

Vacuum Control on the Milking Machine

By W. G. WHITTLESTON, Physical Chemist, Department of Agriculture Animal Research Station, Ruakura.

IT is over a year since a commercial form of the damped weighted vacuum regulator appeared on the market in New Zealand. Practical experience has demonstrated the value of this device, but through lack of understanding the regulator has on occasion been installed incorrectly. This article explains how the regulator works and how it should be installed.

THE job of the relief valve on a milking machine is to prevent the vacuum from rising too high when the pump is removing more air from the machine than there is flowing into it via the air admission holes, pulsators, etc. This extra air may be called the "reserve air"; that is, it is extra air which will be needed when cups are being changed or any accident such as slipping cups occurs. For efficient milking a stable vacuum which should be kept between 14 and 15 in. of mercury is needed. A low vacuum means falling cups and slow milking; a high vacuum endangers the delicate tissues of the cow's udder. It is obvious that on a 4-cow plant the cups are changed four times during the milking of each cow. If the vacuum falls too much each time the cups are changed, there will be trouble due to falling cups. Three things can make the vacuum fall too much: A poor or slow pump, leaks, or a bad relief valve. A good pump and a poor relief valve are no better than a bad pump and a good relief valve. If the pump is running fast enough or is efficient enough to displace sufficient air to give a good reserve, this reserve must be accurately controlled.

What happens with a bad relief valve: Suppose the machine is fitted with a poor poppet-type valve and a set of cups slips; extra air comes into the machine and the vacuum falls. As

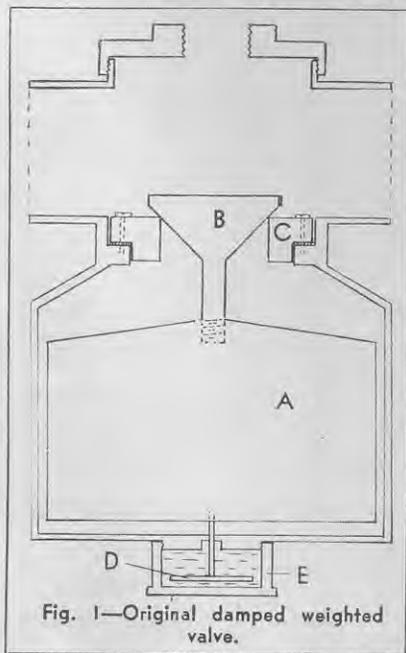


Fig. 1—Original damped weighted valve.

the relief valve is insensitive, it still lets in air when the vacuum is down to 11 in. and the cups fall off. This shows that a poor relief valve is like a leak in the plant; it reduces the effective capacity of the pump.

The action of a good relief valve: As soon as the vacuum falls by a small amount—perhaps only $\frac{1}{4}$ in.—a good relief valve closes quickly and makes all of the reserve capacity of the pump available to hold the vacuum. This may save the cups from falling off and so disorganising the milking routine. In other words a good relief valve gives the plant more reserve capacity to cope with accidents.

Weighted Relief Valve

The only satisfactory relief valve is the weighted type. The weight remains constant and does not cause an increase in the force on the valve head when it moves to let air in, as happens in any spring valve. Of course, the fact that a valve is weighted does not necessarily mean that it is a good valve.

The original damped weighted valve is shown in Fig. 1. The metal weight A hangs from the head B, which seats in a removable ring-shaped seat C. Such a valve without a damping device is unstable. The small piston D fitted to the weight moves in the oil-filled cup E and damps the valve enough to make it stable. Though quite efficient such a valve is expensive and difficult to install.

Damped Weighted Valve: Reaction Compensated

To be effective the original valve had to be installed on the machine by cutting a piece out of the air line and sweating in the valve unit. This was necessary because if the valve is connected to the machine through a length of tubing, it loses its sensitivity due to the resistance of the rubber tube. However, to be convenient for farmers the relief valve should be capable of being fitted by a rubber tube. The new valve to be described overcomes the difficulty and at the same time is stabilised by damping.

A diagram of the valve or regulator is shown in Fig. 2.

The main moulding 1 is held to a wall or other solid structure by the flange 2. A threaded cover 3 screws into the main moulding and encases the weight 8, which is enclosed in the plastic case 7. The bottom of this case is specially shaped to give a "reaction" valve seat 9 and 10 which rests on the air inlet tube 4. Air entering the valve passes through the screen 5 and leaves by the tube 6. The movement of the weight is damped by the piston ring 11 fitting snugly into the highly polished interior of the cover 3.

Action of Valve

The action of the valve is as follows:—

As the tube 6 is connected to the milking machine by a length of rubber tube, the vacuum in the machine is applied inside the cover. This means that the pressure of the atmosphere acts upward on the valve seat at 10 and tries to lift the weight. If the valve is set to open at 15 in. as soon as the vacuum has reached this level the force pushing up on the weight just manages to lift it and some air flows into the machine past the seat 9. If only a small amount of air passes, the force downward of the weight remains constant.

But suppose that the cups are hung up in two bails of a four-bail plant: A fair volume of reserve air now tries to come into the valve and the vacuum in the machine tries to rise. This lifts the weight and more air flows in. This extra air flows out of the valve down the rubber tube and in so doing causes the vacuum in the

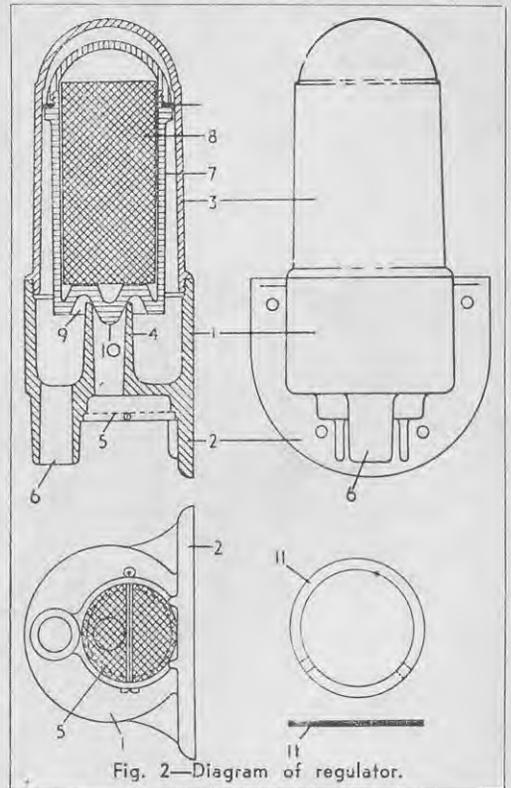


Fig. 2—Diagram of regulator.