Method for Testing Milking Machine Pulsators

A research study by the author has resulted in developing a method for testing milking-machine pulsators that will prove of value to designers in connection with pulsator layouts

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FOR judging the operating quality of a milking machine pulsator, the milking output may prove useful. The milking output is the kilograms of milk which can be milked per minute. In relevant literature this value is also called milking speed. This again is not the actual milking speed but an average value for a standard time. A continuous picture of the actual milking speed can be obtained by using the milking output recorder developed and used in 1932 by W. Fritz, Weihenstephan (Fig. 1). This instrument helped such men as Fritz, Eisenreich, Korkmann, W. E. Petersen and V. R. Smith in their research work on the influence of vacuum height, pulse number and vacuum-release ratio.

The Influence of the Pressure Change Period

From 1950 to 1955 extensive investigations were made, for the first time, by the author on the influence on pressure-change periods with the same vacuum, the same pulse number and the same pulsation ratio. The pressure-change period is the time necessary for the pulsator to change over from vacuum (negative pressure) to release (normal pressure), or from release to vacuum, respectively. To investigate the influence of the pressure-change period, all pulsators in question were operated with a negative pressure of 4500 mm water column and a pulse number of 46 pulses per minute. The findings of the aforementioned research work had proved these values to be favorable for good milking results. It was found that, with different pressure-change periods with more than 1,000 measurings of cows of various breeds, the milking results varied by about 20 percent maximum. This value clearly shows the importance of the influence of the pressure-change periods. Apart from the technical aspects, such as vacuum height, pulse number, construction of the teat cups, such factors as feeding, milking technique, and operating personnel were the same for the different experimental groups. Deviations in connection with lactation periods, breed, and barn temperature were reconciled by about 100 to 150 measurings per pulsator.

Paper prepared expressly for AGRICULTURAL ENGINEERING.

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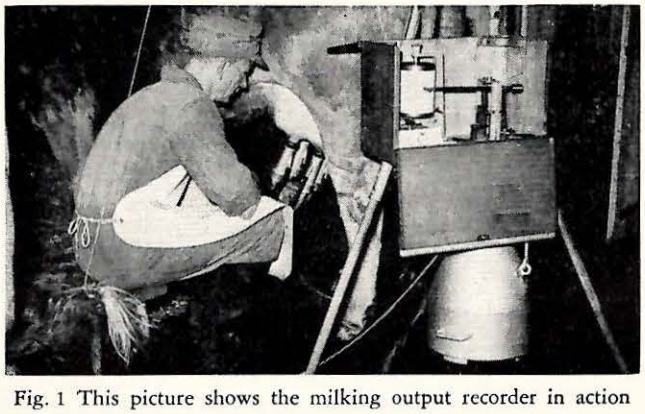

Fig. 1 This picture shows the milking output recorder in action

Influence of Milk Quantity

With regard to the influence of the milk quantity on the milking speed, average milking-speed values were found for certain milk quantities. Thus average-value curves can be drawn approximately corresponding with the ratio. Such average curves are shown in Fig. 2.

Finding the Pressure Change Periods

To test the pressure-change periods with sufficient accuracy, the pulse curves of the various pulsators were reproduced on the screen of a Philips electron-beam oscillograph (GM 3156/01). This was done by a steel membrane onto which strain gages were fixed, further by a direct-recording Philips measuring bridge (SM 5536/01) and by a Gena direct-voltage amplifier (EV 215). The curve branches of one pulse are superimposed since it was not possible to choose a lower relaxation oscillator frequency in order to

