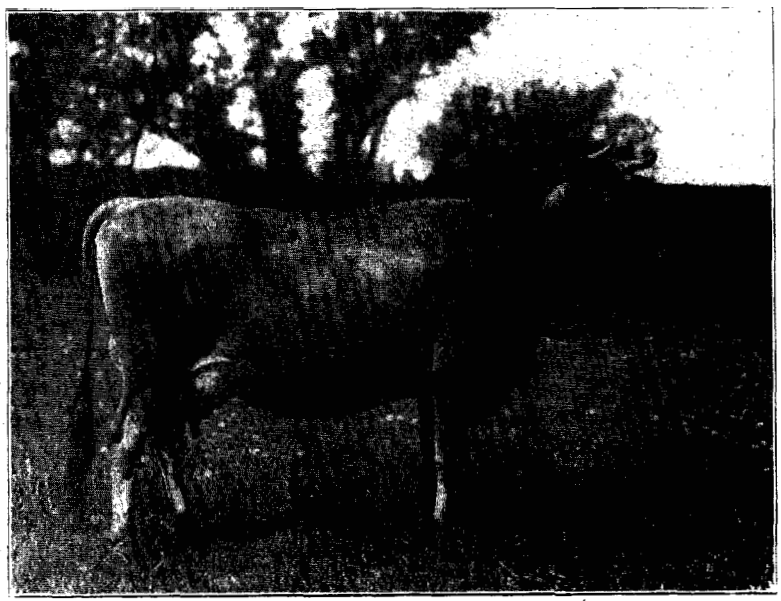

PLATE No. 2.—The Owl's Design, Jersey cow, owned by the Kansas State Agricultural College. Record for one year, 14,606 pounds of milk, 765 pounds of butter.

number of special dairy breeds have been developed by careful breeding and selection, covering periods of from 100 to 2000 years. Very often good milk cows are found among ordinary herds of scrub cattle, or among the beef breeds, but the great objection to such cows is that they do not always transmit their milking qualities to their offspring,

BREEDS OF DAIRY CATTLE.

The following named breeds are now classified as dairy cattle: Jerseys, Guernseys, Ayrshires, Holsteins, Brown Swiss, Dutch Belted and Milking Shorthorns.

Jerseys. The Jersey is, perhaps, the most popular breed of dairy cattle in the United States. More cattle of this breed have been registered than of any other. The Jersey is small in size. The cows weigh from 800 to 1000 pounds, when mature. The native home of this breed is Jersey Island, the largest in the group of the Channel Islands, lying between England and France. The majority of the animals are of solid yellow or gray-fawn color with a black nose, black tongue and switch of solid black. There are a great many broken-colored Jerseys, the bodies of which are some color of fawn with white spots. The milk of the Jersey is very rich in butter fat, the average test for the breed being about 5.2 per cent. It has a high color and is easily churned. The color and richness of her milk makes the Jersey a great favorite as a family cow. The cows of this breed are very economical producers of butter fat.

PLATE No. 3.—Bernice Countess 2d, Guernsey cow, owned by the Kansas State Agricultural College. Record for one year, 9942 pounds of milk, 614 pounds of butter.

Guernseys. The Guernsey breed had its origin on the Island of Guernsey, \$he second largest island in the Channel Island group. Cows of this breed are somewhat larger than the Jerseys, averaging about 1000 pounds in live weight. The characteristics of the Guernsey are somewhat similar to those of the Jersey. In color the Guernsey may be either a solid lemon, orange fawn, or fawn with white markings,

never gray or black. The nose is buff color, and the tongue and switch are generally white. The milk of this breed is not quite as rich as that of the Jersey, but there is a little more of it. The milk is especially noted for its extreme yellow color, and the butter made from it at any time of the year has a good yellow color. The average milk contains about 4.9 per cent butter fat.

Ayrshires. The native home of the Ayrshire is the county of Ayr, Scotland. The cattle of this breed are very strong and thrifty. They rank between the Jersey and Holstein in size. The cows average about 1000 pounds in live weight. In color

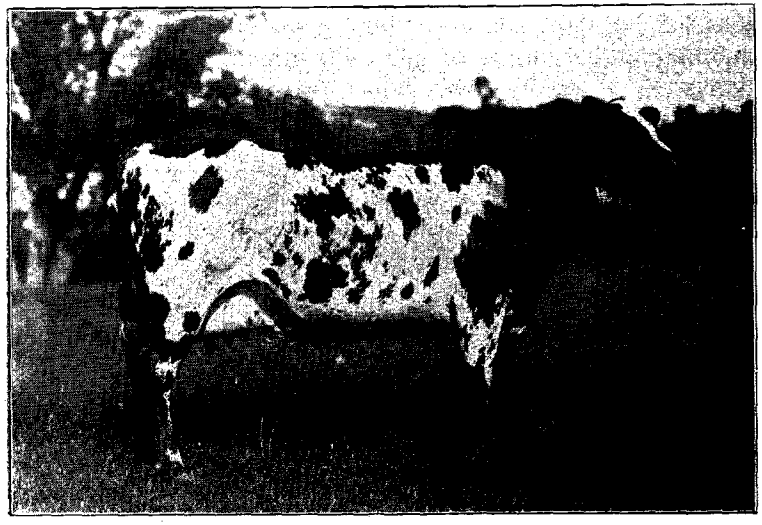

PLATE No. 4.—Elizabeth of Juneau, Ayrshire cow, owned by the Kansas State Agricultural College. Record for one year, 15,122 pounds of milk, 631 pounds of butter.

they may be either a dark red and white or light red and white. The red color in the bulls often deepens into mahogany. The color of the Ayrshire gives her an advantage over the other breeds when fattened and sold for beef, as there is still a general prejudice among stock buyers against the dairy breeds for beef, especially against the Jerseys and Guernseys. In form the Ayrshire does not; show the extreme angular dairy type exhibited by high-class Jerseys or Holsteins. They are somewhat smoother over the shoulders, back and hips, and show slightly more of the beef type, especially in the rear quarters. The Ayrshire cow is especially noted for her sym-

metrical udder. The milk has an average composition of 3.89 per cent butter fat, which adapts this breed to the production of market milk. These cattle are excellent rustlers, good breeders, and the calves are very strong and healthy.

