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C. H. H. RODANET

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MAGNETICALLY-ACTING SPEEDOMETER

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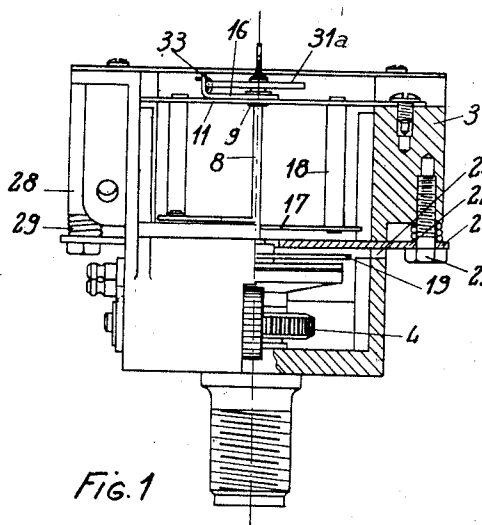


Fig. 1

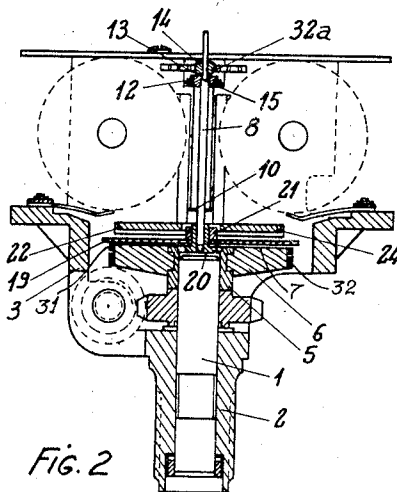


Fig. 2

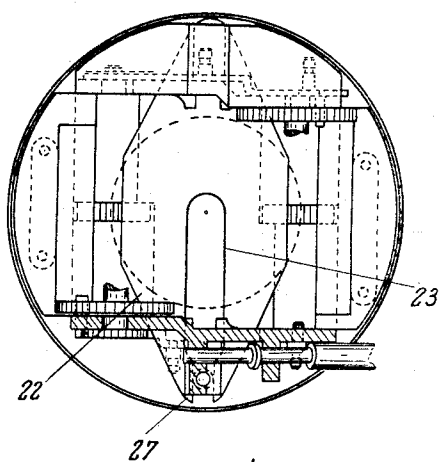


Fig. 3

INVENTOR
CHARLES HILAIRE HENRI RODANET
By
Hasseltine, Lake & Co.
AGENTS

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MAGNETICALLY ACTING SPEEDOMETER

Charles Hilaire Henri Rodanet, Neuilly-sur-Seine,
France, assignor to Etablissements Ed. Jaeger,
Seine, France

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The present invention relates to improvements in magnetically-acting speedometers of the type in which a permanent plane magnet with concentrated induction field, rotating about an axis at right angles to its plane and consisting of a magnetic material agglomerated under high pressure, drives a movable unit comprising a suspended member of non-magnetic material having a low moment of inertia, this speedometer being thermo-magnetically compensated by means of a self-compensating shunt made of a metal having a very low Curie point and mounted on the magnet. This self-compensating shunt may be mounted on the plane magnet like a binding or hoop member and encloses the lateral surface of this plane magnet.

In some applications such as, for instance, the use of a speedometer of this type in aviation, the self-compensating shunt made of metal having a very low Curie point will not ensure the desired thermo-magnetic compensation in the whole range of temperature variations to which the apparatus may be subjected.

In order to avoid this drawback and render it possible to use such speedometers within temperature ranges of the order of for example -50° F. and 149° F., the present invention has for its main object to provide a magnetically-acting speedometer of the kind described, wherein the thermo-magnetic self-compensating effect is obtained by means of a pair of shunts made of different metals having different expansion and magnetization coefficients, one shunt serving for cold operation and the other for warm operation.

According to a preferred embodiment of the invention, these shunts are mounted on the plane magnet of agglomerated magnetic material in the way of binding or hoop members obtained, preferably, from metal strips cut and shaped according to the outer contour of the plane magnet and having their adjacent ends connected together in any suitable and known manner such as electric welding, clamping, etc. The shunts are preferably made of thermostatic metals or alloys having different percentages of silicon therein.

The ensuing description made in reference to the accompanying drawings, given by way of non-restrictive examples, will provide a clear understanding of the way in which the invention may be put into practice.

Fig. 1 is a view in elevation and partly in section of a speedometer according to the invention.

Fig. 2 is a side view partly in section of Fig. 1.

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Fig. 3 is a plane view partly in section of Fig. 1.

The flexible drive cable extending from the member the speed of which is to be measured is made rigid with the drive spindle 1 of the speedometer through any known means not shown, such as a square drive socket for instance. Said spindle 1 is centered in a bearing 2 integral with the general support 3 of the apparatus. On said spindle there is mounted in a manner known per se, a pinion 4 adapted to drive the totalizing device which may be of any general type.

Said spindle supports at its top end a ring 5 on which is rigidly mounted a flat magnet 6 having six poles on its face 7. Said magnet is constituted by any agglomerated material such as iron powder, aluminum-steel powder, etc.

