the reducing valve, into a small chamber (C) fitted with leads the entry of gas into which could be controlled by fine needle valves. From one of these leads the gas was passed, through a bubbler tube (D) partly filled with water to the plastic tube (E) which delivered it to the queen holder. The gas could also be passed directly from the reducing valve (B) through a tube which could be closed with a stopcock and through the bubbling system (F) to the container (G) which was used for anaesthetising caged queens. The supply of carbon dioxide to the queen could be gauged easily by the rate of bubbling in the bubbler and regulated to give the minimum flow needed to keep the queen completely anaesthetised during insemination.

The manipulating apparatus consists essentially of a heavy stand on which are mounted the queen holder, the syringe, and the holding hooks in such a way that they can be moved and adjusted easily (Fig. 6).

Syringe and instruments: A and B in Fig. 7 are the components of one of the latest-pattern syringes. It consists of a metal plunger which can be screwed up and down a barrel to exert pressure on a rubber diaphragm by way of an intervening piece of pointed metal. A plastic screw tip holds the diaphragm in place. Before use the syringe tip is unscrewed and its base filled with water. Then the semen is sucked into the tip by screwing the plunger back in the barrel. The probe (D) is used to push down the valve-fold so that the syringe can be inserted in the vagina. The holding hooks (E and F) are used to hold the sting chamber of the queen open during insemination. E is the ventral hook, which fits over the ventral plate, and F the dorsal or sting hook used to press the sting out of the way. A blunt dissecting needle is used to push down the sting so that the sting hook can be placed in position.

The manipulating apparatus, syringe, and instruments described were bought from the Department of Economic Entomology, University of Wisconsin, U.S.A. In the apparatus supplied the syringe mounting block could be adjusted to no greater extent than the ventral-hook and sting-hook mounting blocks. It was found of great convenience, however, to modify this part of the apparatus slightly by passing the screw supporting the syringe holder through a horizontal slot cut in a plastic syringe mounting block, which was then mounted on the metal pillar. The screw was flattened and fitted the slot closely so that it could not turn. The syringe holder could thus be moved in the horizontal plane in the same fashion as the queen holder. This arrangement allowed greater flexibility in adjusting the instruments before insemination and reduced the time of the operation.

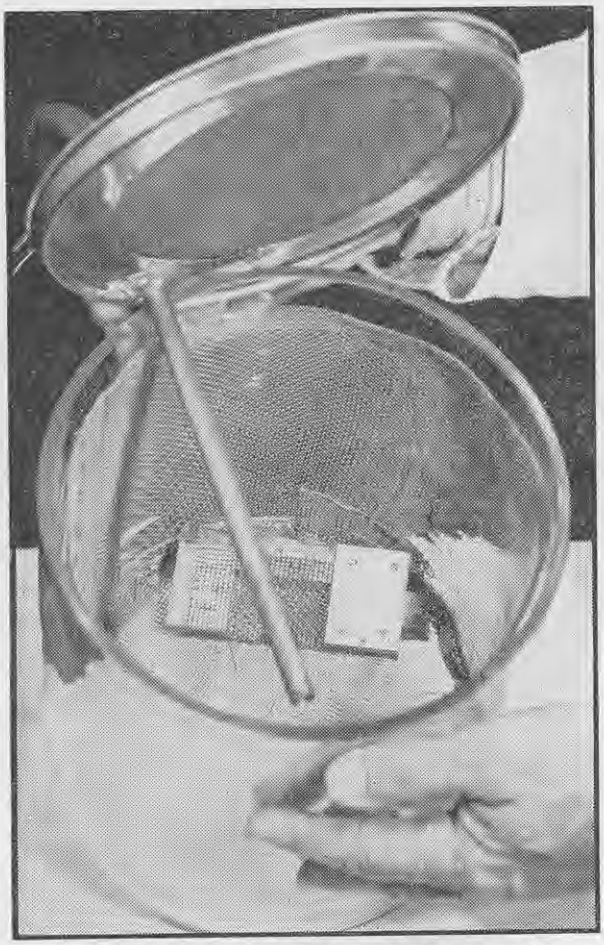

Fig. 5—A closer view of the container in which caged queens are treated with carbon dioxide.

The queen holder is a tube tapered at one end and with a movable stopper fitting closely inside. The queen is backed into the tube and held with the stopper so that her abdomen projects beyond the end. The stopper is bored out so that carbon dioxide can be allowed to flow round the queen, so keeping her anaesthetised during insemination.

Insemination Technique

The queen is run into a plastic tube of the same diameter as the queen holder. This is fitted with a plastic stopper which can be pushed along inside it and used to coax the queen tail first into the queen holder. The queen is always arranged so that when she is anaethetised her upper surface is to the right of the operator.

The two holding hooks are then inserted, one at a time, into the sting chamber and the abdominal plates pulled apart, the operation being performed under the microscope. The syringe is then placed horizontally in its holder so that its tip is in focus, ready to be filled with semen.

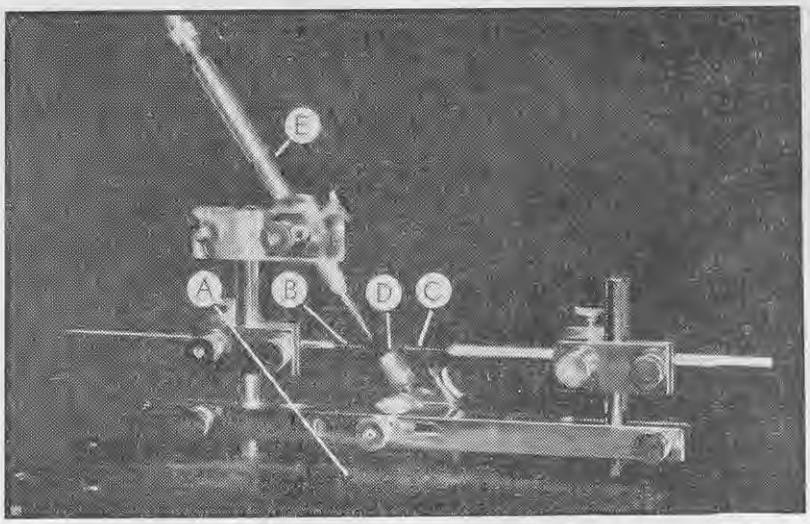

Fig. 6—The insemination apparatus. A: Stand. B: Sting hook. C: Ventral hook. D: Queen holder. E: Syringe.