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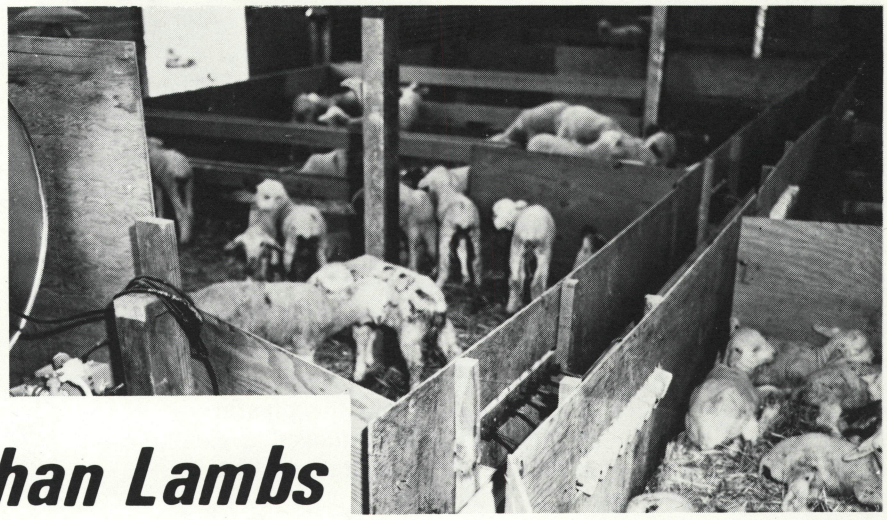
An Electronic Liquid Level Control Device For Feeding Orphan Lambs



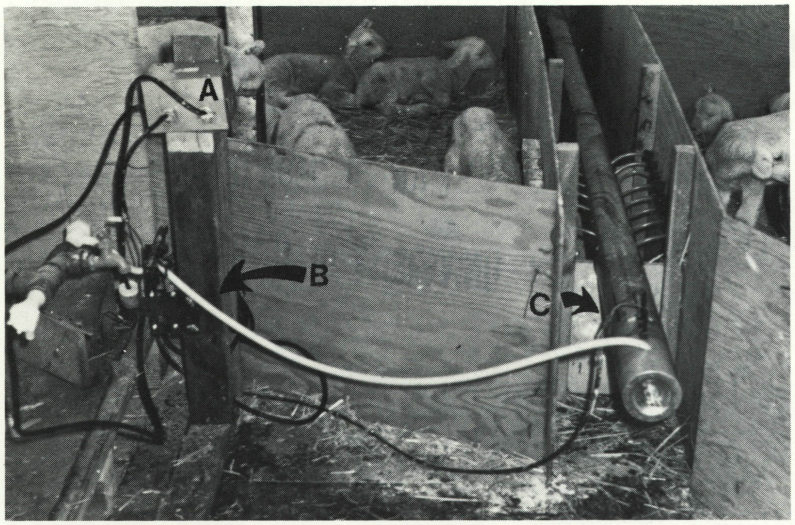
Research by the Idaho Agricultural Experiment Station in cooperation with the USDA Agricultural Research Service at the U.S. Sheep Experiment Station, Dubois, has shown that orphan lambs can be successfully reared using reconstituted milk replacer diets, self-feeding devices and early weaning to solid feed. For artificial rearing to be economical, labor costs must be minimized.

A labor-saving milk feeding system was recently developed at the Dubois station for rearing large numbers of orphan lambs. This system consists of nipples and tubes attached to a metal bar mounted on a framework on each side of a 3- or 4-inch diameter plastic (PVC) pipe, which serves as a milk reservoir. A constant supply of liquid milk replacer flows by gravity from a refrigerated bulk tank through a plastic tube to the feeder pipe reservoir. The photograph above is a general view of the feeding area at Dubois. The nipple bar and tubes are shown in detail in Figs. 1 and 2.

