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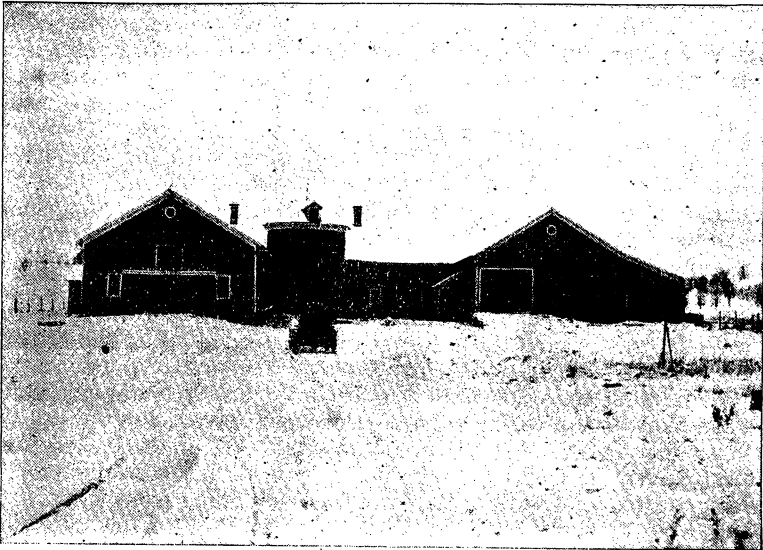
POPULAR EDITION

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New York Agricultural Experiment Station.

GENEVA, N. Y.



A NEW YORK DAIRY WHERE MILKING MACHINES ARE USED SUCCESSFULLY IN
PRODUCING CERTIFIED MILK FOR NEW YORK CITY

LEAKY VALVES ON MILKING MACHINES CONTAMINATE MILK

SUMMARIZED BY

J. D. LUCKETT

FROM BULLETIN BY

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POPULAR EDITION
OF
BULLETIN No. 488*
**LEAKY VALVES ON MILKING MACHINES
CONTAMINATE MILK**

J. D. LUCKETT

Sanitation overlooked in many milking machines Much ingenuity has been displayed within the last few years in developing the milking machine to a point where the milk is drawn from the udder completely and satisfactorily. Unfortunately, however, only a few manufacturers have devoted the attention which the situation demands to insure the production of *sanitary* milk with their machines. There are still certain mechanical defects which interfere with the production of high grade milk due to the contamination of the milk thru the machine. Construction of the machine so as to permit easy cleaning and selection of better materials for the metal and rubber parts offer opportunities for improving many of the mechanical milkers now on the market.

One defect in mechanical construction resulting in contamination of the milk has formed the subject of an investigation by the Experiment Station. This is the entrance into the pail of condensation water and foul material from the vacuum pipe line due to faulty construction of the check valves on the pail lids.

First valves designed to shut out stable air Early types of milking machines lacked any device to check the rush of air into the milker pail at the time that the hose extending from the pail to the vacuum pipe line was pulled off of the stanchion stop cock, thus breaking the vacuum in the pail at the completion of milking. It is now known that this also permitted condensed milky vapor and water to return to the pail from the vacuum pipe line and was a source of contamination of the milk and probably contributed to the irregular and high bacterial counts which were most annoying to the users of these machines.

The first move on the part of the manufacturers was to place a cotton filter on the pail lid to filter inrushing stable air which was believed to be highly charged with contaminating material. Later it was discovered that the contamination was due primarily to condensation water rather than to air and that the filters did not prevent the entrance of water.

* This is a brief review of Bulletin No. 488 of this Station on Milking Machines: VI. Leakage from the Vacuum Pipe Line into the Pail as a Source of Contamination of Milk, by R. S. Breed and J. W. Bright. Anyone specially interested in a detailed account of the investigation will be sent a copy of the complete bulletin on request.

Valves were then devised to maintain a vacuum in the milker pail, thus allowing the operator to lift the pail of milk by means of a handle on the pail cover, a convenience when the teat-cups are attached to the milker. These valves also served to check, to some extent at least, the entrance of condensation water from the vacuum line.

**Valves on
Station
machine
modified**

The milking machines used by the Station are so constructed that during milking a current of air passes continuously into the vacuum pipe line thru an opening in the teat-cup connector. Because of this, the pipe line in the Station stable contains condensation water at the end of each milking.