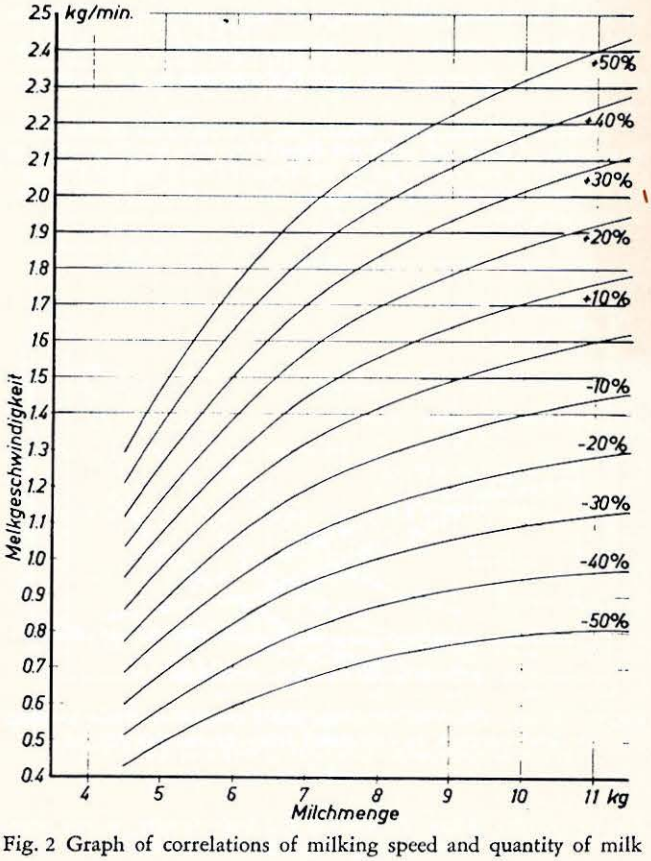

Fig. 2 Graph of correlations of milking speed and quantity of milk

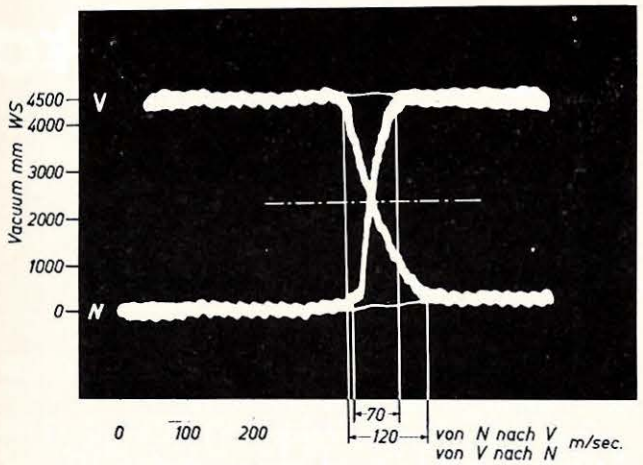

Fig. 3 Oscillogram of a pulse curve. *N* indicates normal pressure (release); *V*, vacuum, and *WS*, water column

secure a linear recording (Fig. 3). For later experiments we used a Voigtlaender-Philips Recording camera (FE 106). Here the time scale is indicated by the electrically-driven camera paper feed (Fig. 4). In both cases the pressure-change periods are found with the help of the time scale.

Relations Between Milking Curves and Pressure-Change Periods of Pulse Curves

As mentioned above, the milking-speed difference between two pulsators with different pressure-change periods was about 20 percent maximum. It was found that pulsators with a pressure-change period of about 125 ms (milliseconds) when going over from vacuum to release and of about 60 ms when changing from release to vacuum had the best milking results.

Evaluation Graph

Plotting the percentage deviation of the various pulsators in relation to the pressure-change periods, which can be read from the average-value curves of the milking speed, the result will be a diagram from which the rate of milking of each single pulsator can be immediately read after the pressure-change periods were found (Fig. 5).

Since the relation of pressure-change periods and milking speed was confirmed with sufficient accuracy by numerous experiments, this method will save us from the otherwise necessary experiments in the barn which would take months.

