A DEVICE FOR AUTOMATICALLY FEEDING AND COLLECTING THE FECES OF SMALL MAMMALS

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ABSTRACT. — An automatic device was designed to feed two caged cottontail rabbits and collect fecal pellets hourly.

Automation in feeding and collecting pellets at hourly intervals facilitates the study of periodic activity and of correlations between foods eaten and fecal pellets deposited. The electrical drive of this feed-fecal machine was perfected by the Central Research Shop, Southern Illinois University. Total cost of construction of the automatic device was approximately $81; $42 for the mechanical part and $39 for the electrical part, not including labor or cages. Although designed for use with wild cottontail rabbits, with slight modifications in type of cage and size of turntables and cups, the apparatus could be used successfully with rodents and other mammals. With smaller animals and using smaller cups, a 24-hour wheel could be constructed thus eliminating the checking of the machine more than once a day.

MECHANICAL CONSTRUCTION

Two metal animal cages, 14 inches wide, 14 inches deep, and 24 inches long, are suspended from the top crossbars of a wooden framework (Figs. 1a and 1b). The cages (C) have solid walls and wire mesh floors and doors. In the rear corner of the floor of each cage (Fig. 1c), there is an opening (FO) of slightly less diameter than the 3-inch feed cup (FdC). The feed cups pass within ⅛ inch of the floor of the cage. A rubberized canvas funnel (F) extends from the floor of each cage to a cup (FcC) which collects the fecal material. Rubberized canvas prevents adherence of fecal pellets. Collars (FuC) hold the terminal ends of the funnels over the cups which collect the fecal pellets.

Movement of the feed cups to a position below the floor openings is by a turntable (FDW, Fig. 1c); movement of the fecal cups beneath the ends of the funnels is by a separate turntable (FBW). Each turntable is of sufficient diameter to arrange two rows of cups on it; the inner row of cups services one cage, and the outer row the other cage. Each row consists of 12 cups, one for each hour. Thus, rabbits are disturbed only when checked at 12-hour intervals. A small metal funnel in each fecal cup prevents droppings from bouncing out. Cups made from cardboard coin tubes with metal ends, provided by the R. C. Can Company of St. Louis, Missouri, were used successfully.

The shaft (S) of each turntable is a ½-inch metal pipe. The lower end of the shaft rotates on a large ball-bearing fitted into a machined concavity. The shafts are held vertical by wooden crossbars. A bicycle chain (CD) connects two sprockets, one on each shaft, forming an inter-shaft chain drive and allowing for the synchronization of movements of both turntables (Fig. 1c).

The rabbit can feed from only the cup in position below the floor of the cage. A new cup is in position each hour and at the same time a new cup is in position for the collection of fecal pellets on the turntable below the cage.

ELECTRICAL DRIVE

The apparatus is driven electrically (115 volts, A. C.) as illustrated in the wiring diagram (Fig. 1d). Each hour a timer motor (TM) (one revolution per hour) closes a timer switch (TS) which applies voltage to a clutch solenoid (CS) for two to four seconds. The clutch solenoid energizes the brake solenoid (BS), brake motor switch (BMS), and the drive motor (DM). The energized brake solenoid withdraws the projectile (P, Fig. 1d), freeing the lower turntable holding the fecal cups. The drive-shaft of the drive motor makes contact with the upper turntable (food cups) which is edged in emery cloth. The turntables, connected by sprockets and chain, commence the cycle of rotation. The rotation of the lower turntable breaks contact between the positioning cam (PC, Fig. 1a) and the stop switch (SS, Fig.

