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# Environmental Physiology and Shelter Engineering

*With Special Reference to Domestic Animals*

LXXIII. METHODS FOR USE AND MAINTENANCE OF  
RUMEN CANNULAS IN DAIRY CATTLE

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# Environmental Physiology and Shelter Engineering

## Methods for Using and Maintaining Rumen Cannulas in Dairy Cattle

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### INTRODUCTION

The rumen fistula fitted with a cannula is a dependable and convenient method for studying physiological and bacteriological functions of the ruminant animal, especially the rumen and the reticulum compartments. Much work has been reported on the method of fistulating cattle.<sup>3,4,6</sup>

Many different techniques have been used to close the fistula area. Schalk and Amadon<sup>3</sup> reported using a fitted block of wood kept in place by a flap of leather on the inside and a flat piece of wood on the outside held together with wire.

Problems arising from the different techniques have been that the cannulas were (1) not gastight, (2) heavy, causing distention of the fistula, (3) easily broken due to use of light construction material, (4) too tight, causing pressure necrosis, and (5) hard to install due to muscle contraction and scar tissue build-up.

The change of fistula size due to tissue extension or sluffing of necrotic tissue has created the necessity of having a type of cannula which will adapt itself to these changing conditions. The fistula sealed with an airtight cannula has been an asset in nutritional studies. Mendel<sup>1</sup> developed a semi-pneumatic plug and reported good results for intrarumen pressure and gas studies.

### Modified Cannula and Component Parts

One objective of this paper is to report the construction of a cannula that will meet the following requirements: (1) simple, (2) easily constructed, (3) gastight, (4) light in weight, (5) permits easy access to rumen ingesta, (6) easily installed, and (7) minimum maintenance during special studies and at times when animals are not on experiment

The design of the cannula is shown in Figure 1. The rubber gasket was made by vulcanizing two 3.50-inch by 4-inch intertubes together which provided a pneumatic gasket on both sides of the fistula. The cannula barrel was made from 4-inch acrylic plastic tubing. Threads were cut as described in Figure 1. The wrenches were constructed to tighten the outer plate and inner plate to reduce the occurrence of cannula coming out due to the unthreading of the inner plate. The inner plate had a tendency to loosen when animals were fed high

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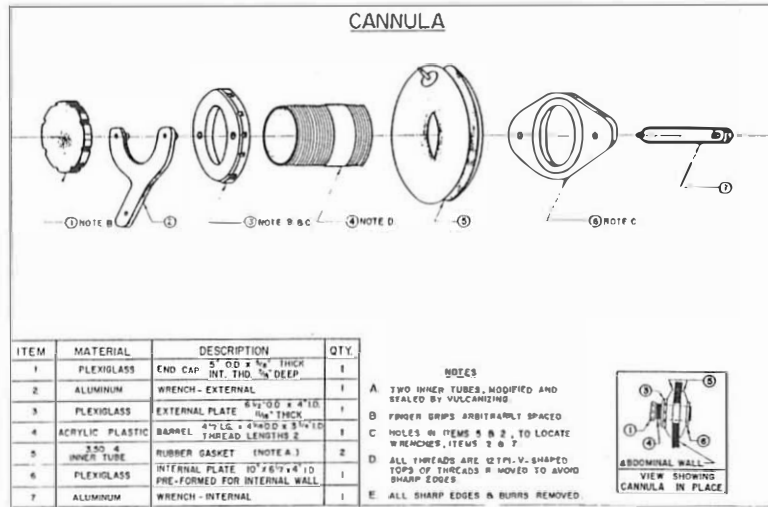


Fig. 1—Cannula assembly with pneumatic gasket.

quantities of coarse forages. When necessary, the inner plate can be locked by placing a nylon cord through a hole drilled in the cannula barrel.

The area between the upper threads and lower threads should be sufficiently wide to allow tightening of plates (Fig. 1, items 3 and 6) without causing decreased circulation, thus preventing the formation of necrotic tissue.

The pneumatic gasket inflated to approximately four pounds pressure will normally provide a ruminal seal. Care must be taken not to over-inflate the gasket as undue pressure may cause the formation of necrotic tissue. If animals are not on experiment, the pressure may be reduced and the cannula will remain in place under normal animal behavior. The gasket serves as a cushion between the tissue and the cannula.

#### Fistula Distender

In animals where problems are encountered in placing the cannula in the fistula due to muscular contraction or increased scar tissue, the use of a fistula distender has proven advantageous. However, it is of little value when using the pneumatic gasket since the fistula must be large enough to allow for installation of the gasket.

