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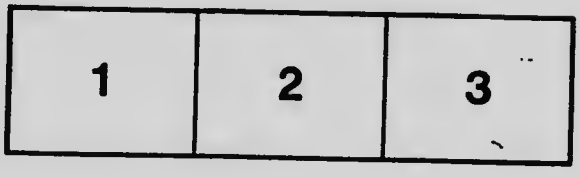

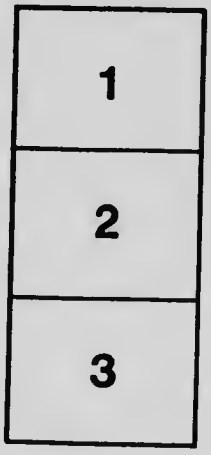

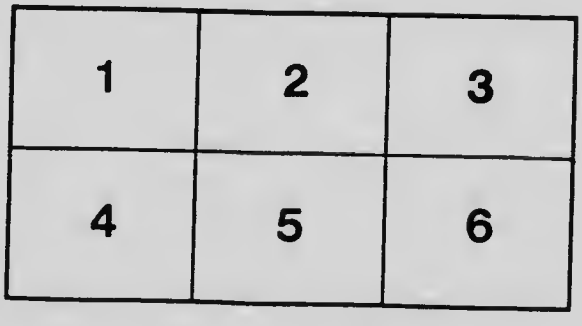

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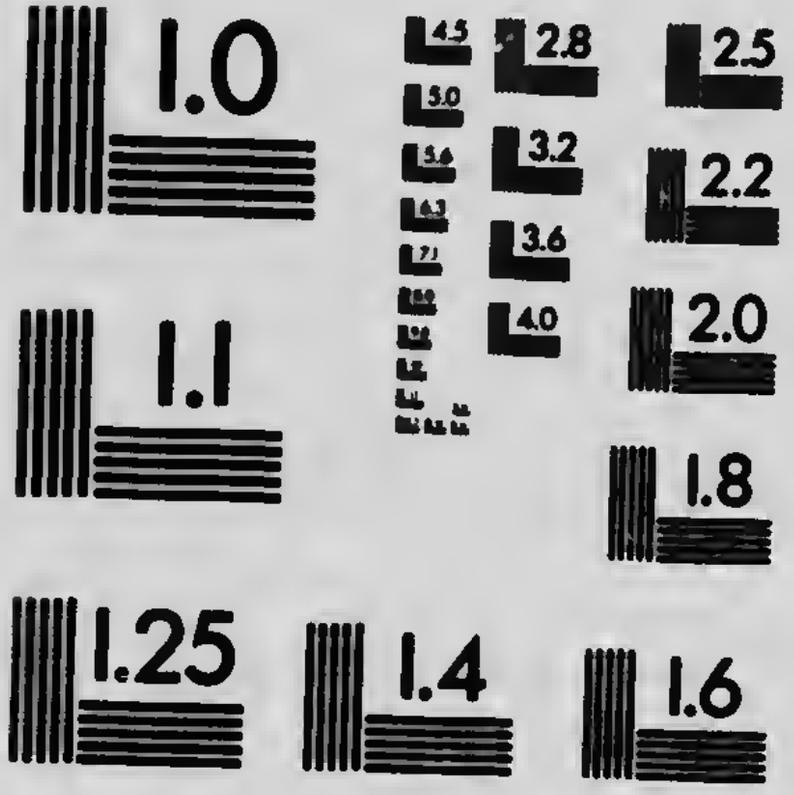

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BULLETIN 183.] [AUGUST, 1910

Ontario Department of Agriculture

DAIRY BRANCH.

Notes on Cheddar Cheese-Making

By Frank Herns and G. G. Publow.

INTRODUCTION.

The Ontario Department of Agriculture maintains a staff of thirty-five Dairy Instructors, whose duty it is to give instruction to the individual maker in methods of manufacture. Thirty of these men devote their time to instruction in cheese-making, two to butter-making, one to both cheese and butter making, while the two chief instructors have general supervision of the work. All Instructors devote more or less time to visiting the individual producers to give them instruction in sanitary methods of producing and handling milk and cream upon the farm until it is delivered to the factory or creamery. Leaflets giving information as to the care of milk and cream are issued each year, and distributed through the Instructors and factorymen to the producers. We have pleasure in presenting herewith some suggestions and information of special value to the makers. The Department expects a hearty co-operation on the part of the men who have direct charge of the manufacturing in making general the methods outlined.

Geo. A. Putnam, *Director of Dairy Branch.*

Toronto, August, 1910.

Branding Cheese Boxes.

There are still some factorymen who evidently fail to recognize the importance of properly stencilling the weights of cheese uniformly on the boxes by the use of a brand or preferably a rubber stamp instead of a lead pencil. If the weights are put on with pencil they are often hardly distinguishable on arrival at point of delivery, especially if handled in wet weather. The cost of rubber stencils is very little, and their use often avoids serious misunderstandings between buyer and seller as to differences in box weights. Not only this, but the style, appearance and quality of the cheese box has an influence on the sale of cheese. In fact

it has been said that a fastidious buyer in the Old Country will sometimes refuse to even examine a lot of cheese when the boxes present a slovenly appearance, preferring to take some other lot which has a neat, trim appearance. The accompanying cut (Fig. A) is intended to indicate how the weights may be stencilled on the cheese box. The factory brand may be put on the left of, or just below, the stencilled weight.

