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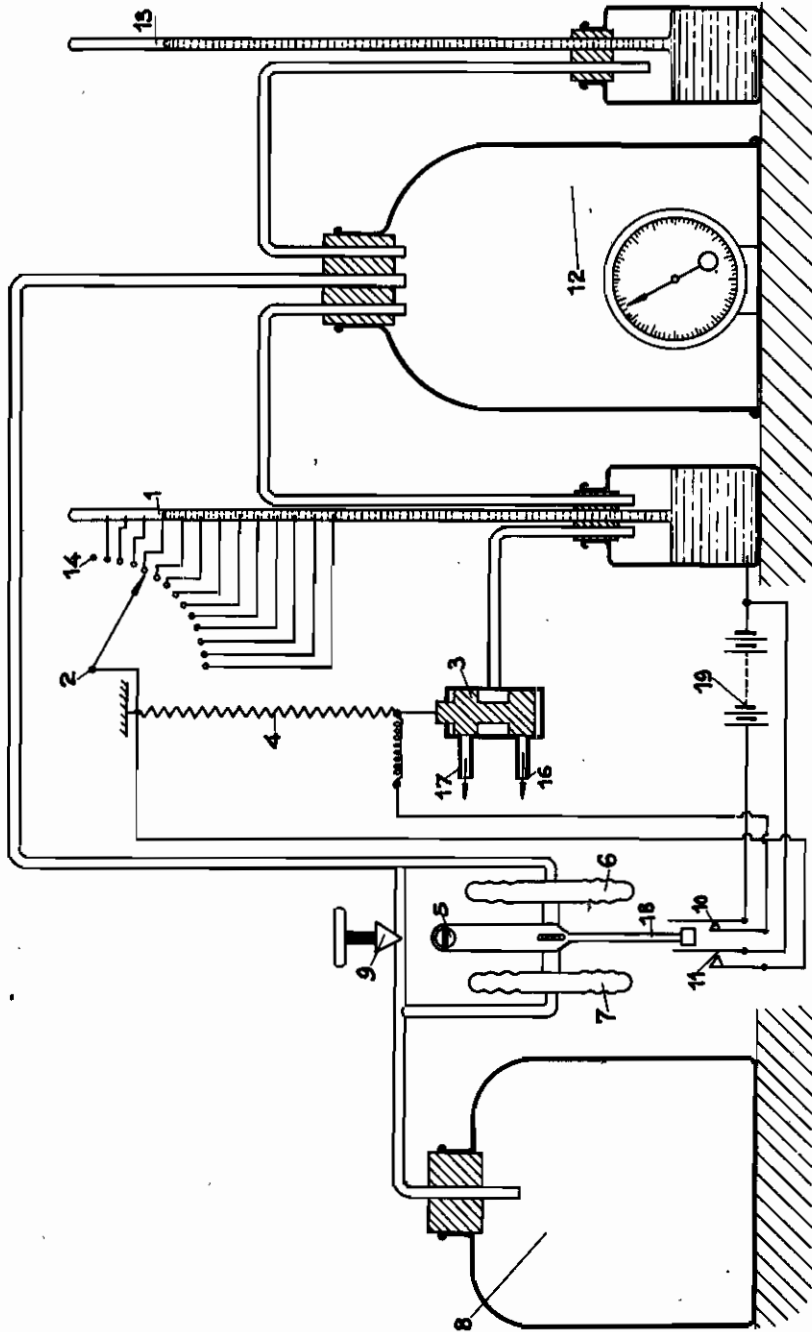
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APPLICATION OF SAID DEVICE TO THE CONTROL OF

BY A. P. C.

ALTIMETRIC AND BAROMETRIC APPARATUS

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AUTOMATIC DEVICE FOR CREATING AND MAINTAINING IN AN ENCLOSURE A PREDETERMINED PARTIAL VACUUM, AND APPLICATION OF SAID DEVICE TO THE CONTROL OF ALTIMETRIC AND BAROMETRIC APPARATUS

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The present invention has for main object an automatic device for creating and maintaining in a closed chamber or enclosure a predetermined partial vacuum; it also includes an improvement by means of which the speed for automatically obtaining said partial vacuum and for re-establishing atmospheric pressure is adjustable at will. Finally, it includes all applications of said device and of its improvement; however, the invention is more particularly applied to the control of the graduation of altimetric, manometric and like apparatus.

In its construction, the device is mainly characterized by the fact that the closed chamber or enclosure is connected to a cock or the like, arranged to put said enclosure in communication either with the atmosphere, or with a source of partial vacuum, according to its position, said source being electrically controlled by a circuit comprising a first adjusting switch, actuated by hand, and a second switch automatically actuated by a standard pressure-gauge which measures the pressure in the enclosure.

Functionally, the device is characterized by the fact that when the pressure in the enclosure exceeds the value corresponding to the position initially given to the hand adjusting switch, the control circuit is in such condition (either closed, or open) that the cock puts the enclosure in communication with the source of partial vacuum; whereas, when the pressure in the enclosure becomes lower than the adjusted value, the manometric switch changes the condition of the control circuit (either opening it, or closing it) so that the cock puts the enclosure in communication with the atmosphere.

The device can therefore form the subject-matter of two main forms of construction:

(a) In one, the control circuit is closed when the pressure in the enclosure exceeds the value corresponding to the position initially given to the hand adjusting switch, and the position of the cock putting the enclosure in communication with the source of partial vacuum, corresponds to the excitation of the control circuit;

(b) In the other, the control circuit is closed when the pressure in the enclosure no longer reaches the value corresponding to the position initially given to the hand adjusting switch, and the position of the cock putting the enclosure in communication with the source of partial vacuum therefore corresponds to the non-excitation of the control circuit.