The threads on the cannula barrel have a tendency to cut or file the fistula lining, thus causing irritation to the fistula wall. The distender was constructed from a solid 4 1/2-inch rod of aluminum tooled as shown in Figure 2. The assembly is constructed so the cannula barrel fits over the head of the fistula dis-

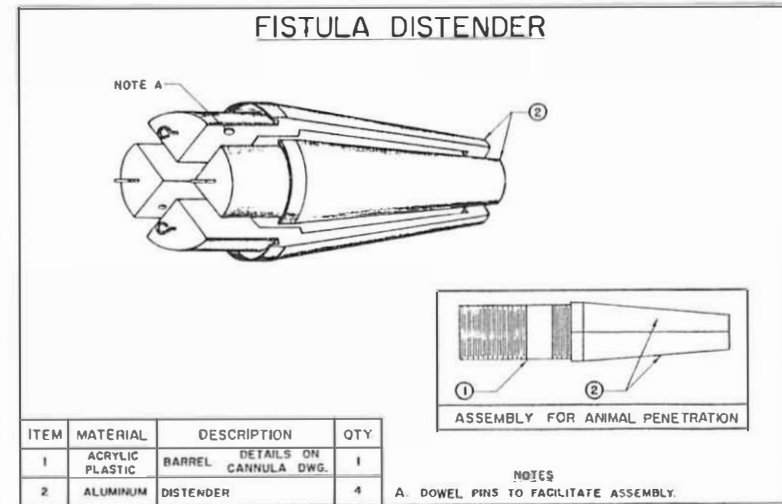


Fig. 2—Tool for inserting cannula barrel into fistula.

tender into a bevel groove, thus holding the distender together as a unit while it is being forced through the fistula opening. When the fistula wall is in contact with the cannula barrel, the distender is pushed into the rumen cavity and allowed to divide into 4 component parts. It is then removed through the cannula opening in sections.

Liquid soap or petroleum jelly is used as a lubricant to facilitate smooth entry of the fistula distender. In difficult cases, it is sometimes necessary to inject a muscle relaxant into tissue surrounding the fistula opening.

#### Ruminal Infusion Assembly

The following technique was developed to facilitate (1) the infusion of fluids into the rumen cavity of cattle; (2) the infusion of different amounts of fluids, 24 hours per day, for as many as 7 days continuously; and (3) discharging fluids into the ruminal ingesta.

The functional assembly is shown in Figure 3. The ruminal infusion probe (Fig. 3, item 1) was made of rigid 3/8-inch plastic tube (water line) approximately 24 inches in length and encased the 1/4-inch plastic delivery tube. It was desired to have this infusion tube penetrate the ingesta media approximately 20 inches. The rumen cannula assembly (Fig. 3, item 2) has been described previously under rumen cannula. A metal tube (Fig. 3, item 3) was used to encase the plastic delivery tube as it came from the rumen cannula assembly to give

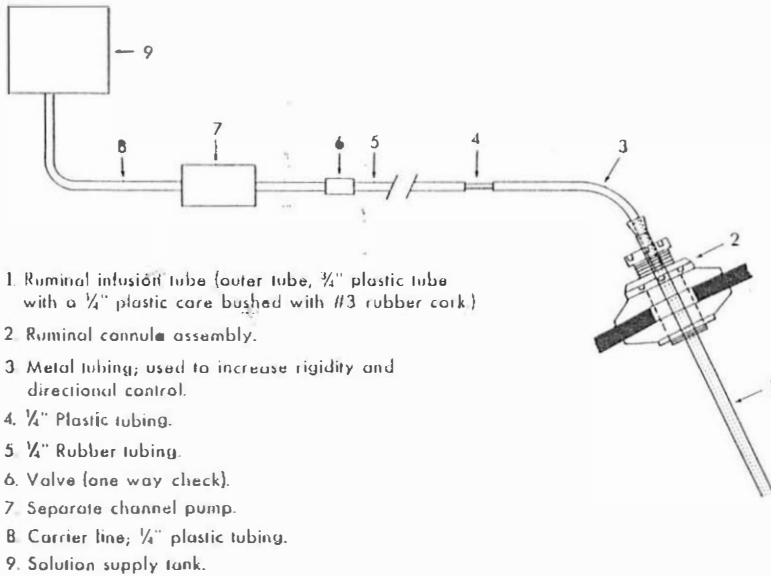


Fig. 3—Ruminal infusion assembly.