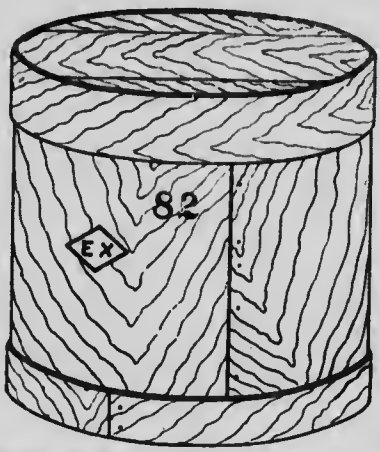


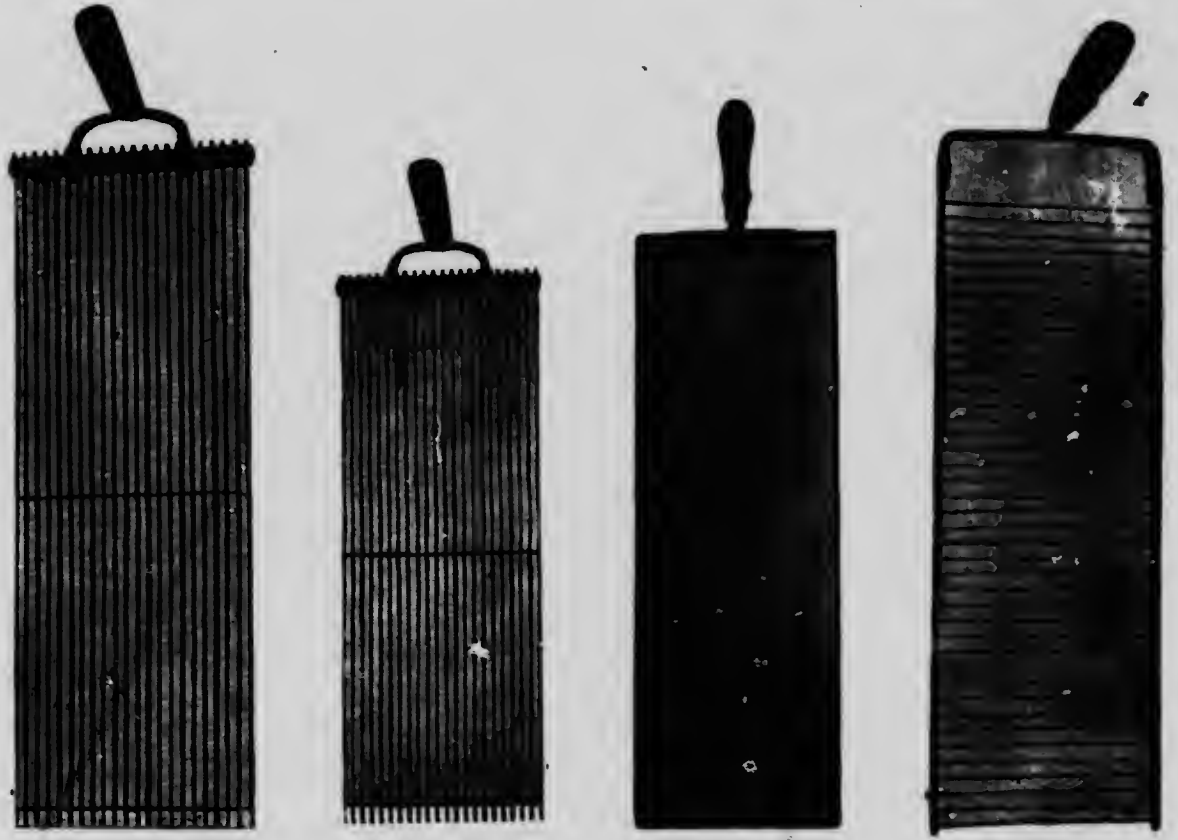
Fig. A. Represents proper stencilling of Cheese Box.

Importance of the Finish of the Cheese.

The finish and stylish appearance of the cheese itself also has a great deal to do with a ready sale. Buyers of cheese will sometimes overlook slight defects in the cheese, provided the outside appearance shows careful and painstaking workmanship on the part of the manufacturer. Note the attractive way in which nearly all food products and other manufactured goods are being put up for sale these days. The inside of a cheese may be ever so good, but if the outside appearance d[illegible] appeal to the eye, the enthusiasm of the buyer is dampened and l[illegible] for other possible defects, which otherwise he might not notice w[illegible] outside appearance neat, stylish and attractive. The cheese sh[illegible] uniform in size so far as possible, neatly finished on both ends, [illegible] from the hoops in the morning, squared up, then put back in the press with the ends reversed. This will improve the finish as well as assist in making a closer cheese.

Quarter-Inch Wire Curd Knife.

The quarter-inch perpendicular wire curd knife for fast working milk is giving good satisfaction. Curds usually have only to be cut once with a three-eighth inch horizontal and twice with one-quarter inch perpendicular wire knife. Cubes of curds are thus obtained one-quarter by three-eighths inch in size, which



¼-inch Blade. ⅜-inch Blade. ½-inch Wire. ¼-inch Blade.

Fig. B.

Perpendicular Curd Knives. Horizontal Curd Knife.

are easily firmed, even with fairly fast-working milk, without rough handling, and insure, under average conditions, a curd properly firmed before sufficient acid has developed for dipping. With the old style coarse half-inch curd knives, the curd often had to be cut several times to get it fine enough to be able to secure sufficient firmness, particularly if the milk was working fast, thus, no doubt, causing some loss of cheese solids, and in many cases the curds retained excessive moisture, resulting in acidy cheese. For normal milk the three-eighths-inch wire curd knives give good results.