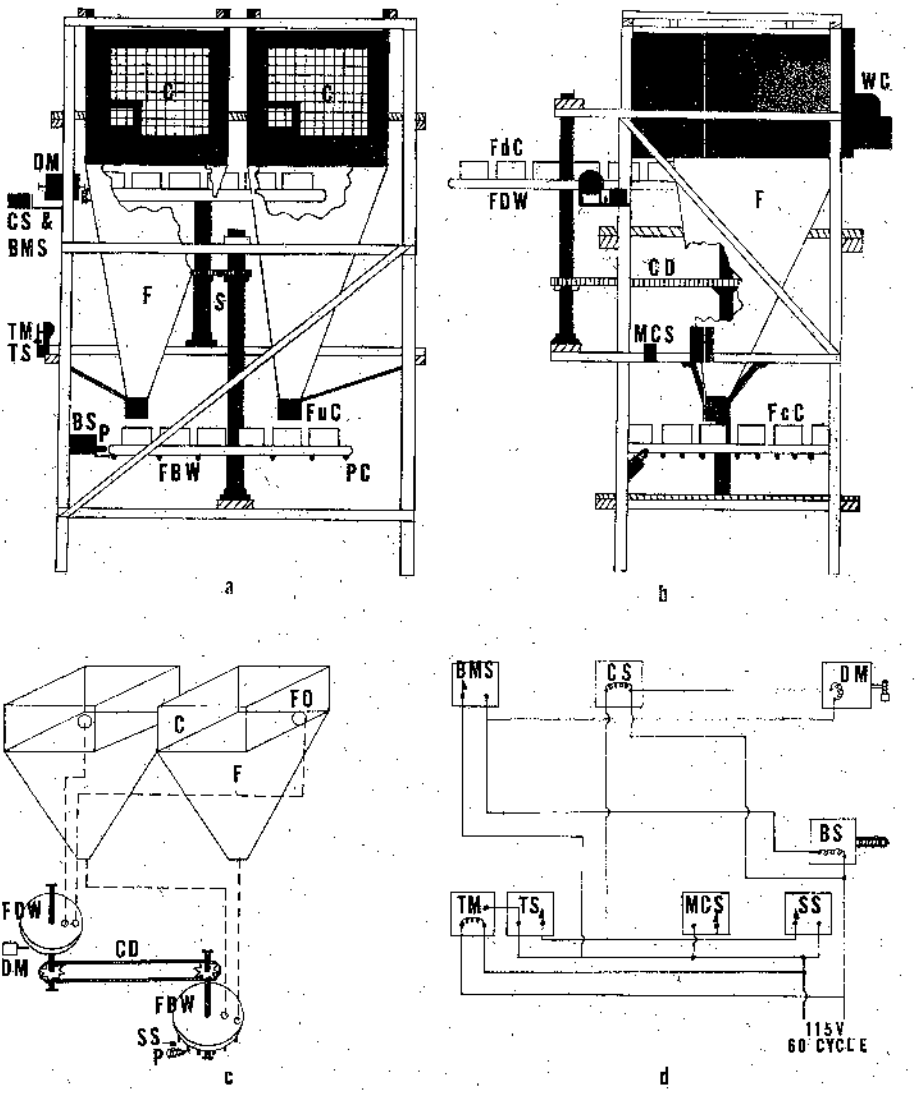

FIGURE 1.—Diagram of automatic feed-fecal device showing a. front view; b. view from left side; c. details of mechanical construction; and flow of d. electrical circuit. Letter symbols used are: C, cage; F, funnel; P, projectile; S, shaft; BS, brake solenoid; CD, chain drive; CS, clutch solenoid; DM, drive motor; FO, food opening; BMS, brake motor switch; FBW, fecal brake wheel; FeC, fecal cup; FdC, feed cup; FDW, feed drive wheel; FuC, funnel collar; MCS, manual cycle switch; PC, positioning cam; SS, stop switch; TM, timer motor; TS, timer switch; WC, water container.

1c). The loss of contact causes the stop switch to open. The lower turntable rotates until the stop switch comes into contact with the next positioning cam which again closes the stop switch, de-energizing the clutch solenoid, brake solenoid, and brake motor switch thus stopping the motor and the lower turntable. The lower turntable is stopped in position by the de-energized brake solenoid and subsequent release of the projectile (known commercially as a spring-loaded out solenoid) against the turntable. Thus, the upper turntable functions in activation of the cup movement and the lower turntable functions in deactivation of the cycle. The intershaft chain drive coordinates the reciprocal reactions. A manual cycle switch (MCS, Fig. 1b) was inserted for convenience in checking the feed and fecal cups.

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