A FURTHER IMPROVEMENT IN THE AUTOMATIC DISPENSING OF LIVE FOOD FOR FISH¹

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Longo and Bitterman (1963) have reported that the live food dispenser designed by Hogan and Rozin (1961) fails to deliver food reliably. The Longo and Bitterman apparatus also has certain deficiencies which result from the use of medicine droppers to deliver live food reinforcement. If small live worms of the type described by Haralson (1964) and by Haralson, Gillman, and Ralph (1965) are used, the distance between the lower meniscus and the upper meniscus should be greater than the length of the worm to prevent it from breaking through the surface tension of one meniscus by pushing against the other meniscus. If this occurs, the worm gains a hold on a surface outside the water column and fails to be delivered. It is also possible for the worm to gain a hold on the surface of the tip of the dropper if there is not an air gap of approximately $\frac{1}{8}$ in. between the tip and the nearest meniscus, or if this gap is reduced by air leaking between the rubber bulb and the glass when the dropper is in a vertical position ready for delivery. Another serious drawback with the Longo-Bitterman apparatus is the necessarily large number of loose droppers which must be individually placed in and removed from the paired guide holes in the plastic discs. This criticism of the use of medicine droppers is a result of several years of using them for manual delivery of worms as reinforcement (*e.g.*, Haralson, 1964).

Figure 1 illustrates an apparatus which provides several advantages over the two apparatuses described above for delivering live food in a liquid medium. When a 1 cps KYC-23RB Bodine motor M is activated it revolves through one cycle, at which point a braking circuit is activated by the slotted disc D and the microswitch arm A. The gear G-1 drives

gear G-2 by a brass ladder chain, and gears G-3, which are secured to the same shaft as G-2, drive two more continuous ladder chains over two pairs of rider gears. Brass rods protrude horizontally through the links of the chain at intervals large enough to permit rotation of the vials V around the rods. The vials are suspended on the rods by holes drilled just below their upper lips. Grommets soldered on the ends of the rods after assembly hold the rods in place. The circuit is designed so that the motor can be made to revolve or brake and to deliver reinforcements in either direction. Reinforcements are typically delivered from the far end of the apparatus as illustrated, but the end shown here reveals more detail. The vials are tripped through 360° by their passage over the gear shaft at either end of the apparatus. This shaft was turned on a lathe to the diameter providing the best tripping characteristics. The chain drive ensures exact positioning of the vials. Various sizes of vials and distances between vials can be accommodated by using the same size chain while varying the diameter of the gears. Over a period of two years, two of these apparatuses have run for approximately 180,000 cycles. Only routine maintenance has been necessary. An example of its use may be found in Haralson *et al.* (1965).

The number of vials can be increased by simply extending the supporting horizontal

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beam, crimping in two extra lengths of chain, and, if necessary, adding more rider gears. The resulting increase in torque thus demanded of the motor should be negligible. If the number of vials were increased to 100, the length would be somewhat ungainly. But, in use, the long dimension of the apparatus has been placed parallel to a wall and the added beam length poses no serious problem. The diameter of the central one of the three pairs of gears on which these chains are mounted is large relative to those at the ends to permit passage of the vials without tripping them.

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