We wish to point out that in som cases when the wires break they are not replaced soon enough; and, through this neglect, the curd cannot be cut uniformly, bringing about conditions that are likely to result in open cheese. Wire necessary for repairing these knives should always be kept on hand; and, immediately a wire breaks, it should be replaced with a new one if best results are to be expected from the use of the wire curd knife. The accompanying cut is intended to illustrate the one-quarter inch perpendicular wire curd knife and the three-eighth horizontal blade knife. The horizontal knives should always be kept sharp.

The Pure Culture.

A pure culture made by using pasteurized milk is now recognized as almost a necessity in cheese making and is a great improvement over the old ordinary milk starter or none at all. Cheesemakers are each year becoming more familiar with pure cultures and are using good judgment in handling them. However, it is just possible that occasionally some makers may get a little careless in handling this culture, allowing it to become overripe and of poor flavor. If such culture is introduced into the milk the result will certainly be off-flavored cheese, perhaps not showing at the time of shipment, but in the buyer's hands later on, if the cheese are held. Impure cultures introduced into the milk will sow the seeds which are almost sure to cause off-flavored cheese. We would urge that particular attention be paid to the cultures. As soon as signs of off-flavor are observed secure another. Cultures with an acidity of about .7 per cent. to .75 per cent. are usually in the best condition. All utensils which come in contact with the culture should be sterilized, as it is useless to pasteurize the milk for a culture and then allow it to become contaminated by coming in contact with unsterilized utensils. Dippers with holes in the handles, or wood n paddles, should never be used for stirring a culture. A wire-handled solid dipper is best. The thermometer should be sterilized by dipping in boiling water before coming in contact with the culture. The accompanying cut is intended to illustrate a good style of culture can and a wire-handled dipper. The starter box may be made of galvanized iron or of wood and lined. If the water supply is short the culture may be cooled by suspending the can in the well.

WIRE HANDLED DIPPER
STARTER CAN 8" x 20"
OVERFLOW
OUTLET
STARTER BOX
WATER PIPE
STEAM PIPE
VALVES

Fig. C (2).

Fig. C (1).

Late Fall Cheese.

Proper provision should be made for curing the late fall cheese. The percentage of factorymen whose attention should be called to this matter may be small, but there are enough fall cheese neglected in this way to have considerable effect on the reputation of our November and later made cheese. The press rooms in some cases are not kept warm enough. The cheese, after being taken from the press, are placed in curing rooms, the temperature of which goes far too low, and not sufficient care is taken to keep the cheese at an even temperature. Even after two weeks, the cheese in some cases are not broken down. The color does not develop properly, the texture shows pasty, and the flavor in some cases turns bitter. Cheese of this character do not by any means come up to the high standard expected of Ontario cheese, and it is to be hoped that makers who may be guilty of neglect in this connection will make a special effort to take proper care of the late fall cheese and see that an even temperature of about 60 degrees is maintained in the curing room until the cheese are broken down.

The Acidimeter Test.

This test is coming into use generally among cheese makers; and we would point out the necessity for having the alkaline solution and the indicator of uniform strength. We would here mention that we think it a good plan for the makers, particularly the younger makers, not to entirely discard the hot iron or rennet tests but use them occasionally along with the acidimeter and keep perfectly familiar with these tests, as they come in very handy at times. Directions for making alkaline solution may be found in Dairy School Bulletin No. 172, of the Ontario Department of Agriculture. A standard alkaline solution, such as is used in dairy work, is known as .111 normal, sometimes expressed as 1.11 deci. normal or a one-ninth solution.

Pasteurization of Whey.

"Pasteurization of whey (which is to be returned to the patrons in the milk cans) is being recommended by many dairy authorities. The term "pasteurization" is derived from the name of a distinguished French scientist, Louis Pasteur. Whey is pasteurized to partially or entirely get rid of the germ life present, to secure an even distribution of the whey fat, to keep the whey tanks at the factory in better condition, and to return the whey to the farm comparatively sweet, and as nearly possible in the condition in which it was drawn from the vats. This is done by heating the whey with steam to a temperature of about 155 degrees F., and allowing it to remain at or near this temperature for some time. The time of exposure to this, or near this, temperature is an important factor in destroying the minute

plants known as bacteria. If the whey is exposed to a temperature of 155 degrees F. for a length of time, as is the general practice in the present system of pasteurizing whey, it is supposed to be as effective in relieving the whey of germ life as a higher temperature for a more brief period. If the whey tanks are kept reasonably clean and covered, in order that the heat may be kept up as high as possible during the night, the whey should go into the patrons' cans the following morning in almost a sterile condition. Through this method the danger of spreading acid flavors to the milk from the whey tank or germs of disease to the stock on the farm through the medium of the milk can in which the whey is returned, should be almost eliminated. The composition of whey is about as follows: Water 93 per cent., fat .25 per cent., casein and albumen .85 per cent., sugar 5.2 per cent., ash .7 per cent. Pasteurization properly done prevents the fat separating and rising to the top of the whey in the tank, thus insuring an even distribution of the fat contained in the whey among all the patrons and preventing an accumulation of decomposing material in the whey tank and the probability of introducing in one or more patrons' cans this greasy mess, which is not only difficult to wash from the cans but also from the whey tanks. When whey becomes sour, more or less of the sugar has been changed to lactic acid. We know of no claim made that the latter is of any direct food value. Some benefit may be derived from its effect on digestion in older animals.

