growth with only twelve days difference in the time of cutting the first crop. A few days prior to the cutting of the second growth on July 31 the nymphs had largely become adults and through migration caused a yellowing of all the alfalfa. However, they disappeared rapidly after this cutting. It does not appear that conditions are favorable for their propagation during the period of the third growth—at least, this crop is rarely injured seriously by them in Wisconsin.

L. F. GRABER
V. G. SPRAGUE

AGRONOMY DEPARTMENT
UNIVERSITY OF WISCONSIN

### CONJUGATION IN RHIZOPUS INHIBITED BY FEMALE SEX HORMONE

ALTHOUGH the female sex hormone has been isolated from various plant tissues, the authors have been unable to find any reference to experiments as to its effect on plants.

For a preliminary test of the effect of estrin on plants, *Rhizopus nigricans* was selected because of its rapidity of growth and conjugation. Estrin used in this work was prepared from human pregnancy urine by R. G. Gustavson and his coworkers at Denver University. Parke, Davis' commercial theelin preparation was also used.

All cultures were grown on standard potato dextrose agar, in petri dishes. The agar substrate was divided into two parts by a groove about an eighth of an inch wide. One side of the plate was inoculated with + strain of *R. nigricans* and the other side with − strain.

An initial concentration of about 5 Coward-Burns rat units of estrin incorporated in the agar was found to be more satisfactory. In some cases, estrin was added after the colonies had begun to grow. A total of over 300 cultures have been studied in the several tests and in every case the estrin or female hormone inhibited zygospore formation, while accompanying untreated check cultures conjugated profusely. With the initial treatment the formation of gametangia was delayed from four to six hours. With continued dosage the sexual fusion was delayed for longer periods of time. The same effect was observed in the case of theelin.

The results of these experiments are comparable to those of D'Amour and others, who found that estrin terminates pregnancy in rats. Agreement with his work was also found in that one Coward-Burns unit is the equivalent of about 12 Allen and Doisy units.

G. W. PLUMB
L. W. DURRELL

COLORADO AGRICULTURAL COLLEGE
FORT COLLINS, COLORADO

# SCIENTIFIC APPARATUS AND LABORATORY METHODS

## AN ELECTRICALLY DRIVEN CONTACT BREAKER CAPABLE OF DELIVERING GALVANIC SHOCKS RANGING FROM 0.000,01 TO 1.0 SECOND DURATION

THIS contact breaker, designed primarily for research, has been used in the student laboratory for several years in a class experiment on the correlation of duration and strength of galvanic stimulation. Its ruggedness and dependability for student and research purposes, its convenience of manipulation and long range of shocks may be of interest to those contemplating a similar device.

The construction is simple and most of the details are apparent in Fig. 1. It consists of two essential parts—a heavy iron flywheel carrying a knock-over and an automatically advancing carriage for moving the knock-over keys into the path of the knock-over.

The flywheel (7.5 cm × 21 cm) is revolved at a rate of 1,200 r.p.m. by a lead screw serving as a connecting shaft to the motor. The employment of a synchronous motor and a heavy and well-balanced wheel and motor insures a uniform velocity of movement of the knock-over. Note that a dummy knock-over is mounted in the opposite face and circumference of the wheel.

Two keys are mounted on the carriage. The key at the left is for coarse adjustment of 0.05 of a second intervals. By separating the keys 20 scale divisions (each division is equivalent to 1 thread of the lead screw), the maximum interval of 1 second is attained. The key at the right is mounted on a disk, also 21 cm circumference graduated into 500 equal parts. This disk is in turn attached to a heavy vertical support fixed to the horizontal bar and sliding in a snugly fitting way in the supporting base. A vernier permits setting of the keys at intervals of 0.000,01 second.

The carriage is operated by a swinging quarter nut clutch which is thrust into position as the motor is turning. Just as the clutch is completely engaged, a spring operated latch pops out of the free end of the clutch to the inside of a guiding bar and keeps the clutch engaged for the entire excursion (Fig. 2). Towards the end of the excursion it passes between the guiding bar and another bar mounted on a steel spring, and as it clears the guiding bar it is thrust

