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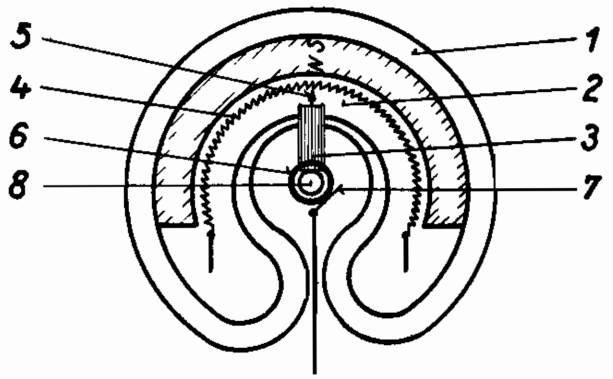

Fig. 1

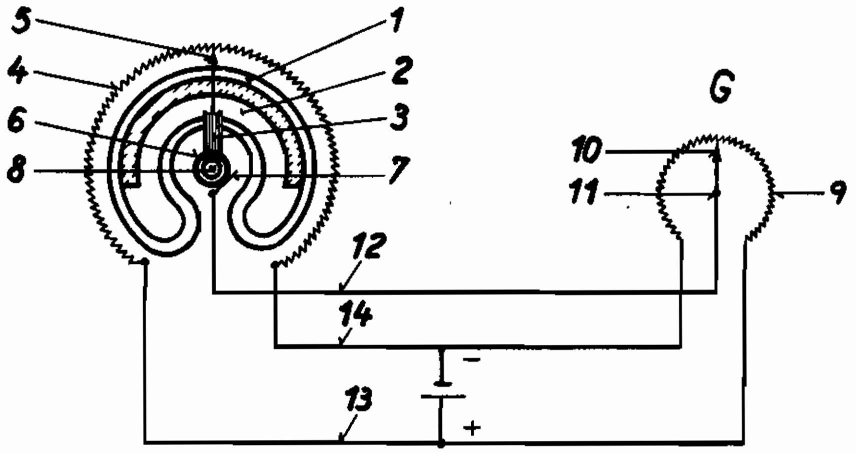

Fig. 2

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ALIEN PROPERTY CUSTODIAN

MEASURING INSTRUMENT

Albert Patin, Berlin, Germany; vested in the Alien Property Custodian

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This invention relates to a measuring instrument and refers more particularly to an instrument, the indicating hand of which should be capable of swinging within a comparatively large range, namely, to an angle of 180° and more. The invention is particularly concerned with a measuring instrument comprising a unipolar magnet system combined with a variable resistance.

Systems of this type are most advantageously utilized in equalizing bridge connections, such as Wheatstone bridge connections, the coils of the system constituting a part of the zero or neutral line of the bridge connection. The devices are particularly suitable for bridge connections wherein changes in the resistance of a bridge arm caused by an externally actuating force result in the movement of a coil system included in the diagonal or neutral line of the bridge connection.

In prior art, unipolar magnet systems have not been used to any large extent, since the induction of the air gap of these systems is comparatively small as compared to that of the instruments the indicating hand of which is movable to an extent of 90°. Furthermore, it was found that whenever unipolar magnet systems are used, it is difficult to provide for a homogeneous induction of the air gap, which is absolutely necessary for measuring purposes.

An object of the present invention is the provision of a measuring instrument having a unipolar magnet system, the indicating hand of the instrument being capable of moving within a comparatively large range, the positions of the hand corresponding exactly to any amount to be indicated, irrespective of the uniformity of the induction of the air gap.

Other objects of the present invention will become apparent in the course of the following specification.

The objects of the present invention may be realized by means of a unipolar magnet system which is provided with a comparatively thin resistance ring contacted by one or more slidable contacts which are connected mechanically with the axle of the system and which are connected electrically with one end of a coil system. The coil system constitutes the indicating means of the measuring instrument and may swing within a range of 180° or more.

The invention will appear more clearly from the following detailed description when taken in connection with the accompanying drawing showing by way of example a preferred embodiment of the inventive idea.

In the drawing:

Figure 1 is a diagram showing a receiving instrument having a unipolar magnet system combined with a variable resistance and a coil; and

Figure 2 is a diagram illustrating the arrangement of the devices shown in Figure 1 in a bridge connection.

The receiving instrument shown in the drawing comprises an annular permanent magnet having the poles N, S.

Obviously, any other suitable unipolar magnet system may be used in lieu of the one illustrated.

The annular magnet N, S is enclosed by a casing **1** consisting of soft iron or magnetic iron and used for transmitting the flow of the magnetic lines of force. Thus, a magnetically inducted air gap **2** is formed between the magnet and the casing **1**.

The coil **3** is so arranged that it can swing within the air gap **2**. For this purpose, the coil **3** is connected with a support (not shown), which is swingably mounted upon an axle **8**, so that the coil **3** can swing about the axle **8**.

The coil **3** is mechanically connected with an indicator or contact **5** which is in contact with an annular resistance **4** and which slides over that resistance.

