A Mercury Switch for Thermocouples

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During the recent national emergency, when materials for research either were not available or were difficult to obtain within a reasonable period of time, the need arose for a switch which would automatically and alternately close each of two thermocouple circuits connected to a single recording potentiometer. Such a switch must be so constructed that the contact points do not become fouled, thus creating electrical resistance. To meet this need, the mercury switch described below was constructed and found to operate efficiently.

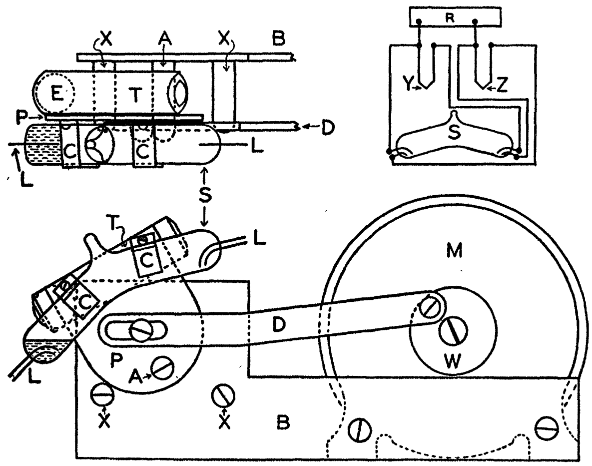

FIG. 1

The switch proper (S) was made from a piece of 12-mm. soda-lime glass tubing, 65 mm. in length and bent to form an angle of about 150°, as shown in the front and top views in **Fig. 1**. Two platinum lead wires (L) were sealed into the ends of the switch as indicated. A minimum quantity of distilled mercury was placed inside the tubing to insure that the two lead wires at one end would be adequately covered and, thus, the circuit through them closed. The glass switch was evacuated and sealed off as shown.

The switch (S) was mounted by means of two small brass strips (C) to a brass plate (P), mounted on a brass base (B) by means of a pivot (A) which was made of a brass collar on a 1-inch, No. 10, 32-thread brass machine screw. The plate (P) and the base (B) were made of $\frac{1}{16}$-inch sheet brass.

In order to change from one thermocouple circuit to another, the driver (D), made from $\frac{1}{16}$-inch sheet brass, was attached to the driving wheel (W) on the shaft of a 1-r.p.m. motor. Obviously, any desired period of time for each circuit may be obtained by using a motor (M) with the desired r.p.m. or suitable reduction gears on an available motor. On this switch a Speedway motor,[2] No. 953-W, for 110-volt, 60-cycle alternating current, having a shaft speed of 1 r.p.m. was used. This afforded a 30-second cycle for each thermocouple circuit.

To insure the quick breaking of one circuit with the simultaneous quick closing of the second circuit, a steel ball (E), $\frac{3}{8}$ inch in diameter, was placed inside a $\frac{1}{2}$-inch brass tube (T), $1\frac{3}{4}$ inches long. The ends were crimped and the tube soldered on the back of the brass plate (P) as shown in Fig. 1. The extent to which the switch may be thrown in either direction is governed by the studs (X) upon which the brass plate (P) rests. These studs were made in the same manner as the pivot (A) previously described.

The wiring diagram for the thermocouple circuit is shown in the upper right-hand corner of Fig. 1. The two thermocouples are indicated by Y and Z; the recording potentiometer by R.

Very satisfactory results were obtained using this switch with one recording potentiometer to determine the temperatures of the heads of two gas fractionating columns operating simultaneously.

[1] The author is indebted to A. E. Wood for suggested improvements in the original design of this switch.

[2] Manufactured by the Speedway Manufacturing Company, 1834 South 52nd Avenue, Cicero, Illinois.

Carbon 14 Production From Ammonium Nitrate Solution in the Chain-reacting Pile[1]

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It may be of interest to describe the method of production of the radioactive C^{14} currently being released by the Manhattan District in its isotope distribution program. C^{14} was discovered several years ago (*4*), and its general characteristics were correctly determined from weak samples resulting from prolonged cyclotron activation. These characteristics may be summarized as follows: (a) a half-life estimated as some thousands of years; (b) no gamma rays; (c) beta particles with a maximum energy of 0.14 Mev. In addition, it had been ascertained that C^{14} results from the reaction of neutrons with nitrogen—$N^{14}(n,p)C^{14}$, and that this reaction takes place under the action of slow neutrons (*1*). The latter property has become a particularly fortunate one since the advent of chain-reacting piles, with their great abundance of slow neutrons. Its significance is twofold: in the first place, samples thousands of times stronger than those which were made with great patience with the best cyclotrons can now be produced with relatively little effort, and, secondly, the C^{14} which results is (at least in theory) isotopically pure, since no other carbon is involved in the manufacturing process. Thus, a high level of specific activity is obtainable—always an important consideration, but particularly so when very long half-lives are involved.

Thus, the problem of manufacture becomes one of irradiating nitrogen in the pile and of subsequently separating the carbon. Although there are many ways of doing this, the choice is narrowed by practical considerations. For example, space economy demands that the nitrogen be in some form of high atomic density, and neutron economy demands that it should not be combined with elements which would contribute high parasitic neutron absorption. Furthermore, the nitrogen must not be in the form of a compound which will decompose

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