SCIENTIFIC APPARATUS AND LABORATORY METHODS

A KYMOGRAPH TIME-INTERVAL RECORDER

A KYMOGRAPH time-interval recorder is a valuable but not always available asset to any physiology laboratory. It is possible, however, to construct such an instrument at almost no cost. The device which we will describe possesses the decided advantage of recording one-half second intervals.

All extraneous parts such as case, face and alarm mechanism are removed from an ordinary alarm clock. It is not entirely necessary to remove this last. The mechanism is mounted by its frame to a wooden base with the balance and escape mechanisms at one end of the frame of the clockwork and not at the top or bottom.

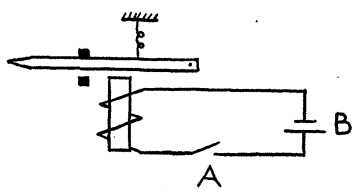

FIG. 1.

A brass wire about 0.2 mm in diameter is manipulated in the following manner: Wind it in from 3 to 5 coils, each having a diameter of about 5 mm, leaving 2 cm at one end and 10 cm at the other; bend the short end along the axis of the coil for 1 cm and the rest at right angles to this; bend the long end at right angles to both the coil and the last length of the short end. The arrangement of this wire is shown diagrammatically in Fig. 2.

Next, fasten the long end of the brass wire by means of a screw driven into the wooden base so that the straight part of the long end rises vertically and the last length of the short end just escapes the cogs of the escape wheel and is parallel to its axle in a horizontal plane. See Fig. 2.

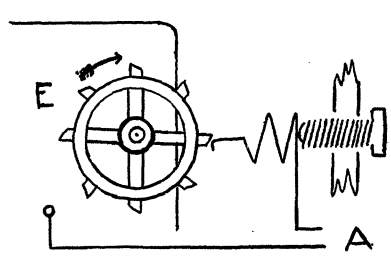

FIG. 2.

Mount a wooden panel to the base in such a manner that it rises vertically, is parallel to the axle of the escape wheel, and lies 1 cm from the coils of the brass wire. Drive a bolt through a close-fitting hole in the panel along the axis of the brass coil.

Wire the apparatus according to Fig. 2. (A) represents two terminals of the clockwork. One of these is taken from the brass wire where it is fastened to the base; the other is taken from the frame of the clock. These two terminals are wired in series with a signal magnet and a battery of sufficient electromotive force to operate the magnet (Fig. 1).

Now, if the bolt through the panel is used to spring the coil of the brass wire close enough to the escape wheel (E, Fig. 2) so that a light contact is made with each cog as it passes, a circuit will be closed regularly, causing the stylus of the signal magnet to make a stroke each time. Also, if the alarm clock used is constructed as most alarm clocks are, this circuit will be closed each one-half second.

Other panels can be used to enclose the clockwork in a box leaving one side hinged for winding. The terminals of this unit of the circuit can be wired to posts through a panel.

It will probably be necessary to calibrate the instrument by adjusting the hair spring.

The apparatus may be placed in some inconspicuous place and any number of signal magnets wired from it to remote parts of the laboratory.

Except for a periodic winding, this instrument requires no care and should record accurately for ordinary purposes.

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A MECHANISM FOR THE CONTINUOUS CIRCULATION AND AERATION OF WATER IN SMALL AQUARIA[1]

IN biological experimentation with aquatic organisms it is frequently necessary to keep the water agitated and aerated for considerable periods of time. Generally air is bubbled into the water while a stirring motor functions. This method is often unsatisfactory when the experiment is to continue for some time, for oil vapor is liable to enter the water with the air current; also, the stirrer tends to create strong currents which may interfere with the experiments. The mechanism here described eliminates these difficulties. It has been used by the author during two years with entire satisfaction. It may be kept in operation for weeks or months with little attention.