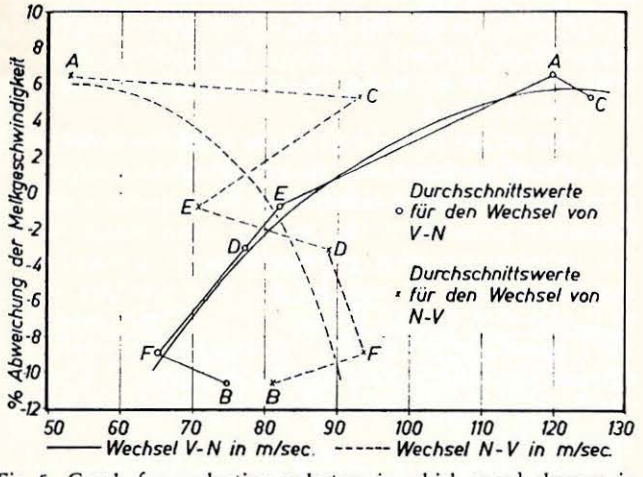

Fig. 5 Graph for evaluating pulsators in which speed changes in milliseconds are plotted against deviations in milking speed in percent. The solid-line curves represent average speed changes from vacuum to normal pressure *(V to N)*, and the broken line curves the changes from normal pressure to vacuum

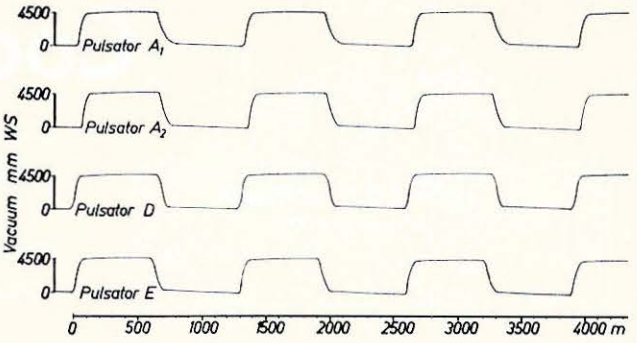

Fig. 4 Pulse curves of different pulsators as photographed by the recording camera

This technical method also confirms the results of the outstanding research work of Professor W. E. Petersen on the physiology of the milking procedure, for it shows that a soft, yet continuous and sufficiently long normal-pressure period (massaging the teat), as well as a quick change-over from normal to negative pressure, are of great advantage (Fig. 6).

The values of the pressure-change periods also provide valuable directions to the designer of milking machines for the layout of a pulsator. When time, content of the pulsator construction rooms to be emptied, and pressure difference are known, the necessary jet cross section can be found quickly and easily by electronic measuring.

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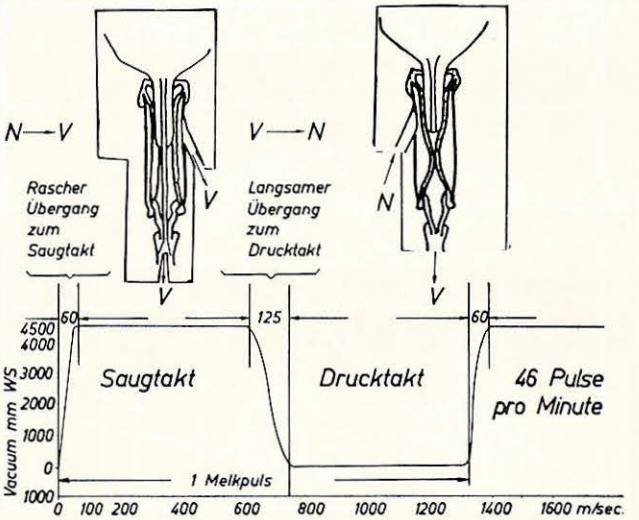

Fig. 6 *(Above)* Diagram at left indicates quick changing from normal to negative pressure, and at right from vacuum to normal pressure. *(Below)* A typical pulse curve- vacuum (Saugtakt) and release (Drucktakt)