May 25, 1948. R. M. HEINTZ 2,442,170

GOVERNOR

Original Filed Dec. 15, 1943

Fig. 1.

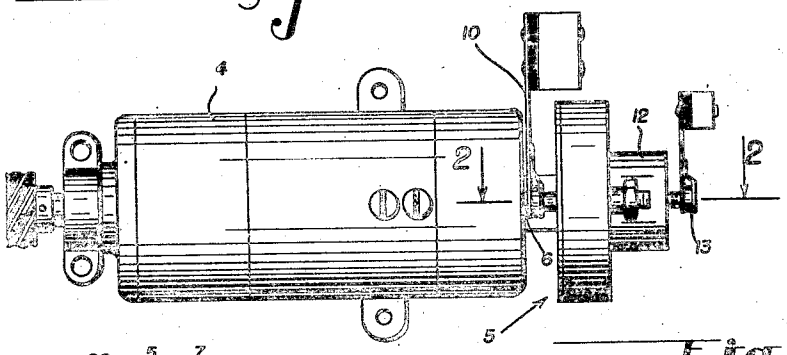



Fig. 2.

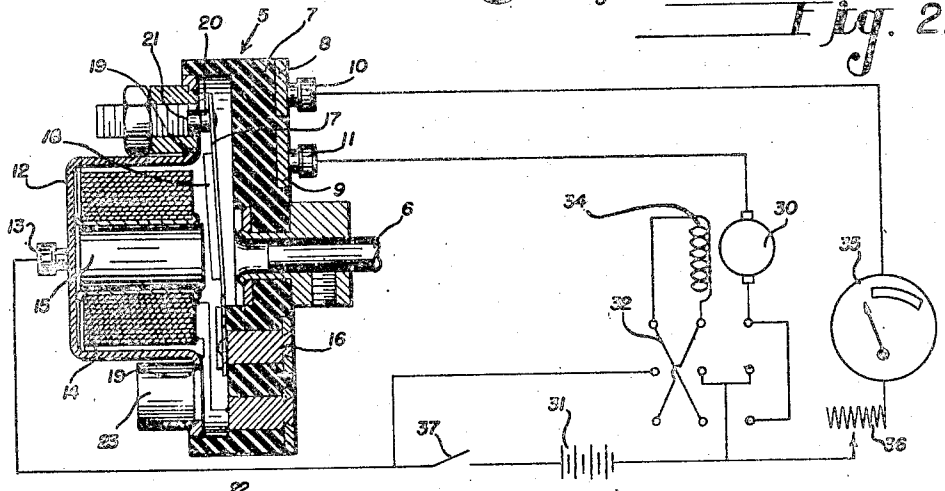
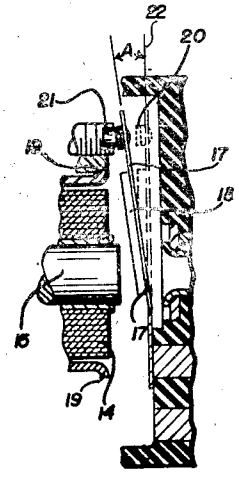



Fig. 3.




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## GOVERNOR

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Original application December 15, 1943, Serial No. 514,388. Divided and this application January 17, 1945, Serial No. 573,195

1 Claim. (Cl. 200—80)

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This invention relates to a governor for electric motors and the like, the present application being a division of my application Serial No. 514,388, filed December 15, 1943, and entitled "Automatic pilot turn rate control."

The general object of the invention is to provide a novel governor control for motor driven mechanisms wherein the governor is adjustable in operation by means of an external electrical control circuit.

A more specific object is to provide a novel governor switch having electromagnetic biasing means remotely adjustable by an external circuit for response to different speeds.

These and other objects will become apparent to those skilled in the art as the specification proceeds in connection with the accompanying drawings, in which:

Figure 1 is an elevational view of an electric motor provided with a governor according to the present invention,

Figure 2 is a longitudinal sectional view through the governor taken on the line 2—2 of Figure 1 and including a schematic wiring diagram of the control and power circuits for the governor and motor, and

Figure 3 is a partial view taken as Figure 2, but showing the angular position of the contact arm in greatly exaggerated relation to illustrate the principles of the invention.

The invention is illustrated in association with an electric motor 4 which is of general application wherever a variable speed motor drive is desirable and is particularly adapted for the use specified in the parent application. The governor device is indicated generally by the numeral 5 and is mounted on the motor shaft 6.