In alignment with the axial line of the drive shaft 1, a spindle 8, the movable structure spindle, is mounted on two bearings 9 and 10. The bearing 9 rigid with the strip 11 secured to the frame 3 comprises a cup member 12 through which extends the spindle 8, a washer 13 and a stop ring 14 press-fitted around the spindle and leaving a longitudinal clearance between the internal face of the cup 12 and the washer 13 applied against the bearing-surface 15 of the spindle 8. The cup 12 is made rigid with the strip 11 by crimping. The second bearing 10 of the spindle 8 is formed by a bore made in a cage 17 rigidly connected with the strip 11 through posts 18, the assembly as a whole constituting a cage.

In overhanging relation with respect to the bearings 9 and 10, the spindle 8 supports a disc 19 of a non-magnetic metal, aluminum for instance, the external diameter of which is substantially greater than that of the flat magnet 6. Said disc 19 is mounted on the spindle 8 through the medium of a shouldered ring 20 and a washer 21 press-fitted over said ring.

The field-closing plate 22, made of soft steel or silicon-containing sheet iron for instance, is provided with a port 23 allowing it to be mounted above the movable disc 19. It moreover traverses two slots 24 formed in the body of the frame 3 and is secured to bosses carried by the latter by means of bolts 25 respectively extending through a bore 26 formed in the end of the plate 22 opposite from the port 23 and the restricted portion 27 of said port. Between the plate 22 and the bosses 28 springs 29 are inserted tightly surrounding the bolts 25. The bolts 25 serve to adjust the position of the field-closing plate 22 with respect to the flat magnet 6 and consequently the total air-gap, thus allowing the determination of the various ranges for the maxi-

imum amplitude of the disc 19 under the influence of the eddy-currents generated in said disc by the flat magnet 6. The same constituent elements may, by way of example, serve to construct speedometers which, for an angular scale of 360° cover speed ranges comprise between 2,300 and 4,350 R. P. M.

In order to allow the speedometer to operate both in cold and warm conditions, the magnet is thermomagnetically compensated by a pair of shunts 31 and 32 consisting of two binding members made of different metals like those used in altimeters, these metals having different expansion and magnetization coefficients. The binding or hoop members 31 and 32 have different widths and the former acts as cold operation shunt while the latter acts as warm operation shunt.

According to a preferred form of embodiment, the binding member 31 consists of a metal having a Curie point of 50° F. and a magnetic vanishing range comprised between -40° F. and 50° F., such as the alloy used in altimeters and which comprises:

	Percent
Carbon	.11
Magnesium	1.12
Silicon	.13
Nickel	29.04

The binding member 32 consists of a metal having a Curie point of 149° F. and a magnetic vanishing range comprised between 68° F. and 149° F., such as the alloy used in altimeters and which comprises:

	Percent
Carbon	.08
Magnesium	1.02
Silicon	.01
Nickel	30.

The spiral spring 31a which supplies the antagonistic action against the drive of the movable disc 19 by the flat rotating magnet 6 has one of its ends secured to a ring 32a rigidly mounted on the spindle 8. Its other end is secured to a hook 33 forming part of the part 16. The latter is mounted with a soft friction fit on the external portion of the cage 12. As a result the zero-adjustment of the speedometer may be effected in an approximate manner on mounting, but is finally accomplished in the initial operations of the speedometer through the retarded rotation of the attachment of the spiral spring 16 about the cage 12.

The simplicity in mounting the constituent elements of the speedometer according to the invention, as well as the compact form of their

assembly, makes it possible to realize the frame 3 in the form of a unitary frame.

It will be quite evident that without exceeding the scope of the invention, modifications may be made in the forms of embodiment of the various elements constituting the speedometer, especially as regards the shape of the low-inertia member, the shape of the field-closing plate, the number of poles of the flat magnet, the construction of the adjustable bearing for the movable structure spindle etc.

What I claim is:

1. In combination with a magnetically-acting speedometer of the type in which a permanent plane magnet having a cylindrical contour and a concentrated induction field, rotating about an axis perpendicular to its plane and consisting of a magnetic material agglomerated under high pressure, drives a movable unit comprising a member made of non-magnetic metal suspended and having a low moment of inertia, of a first ring acting as the hoop member and made of a metal having a relatively low Curie point and a magnetism vanishing range, said first hoop member being mounted peripherally on said plane magnet in the portion thereof which is nearest to the member of non-magnetic metal, and of a second ring acting also as a hoop member and made of a metal having a Curie point substantially higher than the metal of the first hoop member and a magnetism vanishing range the extreme temperatures of which are higher than those of the corresponding range of said first hoop member, said second hoop member being mounted peripherally on the contour of said plane magnet opposite to said first hoop member with respect to the member of non-magnetic metal.

2. A combination, according to claim 1, wherein the metals of the first and second hoop members are made have Curie points of 50° F. and 149° F., and magnetism vanishing ranges comprised between -40° F. and 50° F. and between 68° F. and 149° F., respectively.

CHARLES HILAIRE HENRI RODANET.

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