Initially a float-type valve was used to regulate the level of milk in the pipeline reservoir. However, this was not completely satisfactory as fat globules in the milk replacer tended to build up on the float, causing the feeder pipe to overflow unless the unit was frequently cleaned and monitored. This problem was solved by installing a simple control unit developed by the Department of Agricultural Engineering at the University of Idaho.

This control unit is a low-cost, liquid level, electronically controlled device consisting of a plastic tube valve, an electronic control unit and electrodes. The valve (Fig. 3) is constructed from a soft silicone plastic tube, a 110 vac solenoid and a tension spring. The valve is positioned between the refrigerated milk storage tank and the milk feeder pipe reservoir as shown in Fig. 1. The tension spring holds the valve lever against the silicone tubing, pinching it to stop the flow of milk. When the solenoid is activated, the solenoid pulls the lever away from the tube, allowing the milk to flow in the tube. Construction details are shown in Fig. 4.

The electronic control unit (see A, Fig. 1) is used to receive a signal from the three electrodes, located by arrow C, and to activate the valve solenoid. The three electrodes are mounted in the distribution pipe as shown in Fig. 5. One electrode is a ground or common electrode. The other two are high and low electrodes. When the milk level falls below the low level electrode, the electronic control unit activates the valve solenoid to open the valve, allowing milk to flow to the feeder pipe reservoir. As the milk level rises and comes in contact with the tip of the high electrode, the controller deactivates the solenoid and the spring pulls the valve level to pinch the tube, stopping the flow of milk. The wiring diagram and electronic components to construct the controller are shown in Fig. 6. Fig. 7 shows the terminal connections of the power and electrode leads. Commercial controllers are available at reasonable prices.



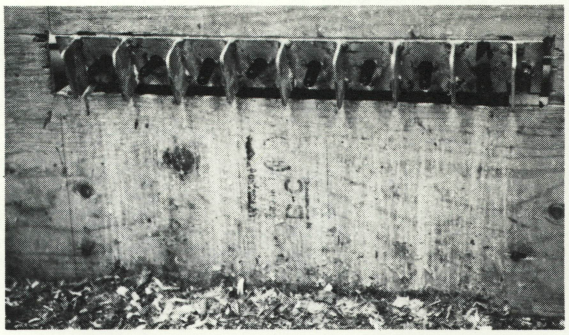


Fig. 1. In the feeding system installed at the U.S. Sheep Experiment Station at Dubois, nipples are mounted on aisle panels in each pen. The pipeline reservoir extends the full length of the aisle and liquid milk replacer is supplied to the pipeline through a plastic tube from a refrigerated bulk tank. The electronic controller is located at A, the tube valve at B and electrodes in the distribution pipe are indicated by C.

Fig. 2. A lambs' eye view of the nipples.

DISCUSSION

One advantage of the tube valve is that no milk is in contact with any part of the valve except the plastic tubing. The plastic tubing can easily be removed and cleaned as required to maintain good sanitation. The only attention required for the tube valve is periodic checking for possible plugging of the tube and checking the electrode tips. With some milk replacer powders, an electrolysis effect may occur which causes build-up on the tips of the electrodes. Any build-up, however, will cause a lowering of the liquid level rather than an overflow. The deposits can be easily removed.

The 110 vac input voltage is converted to low dc voltage to the electrodes. This eliminates any hazards of electrical shock to the lambs. A shock, of course, could discourage them from eating.

The controller-valve unit worked successfully during the 1975 and 1976 lambing seasons at the U.S. Sheep Experiment Station. Between 75 and 200 lambs were fed with the unit at one time.

Additional information regarding the installation and operation of the liquid level control and valve unit can be obtained by contacting the authors.