The resistance **4** may consist of a single bent resistance wire, preferably of a very small diameter, or it may consist of a resistance wire which is wound about an annular support (not shown). If the last-mentioned construction is used, then in order to change the resistance substantially without steps the resistance wire should be extremely thin and it should be wound one winding next to the other upon the annular support.

The contact **5** is electrically connected with one end of the coil **3**. The opposite end of the coil **3** is connected with a conducting ring **6**, which is movable along with the coil **3**, and which is in engagement with an immovable contact or brush **7** connected to a terminal (not shown).

The contact **7** may be substituted by a current-conducting soft spring which does not exert any substantial directional forces upon the coil **3**, or with a small current conducting band.

The described construction may be advantageously included in a bridge connection illustrated in Figure 2, although the bridge connection may be conveniently substituted by any suitable equalizing connections.

A transmitting device G comprises a contact **10** which is in contact with and slidable over an annular resistance 9. The contact 10 is swingable about an axle 11.

Any suitable device not shown in the drawing may be used for actuating the contact 10 and for moving it in relation to the resistance 9. The movements of the contact 10 may be caused by any physical quantity, for instance, by the changes in the lever of a liquid filling the tank, by a temperature-measuring device, by a change in pressure, or the like. The movements of the contact 10 should be a function of changes in a certain physical quantity.

Furthermore, the illustrated device G may be substituted by a thermal element or by an ohmic resistance which is influenced by changes in temperature.

An important task of the present invention is that changes in the resistance of the device G should be transmitted to the receiving instrument shown in Figure 1 and should be exactly reproduced by that receiving instrument.

For that purpose, the contact 10 is connected with a wire 12 the opposite end of which is connected to the immovable contact 7. One end of the resistance 9 is connected by a wire 13 with an end of the resistance 4, while the opposite ends of the resistances 9 and 4 are connected with each other by the wire 14. The wires 13 and 14 are connected to a source of electrical energy which is diagrammatically indicated in Figure 2.

Thus, the receiving device of Figure 1 and the transmitting device G are included in a Wheatstone bridge connection. The contact 10 is connected by means of the wire 12, the contact 7, and the ring 6 with one end of the rotary coil 3 of the receiving device, and is also connected by means of the contact 5 which is electrically connected to an end of the coil 3, with the resistance 4. Thus, the contact 5, the coil 3, the wire 12, and the contact 10 constitute the diagonal or neutral line of the Wheatstone bridge.

The arms of the bridge are constituted on the one hand by the conduit 13, a portion of the annular resistance 9, and a portion of the annular resistance 4, and, on the other hand, by the wire 14 and the other portions of the annular resistances 4 and 9.

The illustrated unipolar magnet system may be so constructed that the device can be advantageously utilized in connection with an alternating current.

The operation of the device is as follows:

As soon as some physical quantity causes a movement of the contact 10 over the resistance 9, the balance of the bridge connection is disturbed and a current flows through the diagonal or neutral line of the bridge, that is, through the contact 10, the wire 12, the contact 7, the ring 6, the coil 3 and the contact 5. The current flowing through the coil 3, which is situated in the magnetic field of the magnet N, S, will exert a force upon the coil which will cause the coil to swing within the gap 2, along with the contact 5, which is mechanically as well as electrically connected to the coil 3. The coil 3 will continue its movement until the position of the contact 5 again corresponds to the position of the contact 10, i. e., until the voltages are balanced at both parts of the bridge connection.

The new position of the indicator 5 will, therefore, correspond exactly to the changes in the physical quantity which are to be measured by the instrument. The contact 5 may swing over a scale which will clearly indicate the extent of such changes.

It is apparent that the specific illustrations shown above have been given by way of illustration and not by way of limitation, and that the structures above described are subject to wide variation and modification without departing from the scope or intent of the invention. For example, the single contact 5 shown in the drawing may be substituted by a plurality of comparatively thin contacts.

Whenever necessary, the receiving device may be combined not only with an indicating device, particularly with one comprising a hand movable over a scale, but it can release, depending upon the movements of the contact 5, certain steering or regulating forces. One or more additional contacts engaging the resistance 4 may be utilized for such steering or regulating purposes, and it is not absolutely necessary that these additional contacts be electrically and conductively connected with the transmitting device G, but they may be utilized to influence currents in secondary circuits. Furthermore, in addition to the coil 3 through which the bridge current flows, other coils may be provided each of which is dependent on different transmitting devices, so that each of the coils will additionally influence the position of the contact 5. For example, in a transmission level gauge, the air pressure may be additionally considered and may have a correcting effect upon the measuring device, or certain corrective forces may be utilized along with the principal forces for steering purposes. Furthermore, it is possible to provide a construction wherein the annular resistance 3 will be mechanically connected with the coil 3 and will swing along with the coil, while the contact 5 will remain immovable and be firmly connected with the casing of the instrument. All of such and other variations and modifications are to be included within the scope of the present invention.

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