could be remedied. Mr. Wallace reports that the machine, which is called the Thistle, is thoroughly efficient, milking the cows as thoroughly as could be done by hand, while Principal McCall certifies that no injury was done to the teats and milk vessels of the cows. A company has now been formed and the machine will be put on the market at once.

The *North British Agriculturist* gives the following description of it:

The Thistle milking machine requires to be seen before any one can have any true idea of its marvellous ingenuity and capacity for performing the work for which it is designed. Like most other milking machines which have been produced before, it works by suction generated by an air-pump. But, unlike all other milking machines, the suction is applied on the pulsating principle in precisely the same way as is done by the calf in sucking the milk from the udder of the cow. This is accomplished by means of a teat "cup," which is a marvel of ingenuity. The teat "cup" is of cylindrical shape, and is made of the very best quality of rubber. By means of the suction in the rubber tube connecting with the air-pump, the "lips" of the cup fit firmly on to the vessel of the cow at the neck of the teat, precisely as the lips of the calf do when sucking. But immediately behind the "lips" and inside the "cup" are two "gums," which, with every stroke of the piston in the pump, clasp firmly round the neck of the teat, and, from the peculiar formation of the tube, the pressure, when it slackens at the neck after each pulsation, is continued down the teat, so that the milk is drawn off just as is done by the calf in sucking, or by the skilful milker with each movement of the hand in the milking process. The air-tight milking pail, into which the milk of each cow is drawn, is also a most ingenious and thoroughly original contrivance. The milk is first received into a small cylindrical compartment on the top of the "pail," this compartment having a glass gauge on one of its sides. In the bottom of this compartment is a small aperture, on which rests a ball of rubber filled with air. The milk as it falls into the compartment causes the rubber ball to rise and allow the milk to have free ingress to the milk pail, the rubber ball again closing and keeping the pail air-tight the moment the current of milk has ceased. The milk pail has also a glass gauge up one of its sides so that the amount of milk in it may be easily seen. The arrangements for regulating the pressure are equally notable as marvels of ingenuity and simplicity combined. In fact, the machine, as a whole, is one of the most notable inventions of the nineteenth century. The cows seem undoubtedly to prefer the mechanical milker to the hand milking; and the milking is done to perfection, even the last strippings being thoroughly drawn off by the machine. If the teats be brushed or washed clean before the teat "cup" is applied, the pure milk, thoroughly free from dirt on the udder or teats of the cow, or on the hands of the milkers, and perfectly uncontaminated by the germs of putrefaction, is drawn straight away through a vacuum tube into the vacuum in the air-tight milk pail.

Whey Butter.

In the process of cheesemaking a small percentage of fat escapes in the whey, writes Prof. Wing in Bulletin 85 of the Cornell Experiment Station. This fat is lost except in so far as it adds a slightly increased feeding value to the whey. From some hints that we had received from Dr. S. M. Babcock, of the Wisconsin Agricultural Experiment Station, we were led to believe that this fat could be utilized in the form of commercial butter. Partly with the purpose of making some investigations into this matter, and partly to afford our students additional practice in running the separators, we determined at the beginning of the Short Dairy Course term of 1895 to run the whey through the separators, and, if possible, to make butter of the fat that we were thus enabled to secure. Accordingly, January 18th, 1895, we began to run the whey from the cheesemaking regularly through the separators, and we have been successful in securing a large proportion of the fat in the whey in the form of commercial butter of good quality. This butter has been scarcely, if any, inferior to that made from cream, separated from whole milk, and it has been printed and sold in the same market with our best butter.

Upon the average, we have been able to secure 2.57 pounds of butter from each 1,000 pounds of whey, and the whey has contained upon the average .25 of 1 per cent. of fat, showing that we have recovered, in the form of butter, nearly all of the fat in the whey.

In only a few details does the manufacture of whey butter differ from ordinary buttermaking.

On account of the small percentage of fat in the whey, it was found to be impracticable to secure at one separation a cream thick enough for best results without churning it more or less in the separator. In order to overcome this, the whey was put through the separator in the same way milk would have been, and about one-tenth the whole bulk taken from the cream outlet. This was found to contain on the average from 2 per cent. to 5 per cent. of fat, or to be of nearly the same fat content as ordinary milk. This so-called "first cream" was run through the separator a second time, and in this way the cream condensed to the proper consistency for churning. In running the Danish-Weston machine, this was not found to be necessary. The Danish-Weston machine is provided with a contrivance whereby the proportional flow from the skim-milk and cream outlets can be controlled at will, and in running the whey through this machine it was found entirely feasible to shut off the cream outlet entirely until a sufficient amount of cream had gathered in the centre of the bowl, when by turning in the skim-milk point this cream could be thrown out, and after being so removed the skim-milk point could be thrown back again until a second portion of the cream had gathered in the centre of the bowl. In this way we were enabled to get a clean separation and cream of good consistency in one operation.

In all of our experiments the whey was run through the separator immediately after it was drawn and before it had cooled down. It was at this stage, of course, slightly acid, and the resulting cream was in good condition to churn at once after being reduced to the proper temperature. We have had no difficulty, however, so far as the flavor of the butter was concerned, in holding the whey 24 or even 48 hours in some cases, but would strongly recommend that the whey cream be churned as soon as convenient after separation. In one case where it was attempted to hold the whey 48 hours before separating, the development of lactic acid went so far that the flavor of the butter was spoiled. The practical point seems to be that the whey should be separated at once, and where possible the cream churned quickly, and preferably in any case the whey cream should not be held more than 24 hours.