Holsteins. This breed originated in Holland and has been bred in this region for at least two thousand years. During this time there has been very little if any mixing with outside blood. Since ancient times, Holland has been noted for its butter, cheese, and immense oxen. The Holsteins are the largest of the dairy-bred cattle. The average weight of the mature cow is 1200 pounds or more, but individual cows often weigh 1400 or more. The color markings are black and white. As a rule the breeders prefer animals on which the colors are evenly divided. The cows have good dispositions and are not easily frightened at any sudden disturbance.

As milk producers Holstein cows are unexcelled. They produce more milk and at a less cost per 100 pounds than any other breed. The milk is not very rich, averaging about 3.5 per cent butter fat. As beef producers this breed ranks high for a dairy breed. The calves are large at birth, grow rapidly, and make excellent veal. The Holstein is well adapted for supplying milk for cities or factories on account of the high yield and low average per cent of butter fat.

Brown Swiss. The Brown Swiss, as they are known in America, represent one of the leading breeds. It has been developed in Switzerland, and is probably one of the oldest breeds known. In its native land it is classed as a dual-purpose breed and formerly showed both as a beef and a dairy breed in America, but is now classed as a dairy breed. The cows weigh from 1200 to 1400 pounds and the bulls often weigh more than a ton. The color is brown to silver gray, resembling the color of some families in the Jersey breed. The cows give a good flow of milk, containing about 3.7 per cent of butter fat.

Dutch Belted. This oddly colored breed had its origin in North Holland and its development is considered a remarkable accomplishment in the way of breeding. In size the cattle rank with the Ayrshires but the general conformation is more like that of the Holstein. These cows weigh from 1000 to 1300 pounds. Their most distinctive characteristic is the presence of the white belt around the body. This belt extends around the body from just behind the shoulders to just in front of the

hips. Cows of this breed are reputed to be fairly good milkers. The milk contains about 3.5 per cent of butter fat.

Milking Shorthorns. In the development of the Shorthorn breed several noted breeders placed considerable stress on the milking qualities of the animals kept in their herds. In this way several families of the breed have become famous as milk producers. An effort has been made by many breeders to develop a dual-purpose Shorthorn-one that would have superior dairy and beef qualities combined. So far very little has been accomplished. All Shorthorn cows producing large quantities of milk conform very closely to the dairy type shown by large breeds of dairy cattle. Their calves sell for a better price for beef than calves of the strictly dairy breeds, chiefly because of their color. It is very difficult to find any number of good Shorthorn milk cows that will transmit their milking qualities with any degree of certainty. A number of cows have made records of production of over 600 pounds of butter fat, but such cows are the exception rather than the rule. The Shorthorn cattle were developed in northeastern England, especially along the River Tees, and formerly were known as Tees Water cattle. The exact origin is not known but their development began early in the eighteenth century. In England to-day Shorthorns of the nonpedigreed type furnish a large per cent of the dairy products used. The milk of the Shorthorn contains from 3.5 to 4 per cent of butter fat and resembles the milk of the Holstein in color. Mature cows weigh from 1200 to 1400 pounds. The predominating color of this breed is red or red and white, but it may be roan or white.

BREEDS COMPARED.

In a comparison and classification of the four principal breeds of dairy cattle, they rank as follows:

With reference to amount of milk produced: Holstein, Aryshire, Guernsey, Jersey.

With reference to richness of milk produced : Jersey, Guernsey, Ayrshire, Holstein.

With reference to yellow color of milk: Guernsey, Jersey, Ayrshire, Holstein.

With reference to size : Holstein, Ayrshire, Guernsey, Jersey.

With reference to early maturing qualities: Jersey, Guernsey, Ayrshire, Holstein.

With reference to the amount of butter fat produced, there is very little difference between the breeds. There is more difference between individual cows of the same breed than between the breeds. Individual cows of the Jersey, Guernsey, Holstein, Ayrshire and Brown Swiss breeds have made over 1000 pounds of butter in one year.

Following is the name and yearly record of the cow holding the highest butter fat record of the breed she represents:

	Pounds milk.	Pounds fat.
Guernsey—May Rilma	19,673	1,073.4
Holstein—Banostine Bell DeKol	27,404.4	1,058.3
Jersey—Sophie 19th of Hood Farm	17,557	999
Ayrshire—Aucherbrain Brown Kate 4th	23,022	917.6
Brown Swiss—College Bravura 2d	19,460.6	798.2

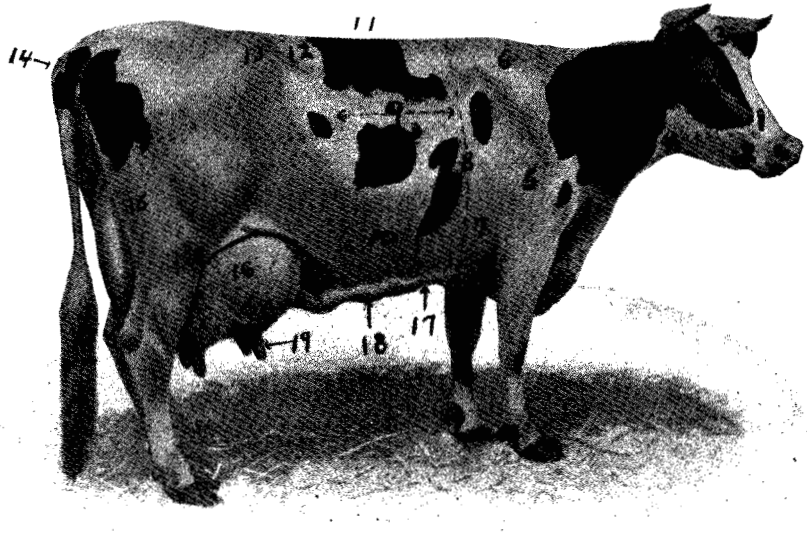

PLATE No. 5.—Location of points on cow.