Much of the ordinary unpasteurized factory whey returned to the farm under average conditions is shown to be not only sour, but practically gravity skimmed. The fat which is returned in pasteurized whey is shown to be one of the chief valuable constituents for feeding. Recent experiments with sweet whey direct from the cheese vats show a difference of from 25 to 33 per cent. in favor of unskimmed whey as a food for stock. For young animals, comparatively sweet whey is no doubt to be preferred. Were no whey returned in the cans it would be better for the quality of the cheese, but conditions as they exist compel us to recognize the fact that in the majority of cases the patrons wish to have the whey returned.

Some Other Advantages.

Whey properly pasteurized should go into the patrons' cans each morning from the whey tank, provided the tanks are kept reasonably clean, with an average acidity of not more than .3 per cent., and an average fat content of about .2 per cent., while unpasteurized whey will have an acidity of from .9 to 1.7 per cent. average about 1.15 per cent., and a fat content as low in many cases as .03 per cent., average about .09 per cent. Less of the sugar is converted into lactic acid, and the fat is more evenly distributed in all the whey where properly pasteurized.

Yeasty or bitter flavors may develop in the milk of one or more patrons through rusty or unclean cans, or through certain conditions at the farm, but heating the whey to the proper temperature and doing the

work as it should be done, will prevent to a great extent the infection of other patrons' cans and the bacteria from being seeded at many other farms. Therefore the patron who is guilty of sending yeast infected or bitter milk may be detected by the curd test and dealt with accordingly. The cans in which pasteurized whey is returned are no doubt easier to wash, *but it is absolutely necessary that the cans be scalded with boiling water whether the whey is pasteurized or not.* Pasteurization prevents to some extent at least the tin from being taken off the can, since less acid is present; therefore, the cans should last longer.

Pasteurization keeps the whey tanks at the factory in a condition that they can be readily and easily kept clean, no fat floating on top of the whey and leaving no excuse for not keeping them clean.

Precautions.

Pasteurization should begin as soon as possible after the first whey reaches the tanks to prevent the development of acid and take advantage of the temperature of 98 degrees before it begins to cool. *Care must be taken that the temperature does not rise much above* 160 *degrees. A higher temperature will precipitate the albumen and cause the whey to be flocculent and slimy. A uniform temperature of* 155 *degrees each day will give good results.*

If possible to avoid, small or large quantities of whey should not be left over in the tank from day to day as this will eventually become sour and act as a culture in the new whey, rapidly raising the acidity.

The boiler should be large enough to furnish economically the steam required. Inexpensive results cannot be obtained otherwise. The tanks should be close to the boiler and the pipes insulated to prevent condension of steam before it reaches the whey.

Pressure as high as practicable should be carried on the boiler during the time the pasteurizing is being done and the steam not given too much vent into the tank, or the boiler will rapidly be emptied of water. Heat under steam pressure, by keeping the live steam as it is generated by the fuel going gradually into the whey. Begin with good steam pressure and maintain this pressure during the time required for pasteurization. It is not wise to attempt to pasteurize unless it can be done properly. It will be a waste of steam and the results will be disappointing.

Pasteurization of whey is advocated for the purpose of overcoming many of the difficulties of the whey question, and *not as a panacea for the evils of improperly cared for milk, rusty, old, or carelessly washed cans.*

The wash water should not be run into the whey tank, as it dilutes the whey and introduces undesirable bacteria. Septic tanks or other means should be employed to dispose of wash water and other factory refuse. The patrons should co-operate with the maker in emptying the tank each morning so that only the fresh whey will be in the tank

from day to day. One of the methods adopted at many of our larger factories is to have a man hired to measure out the whey each morning; cost about 50 cents per day.

From data secured in 1908-1909 it is shown that during the summer months, say, 20,000 lbs. of whey in average covered tank, if heated to 155 degrees, will remain above 150 degrees from one hour to one and a half hours, and above 140 degrees from one and a half to two hours, and above 130 degrees from two to three hours and twenty minutes, and in many cases much longer, and delivered in the patrons' cans after twenty hours at a temperature of from 110 to 120 degrees. During the cool weather of spring and fall, with smaller amounts of milk, these temperatures will be more difficult to maintain, but every precaution should be taken by covering and insulating the tanks.

Fig. D. Steel Whey Tank—9 feet long, 4 feet wide, 4 feet deep. Bottom of Tank 7 feet from cement platform.

Whey Tanks.

Steel whey tanks so far as we can learn are giving excellent satisfaction, are easily kept clean, and give every evidence of lasting for years. Cement whey tanks are not in the majority of cases giving good satisfaction, and it is not thought advisable to build these tanks, as the acid in the whey seems to dissolve the cement surface, and as soon as the rough face is exposed all kinds of trouble begin. Badly constructed and unclean whey tanks certainly have a detrimental effect on the flavor of the cheese.

The accompanying cut is intended to illustrate an elevated steel whey tank properly supported, showing a cement platform (with drain) on which the waggons stand while loading. Any whey which may be spilled can readily be flushed off the platform and everything around the tanks kept clean, with no unsightly, bad-smelling mud holes. The whey is delivered to cans through a 2-inch pipe.

The accompanying illustrations show five different systems of heating whey, some one of which can be arranged to suit nearly all conditions. The plan of heating all the whey in the lower tank before raising to upper tank seems to give best results, particularly in cool weather (spring and fall), as it is desirable at all times to maintain a high temperature (150 degrees or over) as long as possible, in order that the greater number of germs may be destroyed, and to have the whey go into the patrons' cans after 20 hours not lower than 110 degrees.

If a single tank is elevated and the whey ejected directly from the vats, a steam pipe may be introduced into the pipe above the ejector and sufficient steam turned on to raise the temperature to 155 degrees. This is illustrated in Figure 2.