The aerating and circulating device consists of a small, motor-driven, centrifugal pump made of transparent celluloid $\frac{1}{8}$ inch thick (Fig. 1). The pump is similar in design to ordinary pumps of this type save that it is enclosed within a chamber from which it

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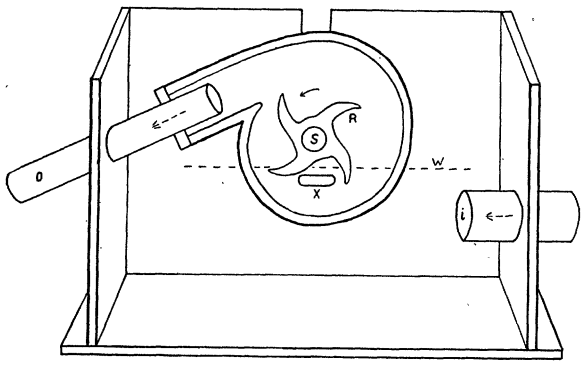

FIG. 1.

draws water. In the figure one side of the chamber and of the pump have been removed to show details. The pump is made with two sides (vertical diameter 1½ to 2 inches), and the peripheral border, slightly greater than ⅛ inch wide, which is bent in warm water to correct shape and cemented in place with a solution of celluloid in acetone. The rotor (R) is cut from a piece of ⅛ inch celluloid and mounted on the shaft of ¼ inch glass tubing with a short length of rubber tubing in between. The openings for the shaft in the sides are considerably larger than the shaft to eliminate friction. The completed pump is simply cemented into the chamber in which slots are left for the two ends of the shaft. The slots extend downward only far enough to leave the shaft clear. In action the pump receives water through the hole (X) in each side and pumps it out through the tube (o) leading directly into the experimental aquarium. A larger tube (i) leads from the aquarium into the pump chamber to permit continuous replenishment of the water. It was generally arranged so that the pump discharged water to the bottom of the experiment tank.

It is only necessary to keep the water level relatively constant so that the pump does not run dry. The pump is so placed with reference to the experiment tank that when not running the water level (W) is slightly above the intake apertures (X). When running the pump discharges water as rapidly as it enters through the apertures, reducing the water level so that both air and water are drawn into the pump. Here the water is violently churned with air by the rotor and the water entering the aquarium is full of small bubbles.

The pump is entirely water-lubricated and the only foreign materials in contact with the water are celluloid, rubber and glass. Neither oil nor metallic ions can enter. Several such pumps may be mounted in series and run by the same motor to aerate and circulate the water in a number of aquaria. Due to the loose bearings there is no indication of wear even after months of almost continuous running.

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SPECIAL ARTICLES

ACTION OF DINITRO COMPOUNDS ON SEA URCHIN EGGS[1]

A STUDY of the effect exerted by 4–6 dinitro-o-cresol (DNC) on the eggs of the sea urchin (*Arbacia Punctulata*) shows that this reagent, at 21° C., in optimum concentrations, stimulates oxygen consumption four hundred per cent. in fertilized and six hundred per cent. in unfertilized eggs, and that it simultaneously suppresses cell division in the fertilized eggs. Potassium cyanide antagonizes the respiratory stimulating action, but supplements the division suppressing action of DNC.

The DNC block to division in fertilized eggs is completely reversible even after three hours exposure to a concentration seven to ten times the optimum for respiration. The eggs, on being returned to sea water, continue cell division from the point of interruption and develop to swimming larvae. That these effects are attributable to the nitro substituted molecule is indicated by the fact that phenol and o-cresol block cell division only in concentrations several thousand times as great as those required for the corresponding dinitro compounds.

The data indicate that the optimum respiratory concentration of DNC is also the concentration which first significantly suppresses cell division. Similar experiments with thirteen other cell penetrating nitro compounds and with the eggs of other invertebrates have shown that the optimum concentrations for respiration are invariably critical concentrations for division. The ability of dinitro compounds to affect respiration and division becomes less as their ability to penetrate the cell decreases.

The data further show that if DNC in optimum respiratory concentration is added more than 20 to 25 minutes before first cleavage is due to occur relatively few eggs divide; if added after this time a normal proportion of eggs proceeds to the two-celled stage, where most of them are arrested in development. A similar critical point has been observed at about the same relative time prior to the second and third cleavages.

A preliminary cytological examination, made by Dr. Henry J. Fry, seems to have established two points regarding eggs in which division has been suppressed by DNC.

(1) Nuclear division does not continue after cytoplasmic division has ceased.

[1] Preliminary note.