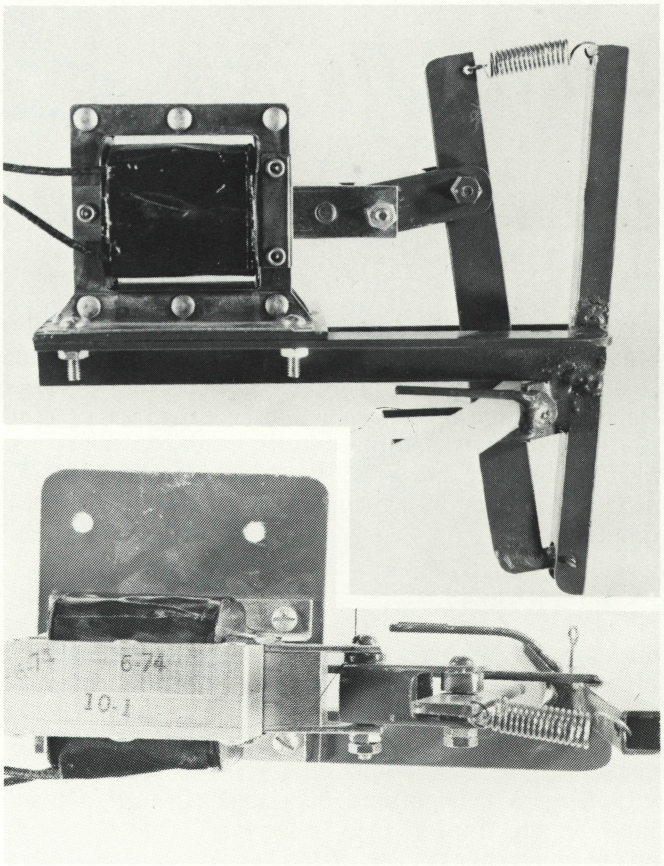


Fig. 3. Side view (top) and bottom view of the tube valve. Note on side view the location of the connecting link between the solenoid and the valve lever. This off-center is important for smooth operation of the solenoid. Bottom view of the valve shows how the silicone rubber tube is pinched closed.

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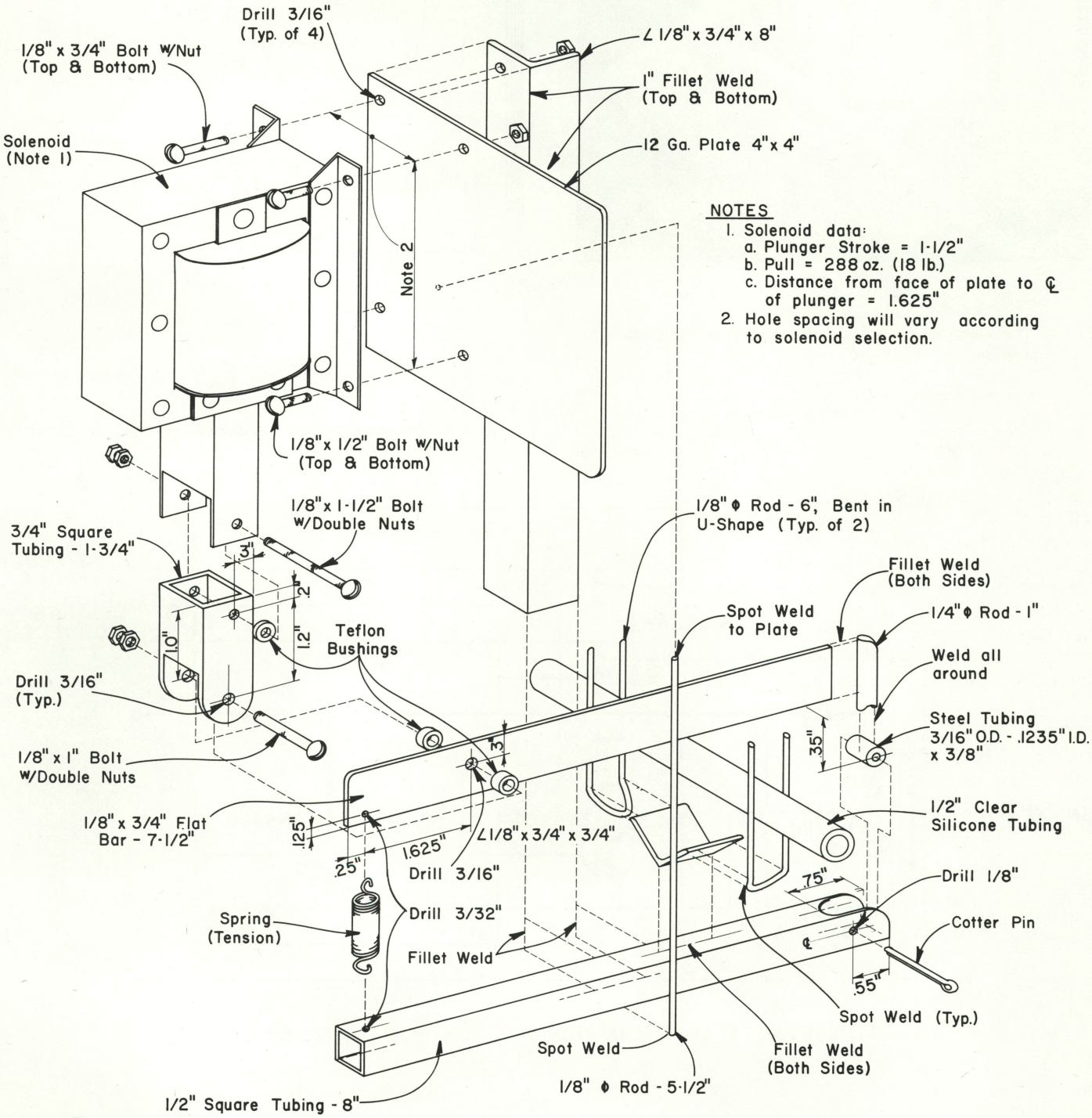


