May 10, 1932. J. ZUBATY 1,857,674

SPEEDOMETER WITH ROTATING MAGNET

Original Filed Oct. 7, 1926

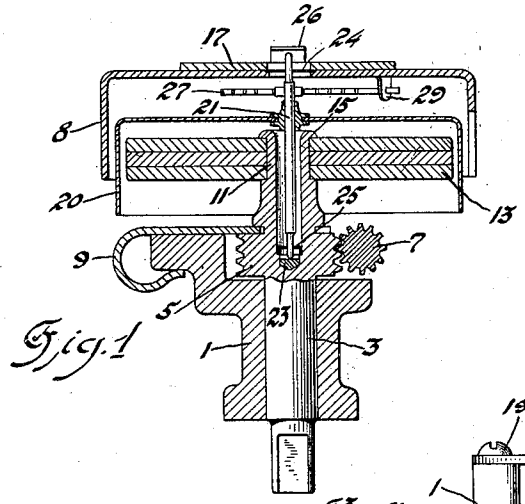


Fig. 1

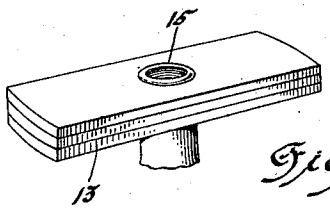


Fig. 3

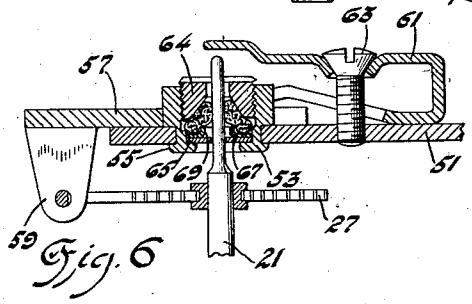


Fig. 6

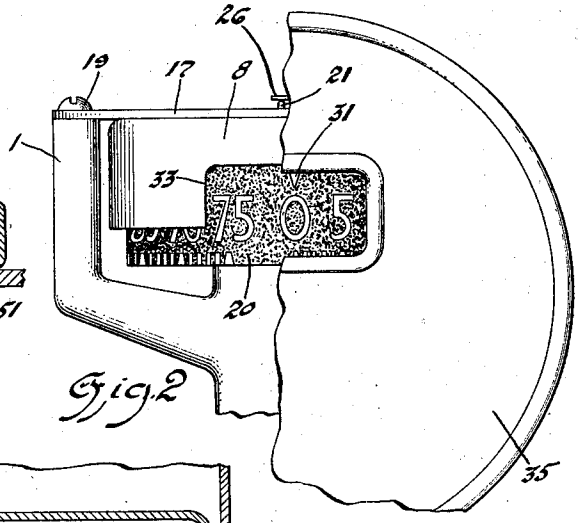


Fig. 2

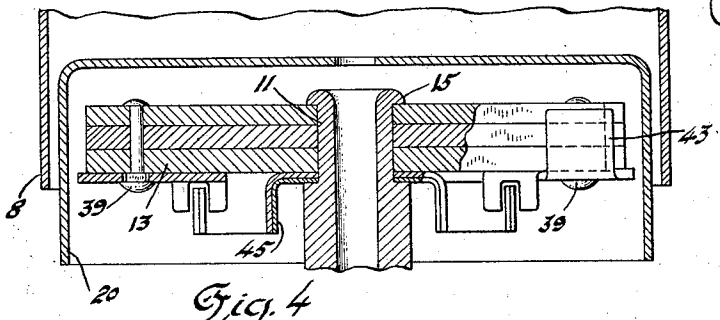


Fig. 4

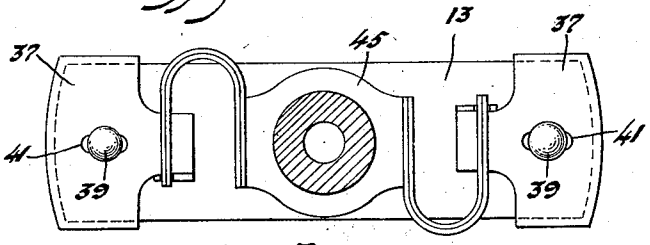


Fig. 5

Inventor
Joseph Zubaty

By Blackmore, Spencer & Flint
Attorneys

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UNITED STATES PATENT OFFICE

JOSEPH ZUBATY, OF FLINT, MICHIGAN, ASSIGNOR TO A C SPARK PLUG COMPANY, OF FLINT, MICHIGAN, A COMPANY OF MICHIGAN

SPEEDOMETER WITH ROTATING MAGNET

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This invention relates to measuring instruments, and more particularly has been designed as an improvement in a magnetic speedometer for vehicles.

An object of the invention is to combine the advantages of different known types of instruments and to avoid their disadvantages.

Another object is to employ comparatively light rotating parts to thereby increase the life of the flexible drive shaft.

