SCIENCE

VOL. 96 | FRIDAY, OCTOBER 30, 1942 | No. 2496

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

CHEMICAL STRUCTURE OF CYTOPLASM

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IN a recent note written as a supplement to a symposium on the structure of protoplasm, K. H. Meyer[1] summarizes Seifriz's view of the structure of protoplasm as follows: "the ultimate structural units of the living substance are probably linear molecules or micellae so arranged as to form a framework" and "the living substance is composed of a true network of primary valence chains which at several points are tied together by chemical bridges held by molecular cohesion (to-day one would say residual valences or hydrogen bonds)." If Meyer had substituted in the first statement the work "some" for "ultimate" and left out the framework which requires further definition, and in the second statement had substituted the word "contains" for "is composed of" this would be acceptable to the majority of students of cell structure. X-ray diffraction and birefringence studies have brought convincing support to the conception of structural constituents in protoplasm which Seifriz[2] with so much genius and foresight advanced a decade and a half ago.

This theory, however, interprets only some of the properties of protoplasm. These as listed by Seifriz[3] are: "contractility, elasticity, cohesiveness, rigidity, and tensile strength." All these may be possessed by non-living systems. Protoplasm on the contrary respires, excretes, performs complicated chemical operations, uses or liberates energy and reproduces its own substance in kind. This metabolism is mediated by a multitude of intracellular enzymes and carriers and

[1] K. H. Meyer, "The Structure of Protoplasm," Iowa State College, p. 267, 1942.

[2] W. Seifriz, *Brit. Jour. Exp. Biol.*, 1: 431, 1923–4.

[3] W. Seifriz, *Am. Nat.*, 63: 410, 1929.

dustry where materials of small surface area are to be counted and identified. While elaborate counting procedures involving ruled-glass plates or chambers have been applied on bacteria, blood and particle counts, they are not applicable to fiber counts.

Only recently has projection equipment for enlarging microscopic objects found wide application. Much of the eye fatigue associated with techniques involving direct scrutiny of objects through a microscope is eliminated. The problem of counting the images still remains and while it may be possible to count mentally the number of objects occurring within a projected area, a direct marking counting device may be profitably applied. To fulfil the need for a counter that will mark small objects, an electric recording counter was designed. The marking is accomplished with large soft lead pencil. The motion involved in the marking closes a small switch causing the current to pass through a coil. The magnetic field set-up moves a small laminated steel armature directly connected to an ordinary ratchet counter. A spring assembly quickly returns the counter in readiness for the next count. The counter-actuating assembly may be likened to a small electric motor whose rotary motion is limited to an arc of 45°, just sufficient to bring up the consecutive figures on the counter. A number of ratchet counters are suitable which add one unit for each oscillation of the shaft through approximately 45°. It was found desirable to select a counter without the return spring and supply an adjustable coil spring of greater tension. After experimenting with a number of different solenoids connected by means of a lever system to the counter, the above arrangement, which gives a rotary motion, was considered the best. The laminated core and the high inductance of the field coil makes the use of electric supply from ordinary A.C. line feasible. A three-foot flexible cord is desirable to connect the switch marking assembly with the electrically actuated counter, see Fig. 1.

Fig. 1 is the wiring diagram of the counting assembly. Probably the most vital factor in the proper operating of the counter is the selection of a suitable micro-type switch. There are a number of these switches which are now available on the market. An adjustable metal band holds the pencil in contact with the small plastic pin operating the switch and permits replacement or removal for resharpening. A very slight movement of the pencil causes the circuit to be closed. The silver contacts within the switch permit long continuous operation. It is important to choose a pencil that will mark with slight pressure. The quality of lead should not be any harder than a No. 2. Colored leads or waxes may be substituted for differentiating between materials being counted and for marking various types of surfaces.

Rapid counting and marking of a series of items are possible. It is easy, for example, to count and mark 150 fiber cross sections in one minute. Utilization of the electric counter has greatly speeded up wool fiber analysis by the count method outlined by

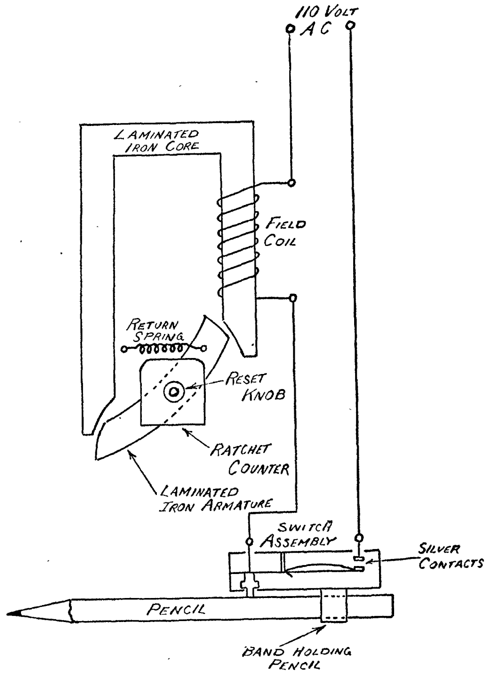

FIG. 1. Wiring diagram for electrical marking counter.

Hardy and Wolf[1]. This method consists in counting the number of wool-fiber cross sections included within a 125-square-centimeter area at a magnification of 500 diameters. Many applications could be mentioned, where advantages are possible by lessening the potential personal errors and speeding up tiresome routine procedures.

H. W. WOLF

[1] J. I. Hardy and H. W. Wolf, U. S. Department of Agriculture Circular 543, 16 pp., illus., 1939.

BOOKS RECEIVED

BENNETT, GRANVILLE A., HANS WAINE and WALTER BAUER. *Changes in the Knee Joint at Various Ages.* Illustrated. 31 Plates. Pp. vii + 97. New York: The Commonwealth Fund; London: Oxford University Press. $2.50.

CAMPBELL, ARTHUR SHACKLETON. *Scientific Results of Cruise VII of the "Carnegie," 1928–1929; Biology II: The Oceanic Tintinnoina of the Plankton Gathered during the Last Cruise of the Carnegie.* Illustrated. 1 Plate. Pp. v + 134. Carnegie Institution of Washington. $1.50.

CHERONIS, NICHOLAS D. *Semimicro and Macro Organic Chemistry.* Illustrated. Pp. xiii + 388.

DUNLAP, ORRIN E., JR. *The Future of Television.* Pp. xi + 194. Harper and Brothers. $2.50.

WIETING, C. MAURICE. *How to Teach Consumers' Cooperation.* Pp. xv + 206. Harper and Brothers. $2.00.