Fig. 4. Exploded view of the tube valve showing parts and dimensions.

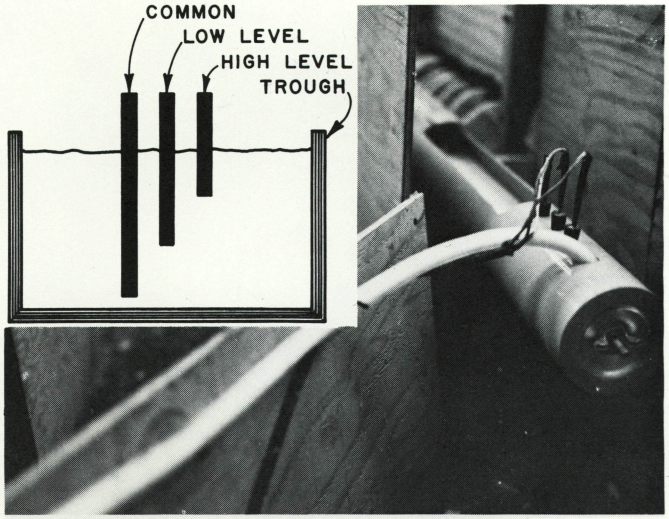


Fig. 5. The electrodes were mounted in these positions in the feeder pipeline.

