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ADJUSTMENT OF MAGNETIC TACHOMETERS

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FIG. 1.

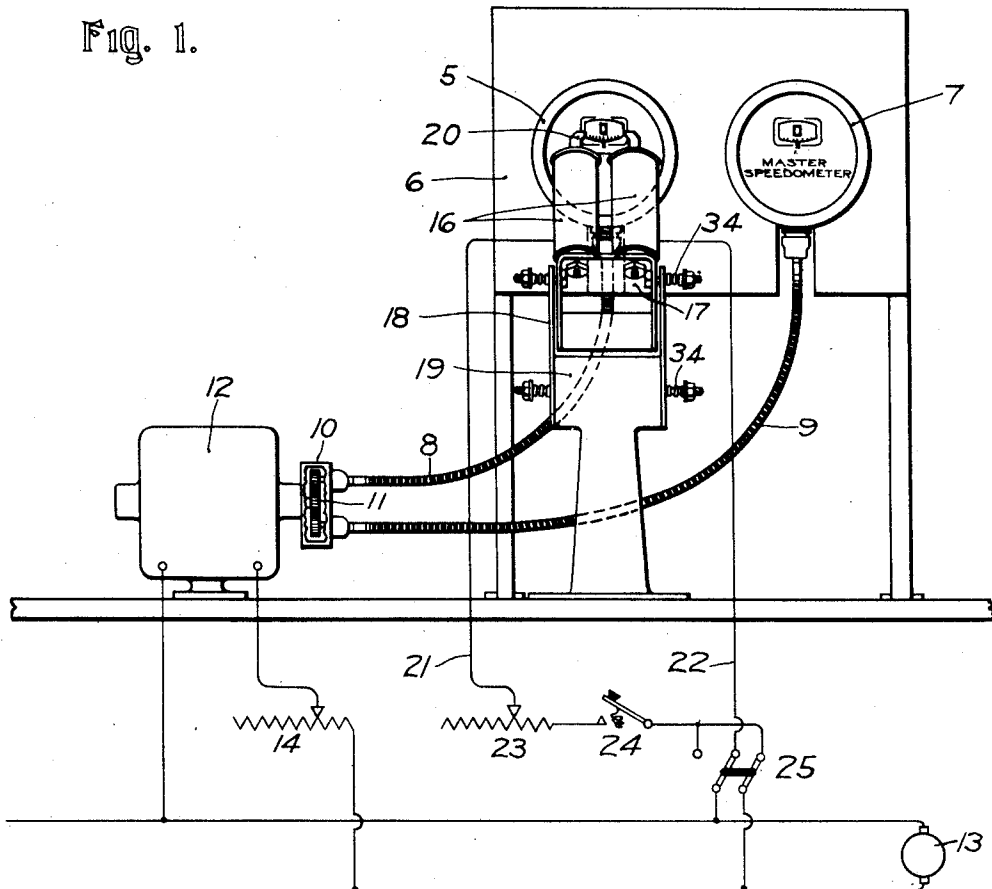
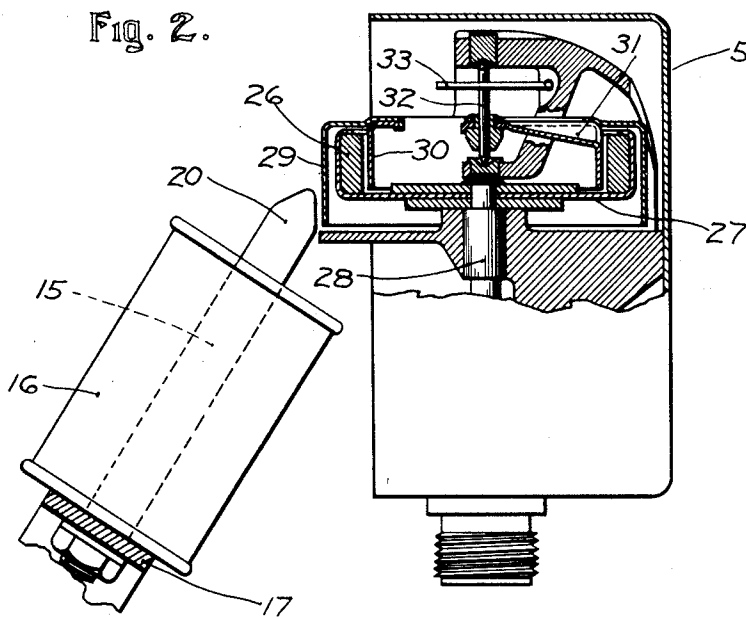


FIG. 2.



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## UNITED STATES PATENT OFFICE.

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## ADJUSTMENT OF MAGNETIC TACHOMETERS.

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This invention relates to the adjustment of tachometers of the magnetic type, in which a magnetic field, produced by a permanent magnet, is effective on an indicator by reason of eddy currents therein resulting from relative movement of the field and the indicator.

In instruments of the type in question the correctness of the indications depends, among other factors, upon the strength of the magnetic field, and accordingly it has been customary to provide, in the construction of such instruments, some means for varying this strength, either by shunting a variable portion of the magnetic lines of force or by changing the relative positions of the parts, so that the instrument may be calibrated or adjusted whenever necessary.

The object of the present invention is to simplify the construction and the adjustment of magnetic tachometers by eliminating the necessity of the provision and the use of the adjusting means just referred to. To this end I have devised a method, and means for practising it, by which necessary changes in the strength of the magnetic field of such an instrument may be made by changing the density of magnetization of the permanent magnet, and whereby this may be accomplished by means external to the instrument, while the instrument is in operation.