Experience has shown that the pipes B1 are more satisfactory than B2, as the small holes in B2 are likely to clog. Some factories have adopted the system of two elevated tanks, using one each alternate day. Each tank is cleaned the day it is not in use.

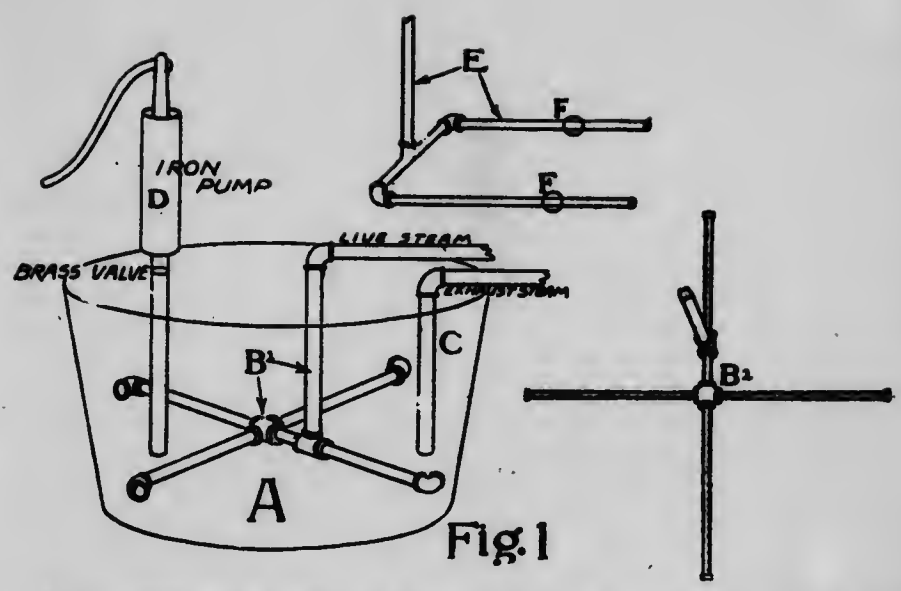


Fig. 1

FIG. 1 represents conditions where only one ground whey tank is used (close to boiler), whey being pumped in cans by hand. This single tank can be elevated if desired and the whey ejected directly from the vats, delivered to elevated tank at temperature of about 122 degrees. One of the systems of pipes shown can be put in and whey heated to 155 degrees with live steam. When engine is in use exhaust may be used in ground tank. (A) Tank; (B 1) three-quarter inch live-steam pipes as shown, with open elbows; (B 2) another three-quarter inch system of live-steam pipes, ends plugged and holes drilled as shown, holes turned same angle (either system will keep whey in circulation and assures even heating); (C) exhaust steam; (D) iron hand pump, with brass valve (leather valves wear out quickly with hot whey); (E) another method of arranging live-steam pipes in tank; (F) noiseless heaters. Four noiseless heaters may be placed on (B 1) if desired, instead of elbows.