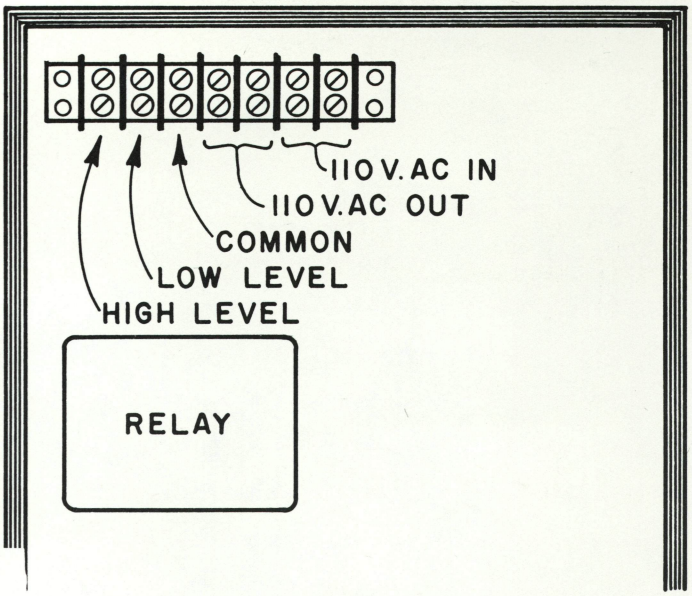
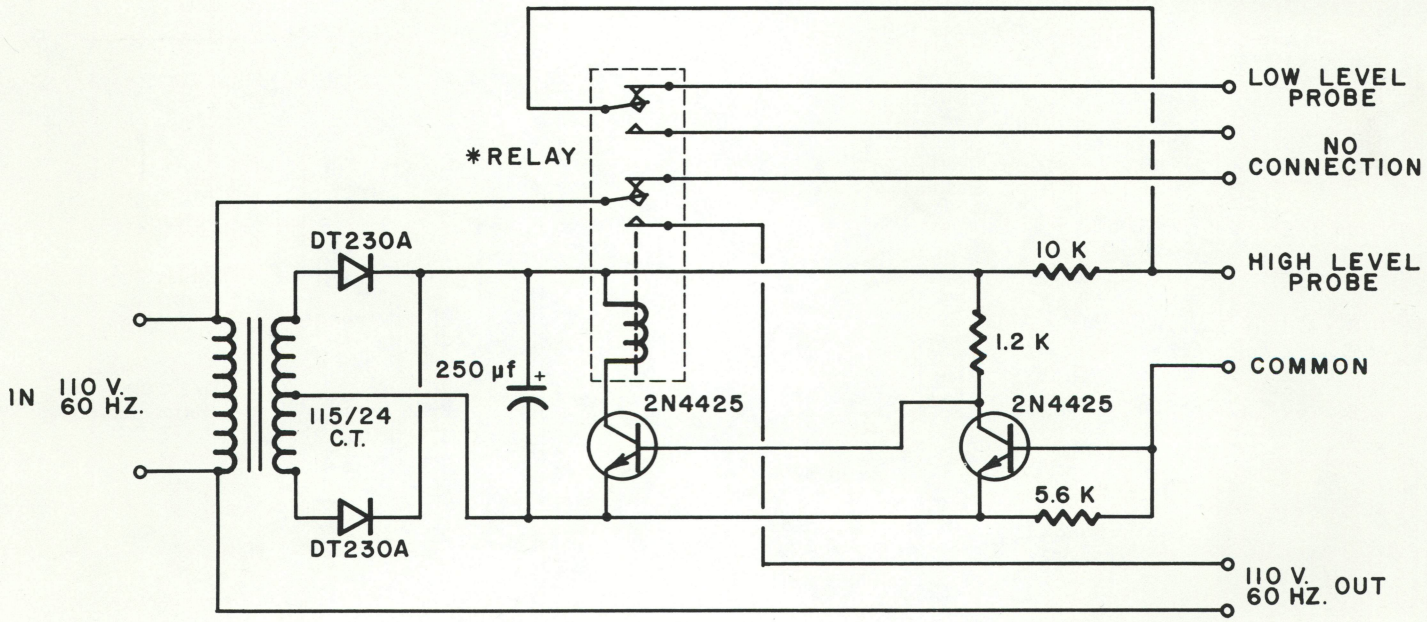


Fig. 7. Power and electrode connections at electronic controller.



*RELAY CONTACTS SHOWN IN NORMAL POSITION WHEN COIL IS NOT ENERGIZED.

Fig. 6. Schematic wiring diagram of the electronic controller.

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