rigidity and general direction for the plastic delivery tube. A  $\frac{1}{4}$ -inch I.D. (Fig. 3, item 5) recoil nylon<sup>a</sup> delivery tube (Fig. 4) was used in front of and behind the check valve in order to facilitate ease in connecting the units to the 12-channel pump (Fig. 3, item 7). The 12-channel pump<sup>b</sup> was constructed to allow 12 individual infusion operations, thus making it possible to have different rates, materials, or animals. A check valve (Fig. 3, item 6) was placed between the

<sup>a</sup> Akro-Mils, Inc., Akron, Ohio

<sup>b</sup> Durrum Instrument Corp., 923 East Meadow Drive, Palo Alto, Calif. 94303

Fig. 4—Recoil nylon delivery tube.

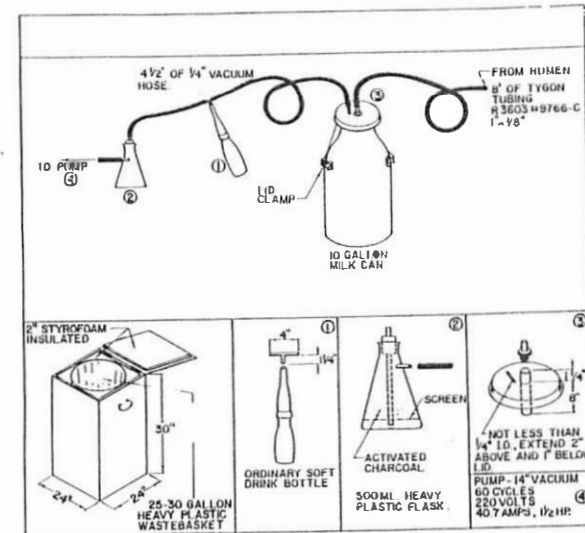
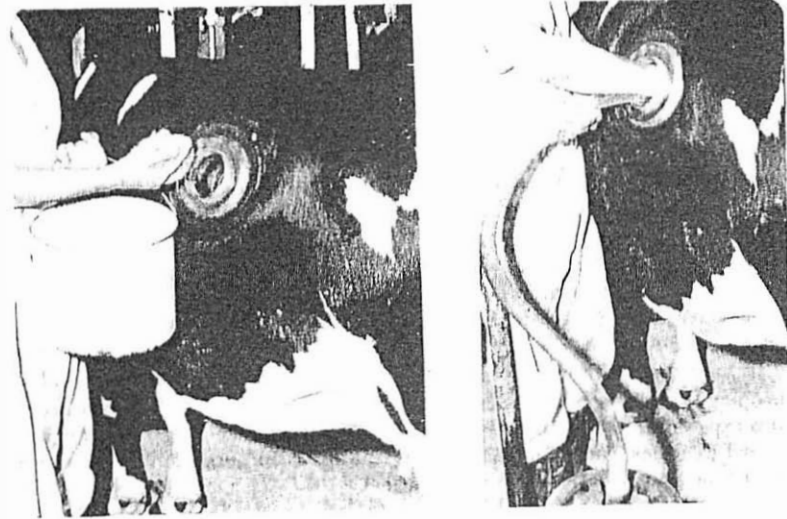


Fig. 5—Pasting technique for ruminants.

pump and the animal being infused, thus overcoming back pressure caused by ruminal contraction. Rubber couplings were used in the carrier lines where it was necessary to make connections between units; this gave added flexibility. The solution supply tank (item 9) was constructed of acid resistant plastic material holding approximately five gallons of liquid. The size and material used in the tank construction can be regulated to suit type and volume of material or materials to be infused within a given period. With slight modification a similar system was designed using 0.062 inch I.D. Polyethylene tubing to infuse volumes as small as 10 ml. per hour.

#### Fasting Studies

A technique, shown in Figure 5, was used to study cattle in fasting condition. The animals were fed a ration of 55 percent ground alfalfa hay and 45 percent ground concentrate which aided in the removal of material from the rumen. The solid rumen contents were removed by hand as shown. The fluid and remaining solid portion were then removed by vacuum. The source of vacuum for this experiment was a standard milker vacuum system. The rumen contents were stored in an insulated container for a period up to 24 hours and then returned to the rumen.

#### SUMMARY

A simple and economical rubber pneumatic gasket was designed and successfully tested in creating a gas-tight seal for a 4-inch rumen cannula. The gasket is easy to use and maintain in research studies. Other methods are described for inserting the cannula into a restricted fistula opening and for infusing liquids into the rumen. The bulletin also describes a technique for conducting fasting studies with ruminants.

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