As shown in Figure 2, the governor parts are carried by an insulating base 7 in the form of a circular plate adapted to be secured to the end of shaft 6. One side of the base 7 carries a pair of conductor rings 8 and 9 adapted for engagement by a pair of brushes 10 and 11, and the other side of the base carries a metallic cover member 12 adapted for engagement by a single brush 13. The cover member 12 is made of magnetic material and is cup-shaped to accommodate a solenoid 14 having an iron core 15. One end of the solenoid circuit is grounded on the cover 12 and the other end makes electrical connection with the outer conductor ring 8. Secured to the base 7 by a rivet 16 making electrical connection with the inner conductor ring 9 is a spring contact arm 17 carrying an armature 18 of magnetic material bridging the core 15 and the rim 19

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of the cover 12. The armature 18 thereby completes the magnetic circuit through parts 12 and 15, except for small air gaps sufficient to prevent the armature from actually contacting the core or cover. The arm 17 carries at its extremity a contact 20 adapted to engage an adjustable contact 21 mounted on and grounded to the cover member 12, the normal closed circuit position of the arm 17 being determined by the adjustment of contact 21. A mass of metal 23 is provided opposite the contact 21 to balance the device in rotation.

As shown in exaggerated representation in Figure 3, the arm 17 in its normal closed circuit position makes a small angle "A" with respect to a perpendicular 22 to the shaft 6. Upon rotation of the shaft, centrifugal force tends to swing the arm toward this perpendicular, or from the full line position to the broken line position, but is restrained from such movement by the magnetic attraction of the armature 18 toward core 15 and rim 19 when the solenoid 14 is energized. Thus it will be seen that the magnitude of the restraining force acting on arm 17 will be directly proportional to the current in solenoid 14, this being the only variable involved since the contact 21 is not intended to be adjusted after the device is assembled.

It is accordingly a primary advantage of the present governor that the speed at which the contacts 20, 21 separate may be adjusted or preselected at a remote station by simply controlling the current in a control circuit through brushes 10 and 13, the brushes 11 and 13 forming a part of a power circuit to the motor 4. Inasmuch as the magnetic attractive force on armature 18 rapidly diminishes upon the slightest movement of the arm 17 in a circuit opening direction, the breaking of the circuit is rapid and decisive, without possibility of chattering of the contacts. Also, a desirable speed differential of operation is provided because with a given solenoid strength the magnetic holding force on the armature when the switch 20, 21 is closed is greater than the closing force when the switch is open, providing inherently stable and non-hunting governing action. It may be mentioned that the angularity of the arm 17 with respect to the perpendicular is also exaggerated in Figure 2, the angle A being in reality quite small.

In operation, the switch arm 17 controls a power circuit through the armature 30 of the motor 4, the armature 30 being connected with a battery 31 through one blade of a three pole double throw reversing switch 32. The reversing

switch 32 operates to reverse the battery connections to the field 34 of the motor 4.

The control circuit for the governor solenoid 14 may be traced from the outer conductor ring 8 to a current measuring instrument 35, and thence through a rheostat control 36 to the battery 31. The other side of the solenoid circuit connects with the battery through a switch 37 which in the parent application constituted a station selector switch. For the purpose of explaining the operation of the governor it may be assumed that there is only one control station, as shown in Figure 2, the switch 37 operating merely as an off and on switch for the system.

An important advantage of the present governor is that the motor speed may be carefully set prior to operation of the motor since the control circuit through solenoid 14, instrument 35, and rheostat 36 is independent of the motor power circuit through switch 32. Once set, the speed adjustment need not be changed unless the battery voltage changes or until a motor speed is desired. That is to say that successive motor operations at the same speed may ordinarily be had without altering this adjustment, the closing of switch 32 effecting motor operation immediately at the desired speed.

The face of the instrument 35 may be calibrated in units of rotation speed or in other units indicative of the effects produced by motor operation, as disclosed in the parent application.

Various other changes and modifications may be made within the spirit and terms of the appended claim. For instance a zero center instrument may be used in place of instrument 35 to indicate the direction as well as the speed of rotation. Also, the function of rheostat 36 may be combined with the reversing switch 32 so that movement in opposite directions produces motor operation in opposite directions at variable speeds. These and other modifications are included in the invention, the same being limited only by the scope of the appended claim.



I claim:

A governor comprising a flat insulating base adapted for fixed mounting on a rotatable shaft, a switch contact arm carried by said base approximately in a plane normal to said shaft, a cup-shaped cover member of magnetic material axially disposed on said base, a solenoid carried within said cover member and arranged to bias said arm slightly out of said plane against the influence of centrifugal force, a contact carried by and electrically connected with said cover member and serving as a stop for said arm, a pair of conductor rings carried by said base, electrical connections from said solenoid to said cover member and one of said conductor rings, and an electrical connection from said arm to said other conductor ring.

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