1. Face.
2. Muzzle.
3. Forehead.
4. Neck.
5. Shoulder.
6. Withers.
7. Chest.
8. Heart girth.
9. Ribs.
10. Barrel.
11. Back.
12. Loin.
13. Hips.
14. Pin bones.
15. Thigh.
16. Udder.
17. Milk wells.
18. Milk veins.
19. Teats.

SELECTION OF THE DAIRY COW.

In starting a dairy herd the first thing to consider is the selection of the cows. There are two methods which can be used. The first is selection by conformation or type of the

cow; the second is the selection of cows according to records of milk production. The first method is the one most generally used. The second method can not be followed very extensively, because only a small per cent of the cows have records.

SCALE OF POINTS FOR DAIRY CATTLE.

	Possible score.
GENERAL APPEARANCE, 18:	
1. *Form*—Inclined to be wedge-shaped	6
2. *Quality*—Hair fine, soft; skin mellow, loose, medium thickness; secretion yellow; bone clean, fine	6
3. *Temperament*—Nervous, indicated by lean appearance when in milk	6
HEAD AND NECK, 7:	
4. *Muzzle*—Clean cut; mouth large; nostrils large	1
5. *Eyes*—Large, bright, full, mild	1
6. *Face*—Lean, long; quiet expression	1
7. *Forehead*—Broad	1
8. *Ears*—Medium size, yellow inside, fine texture	1
9. *Horns*—Fine texture, waxy	1
10. *Neck*—Fine, medium length; throat clean; light dewlap	1
FORE QUARTERS, 5:	
11. *Withers*—Lean, thin	1
12. *Shoulders*—Light, oblique	2
13. *Legs*—Straight, short; shank fine	2
BODY, 26:	
14. *Chest*—Deep, low; girth large, with full fore flank	10
15. *Barrel*—Ribs broad, long, wide apart; large stomach	10
16. *Back*—Lean, straight, open-jointed	2
17. *Loin*—Broad	2
18. *Navel*—Large	2
HIND QUARTERS, 44:	
19. *Hips*—Far apart, level	2
20. *Rump*—Long, wide	2
21. *Pin Bones or Thurls*—High, wide apart	1
22. *Tail*—Long, slim; fine hair in switch	1
23. *Thighs*—Thin, long	4
24. *Udder*—Long, attached high and full behind, extending far in front and full, flexible; quarters even and free from fleshiness	22
25. *Teats*—Large, evenly placed	5
26. *Mammary Veins*—Large, long, tortuous, branched, with double extensions; large and numerous milk wells	5
27. *Legs*—Sraight; shank fine	2
Total	100

Selection by Type or Conformation. There is no doubt that there is a certain type or form that is associated with large milk production, and in conformation the dairy cow is quite the opposite of the beef animal. The dairy cow is angular, spare in flesh, and is usually referred to as being wedge-shaped, while the beef animal has a square, blocky form. The score card given below may be used somewhat as a guide in selecting cows. It shows the relative importance of the different parts of the body.

General Appearance of the Cow. The first impression one gets when viewing a high-producing cow, or a photograph of a high producer, is the marked angularity and thin, loose-jointed, appearance. The thin appearance is not a condition caused by lack of feed, but the animal is well-muscled and neat, with the hair and skin in good, healthy condition. The angular conformation is best described by the term wedge-shaped. The dairy cow has three wedges. A wedge is noticed when the cow is viewed from the front, from the side, and also from above. The first wedge mentioned is formed by the withers being sharp at the top and the chest being wide at the base. The depth through the rear part of the barrel and udder tapering to the neck and head forms the wedge as viewed from the side. The wedge, as seen from above, is formed by the extreme width through the hips gradually tapering to the sharp withers. The wedge shape is not extremely pronounced in all dairy cows but is usually found in the best animals.

Quality. The dairy cow should have plenty of quality. High production of milk and butter fat is associated with this characteristic. Quality is indicated by fine hair, soft, loose, mellow skin of medium thickness, and a fine, clean bone. Dairy temperament is another essential, By this is meant the ability to convert the feed into milk, and it is indicated by a good nervous system well under control. A cow may have a good nervous system, yet not have the dairy temperament, on account of the nervous system not being under control. A good nervous system is indicated by a neat, refined appearance, spareness in flesh when in milk, and a large, full, mild eye. The dairy cow should be healthy and in good condition; should be spare in flesh while in milk; but may be allowed to carry considerable flesh when not giving milk.

The Head. The head should be clean cut, of medium length, quiet expression, and of feminine appearance. The eye should be large, bright and full. A mild expression in the eyes indicates a good disposition. The forehead should be slightly dished and broad. The jaw should be strong and wide, tapering somewhat to a strong, broad muzzle. A good-sized muzzle and strong jaw are indications of a good feeder. The ears should be of medium length, good texture and fine quality, with an abundance of orange or yellow color inside. This color is believed to indicate the richness of the milk. The neck of the cow should be moderately long, thin and muscular, with clean throat and light dewlap. The neck of the typical dairy cow does not join the body as neatly as does the neck of the beef animal, but is long, lean and free from fleshiness.