In the accompanying drawings Fig. 1 is a partly diagrammatic front-elevation of apparatus embodying the present invention, together with a magnetic tachometer in position to be adjusted; and Fig. 2 is a sectional side-elevation showing the relative position of the tachometer and of the electromagnet of the apparatus.

In the apparatus illustrated in the drawings the tachometer 5, which is to be calibrated, is of the type commonly used on motor-vehicles and described as a "speedometer". It is mounted on a supporting plate 6, which also carries a master speedometer or tachometer 7 of any preferred type. The two instruments are driven by flexible shafts enclosed in the usual tubular casings 8 and 9, and the two shafts are connected, through gears 10, with a pinion 11 which is fixed on the shaft of an electric motor 12.

The motor is arranged to be driven at variable speed, and for this purpose it is

connected, with a suitable source 13 of electricity, through a rheostat 14.

The adjustment of the speedometer is effected through the instrumentality of an electromagnet comprising two parallel cores 15 provided with windings 16 and connected and supported by a yoke-plate 17. This yoke-plate is pivoted between arms 18 at the upper end of a column 19, so that the poles 20 of the magnet may be swung towards and from the front of the speedometer, and the arms 18 are also pivoted to the column for the purpose of adjustment. The pivots 34 connecting these several parts are provided with springs to cause frictional retention of the parts in any adjusted position.

The electromagnet is arranged to be energized with variable strength and reversible polarity, for longer or shorter periods as required. For this purpose it is connected with the source of electricity, 13, through wires 21 and 22, a rheostat 23, a circuit-closing key 24 and a pole-changing switch or commutator 25.

The method of adjustment is applicable to magnetic tachometers of various construction, but is illustrated as used in connection with an instrument having a ring-shaped magnet 26 which is mounted in a non-magnetic cup 27 at the upper end of a rotary shaft 28. This magnet cooperates with an oscillatory indicator comprising outer and inner skirts or flanges 29 and 30, carried by an arm 31 which is fixed to a vertical pivot 32. The pivot is connected with a spring 33 by which the movement of the indicator is controlled. The operation of the instrument need not be described herein, as it is of a well known type.

The speedometer may be calibrated either complete or with the front glass and face-plate removed, but the latter method is preferable as it permits the electromagnet to be brought closer to the permanent magnet 26 of the instrument.

With the parts in the position shown in the drawings, the operator starts the electric motor and adjusts its speed to cause the master speedometer to indicate some convenient speed of operation. If the speedometer to be calibrated is inaccurate it will give an indication different from that of the master. The operator then sets the rheostat

23 to minimum-current position, moves the commutator 25 to one position or the other, according as the strength of the magnet 26 is to be increased or diminished, and then 5 taps the key 24 one or more times so as momentarily to energize the electromagnet. As the speedometer 5 is constantly running during this operation it at once gives an indication of any change which has been produced in its magnet. If the required adjustment is not at once effected the operator continues to tap the key 24 and at the same time moves the rheostat 23 gradually in the direction to increase the strength of the 15 current flowing through the electromagnet, until the reading of the speedometer 5 indicates, by its coincidence with that of the master, that the required correction has been accomplished.

20 If the effect at first produced happens to be in the wrong sense, or has been carried too far, the operator reverses the commutator 25, thus reversing the effect on the magnet 26.

25 In order to secure the greatest stability in the magnet 26 it has been found preferable to raise its strength, first, until the speedometer reads higher than the correct speed, and to then make the final adjustment by carefully reducing the strength of the 30 magnet until the reading is correct.

Where this method is applied to a speedometer of the type illustrated it constitutes a specific application of the method of 35 magnetizing and demagnetizing ring-magnets disclosed in my application for Letters Patent of the United States filed Oct. 13, 1922, Serial No. 594,415, since the effect of the electromagnet is to produce a magnetic 40 field, of an intensity sufficient to overcome the coercive force of the speedometer magnet, this field traversing a limited part of the length of the latter, and the rotation of the latter causing all parts of it to be successively passed through the field. The invention is not limited to use with an in-

strument of this particular construction, however, since the electromagnet, by suitable modifications in its size and strength, and in the position in which it is applied to 50 the tachometer, may be caused, in any case, to produce a field effective upon the permanent magnet of the instrument and of sufficient intensity to overcome the coercive force of the permanent magnet. 55

The invention claimed is:

1. Apparatus, for adjusting a magnetic tachometer, comprising, in combination, means for supporting a tachometer; means for actuating the tachometer at different 60 known speeds; means for simultaneously producing a magnetic field operative upon the magnet of the tachometer with a strength sufficient to overcome the coercive force of the magnet; and means for varying the 65 effectiveness of the field according to the indications of the tachometer.

2. Apparatus, for adjusting a magnetic tachometer, comprising, in combination, means for supporting a tachometer; means 70 for actuating the tachometer at a known speed; an electromagnet; means for supporting the electromagnet with its poles in proximity to the magnet of the tachometer; and a rheostat and a commutator connected with 75 the electromagnet.

3. Apparatus, for adjusting a magnetic tachometer, comprising, in combination, a speed-indicator; an electric motor; driving-connections through which the motor may 80 drive the speed-indicator and the tachometer simultaneously; means for varying the speed of the motor; an electromagnet; means for supporting the magnet in a position such that its field is effective upon the magnet of 85 the tachometer while the tachometer is actuated by the motor; and means for controlling the energization of the electromagnet to control its effect on the magnet of the tachometer.

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