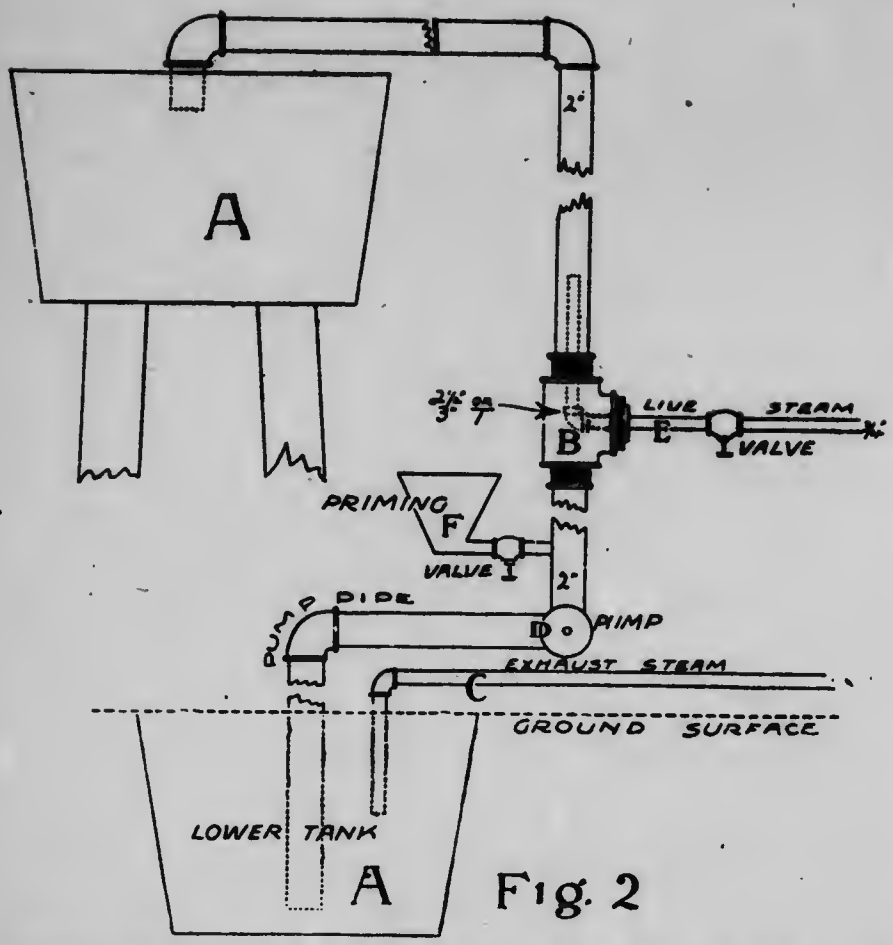


Fig. 2

FIG 2.—(A A) Lower and upper tank; (B) 2 1-2 inch or 3 inch T; (C) exhaust steam; (D) pump or ejector; (E) live steam turned up 8 inches inside T (B), as shown by dotted lines. When pump or ejector is started sufficient live steam is turned on through (E) to deliver whey in elevated tank at 155 degrees. (F) Priming valve for pump. Pump pipe two inches, the T (B) reduced to fit. If ejector is used, 1 1-2 to 1 1-4 inch pipe instead of 2 inch. Exhaust steam (C) will be heating whey in lower tank while pump is running. Exhaust steam (C) can, if desired, be turned in the T (B) instead of tank, but would not keep lower tank in as good condition. Will probably cost less to pasteurize whey when elevated with this system than any other. Using an ejector instead of pump with this system has been found fairly satisfactory. Instead of the 2 1-2 or 3 inch T (B) a piece of 3 inch pipe about 3 feet in length may be used. Each end of this pipe is reduced to fit the pump or ejector pipes. This large pipe is tapped near the bottom. The steam is carried into the side in the same way that it is taken into the T (B). The live steam turned up as shown in the cut. The advantage claimed is that it allows a larger volume of whey to be heated by the live steam before passing on through the pipes to the tank.

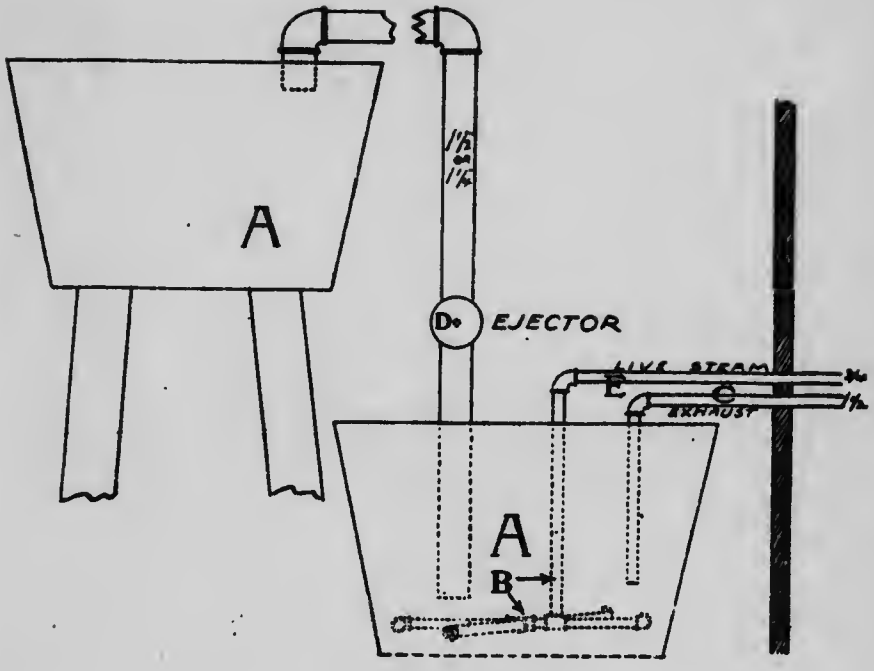


Fig.3

FIG. 3.—(A A) Lower and upper tanks; (B) (E) live-steam pipes; (C) exhaust steam; (D) ejector or pump. If ejector is used, heat to about 125 degrees to 130 degrees in lower tank; ejector will then deliver to upper tank at about 155 degrees. If pump used, heat to 155 degrees in lower tank.

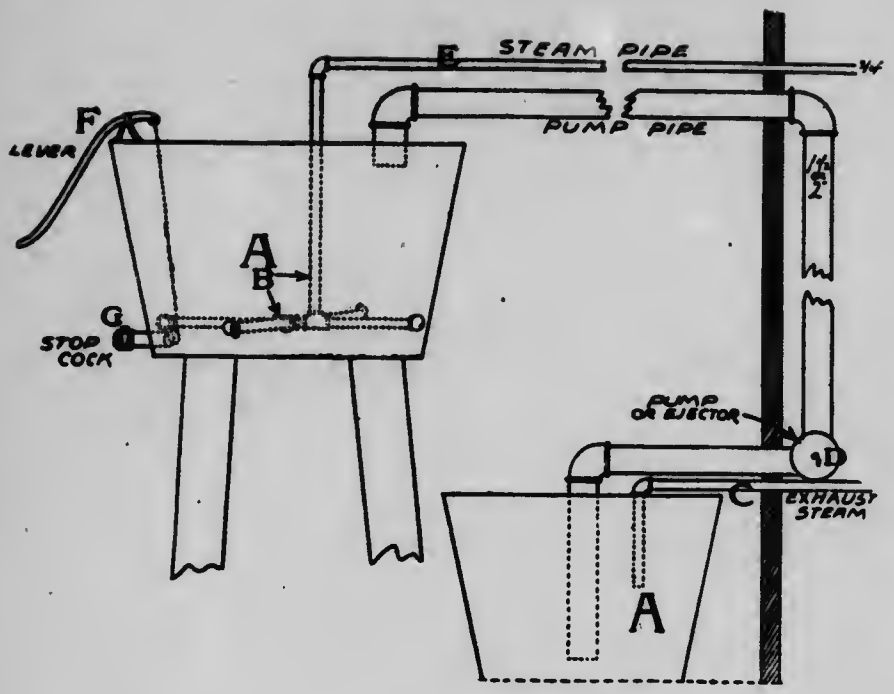


Fig. 4.

