United States Patent

[11] 3,585,561

[72] Inventor **Kristian Iversen**
Sonderborg, Denmark

[21] Appl. No. **841,820**
[22] Filed **July 15, 1969**
[45] Patented **June 15, 1971**

[73] Assignee **Danfoss A/S**
Nordborg, Denmark

[54] **RESTORING POTENTIOMETER FOR A SERVO MOTOR**
6 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **338/150,** 338/162, 338/176
[51] **Int. Cl.** **H01c 5/08**
[50] **Field of Search** 338/68, 79, 114, 118, 135, 160, 93, 210, 304, 305, 147, 162, 172, 173, 176, 178, 179, 150, 152

[56] **References Cited**
UNITED STATES PATENTS

2,277,883	3/1942	Rich	338/162 UX
3,154,759	10/1964	Watrous	338/162

Primary Examiner—Lewis H. Myers
Assistant Examiner—D. A. Tone
Attorney—Wayne B. Easton

ABSTRACT: The invention relates to a restoring potentiometer for a servomotor having a movable output member. The resistor element of the potentiometer comprises a helical coil of spring wire and retaining means are provided for adjustably positioning one or both ends of the spring so that the full potentiometer resistance can be utilized for any size of working range. The retaining means can also be used to actuate a limit switch.

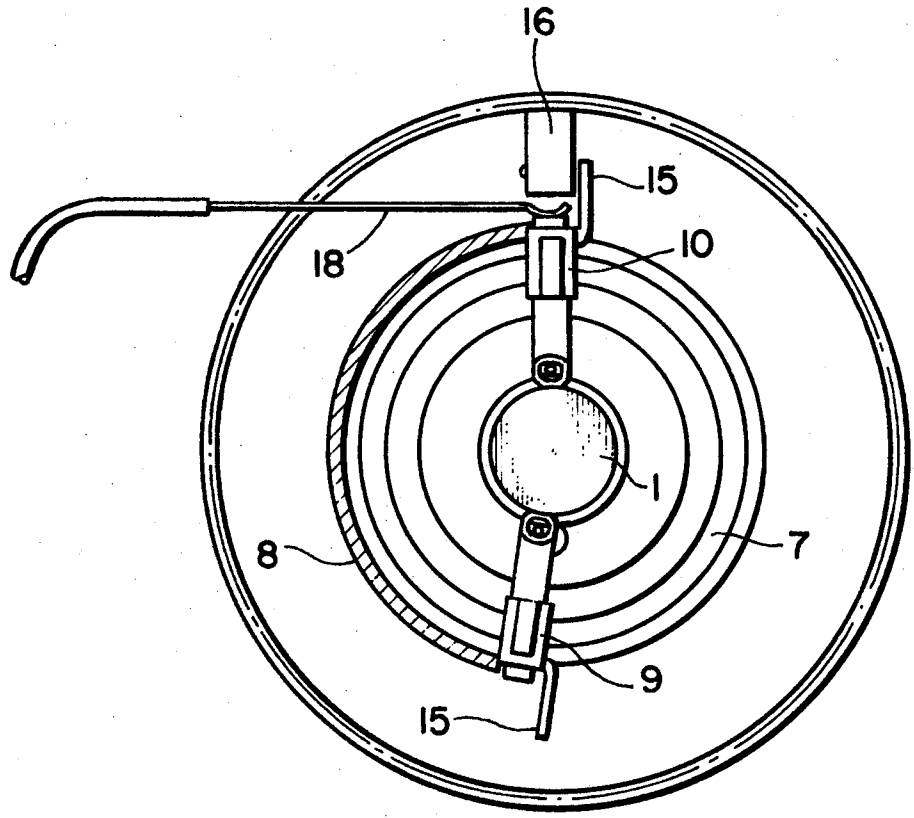