Body. The heart girth should be large, indicating lung and heart capacity. The back should be long, strong and loose jointed, but not necessarily straight. The ribs should be long, wide and far apart. The abdomen or barrel should be long, wide and deep, especially just in front of the udder. A cow must have capacity of barrel to be able to handle large amounts of food. Often a cow will not show a great depth of barrel but may have a large capacity for food by having a greater width of barrel and wide spring of ribs. A strong jaw, keen eye, large muzzle and capacious barrel are the indications of ability to consume and digest large quantities of food, which is necessary for high production. The loin should be broad and strong, with roomy coupling.

Hind Quarters. The hind quarters should show the leanness characteristic of other parts of the body. The hips should be far apart, prominent and level with the back. The rump should be long and wide with a roomy pelvis; the pin bones high and wide apart. Such a conformation of this region affords plenty of room for the generative organs and reproduction. The thighs should be long, thin and wide apart, with plenty of room for the udder. The legs should be fine, straight and far apart.

Udder. The udder of the cow is one of the most essential organs, and is largely used as a determining factor of the ability of the cow as a producer, The udder should be capacious, free from flesh and when empty should be soft and flexible. Capacity of the udder should be gained by length and

width rather than depth. It should be attached to the body high behind and far forward toward the naval and show plenty of width throughout. This conformation permits of more surface for the blood vessels to spread over as they pass through the udder. The udder is the milk factory, where the nutrients are taken from the blood and made over into milk. By some unknown process, in the udder the food materials taken from the blood are changed to the substances found in the milk. The milk veins serve as an index to the amount of blood that flows through the udder. These veins carry the blood from the udder back to the heart. They can be noticed leading from the four quarters of the udder and running forward just underneath the skin and entering the abdomen near the center of the body. The milk wells, through which the milk veins enter the body, should be large. There may be more than one milk well on each side of the body. In some cases, the milk veins branch as they leave the udder and enter the body in several places. Cows have been known to have as many as five milk wells on each side, and it is not uncommon to find cows with two or three milk wells on each side of the body. The quarters of the udder should be even in size and not cut up; but the base or sole of the udder should be flat. The teats should be even, of good size for milking conveniently, and set squarely on each quarter of the udder. The hair on the udder should be fine and soft, indicating quality.

KEEPING RECORDS OF THE COWS.

After one has a herd there is no excuse for not knowing the records of each animal in it, for this is the only sure way of selecting profitable cows. A cow may score very high, according to the score card, and still not be a very profitable producer. By selecting cows on their records, discarding the unprofitable ones, using good sires and raising heifer calves from the best cows, one is sure to increase the productiveness of the herd.

In keeping records of the cows one must consider the disposition made of the milk and keep the records necessary to figure the profits or the loss of the product sold. One who sells milk, either wholesale or retail, regardless of the fat content, need only keep a record of the amount of milk produced and feed consumed. When the product is sold as

KANSAS STATE AGRICULTURAL COLLEGE.
DEPARTMENT OF DAIRY HUSBANDRY.

MILK RECORD. For the Month ending _____ 191__

NAME OR NUMBER OF COWS.

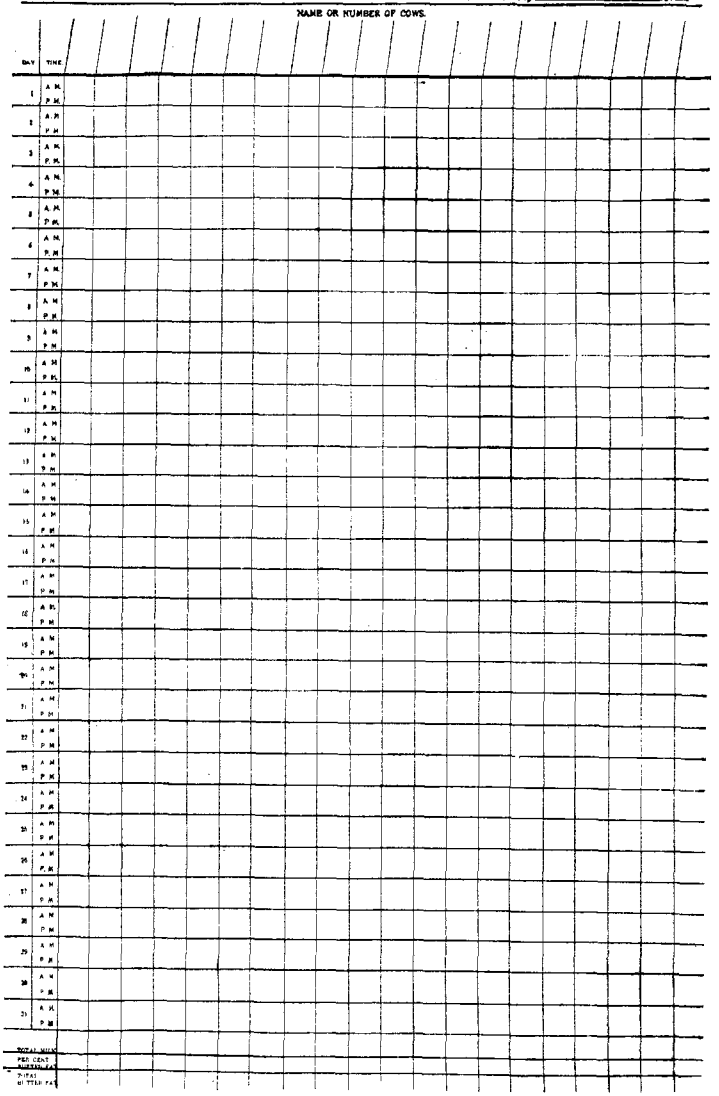

PLATE No. 6.—Milk record chart.

cream and payment made on a butter-fat basis, or where butter is sold, a record should be kept of the butter-fat production.