FIG. 4.—(A A) Lower and upper tank; (B E) live steam in upper tank instead of lower; (C) exhaust steam; (D) pump or ejector; (F) to close valve inside of tank to prevent leaking (can be put on any tank); (G) stopcock; (B E) can be put into lower tank if desired.

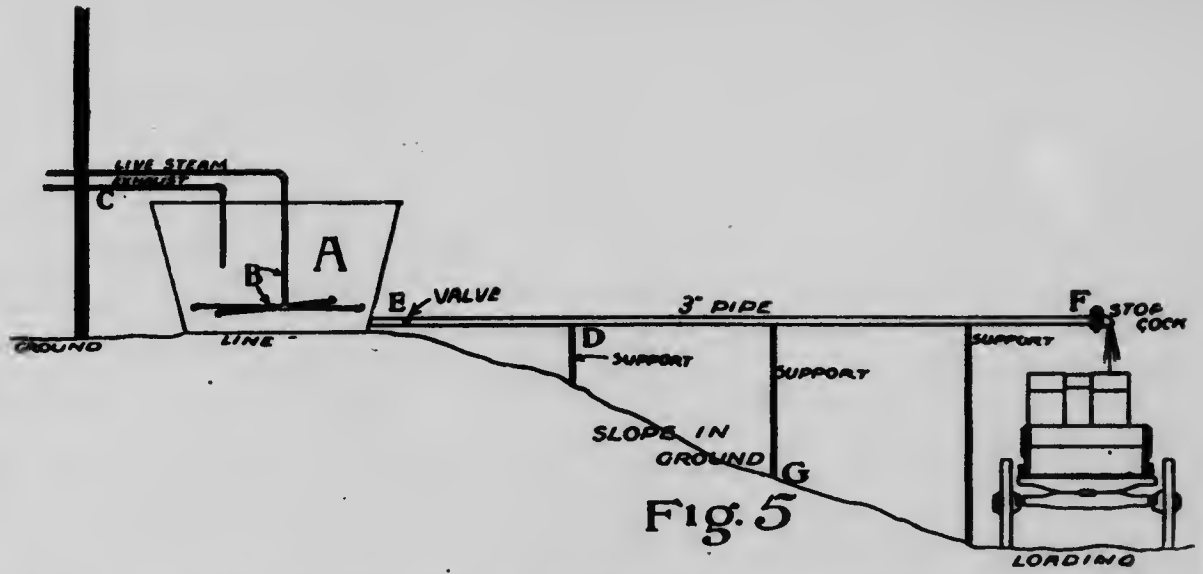


Fig. 5

FIG. 5.—(A) Single tank near boiler; (B) live-steam pipe; (C) exhaust steam; (D) 3-inch pipe to carry whey to loading point; (E) valve; (F) stopcock; (G) sloping ground line. This system used where formation of ground makes it necessary. No pumping.

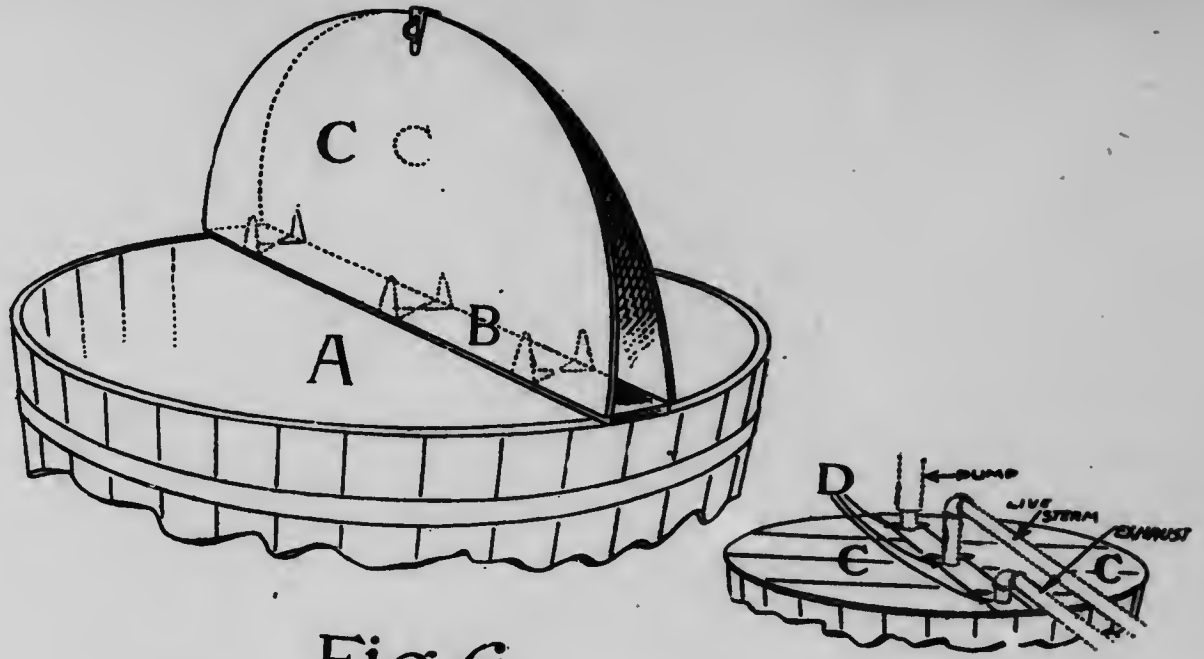


Fig 6

FIG. 6.—(A) Tank; (B) 8- or 10-inch cross piece, 1 1-4 inch thick, over centre of tank; (C C) cover raised for cleaning; (D) showing arrangements of pipes through cross piece (B) in order not to interfere with covers when raised; (C C) shows covers lowered over tank. If a very wide tank is used the cross piece may be increased to 2 or 3 feet, making the covers more narrow and easier to handle.

