Dr. E. Lederer, Paris, $300 for continuation of work on carotinoids and vitamin H.

Dr. Perrin H. Long, the Johns Hopkins Hospital, $300 for continuation of studies on the biology of the Pertussis Bacillus.

Dr. Balduin Lucké, University of Pennsylvania, $200 for problems of cellular permeability.

Dr. David H. Marine, Montefiore Hospital, New York City, $250 for further study of exophthalmos.

Dr. E. V. McCollum, the Johns Hopkins Hospital, $300 for chemical and histological work on the relationship between hypophysis and magnesium.

Dr. S. W. Ranson, Northwestern University, $300 for work on the production of catalepsy in cats by making lesions behind the mammillary bodies.

Thorndike Memorial Laboratory, Boston City Hospital (Professor George R. Minot, director), continued since 1927 in recognition of Dr. Francis W. Peabody's services to this foundation.

Dr. Carl J. Wiggers, Western Reserve University, $300 for research on the dynamics of the coronary circulation.

Professor Richard Willstätter, Munich, $400 for continuation of research on enzymes, chiefly on amylases of leucocytes.

Professor René Wurmser, Paris, $300 for continuation of work on electrochemical equilibrium in the surrounding cells and its bearing on cellular metabolism.

Academic Assistance Council, London.

During the present emergency, grants (usually less than $500) will be given on the sciences closely related to medicine without reference to special fields. Applications for the year 1934 to 1935 must be in the hands of the committee by May 1. They should be sent to. Dr. Joseph C. Aub, Collis P. Huntington Memorial Hospital, 695 Huntington Avenue, Boston, Massachusetts.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

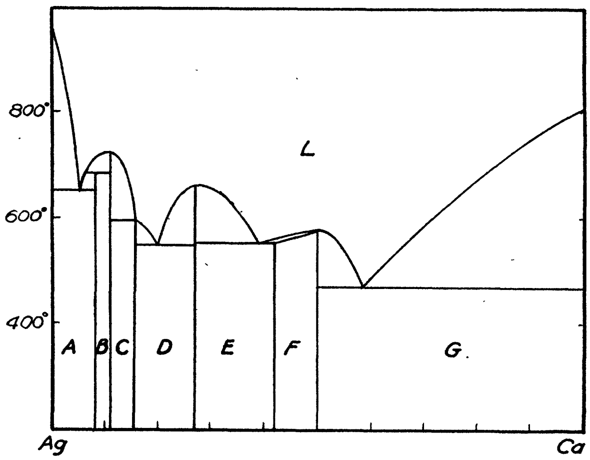
A RULE FOR THE INTERPRETATION OF MELTING POINT DIAGRAMS

To overcome the difficulty frequently encountered in the interpretation of melting point-composition diagrams of system of two components, the writer suggests the following rule, which has been found very useful in determining the number of phases present in a system represented by any given region of the diagram.

A horizontal line represents the conditions under which the coexistence of three phases is possible. Three regions of one phase touch the horizontal line at only one point each. Regions of two phases which touch the line are in extended contact with it.

In this discussion the phrase "one phase region" refers to the sum total of points which represent the temperatures and compositions for which the system consists of a single characteristic phase. Similarly, "two phase region" refers to points which represent temperatures and compositions for which the system consists of two characteristic phases. A one-phase region may be either an area or a vertical line; a two-phase region is always an area.

Application of the rule is illustrated in the accompanying figure. Many of the regions of such diagrams may be interpreted by means of an old rule, according to which those to the right and left of a one-phase region are of two phases, and similarly, those to the right and left of a two-phase region are of one phase. By this means, all the unlettered regions of the figure can be shown to be of two phases, for they are all either to the right or to the left of the one-phase liquid region, but the lettered regions are not so easily interpreted. Since only



areas and vertical lines can represent single phases, the upper left boundary of region F can not represent a phase, and hence the whole region F must represent one phase, and the regions G and E must therefore be two-phase regions. We are unable, however, by the use of this old rule, to determine whether D, C, B and A are alternately one, two, one and two-phase regions, or whether they are all two-phase regions, with the vertical bounding lines as the intervening one-phase regions. By the new rule, however, one can immediately see that all the lettered regions except F and L and all the unlettered areas are two-phase regions, because each is in extended contact with some horizontal line. The areas F and L and the vertical lines between the areas A and B, B and C, C and D and D and E, are one-phase regions, for each has single-point contact with one or more horizontal lines.

