bubbled through the solution until growth and subsequent lysis was complete. After lysis the solution was adjusted to pH 9.0, dilute lead sub-acetate added and the supernatant solution from the lead acetate precipitate concentrated in vacuo to one tenth its original volume, digested with crystalline trypsin and the active protein isolated by fractional precipitation with ammonium sulfate between 0.2 and 0.4 saturation at pH 7.0. About 40 mg of protein, representing about 30 per cent. of the original total activity, may be obtained in this way from 200 liters of lysed culture.

The protein preparation obtained in this way is brownish and forms highly viscous, slimy solutions. The brown color may be removed by repeated precipitation with ammonium sulfate, but the protein is always mucin-like in character. It contains about 1 per cent. reducing sugar and small amounts of glucose amine.

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# SCIENTIFIC APPARATUS AND LABORATORY METHODS

## SIMPLE SYNCHRONOUS MOTOR FOR THE HARVARD KYMOGRAPH

THE synchronous motor described below was devised to operate a small Harvard kymograph with two drums, the original spring drive being found to produce a very inconstant drum speed. It is simple to construct, inexpensive and durable. Its speed is constant when the frequency of the alternating-current supply is accurately controlled (*i.e.*, when the current is suitable for the operation of the ordinary variety of electric clock), and is independent of variations of the line voltage or of the load applied. It requires manual starting, will run in either direction and uses no belts or external gears.

The apparatus consists essentially of a toothed soft-iron disk rotating between similarly toothed pole-pieces which are energized by alternating current. The speed depends on the number of teeth in the disk and the frequency of the supply current, according to the following formula:

$$\text{Speed (r.p.m.)} = \frac{120 \times \text{frequency (cycles/sec.)}}{\text{number of teeth}}$$

It was found that the power and stability of the motor was much improved by the addition of a small flywheel, which fits loosely on the rotor spindle and is attached to the latter by a coil spring.

A satisfactory design is shown in Fig. 1. Considerable deviation from this design is possible, providing the principles mentioned are retained. The 24-toothed rotor shown rotates at 300 r.p.m. and results in a drum speed of approximately 2.8 cm. per minute at the low speed setting of the kymograph. This rotor has a tapered hole in its shaft, and replaces the fans ordinarily used to control the kymograph speed. The pole-pieces are attached to the top plate of the kymograph by machine screws, and the field coil projects over the edge of the kymograph. This coil consists of approximately 2,000 turns of No. 26 enameled copper wire, and the cross-section of the core is $\frac{3}{8}$ inch by 1 inch inside the coil. The flywheel is attached to the

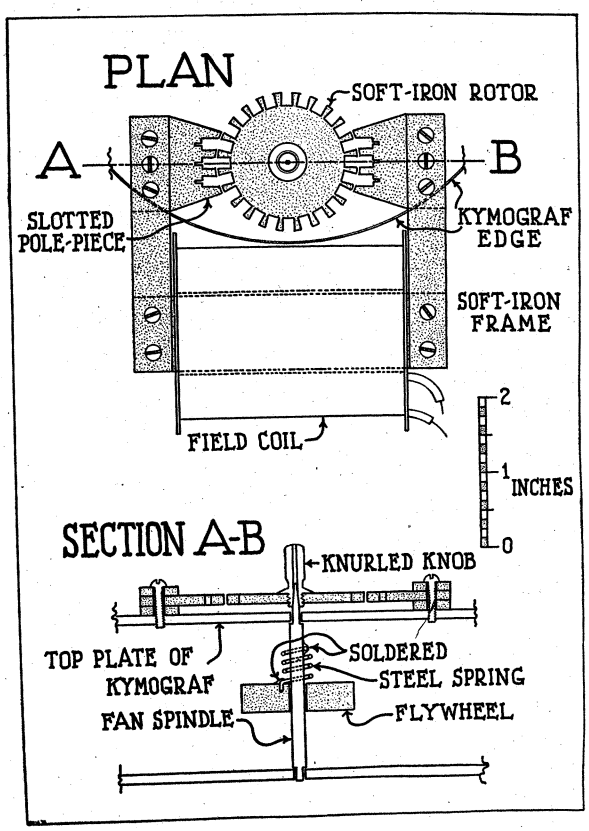


FIG. 1

rotor spindle by its spring inside the kymograph base. The winding lever and ratchets on the spring drum and brake lever on the fan spindle are removed. Care must be taken that the spring is entirely run down when the kymograph is taken apart, else the gears may be injured by the suddenly released spring.

The design might be improved by the use of silicon-steel laminations for the core of the field coil, and it is possible that the coil and core of a cheap electric clock would be satisfactory. The coil will require more turns for operation on 25-cycle current than described for 60-cycle current. If a considerably

greater number of teeth are required, in order to produce a slower drum speed, it would be well to increase the diameter of the rotor.

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## THE CULTURE OF A FREE-LIVING NEMATODE (GENUS RHABDITIS) AND ITS USE AS CLASSROOM MATERIAL

*Ascaris lumbricoides* is generally used as laboratory material for the study of Phylum Nemathelminthes in elementary courses in zoology. The mature worms are usually dissected, and the beginning student seldom sees any of the earlier developmental stages in the life history of the animals. The following account presents a simple method for culturing another species of round worm (*Rhabditis* sp.) on a nutrient agar medium, the advantage of this material being that all stages in the life cycle can be studied by the student from a freshly prepared slide.

Mature individuals and eggs of *Rhabditis* can easily be isolated from the slime found on the under surface of damp logs. This slime consists of molds, bacteria, mycetozoa and fungi in various stages of decay. If a bit of this slime is brought into the laboratory and streaked upon agar slants containing 15 per cent. corn meal, the fungi and bacteria will multiply rapidly. At the end of about two weeks free-living nematodes can generally be found in considerable numbers. Eggs and larvae will be present as well as the adult worms. As the culture progresses the bacteria form a thick slimy layer on the surface of the agar, making an ideal medium for growth and reproduction of the nematodes.

The author has kept a single culture thus prepared for as long as seven months without transfer. If transfers are made from the stock culture about one week before they are to be used, all stages of the worm's life history can readily be demonstrated. In Genus *Rhabditis* the long pointed tail of the female, as compared with the blunt tail of the male, makes the identification of sexes very simple. Under the 4 mm objective the digestive tract and accessory sex organs of the male can be seen. Eggs may be found in all stages of cleavage.

This method for culturing nematodes and their use in the classroom has been successfully demonstrated in the zoology department of Syracuse University.

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## VISIBLE FILE FOR LANTERN SLIDES

THE file described here permits standard lantern slides to be kept in regular $3 \times 5$ filing equipment and to be indexed in the same manner as card files. Each slide is as readily visible as a card and can be found at least as quickly. When a slide is removed from the file, its space is kept for it so that it can be returned to its proper place with a minimum of effort. Any number of slides can be removed without allowing the remaining ones to fall flat in the case.

Obtain chip board at least one eighth of an inch thick. Cut into pieces three eighths by three inches. Glue one of these pieces onto each end of one side of a plain $3 \times 5$ card (medium or heavy weight). Make up one such holder-card for each slide to be filed. Put them into a $3 \times 5$ card file and drop the slides into the spaces so provided.

To make guides, type the desired words on a piece of card and glue it onto one of the holder-cards so the printing will show above the slides. The holder-cards, which are never removed from the case, may bear the title or number of their respective slides.

This same system might be used for microscope slides; the writer has not tried it.

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