Another object is to so construct a straight bar magnet as to overcome the inherent disadvantages of its lesser efficiency as compared with instruments of the ring and horseshoe type.

As another object, the invention contemplates such a relative position of parts as to take full advantage of all available magnetic lines of force.

Among more incidental advantages are the provision of means to prevent interference from outside sources, and to afford a very convenient "zero pointer."

Among the contemplated objects of the invention, are also, means which may be used with the magnetic speedometer, having the above advantages, to act as a damper to prevent oscillations of the speed cup with sudden changes in speed; and the use of a temperature sensitive means to correct errors arising from changes in temperatures.

A reading of the following description and an examination of the accompanying drawings will make known the structure designed to secure the above enumerated and other obvious advantages of the invention.

In the drawings, Figure 1 is a vertical section through the instrument.

Figure 2 is a front elevation partly broken away.

Figure 3 is a perspective of a magnet.

Figure 4 is a view similar to Figure 1 but on a larger scale and showing the thermostatic control used with the magnet.

Figure 5 is a plan view looking at the bottom of the magnet shown in Figure 4.

Figure 6 is a vertical section through a modified form showing the friction damper.

Referring by reference characters to the drawings, and first to Figures 1 to 3 inclusive, numeral 1 is a frame member which is preferably a die casting.

The frame is to be positioned within a casing, not shown, and carries a shaft 3 vertically journaled therein. At the lower end, shaft 3 is suitably constructed for connection with the driving shaft extending to a point outside the instrument. Within a recess of the frame, the shaft 3 is provided with a worm 5 to drive a gear 7, which latter operates the usual odometer mechanism. A clip 9, engages over a shoulder of the frame and enters a notch in the shaft to hold the latter in position. Upon a reduced portion 11 of the shaft is pressed a magnet 13, and the upper end of the shaft is spun over at 15. This magnet has the shape of a straight bar. Part 8 is a stationary armature of cup shape enveloping the top, sides and ends of magnet 13. It is preferably a steel stamping. A plate 17 and fastening means 19 support the armature 8 on the frame 1. Within the space between the armature 8 and the magnet is a speed cup or drag element 20. The speed cup is carried on a rotating bearing 23 within the rotating shaft 3. A ring jewel 25 is also used above bearing 23. At its upper end the spindle 21 is guided by a stationary bearing 24 carried by the fixed armature. Above the end of the spindle is a suitable stop 26 to limit the upward movement of the spindle.

The magnet is not in the form of a single bar but is in the form of a plurality of bars of similar dimensions superposed one upon the other to secure certain advantages to be explained below.

Between the armature and the speed cup is a hair spring 27 secured at one end to the spindle and at its other end to a lug 29 extending downwardly from above. This spring is intended to bias the cup to a position where its "zero" is opposite a pointer 31, on a portion of the armature which is cut away as shown at 33 to render visible the indicating numerals on the speed cup, these numerals being read through the usual openings in the dial plate 35 as shown in Figure 2.

In Figures 4 and 5 there is shown an arrangement whereby automatically compensating means is provided to correct for errors

in readings due to variations in temperature. Pole shoes 37 are provided on one or both, preferably both ends of the magnet. These shoes slide on the magnet and are guided by rivets 39 carried by the ends of the magnet, which rivets move in slots 41 in the shoes.

The shoes have arms 43 projecting upwardly along side the magnet, the arms aiding in guiding the movement of the shoes along the magnet. 45 is a stamping of thermostatic metal, shaped as shown and secured to the rotating shaft with the magnet. At each side of its centre attachment the thermostatic member is of U-shape, the outer ends of the U being connected to the shoes as shown. The characteristics of the thermostat are such that with an increase in temperature the shoes are moved outwardly along the ends of the magnet toward the speed cup and armature. The air gap between the magnet and speed cup is thus made variable and dependent upon changes in temperature.

In Figure 6, is illustrated an arrangement to prevent undesirable oscillations of the rotary spindle and speed cup. The expedient is shown in a somewhat different relation but could as well be applied in the relation shown by Figure 1. In Figure 6 the plate 51 has an aperture to receive a cup 53, pressed into the plate 51, and spun over at 55. The cup is also serviceable as a pivot for a hair spring adjusting arm 57, the hair spring being connected to the spindle and to a part 59 projecting from the arm. The adjusting device 57 is held in position by a generally U-shaped spring 61 straddling an adjusting screw 63 which passes through a forked end of the spring and into the plate 51. The screw 63 engages by its end the upper arm of the spring and its adjustment varies the clearance at the upper end of the spindle. Threaded to the cup 53 is a cover 64 having a slot for a screw driver to permit its adjustment within the cup. A bearing 65 is positioned adjacent the bottom of the cup 53 to guide the spindle 21. Just above the bearing is a stamping 67 having an extruded part 69. Between the stamping 67 and the cover 64 the space is filled with fine cotton to afford a desired degree of friction upon the spindle, the extruded portion 69 guiding the spindle and keeping the lint from the cotton away from the bearing.