When the temperature and humidity are favorable the condensed moisture may amount to as much as a pint or more. This condition led the manufacturer of this machine to replace the early valves with a moisture trap on the pail lid which effectually prevented the entrance into the milker pail of condensation water from the vacuum pipe line under ordinary conditions.

**Defective
valves found
on other
machines**

Realizing that it is possible for sufficient contamination to enter the milker pail thru defective check valves to prevent the production of certified milk or to cause loss of premiums paid for high grade milk, the Station undertook a study of the valves in use on different makes and types of machines.

Detailed observations, which will be described later, were made on one machine of the inflation teat-cup type, while the check valves used on other makes of machines of this type were subjected to less rigid examination.

All of the valves tested were found to be defective in that they permitted some leakage into the pail when moisture was present in the vacuum pipe line. In some cases the leakage occurred with each pulsation of the machine and amounted to a tablespoonful or more, while in other cases only a few drops or no water at all passed into the pail during milking. In all cases, however, more or less leakage occurred at the time that the stop cock was closed and the stanchion hose detached. The valves tested are illustrated in Figs. 1 to 7. Frequently the vacuum pipe lines are free from condensation moisture and in such cases, of course, there is no leakage into the pail even tho the valves may be defective.

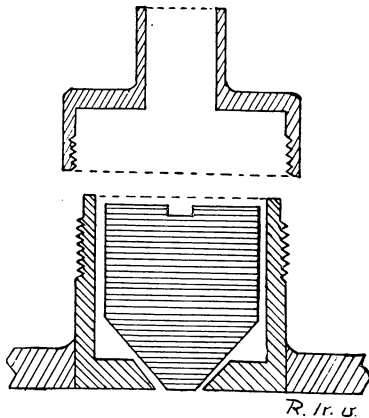


FIG. 1

In order to test thoroly the nature and amount of leakage that may take place with a defective check valve, a machine of the inflation teat-cup type was placed in operation in the Station barn where it could be compared directly with the Station machines which were known to have satisfactory valves. This placed the test machine under rather severe conditions, as the vacuum pipe line in the Station barn always contains an abundance of moisture.

**Leakage
of valve
demonstrated**

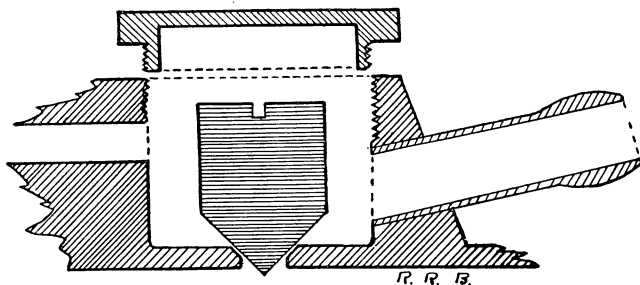


FIG. 2

At first two rather simple tests were made to determine whether leakage actually occurred thru the check valve. A small amount of a solution of a blue dye was placed in the hose connecting the machine to the stanchion stop cock and, at the same time, a piece of clean white gauze was fastened to the under side of the pail lid over the opening leading to the check valve chamber. The hose was then connected to the vacuum pipe line and the machine set in operation.

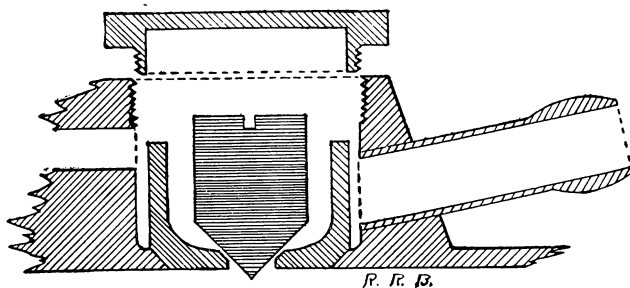


FIG. 3

The suction naturally tended to draw the dye up the stanchion hose into the main pipe line. After a few minutes the stanchion stop cock was closed and the hose disconnected, thereby closing the check valve. When the pail lid was removed and the gauze examined, it was found that a few drops of the dye had leaked back thru the valve and stained the gauze.