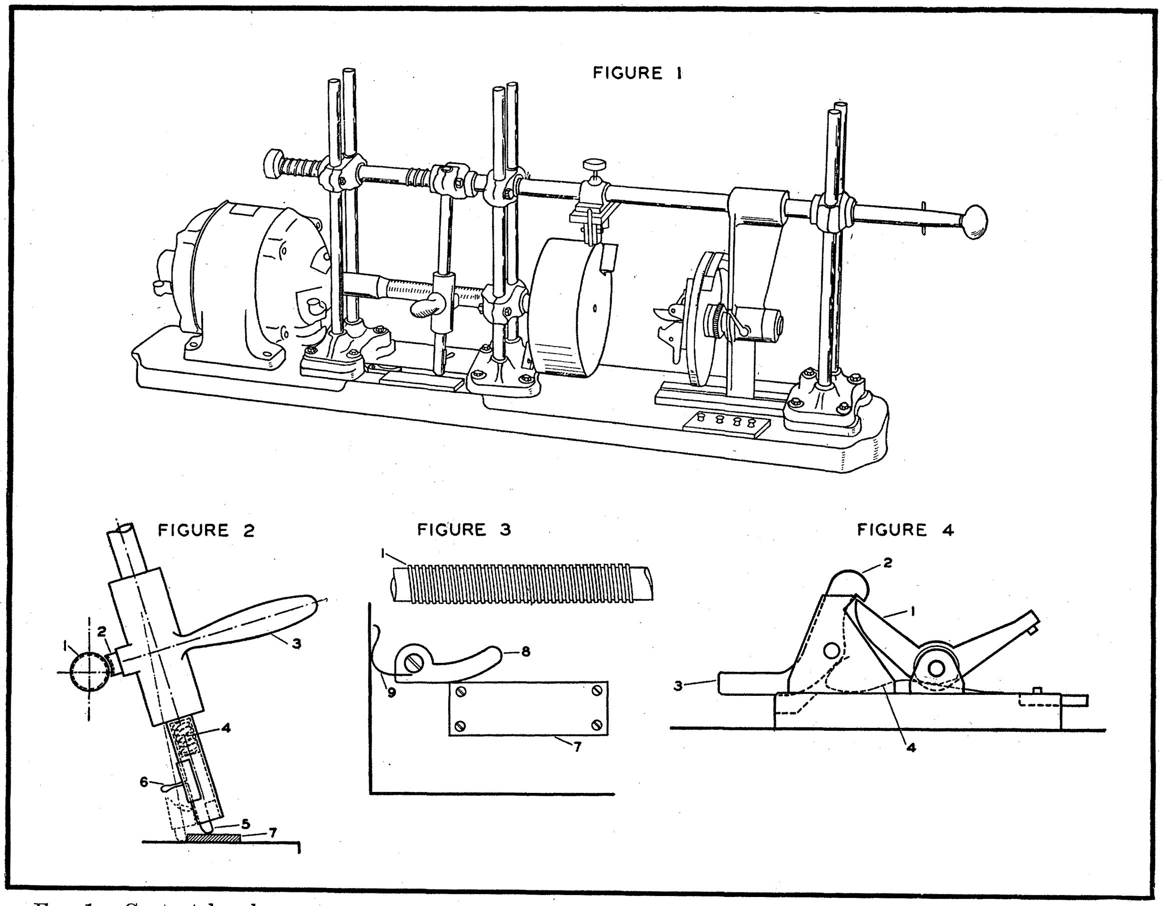


Fig. 1. Contact breaker.

Fig. 2. Arrangement for maintaining engagement of clutch. (1) Lead screw. (2) Quarter nut clutch. (3) Handle for manipulating clutch. (4) Spring to force out latch. (5) Latch. (6) Handle for shifting latch to release the clutch. (7) Guiding bar used to keep clutch engaged.

Fig. 3. Arrangement for automatically releasing clutch at the end of excursion. (1) Lead screw. (7) Guiding bar. (8) Clutch disengaging device. (9) Steel spring operating clutch disengaging device.

Fig. 4. Knock-over key. (1) Arm engaging with knock-over. (2) Catch preventing rebound of key. (3) Arm used to release catch. (4) Steel spring operating catch 2.

outward by the spring, thereby automatically releasing the clutch. This mechanism is detailed in Fig. 3.

The keys are so arranged that when number one is at the zero mark on the carriage arm and number 2 on the zero mark on the disk they are adjacent and open simultaneously. To deliver a shock, *e.g.*, of 0.025 seconds the disks must be turned clockwise 180° or 250 scale division. Since that position requires an additional half turn of the flywheel and lead screw for the knock-over and key to engage, key 2 would advance one half of a thread further than that required to meet the knock-over key. To overcome the resulting difficulty and to attain a uniform engagement of key 2 and the knock-over with any setting of the scale, the disk is mounted on a lead screw similar to the driving shaft. For zero setting the lead screw and disk is opened one complete turn. When key 2 is now set for 0.025 second at the 250th scale division the disk is turned clockwise, advancing it one half of a thread to the right. This insures precisely the same engagement of knock-over and key as at zero setting.

The impact of the knock-over is of sufficient force (velocity 13 meters per second) to require careful hardening of both the knock-over and the key and special arrangements preventing rebound of the keys. The keys are detailed in Fig. 4.

Calibration by the condenser method for the shorter interval settings of the instrument indicate an accuracy of about 0.000,025 seconds.

I am obliged to Dr. Bean, who is conducting experiments on chronaxie with this device for the calibration.

Robert Gesell
University of Michigan