In designing the speedometer having the structural characteristics above enumerated there have been considered the relative merits of the several known shapes of magnets; also there has been taken into consideration the advantages of the fixed and rotary type of magnet, both of course well known. In the revolving magnet of ring shape the full strength of the magnet is not available because the lines of force in large measure cross the air gap between the poles and do not intersect the drag element. To overcome this disadvantage, the magnet must be made heavier and larger which introduces a heavy strain upon the flexible drive shaft and reduces its life. Moreover. the ring shape involves manufacturing difficulty and requires a grinding operation to correct for deformation after heat treatment. Compared with the ring and horseshoe magnets, a rotating bar magnet surrounded by a fixed cup shaped armature results not only in a light and cheap arrangement but possesses very great efficiency since practically all lines of force intersect the drag element. Furthermore, the light weight of the magnet lessens the strain upon the flexible drive shaft. It has been found that the light rotating parts add greatly to the life of the flexible shaft.

Although it is true that efficiency is obtained by a structure arranged so that substantially all the lines of force intersect the speed cup, the inherent disadvantage of the bar magnet, as compared with the magnet of ring and horseshoe type has not been neglected. The bar magnet can not be so highly magnetized and this is true probably because of the fact that in the ring and horseshoe type there is but a small air gap through which the lines of force must pass, whereas in the bar type of magnet, the gap may be said to be longer than the magnet itself.

To render the bar magnet as efficient as possible cognizance has been taken of the fact that to obtain the greatest efficiency in any magnet it is necessary to maintain a certain relation between its length and cross section. It is, therefore, not possible to increase the thickness of a bar magnet beyond certain limits in an attempt to increase its efficiency. This disadvantage has been overcome by making the magnet of several component parts each of which possesses a most desirable ration between its length and cross section. Three magnets each two inches long, 5/8 inch wide, and 1/8 inch thick will be found to be more powerful than a single magnet having the combined dimensions of the three. Incidentally too, the thinner stock can be handled much more advantageously in stamping. By making the magnets in this way, the relative disadvantages of the bar type have been overcome.

The enveloping of the bar magnet within a steel cup possesses another advantage. The instrument is not susceptible to outside interferences such as heavy steel parts or electric wires. The magnet case for such an instrument may be made of any desired material, magnetic or otherwise.

The structure already described provides for a convenient arrangement of the zero pointer. When it has been necessary to place this pointer on the dial and make it of a different color from the dial plate, difficulty has been encountered which will be avoided when

the pointer is made as an integral part of a separate portion, the armature cup.

The effects of temperature are corrected automatically by the movement of the shoes on the ends of the magnet under the action of bi-metallic thermostats. As the temperature rises the shoes move outwardly. This has the effect of lengthening the magnet and reduces the gap between its end and the drag element, thus overcoming the diminishing effectiveness of the magnet owing to the rise of temperature, and the increasing effectiveness with falling temperature.

One advantage of a stationary magnet and a speed cup rotatable between its poles is the influence of the strong magnetic pull to prevent oscillations of the speed cup caused by sudden changes of speed. In the case of a rotating magnet this check upon the oscillations of the speed cup may be had by friction in the spindle jewel bearing. This however makes the indicator slow at the start because a certain speed will be required to overcome the friction in the bearings before any movement can be had. In a construction which is an aid to easy starting one of the bearings is arranged to rotate together with the driving shaft. When a rotating magnet is used so that it cannot be used to retard undesirable oscillation of the speed cup and where also a rotating spindle bearing is made use of, the indicator is very unsteady. To check such unsteadiness, the structure shown in Figure 6 has been arranged. By the adjustment of the cover into or out of the cup, variable pressure is afforded by the cotton within the cup upon the rotating spindle. It will be observed that in this figure the magnet and spindle bearing are not shown, also that the structure differs somewhat from that shown in Figure 1. It will be obvious, however, that the means for preventing the oscillation of the speed cup may readily be applied to the arrangement of Figure 1, with which it is particularly useful in an arrangement as therein shown where the magnet rotates and where one spindle bearing also rotates with the rotary shaft.

Having described my invention, I claim:

1. In a magnetic measuring instrument a casing of magnetic material, a permanent bar magnet, means to vary the efficiency thereof comprising a shoe of magnetic material slidable along an end of said magnet toward and from the casing and heat sensitive means to control the position of said shoe.

2. In a magnetic measuring instrument a casing of magnetic material, a rotor shaft, a permanent bar magnet carried thereby, a shoe of magnetic material slidable along an end of said magnet toward and from the casing, heat sensitive means connected to said shoe and mounted upon said rotor shaft with said magnet.

3. In a magnetic measuring instrument, a rotatable bar magnet, and an independent rotatable speed cup surrounding the same, a fixed armature enveloping said magnet and speed cup, a shoe of magnetic material slidable upon an end of said magnet toward and from the armature, and heat sensitive means to automatically control the position of said shoe.

In testimony whereof I affix my signature.

JOSEPH ZUBATY.