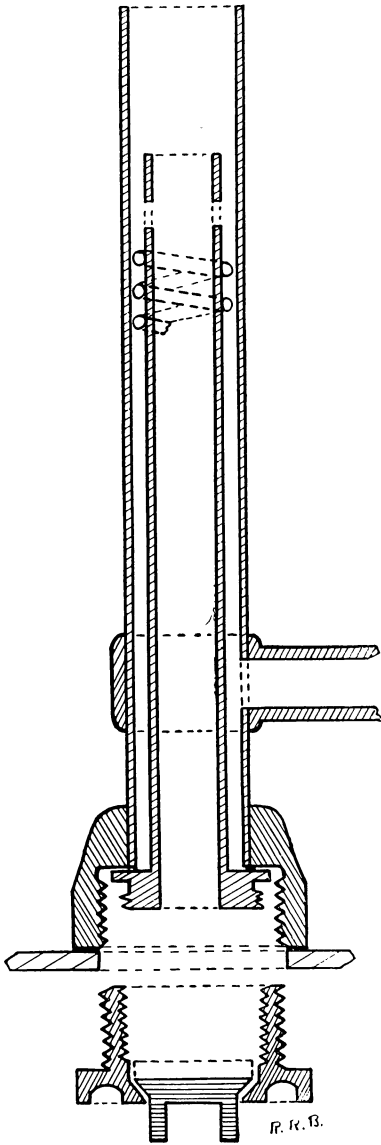


FIG. 4

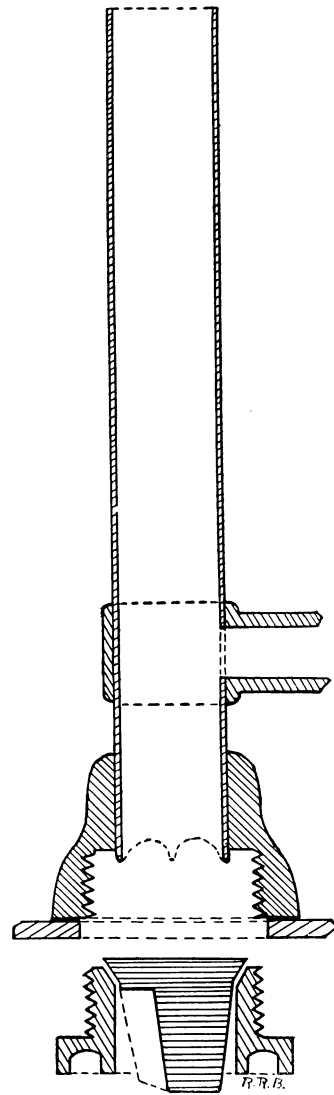


FIG. 5

Leakage thru the valve was further confirmed by placing a dry glass beaker directly under the check valve and then operating the machine for a short time. Upon opening the machine a few drops of moisture were found in the beaker.

With such convincing evidence that leakage of condensation moisture actually occurred thru check valves which were not properly constructed, it was quite evident that milk passing thru machines equipped with such valves may be subjected to continual contamination of foul material from the vacuum pipe line and stanchion hose. That this may be the case was proved

**Bacterial
counts
increased
by leakage**

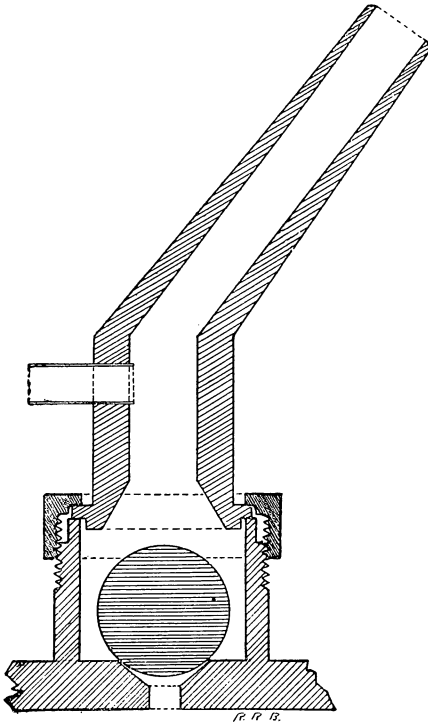


FIG. 6

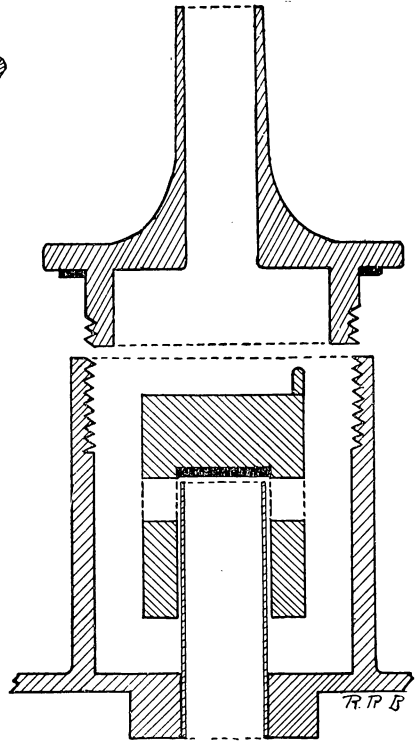


FIG. 7

conclusively by bacteriological tests of both water and milk drawn into the experimental machine.

