out by Gillespie[8] and by Sharp and the author.[4,9] Recently Plummer[5] has confirmed these views and presented much additional data. It is often assumed that most agricultural plants require a slightly alkaline reaction in the soil. Previous work has shown that a reaction of P_H 5.0 is in no way inhibitive to the growth of barley seedlings. This point has been investigated further, with the use of several varieties of beans in sand cultures. The solutions were changed with sufficient frequency to maintain constantly an acid reaction. No evidence of injury was apparent. Truog[10] upholds the view that the acidity per se is not ordinarily the limiting factor in acid soils.

With reference to the latter point it may be of interest to present some observations made on an area of California peat soils. All were found to be decidedly acid, as follows:

TABLE IV

P_H of Soil Suspensions

	Description of Soil	P_H
1.	Surface, never cropped	5.4
1a.	Subsoil from above	6.0
2.	Surface, cropped 15 years	4.9
2a.	Subsoil from above	4.9
3.	Surface, 2 years in potatoes	5.1
3a.	Subsoil from above	4.6
4.	Surface, barley field	4.5

In sections where other inhibiting factors were absent first class crops of barley, oats, beans, potatoes, onions, corn, asparagus, etc., were produced. Incidentally it may be mentioned that from 100 to 3,000 p.p.m. of NO_3 (basis of dry soil) were found. It is evident that in these soils the acid reaction did not interfere with the growth of crops nor the formation of nitrates.

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[8] Gillespie, L. J., *Jour. Wash. Acad. Sci.*, Vol. 6, No. 1, pp. 7–16.

[9] Hoagland, D. R., and L. T. Sharp, *Jour. Agr. Res.*, Vol. XII., No. 3, pp. 139–148, 1918.

[10] Truog, E., *Soil Science*, Vol. 5, No. 3, pp. 169–196, 1918.

AN ELECTRO-THERMO-REGULATOR FOR WATER BATHS

THE majority of electro-thermostats so far devised and in use in paraffin ovens, incubators and control chambers have been constructed to operate directly in the chamber itself. Such installation is not wholly desirable, inasmuch as a regulator so placed is subjected to sudden and extreme variations of temperature each time the door or compartment is opened. This not only interferes with the stability and accurate operation of the instrument itself, but causes an unnecessary number of "makes" and "breaks" on the part of the mechanism, with its attendant corrosion of the contact points, and is also conducive to fluctuations in the temperature caused by the unnecessary heating and slow cooling of the heating element. The thermo-regulator herewith described is designed to be inserted in the tubulature of the incubator, where it is immersed in the water of the water jacket. It is intended to be used in connection with a secondary switch in circuit with an electric heating element. So employed, and with a moderate current passing through the primary circuit, the thermostat will give continuous control within a fraction of a degree of the specified temperature.

The thin brass casing *C* is 29.5 cm. long by 2.5 cm. outside diameter. It is strengthened at its upper end by a collar *D*, which extends on one side to form a rigid arm *A*. Binding posts *B* and *B'* are for wires leading to the secondary switch, which is placed in some out-of-the-way situation. They are thoroughly insulated from the arm *A* by red fiber composition. Binding post *B'* is bolted securely to a curved saddle-piece *S*, in which is suspended a bent lever *L*. Platinum points *P* and *P'* of generous size are soldered to binding post *B* and lever *L* respectively, while a no. 3 cover glass *T* is cemented with hard shellac to the vertical arm of the lever, insulating it from the rest of the mechanism.

The thermostat operates on the principle of the unequal expansion of two different metals composing a couple. Zinc and iron make a sensitive combination; but lead and iron, alu-

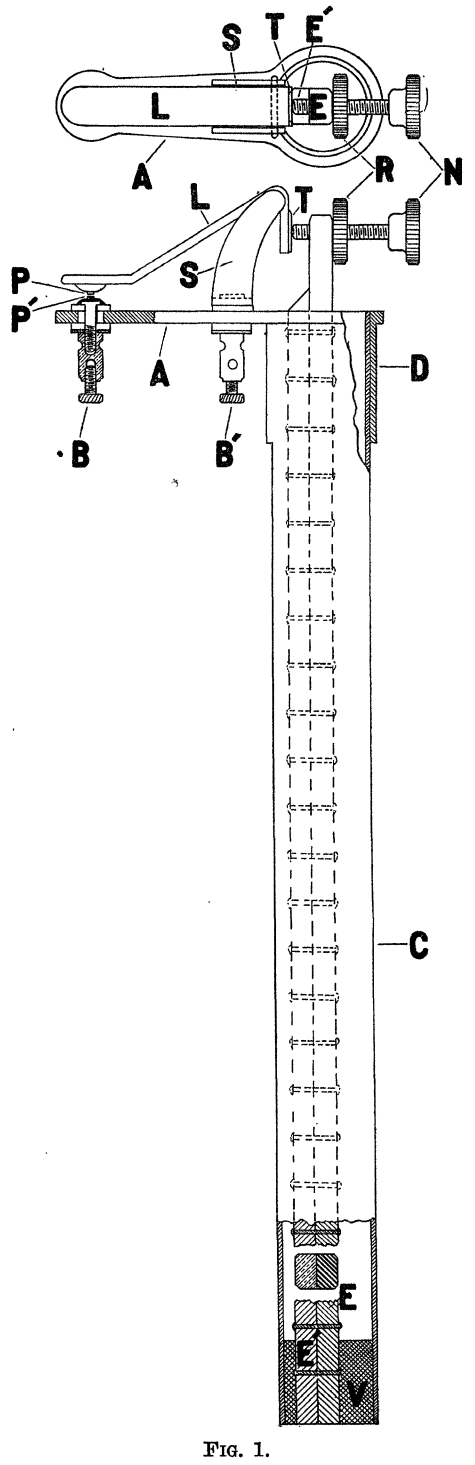

Fig. 1.

minum and iron, copper and iron and other combinations may be used, except that there is a loss in sensitiveness in the order indicated. Two pieces or strips E and E', each about 9.0 mm. in width and 6.0 mm. thickness are riveted together and imbedded in solder V at the bottom of the casing. A screw N and lock-nut R provide means of adjustment of the parts. This method of construction makes a rigid column which is not subject to the vibrations common in a laboratory. In practise, the casing is filled with glycerin, which increases the continuity of parts and prevents corrosion of the metallic couple.

The advantages of this design other than those already mentioned are apparent. First, the generous length of the metallic couple insures a maximum of sensitiveness. Second, this sensitiveness is further increased by the mechanical advantage of the lever. Third, continued movement of the bimetallic column in either direction imposes no strain upon any of the parts of the mechanism, a feature not incorporated in thermostats to be found on the market, and one which makes possible accurate control with least adjustment for long and continuous periods of time.

In the construction and testing of this thermostat, the writer is indebted to the New Hampshire College and Experiment Station for the use of laboratories and equipment.

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