In any of the above systems to get the best results with the least amount of time one tank, either upper or lower, preferably both should be large enough to hold one day's whey. ***Best results can no doubt be obtained by pasteurising all the whey in the lower tank and then elevating to upper tank.*** The lower tank may then be easily cleaned. A tight valve is required between the boiler and tank, or the whey may siphon back to boiler after steam goes down. A small hole drilled in pipe will prevent suction.

To install any of the above systems (outside cost of tank, pump, or ejector and delivery pipe, practically all of which are always in use) should cost from $5.00 to $15.00, depending on distance steam has to be carried.

Experiments on Cost of Pasteurizing Whey.

Amount of Milk, Whey and Cheese—lbs.				Temperature and Time.			Acidity.		
Date. — 1909.	Amount Milk.	Amount Cheese.	Amount Whey.	Of Whey when heating begins.	Of Whey when heating is finished.	Time for heating.	When heating begins.	When heating finished.	17 hours after heating.
June 9	14,000	1,272	12,600	96°	155°	60 min.	.19 %	.2 %	.28 %
10	13,700	1,245	12,330	96°	155°	59 min.	.18 %	.2 %	.26 %

Cost of Fuel.

June 9, 143 lbs. of coal at $4.00 per ton ...	28.6 cts.	
2 cord wood sticks	5 cts.	
	33.6 cts.	33.6 cts.
June 10, 122 lbs, coal at $4.00 per ton	24.4 cts.	
4 cord wood sticks	8 cts	
	32.4 cts.	32.4 cts.

June 9.—To heat 12,600 lbs. of whey cost 33.6 cts. To heat 20,000 lbs. of whey (amount from one ton of cheese) cost 53.3 cts.

June 10.—To heat 12,330 lbs. of whey cost 32.4 cts. To heat 20,000 lbs. lbs. of whey (amount from one ton of cheese) cost 52.5 cts.

Note.—In the above calculations note the following:—

1. 11 lbs. of milk allowed to make one pound of cheese.
2. 90 per cent. of the milk allowed for whey.

3. Boiler pressure on June 9th, when beginning to heat whey, 85 lbs.
Boiler pressure on June 9th, when heating was finished ... 75 lbs.
Average boiler pressure during the time of heating, about.. 80 lbs.
4. Boiler pressure on June 10th, when beginning to heat whey. 70 lbs.
Boiler pressure on June 10th, when heating was finished... 95 lbs.
Average boiler pressure during time of heating, about..... 90 lbs.
5. On June 9th, flues not very clean. On June 10th, flues clean.
6. Size of boiler, 20 horse power.
7. Distance from boiler to whey tank, 75 feet. Size of pipes conveying steam, 25 ft., 1 1-4 in. pipe; 50 ft., 1-in. pipe.
8. A four-way 3-4 inch pipe at bottom of tank, as in figure 1 (B2). The pipe shown in figure 1 (B1) with elbows would no doubt be better, as they would keep the whey in better motion during the time of heating.
9. Boiler pressure was maintained as even as possible during test.
10. Tank was covered with loose boards.
11. Enough pressure was left on boiler after pasteurizing was finished to elevate the whey and fill the boiler with water without extra cost.
12. Best results can be obtained by beginning the heating at once after first whey is run off the vats rather than waiting until all whey is in the tank.

Cost of Elevating Whey with One and One-Half Inch Rotary Pump.

Milk 13,700 lbs., whey 90 per cent. allowed, 12,330 lbs.
Time required to elevate, 50 minutes. Revolutions of pump per minute, 200.
Capacity, 1 1-2 inch pipe, 14,800 lbs. per hour. Pounds pressure on boiler at the time of starting to elevate, 95 lbs.; when elevating was finished, 100 lbs.
Required 33 lbs. of coal at $4.00 per ton, 6.6 cts.
To elevate 12,330 lbs. of whey cost 6.6 cts. To elevate 20,000 lbs. of whey cost 10.7 cts.
Temperature of the air outside 65 degrees.

Conclusions *re* Cost of Pasteurizing Whey.

Although the above experiments seem to indicate that the actual heating of the whey from 98 degrees up to 155 degrees may be done under the very best conditions for about 55 cents per ton of cheese, still when we take into consideration the difference in the cost of fuel and other conditions which exist in different localities and the repairs from time to time, we believe the average cost for heating will be about 75 cts. per ton of cheese (20,000 lbs. of whey). In no case have we known the cost of heating to be greater than $1.00 per ton of cheese.

As the patrons receive the greatest benefit from proper pasteurization of whey, they should in all cases pay the cost which is very small considering the benefit derived, and it is pointed out that when makers receive pay for the work they should in every case use their best efforts to see that the very best possible results are obtained, and the work properly performed.

Whey Barrel.

Attention is also called to the fact that patrons should be careful in the matter of keeping the vessels in which the whey is emptied at the farm sweet and clean, if they are to secure best results from the feeding of whey. It is quite evident that in many cases the feeding value of whey has been underestimated in past years owing to the condition in which it was kept at the factory and at the farm before being fed to stock.