The amount of shrimp released with each operation of the valve is adjusted by varying the duration of the one-shot pulse. In a typical unit, a 20-msec pulse releases 0.1 ml of water containing a few shrimp. A hundred successive drops show no appreciable variation in volume, though the exact number of shrimp may vary.

This feeder was developed specifically to administer fresh frozen brine shrimp to goldfish for striking a target at the water surface. Brine shrimp are a highly attractive food to goldfish, and they are easy to obtain and to store in the laboratory. The feeder handles all sizes of shrimp, including frozen nauplii, but freeze-dried shrimp do not dispense well as they resist wetting and tend to float in the pipette. The main difficulty is that shrimp may clump either at the neck or the tip of the tube. Clumping is rare so long as the pipette is kept clean and the shrimp are clean and fresh. We thaw shrimp in standing water and then gently wash them until the rinse water is clear. If the shrimp is partially decomposed, possibly as a result of having been thawed and refrozen, the fish may show no aversion to eating it, but no amount of washing will prevent clumping.

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NOTES

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An instrument to produce surface colors of continuously variable brightness

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Many experiments on the perception of brightness require a surface color of adjustable intensity. This has been accomplished by some workers through the use of a series of color samples of known brightness such as is found in the Munsell Color System (Beck, 1961; Burzlaff, 1931; Takasaki, 1969) or by use of a rotating disk upon which the percentage of the test color is systematically varied (Coren, 1969; MacLeod, 1947; Stewart, 1959). The former method suffers from difficulties due to the discontinuous nature of the steps, and the necessity of interpolating between samples. The color-disk method suffers from the fact that the motor must be stopped between each setting, making this procedure costly in terms of time and effort. There are some continuously variable color rotors (mixers) on the market, but these tend to be rather expensive (Gerbrands, \$645; Lafayette, \$590; Marietta, \$750). They are also noisy and occupy quite a sizable amount of space, which makes them difficult to integrate into many experimental displays. In order to provide a variable-brightness surface color that is easy to use and allows continuous variations of intensity while still being economical and easy to use, the system illustrated in Fig. 1 was designed.

Let us consider the components in order from the light source. First we have a microscope stage upon which is mounted a metal plate. In front of the microscope stage (Edmunds No. 30,060, \$12.95) is a square aperture. The metal plate and the

aperture serve as a diaphragm that limits

the amount of light entering the system. A piece of flashed opal glass then diffuses the light input. This input is then uniformly distributed across the surface of the final piece of opal glass by means of the multiple internal reflections that take place inside the optical integrating bar. This optical integrating bar is nothing more than a rectangular bar of clear glass or plastic polished on all sides. As a rule, the bar should be at least three times as long as it is wide. If a texture is desired on the final surface, a piece of translucent white paper may be substituted for the final piece of opal glass.

The operation of this apparatus is quite simple. Varying the area of the entrance aperture covered by the metal plate mounted on the microscope stage varies the brightness of the final surface of the system. Readings can be taken directly from the vernier scale on the microscope stage. A flexible cable attached to the knob on the scale would allow the O to adjust the brightness himself. The actual color seen on the surface may be varied by inserting filters between the light source and the unit.

The advantages of this system are that it is compact, inexpensive (about \$15 for a unit with a 1-in.-square face) and provides a continuously adjustable brightness with no vignetting, even at very low levels of intensity.

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Fig. 1. Schematic drawing of an apparatus to produce a variable-brightness surface color.