The best method to follow in keeping such a record is to weigh the milk at each milking and test the milk at regular intervals with the Babcock tester. In this way the actual record of each cow's production can be ascertained. This information will also be of value in the feeding of the herd.

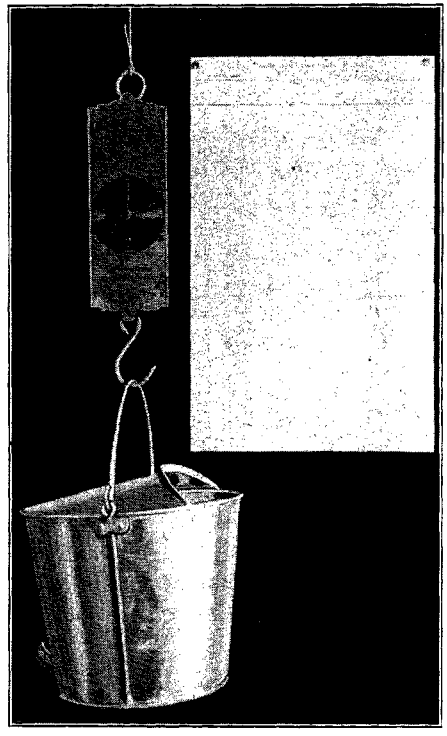

PLATE No. 7.—Complete outfit for keeping milk records.

Milk record sheets may be obtained by writing the Dairy Department, Kansas State Agricultural College. Babcock testing outfit may be obtained from any firm handling dairy supplies.

It is not practical to make a butter-fat test of each milking; testing the milk for several milkings once a month will be sufficient. The fat content does not vary as much as the quantity of the milk. A composite sample, representing the milk given during two days, will give very accurate results.

The per cent of fat obtained from this sample multiplied by the pounds of milk given during the month will give the estimated butter-fat record for the month. The method of testing milk for butter fat is given on page 24.

When butter fat is sold from the farm each cow's production of butter can be estimated by keeping the butter-fat record and then increasing the amount of fat by one-fifth. Average butter contains about 83 per cent of butter fat.

The advantage and value of having a record of the cows in the herd is shown by the results, of the Dickinson County Cow-Testing Association for the past year. (See Experiment Station Circular No. 35.)

The following tables give the records of the ten best and the ten poorest cows in the association:

TABLE 1. *Record of the Ten Best Cows.*

Months milked.	Milk.	Fat.	Value of products.	Cost of feed.	Profit.	Return for $1 in feed.
11	13,689	546	$201.12	$55.91	$145.21	$3.60
12	8,094	449	152.58	49.00	103.58	3.11
11	10,258	386	144.44	50.35	94.09	2.67
11	7,229	384	131.90	48.49	83.41	2.72
10	8,191	377	133.92	26.16	107.76	5.12
11	7,290	376	130.00	49.89	80.11	2.61
9	8,042	375	131.77	37.42	94.35	3.52
11	7,926	372	131.50	37.17	94.33	3.54
10	6,573	368	124.86	41.30	83.56	3.02
10	6,973	365	125.70	47.77	77.93	2.81
Average	8,427	400	$140.78	$44.35	$96.43	$3.11

Butter fat valued at 28 cents per pound and skim milk at 40 cents per hundred.

Profit is the difference between value of butter fat and skim milk, less cost of feed. The manure and calf are liberal offset for other items of expense.

TABLE 2. *Record of Ten Poorest Cows.*

Months milked.	Milk.	Fat.	Value of products.	Cost of feed.	Profit.	Loss.	Return for $1 in feed.
5	1,418	59	$21.58	$33.23	.....	$11.65	$0.65
7	1,260	66	22.83	25.11	.....	2.28	.91
7	2,796	117	42.49	27.35	$15.14	.....	1.68
10	3,405	121	46.16	30.15	16.01	.....	1.53
9	3,102	125	45.89	26.63	19.26	.....	1.72
7	2,784	125	44.62	35.47	9.15	.....	1.26
7	3,801	138	52.25	22.14	30.11	.....	2.36
8	3,222	142	50.95	27.25	23.70	.....	1.87
8	4,102	149	56.04	34.73	21.31	.....	1.61
12	3,534	148	53.92	22.32	31.60	.....	2.86
Average	2,942	119	$43.67	$28.44	$15.23		$1.54

The best cow produced 546 pounds of butter fat in a year, and made an average return of $3.60 for each dollar's worth of food consumed. The poorest cow produced only 59 pounds

of butter a pear and made a return of only 65 cents for each dollar's worth of food consumed. The ten best cows made an average production of 400 pounds of butter fat and an average return of $3.11 for one dollar invested in feed. The ten poorest made an average production of 119 pounds of fat and the return for one dollar's worth of food was $1.54. A hear of 10 cows such as the best cows in this association would return the owner a yearly profit of $964.30, while a herd of 10 cows such as the poorest ten in the association would require the same amount of the owner's attention for a year and return a profit of only $152.30.

The man who owned the best cow, as well as the man who owned the poorest cow, did not realize that he had such animals in his herd. All the good cows were not found in one herd, but there were poor cows as well as good ones in all the herds. This condition is undoubtedly the same as is found in the average herds of the state. The only way that one can detect just how much difference there is between the cows in a herd is to keep records of their production.

THE SELECTION OF THE HERD SIRE.

The future development of the herd depends to a great extent upon the kind of sire used with the herd. It has been said that the sire is half the herd, and it is a fact that all future cows in the herd carry 50 per cent of his breeding.

