TECHNICAL NOTE

A SIMPLE DRY-FOOD DISPENSER FOR AUTOMATIC FISH TRAINING¹

One difficulty encountered in adapting operant techniques to experiments with fish has been the design of a reward dispensing system. Many techniques have been described: dry-food dispensers by Deterline (1956) and Longo and Bitterman (1959), and live-worm dispensers by Hogan and Rozin (1961), Longo and Bitterman (1963), and Haralson and Ralph (1966).

Fish are said to work better for live bait, but no trouble has been encountered in training the common Oscar or velvet fish (*Astronotus ocellatus*) to make pattern and color discriminations when rewarded with dry, granulated fish food. The dispenser described below reliably delivers a few grains of food at a time. It can be activated by a single 40-msec pulse from electromechanical programming equipment, thus eliminating the need for special power amplifiers or extra timing circuits.

The apparatus (Fig. 1), consists of a Plexiglas food hopper with a stainless steel bottom in which there is a small central hole, normally blocked by a loosely fitting stainless steel plunger. The plunger, operated by a solenoid, is held in the down position, and projects about $\frac{1}{16}$ -in. through the hole. When the solenoid is activated, the plunger is lifted about $\frac{1}{4}$ -in. into the hopper and immediately afterwards the dispenser is jolted slightly as the slug in the solenoid reaches the top of its travel. Granulated food is thus shaken down into the gap between the end of the plunger and the hole in the bottom of the hopper. At the end of the pulse, the spring pushes the plunger down through the food and out through the hole, punching several grains out as it does so. The apparatus is rubber-mounted, to minimize jarring of the fish tank, and suspended over the tank so that the grains of food fall directly on the water. It is helpful, although not essential, to float a feeding ring on the surface beneath the feeder so that the food grains do not float around the tank between training trials.

Two of these dispensers have been in continuous operation for six months and have required no maintenance beyond a drop of silicone grease in the hole in the Plexiglas block which acts as a bearing for the stainless steel plunger rod. In a test run of 200 trials the mean number of granules, average mass 1.52 mg, dispensed was 4.68 (S.D. 0.79). In no case did the apparatus fail to deliver at least one grain.

The food used was obtained from a local aquarium dealer, but some of the commercially available fish

foods would do. The dimensions of the plunger and the hole in the base plate can be varied depending on the size of particles used and the size of the fish being trained. The voltage requirements depend on the solenoid, which could be chosen to match any of the various electromechanical or solid-state programming systems. A spark-suppression system, suitable for the solenoid that is employed, should be used.

Besides low cost and reliability this apparatus has several important advantages. It uses granulated food rather than powder to minimize dispersion of the reward over the surface of the water. The spring used to punch out the granules is not strong enough to crush them, particularly as the design has eliminated extensive opposed grinding surfaces so as to further reduce the likelihood of dispersion of food powder.

Fig. 1. A diagram of the dry-food dispenser.

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Lastly, since the powerful pull of the solenoid is used to prime the dispenser for food release, it does not jam.

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