But in both cases, it will be seen that the apparatus comprises means adapted to place the posi-

tion of the automatic switch under the control of that of the adjusting switch; now, numerous control means of this kind are known, and it can be said, in that sense, that the invention is characterized by the new application of these known means to the control of a manometric switch, in order to obtain new industrial results, particularly when the device is used for controlling the graduation of altimetric, manometric or like apparatus.

The control of altimetric apparatus is usually effected by arranging the latter under a vacuum bell in which a pressure is created corresponding to that of the various altitudes at which the indication supplied is to be controlled. This bell is usually in communication with the atmosphere and a vacuum pump, by means of conduits provided with cocks. These cocks are actuated by hand until a standard pressure-gauge connected to the bell indicates the desired value.

Now, experience has shown that it is extremely long and laborious to obtain these exact pressures within 0, 1 m/m, when the operation is repeated many times, owing to the oscillations of the mercury column and to the slowness with which it comes to equilibrium, then, owing to the fact that the changes of pressure of the air in the bell determine variations of temperature, equilibrium with the surrounding medium is only re-established slowly. Finally, notwithstanding all the care taken, an error always subsists, called personal equation.

The invention allows of obtaining automatically, exactly, and in the minimum time, any desired pressure in the vacuum bell.

The device generally characterized above can be constructed according to various forms, all included in the invention, and which can differ from each other, in particular, by the nature of the cock, of the source of partial vacuum, of the hand adjusting switch, of the automatic switch, of the electric wiring putting said second switch under the control of the first one, of the standard pressure-gauge actuating the automatic switch, etc. It is obvious that each of these various members can be any one of those used in the art and not only those which will be described hereinafter in a particular form of construction of the invention taken by way of example.

The improvement by means of which it is possible to adjust at will the speed with which the desired partial vacuum is obtained and the speed with which atmospheric pressure is re-established, is characterized, in its construction, by a normally open contact which, when it is closed,

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shunts both switches of the control circuit; by a normally closed contact arranged in series on the control circuit; and by an adjustable leakage variometer controlling said contacts.

Functionally, said improvement is characterized by the fact that if the speed for obtaining the partial vacuum is too great, the variometer opens the normally closed contact, which cuts off the control circuit and actuates the cock in the direction for throttling the suction of the source of partial vacuum, whereas, if the speed for re-establishing atmospheric pressure is too great, the variometer closes the normally open contact, which closes the control circuit and actuates the cock in the direction for throttling the communication with the atmosphere.

It will therefore be seen that, in the vacuum bell, the pressure will be established according to a law corresponding to a constant upward or downward speed of adjustable value; for instance 5, 10, 20 or 50 meters per second.

The three main elements of the preferred form of construction of the device, illustrated by way of example in the accompanying drawing, are constituted:

(1°) By a mercury barometric pressure-gauge the vertical tube of which is preferably made of insulating material and provided with metal members which can come in contact with the mercury column.

(2°) By an adjustable variometer controlling one or more electric contacts.

(3°) By one or more air cocks controlled by the contacts of the barometric column or those of the variometer or both simultaneously. An electric switch allows of choosing the altitude at which the pressure in the bell is to be adapted, whilst a cock combined with the variometer allows of adjusting the upward or downward speed.

The operation for opening and closing the cock or cocks can be controlled by any suitable means such as an electromagnet, but preferably, by the expansion of a heated wire, the effect being more gradual.

The accompanying drawing illustrates the general diagram of the plant. Reference number 1 designates the mercury barometer having contacts; 2 the altitude switch, adjustable by hand; 3 a three-way cock controlled by the heated wire 4. The variometer 5 is composed of two cap-

sules 6 and 7, an undistortable vessel 8 and a progressive cock 9; it controls the contacts 10 and 11. The vat of the barometric pressure-gauge 1 is connected, on the one hand, to the cock 3 and, on the other hand, to the vacuum bell 12 connected in its turn to the variometer and to a control pressure-gauge 13. The vat of the pressure-gauge having contacts is connected to one of the poles of a source of current 19; the circuit closes through the mercury contacts, switch 2, expansible wire 4 and reaches the other pole through the normally closed contact 10. The wire 4 can also be supplied with current through the normally open contact 11.

The operation is as follows:

When the switch is on the dead contact-piece 14, the electric circuit is cut off, the wire 4 is cold and the cock 3 open to the atmosphere 17. The switch 2 being on the contact-piece corresponding, for instance, to an altitude of 3000 meters, the current passes through the wire 4, which expands, and the cock 3 opens to the vacuum pump connected at 16. Suction takes place in the vat of the pressure-gauge 1 and in the vacuum bell 12 until the mercury column of pressure-gauge 1 reaches below the level of the contact-piece corresponding to 3000 meters, and cuts off the current. The wire 4 cools, actuates the cock which again tends to cause the pressure to increase.

Finally, equilibrium is obtained and the current passes intermittently through wire 4, heating it moderately, which maintains the cock 3 closed. The pressure remains stable in the bell 12. It will be noted that said pressure is automatically fixed when going up or down, on the contact-piece chosen by the switch 2. The speed of the variation of pressure is controlled by the cock 9 of the variometer. Thus, if the upward speed exceeds that fixed by the variometer, the lever 18 will cut off the contact 10, this having the effect of cooling the wire 4 and of reducing the opening of the cock 3 to the vacuum pump. On the contrary, if the downward speed is too great, the variometer will close the contact 11, wire 4 is supplied with current and reduces the opening of cock 3 to the atmosphere. It will be noted that the speeds fixed by the cock 9 are independent of the volume of the bell 12.

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