About a quart of sterile water placed in the milker pail and then examined after the machine had been operated for five minutes and again after a second five minute period of operation showed striking increases in the number of bacteria. Samples of the water taken from the pail before the machine was set in operation showed an

average of 297 colonies of bacteria per cc. This figure was increased to 1,880 colonies per cc. after the first five minute period of operation, and to 4,560 colonies per cc. after the second five minute period. The direct addition to the sterile water of 1 cc. of condensation moisture from the vacuum pipe line increased the number of colonies of bacteria to 1,000,000 or more per cc.

In a similar manner, bacterial counts of milk drawn by the test machine and by the Station machine revealed the fact that the machine with the defective check valve gave consistently higher counts than the Station machines having valves which prevented leakage into the milker pail, and this in spite of the fact that a special effort was made to keep the experimental machine in a sterile condition.

The bacterial counts of the milk from the test machine were not excessive, ranging from 4,300 to 84,000 colonies per cc., but only 7 of the 31 samples examined from this machine showed counts less than 10,000 per cc., the maximum amount allowed for certified milk. On the other hand, with the Station machines, the counts ranged from 2,400 to 62,000 colonies per cc., with 45 of the 52 counts less than 10,000 per cc. These counts are all somewhat high due to the fact that the plates were held longer than usual in order to permit as many colonies to develop as possible.

Evidently it would be quite difficult, if not impossible, to produce certified milk with machines having these defective check valves in stables where moisture accumulates in the vacuum pipe line.

Mechanical milkers in which the units are operated by individual pumps rather than from a main vacuum pipe line may also give trouble thru the return of condensation water into the milker pail. No valves are found on machines of this type, protection being secured by sterilization of the hose connecting the machine to the pump.

A machine of this type was examined by placing a glass tube in this rubber hose. A milky vapor was seen to pass up the hose and, condensing, to run back into the pail. It is evident, therefore, that this hose must be kept as clean as any other part of the machine if high grade milk is to be obtained. The hose can be sterilized by the use of chemicals, hot water, or steam.

Since the defects of check valves in use on different makes of milking machines have been pointed out to the manufacturers many of them have manifested a sincere desire to correct the fault and have so modified the valves on their machines that the difficulty has been largely overcome in the machines more recently placed on the market. It is highly desirable, however, that dairymen using milking machines should know of the possibilities of contamination from this source so that they can guard against the annoyance and loss occasioned by irregular bacterial counts.

A simple test that will reveal any leakage thru the check valve can be applied to any type of milking machine as follows: The machine should be set up as usual after the milker pail has been thoroly dried. The stanchion hose should then be attached to a stop cock, preferably at a point in the vacuum pipe line where condensation water accumulates, and the machine set in operation. After operating for a short time the stanchion stop-cock should be closed and the machine allowed to stand a few minutes before releasing the vacuum in the pail. If the check valve leaks, water will be found in the milker pail upon removing the lid. If this is the case, the matter should be taken up with the manufacturer of the machine for adjustment.

By attaching a short rubber hose to the pail head and fitting a glass tube between this and the stanchion hose it is possible to observe the foul material from the vacuum pipe line passing down the stanchion hose to the machine. A still more severe test of the check valves may be made by pouring a small amount of water into the stanchion hose before it is attached to the stanchion cock.

Even properly constructed check valves will not function as they should if they are permitted to become dirty. Also, foul material in the stanchion hose and in the vacuum pipe line is a constant source of contamination and should not be allowed to accumulate. An inspection of 50 dairies in Grade A districts in this State revealed the fact that no one thing in the care of the milking machine was so generally neglected as the cleaning of the check valves, the stanchion hose, and the pipe line. The check valves should be cleaned after every milking.

In order to secure the best results from the use of mechanical milkers it is necessary to pay strict attention to every detail in the care of the machine, but with such care it is no more difficult to produce high grade milk with milking machines than by hand milking.