The rule can be easily derived. If we express the phase rule for condensed systems by $P + V' = C + 1$, where V' is the variance other than the arbitrarily chosen constant pressure, we see that in a system of three phases having two components, V' is zero, that is, the temperature and the composition of the phases in equilibrium are fixed by the nature of the system and are not arbitrarily variable. Three phases may be in equilibrium in systems represented by points on a horizontal line, and hence under these conditions each of the three phases must be represented by a single composition. The point representing the temperature and the composition of one of the three phases will be a point of a region representing one phase; this region can be in contact with the horizontal line at only one point, for each phase under these conditions can have only a fixed and invariable composition. The regions of two phases must be in extended contact with the horizontal line, for continuous changes of average composition are possible in the system of two phases which lacks the third phase, but is in equilibrium with it.

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AN INEXPENSIVE EFFICIENT RELAY

IN experimental work and in industry an efficient, reliable relay is a valuable instrument. Most relays on the market are very expensive and are quite limited in the quantity of current which they can handle. Probably the most important limitation of the ordinary relay is arcing with subsequent oxidation of the make-and-break contacts. The relay described in this article was designed to obviate this difficulty and has the added feature of being quite inexpensive.

The relay consists simply of an enclosed soft glass "U" tube about half-filled with mercury, as is shown in Fig. 1. On one side a well-fitted polished steel plunger about one and one-half inches long floats upon the mercury surface. A celluloid pin "E" is inserted into the base of the plunger "F," of such size as will just float the plunger. By floating the plunger in this manner there is no tendency for the mercury to creep up between the plunger and the surrounding glass walls. The weight of the plunger is sufficient to raise the surface of the mercury in the other side about one-half inch to make a good connection with the platinum contact "A." A second platinum contact "B" is sealed into the glass well below the equilibrium level of the mercury. The space above the mercury is filled with hydrogen gas and the tube hermetically sealed. "M" is a coil of fine wire which is adjustable to any desired position above the steel plunger. "C" and "D" are connected to the thermostat circuit.

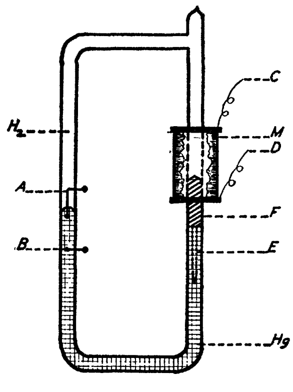

FIG. 1

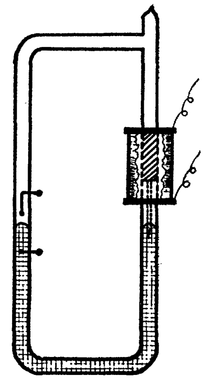

FIG. 2

When a small current, such as is used with the usual thermostats, is passed through coil "M," the steel plunger is drawn up the tube towards the magnetic center of the coil; this lowers the mercury on the other side, breaking the contact with "A" (see Fig. 2). When the current in "M" is shut off, the plunger by force of gravity falls back to its original position, forcing the mercury in the other side to make contact again with "A." The size of the gap and the rapidity with which the contacts are broken may be varied by adjusting coil "M" and the current passing through it. By placing less mercury in the relay (so that in the resting position the mercury does not make contact with "A") and by placing coil "M" at a lower position, the relay may be made to operate in the reverse manner; that is, when the current passes through "M," contact is made with "A."

The make-and-break contacts being placed as they are in an atmosphere of hydrogen gas can not undergo oxidation. It has been found that arcing is eliminated for a current as great as 1.5 kw. Heavier currents have not been tested. Without protecting the contact points by use of condensers, the relay is capable of breaking 110 volts at 12 amperes (D.C.) without any arcing taking place. A spark results, which may be very greatly reduced by placing a 4 mfd. condenser across "A" and "B." Such a current when broken by a copper switch may give rise to an arc from one to two inches long. In order to operate successfully such heavy currents as the above, however, condensers are essential, for on the "make" the platinum contact "A" may fuse.

This relay is particularly adapted for continuous use. One such relay has operated the above current continuously for three months without showing any signs of deterioration. At present, there seems to be no reason why the relay should not continue to operate almost indefinitely.

Its construction, as may be seen, is very simple and the parts should not cost over one dollar.

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