The cream from the whey, containing, as it does, very little casein, was very easily, quickly, and completely churned at a low temperature. The most complete churning was obtained when the churn was started at a temperature from 48° F. to 54° F., the time required in most cases being less than twenty minutes.

In regard to the quality of butter; as before stated, butter made from the whey has gone into the same market as the butter made in the ordinary way. Good judges who have seen the two kinds of butter side by side have been in some cases unable to detect which was made from whey and which from cream. In other cases slight inferiority in texture and flavor have been noticed in the whey butter. That it is possible to make butter of good commercial quality we have clearly shown. Whether or not it can be done at a profit is the practical question for the ordinary factoryman.

In order to enable the ordinary factory to utilize the fat wasted in this way, it would be necessary to provide storage capacity for a large part of the whey produced in any given day, and a centrifugal separator, churn, and butter-worker. In cases where more than one vat of milk is made up, by so arranging the work that the whey would be drawn from the vats at different times, it would not be necessary to provide so much storage, for the separator could be started as soon as the first whey was drawn, and much of the whey could be gotten out of the way before the last vat would be ready. Most factories have the necessary steam power to run such a separator.

The manufacture of butter from the whey will not ordinarily require much increased labor. The whey can be run through the separator at the same time that the latter part of the cheesemaking process is going on, and the churning will take but a small amount of time and labor. The additional items of expense will be the storage capacity for the whey and the separator.

According to the returns made to the Commissioner of Agriculture, there were made in the State of New York, in 1892, 130,991,310 pounds of cheese. Estimating that for each pound of cheese there would be 8½ pounds of whey, we should have a total of 1,113,426,135 pounds of whey produced in the state. Our whey has contained upon the average .25 of 1 per cent., but our cheese is made in small quantities, with special pains to prevent loss of fat in the whey, and the percentage of fat in our whey is undoubtedly smaller than that of the state at large. In Bulletin 65 of the New York Experiment Station, Dr. L. L. Van Slyke gives the average of a large number of analyses of whey made by him during the season of 1893. This work represents analyses of whey made at fifty different factories in eight counties of the state, extending from April to October, and the average of the whole shows .39 of 1 per cent. of fat in the whey. Assuming this to be a fair average of the percentage of fat in all the whey produced in the state, we should have 4,342,362 pounds of fat lost in the whey. Allowing that the butter contained 85 per cent. of fat, and providing for all mechanical losses in the manufacture, we should make from this amount of fat 4,776,598 pounds of butter, which at 20 cents per pound would be worth $995,319, or about 50 cents for each cow in the state.

In nearly all of the factories in the state this butter would find a home market among the patrons of the factory, so that expense of packages and marketing need not be taken into account, and the saving would be a clear one to the patrons.

Feeding Cows Slop.

The experiments conducted by Prof. Dean, in the dairy department of the Guelph Experimental Station, as regards feeding wet meal—so-called "slops"—to cows, tend to show that, not only is there no advantage in so doing, but that it is an expensive method. These experiments were first carried on during 1893, but the results have been corroborated by experiments carried on during November and December of last year. Nine cows were used in this trial.

The meal ration consisted of 2 lbs. ground wheat and 4 lbs. bran. While the cows were slopped once a day, half of this amount of meal was given dry and the other half in the form of warm slop. When the slops were given twice a day, this quantity of meal was given at two feeds. Besides the meal, they were getting some silage and pasture during the day for a part of the time, when the weather was favorable. Some of the cows increased in the quantity of milk and in the percentage of fat, while others decreased, during the period of slopping once a day. The difference in the percentage of fat was 0.14 for the group in the first period, and 0.10 in the second, when compared with the dry feed period. The following is the record for two weeks previous to slopping, for two weeks during which they were slopped once a day, and for two weeks during which slopping twice a day was practised:

Name of cows.	Record for two weeks previous to experiment. Oct. 8 to 21.		Record for two weeks when "slopped" once a day.		Record for two weeks when "slopped" twice a day.	
	Pounds milk.	Per cent. fat.	Pounds milk.	Per cent. fat.	Pounds milk.	Per cent. fat.
Bella	389	3.50	401	3.60	327	3.55
Violet	457	3.45	444	3.50	410	3.35
Bessie	420	3.45	466	3.30	429	3.45
Pansy	451	3.20	465	3.15	448	3.10
Annie	368	4.00	427	3.90	420	3.75
Clara	468	3.55	444	3.30	411	3.20
B. Temple	249	3.75	273	3.20	263	4.65
L. Rose	260	4.75	235	4.60	222	4.80
Totals and averages	3,062	3.96	3,157	3.82	2,940	3.86

After an intervening period of one week, six of these cows—Bella, Violet, Bessie, Pansy, Annie, and Clara—were given nearly all their drink in the form of slop. For the first few days the covers of the water boxes were not properly fastened down, but after this they were given all the warm slop they would drink and no water. The average of the six cows for the week beginning November 19th previous to slopping was 1,110 lbs. milk and 3.60 per cent. of fat. The weekly