The herd sire should be a pure bred of the breed he represents and be backed by good ancestry. If possible he should be a sire whose mother and other close female ancestry have shown high records of production. A yearly record is to be preferred to one of shorter duration.

If it is not possible to know the record of production one should by all means see the mother of the animal in question and note how closely she conforms to the dairy type. If the sire's father has daughters that have proven to be good producers he is more certain to transmit the dairy qualities desired. Very often it is possible to buy an old sire who has proven to be a good breeder. Good results from the use of such an animal are almost certain. The objection to buying an old bull is that he is high priced, if his value is known, and one runs a chance of getting an unruly animal. A bull calf is usually selected. A calf can be purchased for less money

and the owner can train him as he chooses. Too much attention can not be given to the selection of a sire, for future successes depends largely upon the head of the herd.

FEEDING THE DAIRY HERD.

In order to reap the highest and most economical returns from a properly bred and selected herd, the animals must be fed intelligently. One of the principal reasons for the low average production of the Kansas cow is that she is not properly fed. By weeding out the poor cows and feeding the best ones more intelligently it would easily be possible to double the production of the cows of the state.

If the cows are to make their maximum production it is essential that they be properly fed and cared for before they freshen. Each cow should be given four to six weeks rest each year. During the time the cow is dry she must be well cared for, and not turned out on a poor pasture or stalk field to care for herself. The cow needs this rest in order to repair and build up her body. At the same time there is a great demand for food to develop the unborn calf. Hence it is necessary for her to have plenty of food to meet these requirements. She should also be allowed to gain in weight. The cow that freshens poor in flesh can not be expected to milk well during the following milking period. But the cow that is in good flesh when she freshens will start off giving a large flow of milk and will keep it up for a long time.

For several days, or a week, before the cow is due to freshen her grain should consist of bran. The bran will act as a laxative and thus the digestive system of the cow will be brought into good condition before calving. Immediately after she freshens the cow does not need, and should not be fed, a heavy grain ration. A ration of bran, fed dry or as a mash, is sufficient for several days. If the cow has surplus flesh at this time she will draw on the store and produce a large amount of milk from the start. The cow should be given a small quantity of grain at first, this being gradually increased as the milk flow increases. After all swelling and inflammation is gone from her udder she may be given a heavier grain ration. At the end of three or four weeks, she will reach her maximum milk production, and should then be on full feed. From this time on the ration should be regulated according to the quantity of milk given.

The ration given the cow will depend upon the kinds of feed available. This will vary according to location. Thus a general discussion of the feeding question is necessary.

MAINTAINING SUMMER CONDITIONS.

Economic feeding resolves itself into a study and execution of the lesson which Nature teaches. Under natural conditions the average cow makes her greatest production in milk during May and June, or early summer. When she is turned to pasture in the spring, after having received a dry ration, she will invariably increase in milk flow. The ration the cow receives at this time is Nature's ration, grass in its choicest form. There is plenty of food at hand, it is palatable, succulent, easily digested and contains plenty of food nutrients, and the cow is comfortable. The intelligent feeder, therefore, will strive to maintain these conditions as nearly as possible throughout the year.

While the average cow does her best on pasture and receives sufficient nutrients at that time, the high producer will require additional feed while on pasture and should be given all the grain for which she will make returns. A high producing cow on pasture will for a time make up the deficiency by drawing on her body for the necessary nutrients required, but she will soon exhaust this supply and will then decline in milk production. As the season advances the pastures dry up or get short, and they should then be supplemented with other feeds. Silage or green crops such as corn, alfalfa, oats and peas, may be fed at that time. Perhaps that is the most critical time in the milking period of the average cow. The majority of cows in the state freshen in the spring and when the pastures are not supplemented they decline very rapidly in milk production or "go dry" entirely.

BALANCED RATION.

As winter approaches the conditions prevailing in early summer must be provided for by the feeder. The feed supply should be plentiful and be so combined as to make the ration a balanced one. It is highly essential that the cow owner know something of the composition of the various feeds and know how to combine these feeds in a ration to get the best results.

There are three substances which must be considered in making up the ration of the dairy cow. These substances are

contained in almost all feeding stuffs to a greater or less extent. They are protein, carbohydrates and fat. Some feeds contain a high per cent of one of these substances and other feeds contain a high per cent of another substance. The protein or nitrogenous substance is the most expensive of the three. It is used by the animal in the production of hair, hoof, hide, horn, blood and muscle. Such feeds as alfalfa, cowpea and clover hay, cottonseed and linseed meal, bran, oats and gluten feeds, contain a high per cent of this substance. The carbohydrates (sugar and starches), and fat are used for the same purpose and may be classed together. These Substances are used by the animal to produce heat to keep the body warm, to furnish energy and to make the fat that is stored up in the body and in the milk. Such feeds as corn, cane, kafir and corn silage, timothy hay, corn, cane, kafir and corn fodder, millet, oat and wheat straw, all contain a high per cent of carbohydrates, All of the feeds mentioned in both groups contain some fat.

A balanced ration must contain both protein and carbohydrate foods. In sections of the state where alfalfa, clover, peas or other legumes can be successfully grown for hay they should be depended upon to furnish the protein in the ration, and since the protein is furnished in the roughage it is best to feed a grain ration that is rich in carbohydrates in order to balance the ration. Thus if alfalfa hay is available for roughage, corn is the logical grain ration. Where legumes can not be grown the roughages usually are depended upon to furnish the carbohydrates, and under this condition the grain ration should be made up of some food rich in protein. If the roughage consists of cane or kafir hay or fodder, or prairie hay, the grain ration should be made up of such feeds as bran, oil meal, oats, etc. The protein feeds are the most expensive feeds on the market; hence a cheaper dairy ration can be obtained in localities where the protein is produced in such home-grown feeds as alfalfa, pea and clover hay.

COWS MUST BE FED AS INDIVIDUALS.

To feed cows economically they must be fed as individuals and not as a herd. It is often the case that cows in a herd are all fed the same quantity, regardless of the quantity of milk produced. By such a practice some cows are overfed, while others are underfed.

In feeding animals it should be understood that the animal uses a certain amount of the food it receives to maintain the body. This is called food of maintenance and it is the first use to which the animal puts its food, whether producing milk or not. The feed given in excess of this amount is used for producing milk, storing fat on the body, or for growth in the case of the young animal.

Of the two common mistakes in feeding, perhaps underfeeding is the most common. It is a poor practice and a serious mistake to feed a cow only the amount required to maintain her body and to deprive her of sufficient additional feed to produce all the milk she is capable of producing. The effect of underfeeding may not be noticed at once, as a cow will produce milk for a time at the expense of her body. That is, she will take the surplus flesh off her body and convert it into milk. Hence, if a cow declines in weight, while producing milk it shows that she is not receiving enough feed. In the case of a cow being overfed, it may be detected in a short time by the fact that she will put fat on her body, or she may get off-feed.

SILAGE NECESSARY.

Another condition of the early summer ration, which should be maintained or imitated during the winter, is that of feeding a succulent ration. By the term succulent feed is meant feed having that property possessed by green grass. Such a feed has a value in addition to the nutrients it furnishes. It serves to keep the digestive organs in good condition. This succulence may be secured in the winter ration by feeding silage or roots. Where roots can be grown successfully they serve the purpose well. In this state silage is the cheapest succulent feed, because it is possible to obtain large yields of corn, cane or kafir and such feeds make excellent silage. Aside from supplying an excellent feed, the silo furnishes a means of handling the whole forage plant in the most convenient and best way possible.

The main object in formulating a ration, after selecting the feeds to be used, is to provide a sufficient bulk at all times to satisfy the appetite and feeding capacity of the animal and to furnish the amount of nutrients needed for the work the cow is doing. If the ration lacks bulk the cow will be discontented. An animal may be fed enough nutrients in the form of grain to perform her work, but may

receive too little of bulk to be satisfied. The roughage should form the foundation of the dairy ration. A cow should have all the roughage she can clean up at all times and the grain ration should be regulated by the amount of milk produced. A cow giving rich milk should be fed one pound of grain to each three pounds of milk produced per day, while for a cow giving less rich milk, such as a Holstein, one pound of grain to four pounds of milk is sufficient.

As the winter feeding period comes on the animal's comfort should be considered. Shelter and clean quarters should be provided. A cow will respond readily to warm and comfortable stables, well lighted and properly ventilated. If exposed to cold, a large portion of the feed ration which otherwise would be turned into milk goes to supply the necessary warmth. This makes economic feeding impossible, since the feed of the dairy cow is expensive fuel.

SOME RATIONS.

The following rations contain enough nutrients for a cow weighing 1000 pounds and producing 25 pounds of 4 per cent milk daily. If a cow gives more or less than 25 pounds, mix the grain in the same proportion as given and feed in proportion to amount of milk produced. Cowpea hay may be replaced by alfalfa, clover, or soy-bean hay. Corn may be replaced with kafir. Linseed meal may be replaced by cottonseed meal or gluten meal. Silage is considered a roughage, and when added to any of the rations, three pounds of silage in bulk is equivalent to one pound of hay. Silage made from kafir, cane or other sorghums is almost equivalent to corn silage.

	Pounds.
Alfalfa	12
Silage	35
Corn chop	4
Bran	2
Linseed meal	1
Timothy hay	18
Barley (ground)	5
Linseed meal	3
Alfalfa hay	18
Corn-and-cob meal	5
Cottonseed meal	2
Clover hay	12
Corn stover	5
Corn chop	5
Linseed meal	2
Sorghum fodder	15
Wheat bran	5
Kafir corn	5
Linseed meal	2

	Pounds.
Prairie hay	18
Wheat bran	5
Wheat shorts	5
Cow-pea hay	18
Corn chop	5
Linseed meal	2
Prairie hay	18
Oats (ground)	5
Linseed meal	2
Clover hay	8
Timothy hay	8
Sugar beets	20
Corn chop	4
Oats (ground)	3
Alfalfa hay	10
Dried beet pulp	5
Corn chop	4
Gluten feed	1

THE DAIRY BARN.

A cow will not produce the maximum flow of milk unless she is comfortable. The barn does not need to be expensive but must provide a comfortable tie, a substantial floor that can be kept clean, and plenty of fresh air and sunlight, and it should be warm enough for comfort in severe weather.

There must be plenty of windows to admit fresh air and sunlight. A dark barn affords an ideal place for the growth of bacteria. Sunlight is the greatest enemy of bacteria and it does not cost much. A barn must be ventilated by dropping the window's in from the top, or by a system of ventilation, such as the King System, can be installed for this purpose.

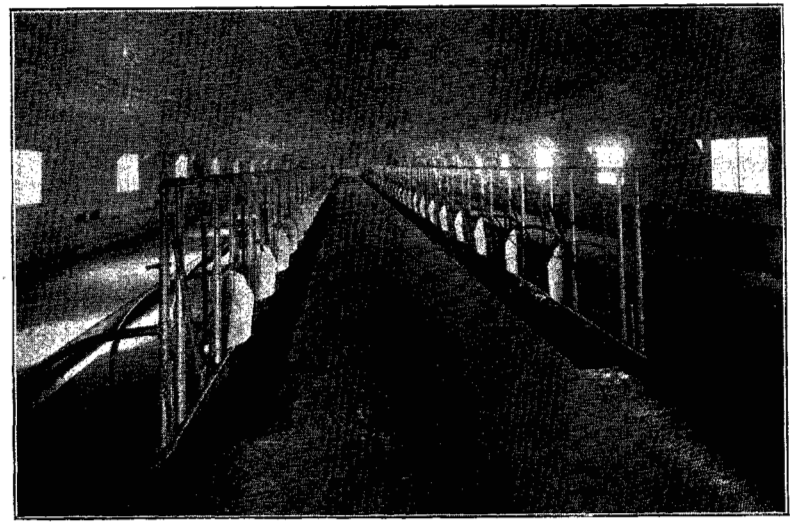

PLATE No. 8.—Interior view of dairy barn at the Kansas State Agricultural College.

The stalls should be adjusted to the size of the cows. For Holsteins, or other large cows, the stalls should be at least three and one-half feet wide, and five feet long, measured from the stanchion to the manure gutter. For cows of the size of the Jersey, the stall should be three feet wide and four and one-half feet long. It is advisable to make the platform wider at one end than at the other, so that the largest cows may be accommodated at the wider end and the smaller cows at the other. When the platform is accurately adjusted to the size of the cow it is much easier to keep the cows clean. The man-

ger should be at least two and one-half feet wide and the manure gutter at least sixteen inches wide and from six to ten inches deep.

The floor of a barn may be made from almost any building material, but a cement floor will give more general satisfaction than will any other, because it is more durable and easier to keep clean. Objection is raised to a cement floor because of its coldness, and some claim that the cow's knees are injured because of the hardness of. the cement. If plenty of bedding is used these objections are easily overcome. In cold climates, or where bedding is scarce and expensive, a wooden platform can be built over the cement floor to protect the cows. The cement floors on which the cows are expected to walk should be made rough to prevent the animals from slippng and falling. Too often the floors are made smooth for the reason that they are easier to keep clean, but the cow's comfort and safety should have first consideration.

DIRECTIONS FOR MAKING THE BABCOCK TEST.

Apparatus: 17.6 cc. pipette, 17.5 cc. acid measure, test bottles, dividers, water bath, centrifuge, and sulphuric acid, specific gravity 1.83 to 1.84. The milk to be tested and the acid used should be brought to a temperature of about 70 degrees; this can best be done by the use of the hot-water bath.

1. Pour sample of milk to be tested from one vessel to another at least five times.

2. Take pipette between thumb and second and third fingers, leaving the index finger free. Draw milk into pipette immediately after stirring, and place the index finger over the top of the pipette; now release the finger very slightly until top of the milk column is even with the mark on the pipette.

3. Hold milk bottle on a slant and place end of pipette in the neck of bottle, leaving an opening for air, so that air bubbles can not form and throw milk out of neck, and release finger and allow the milk to flow into the bottle, blowing the last drop from the pipette.

4. Fill acid measure to mark *(never draw acid into pipette),* take milk bottle by the neck between thumb and fingers of the left hand, so that the bottle can be turned; now bring the

lip of acid measure to mouth of bottle, and pour acid into the bottle, rotating the bottle so that all of the milk will be washed from the neck into the bottle. Hold the bottle at a slant so that the acid will not fall directly on the milk and form pieces of charred curd.

5. Give bottle a rotary motion in order to cause a gradual mixing of milk and acid; sudden mixing will cause large amounts of heat and gas and will throw the material out of the bottle.

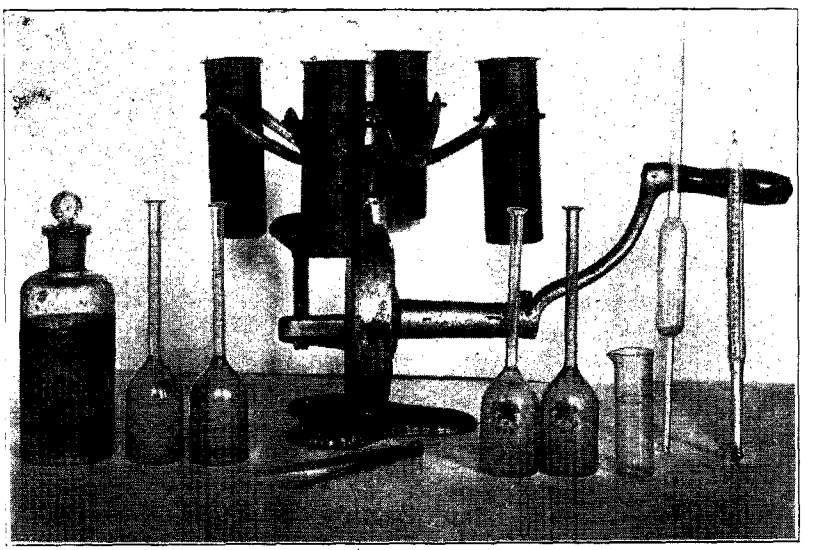

PLATE No. 9.—Babcock testing outfit.

6. After the bottle has been stirred thoroughly and the curd is dissolved, place the bottle in centrifuge and whirl five minutes.

7. Place bottles in water bath of 180° F. for five minutes and fill with hot water to neck.

8. Whirl for two minutes.

9. Place in water bath for five minutes and fill with hot water to within one-half inch of the top of bottle.

10. Whirl for two minutes.

11. Place in water bath, 130° F., for five minutes.

12. Measure fat column by placing one point of dividers at bottom and the other at the top: then, keeping dividers at

that spread, place one point on the zero mark and note where the other point falls on the scale. That number will correspond to the per cent of fat in the milk.

NOTE.—In testing cream, regular cream-test bottles must be used, and the samples of cream for testing should be weighed instead of being measured. Only sufficient acid is used to dissolve the milk solids. In reading the cream test read from lower edge of fat column to a point that includes one-half of meniscus.