FIG 1

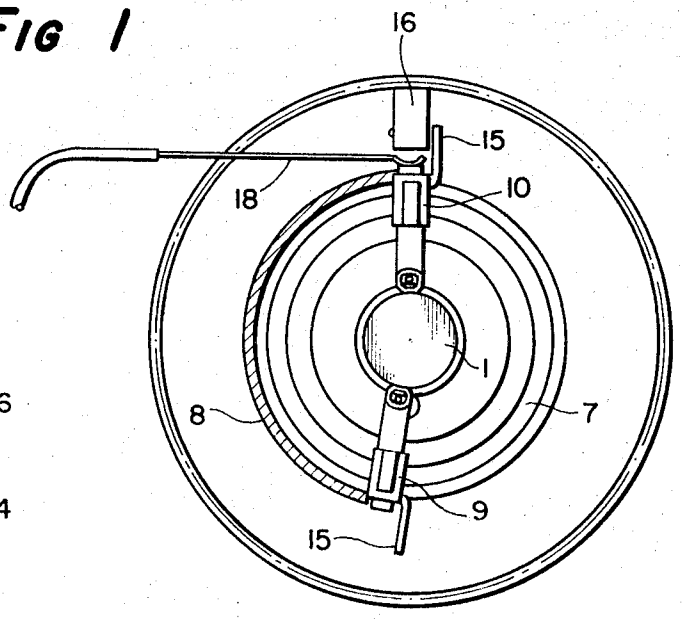


FIG 2

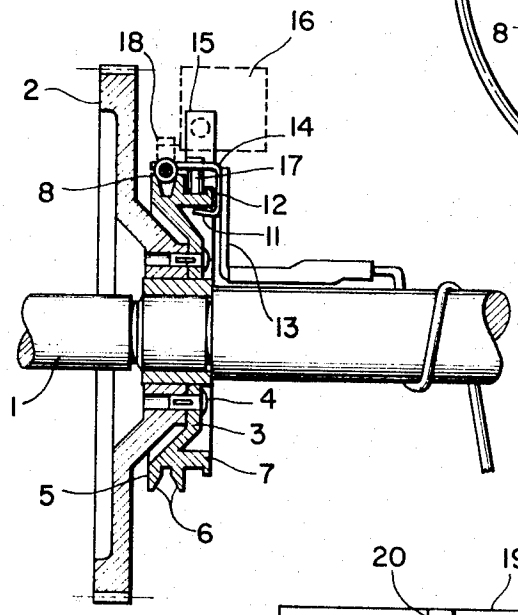


FIG 3

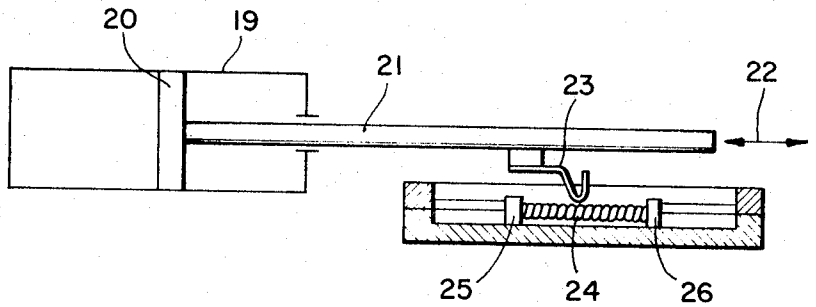
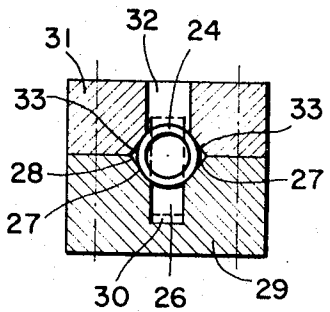


FIG 4



RESTORING POTENTIOMETER FOR A SERVO MOTOR

The invention relates to a restoring potentiometer for a servomotor in which the working range within which its output member is movable can be varied.

In the known servomotors of this kind, the restoring potentiometer is so designed that its overall length corresponds to the maximum working range. If a smaller working range is used, only part of the length and thus part of the resistance of the potentiometer is available.

It is also known to provide, between the output member and the potentiometer, a transmission stage which enables the full resistance of the potentiometer to be utilized for each size of working range. The system is however rendered complicated and expensive by the transmission stage which incorporates, for example, a lever arrangement.

The object of the invention is to provide a restoring potentiometer of the initially described kind, in which the full potentiometer resistance can be utilized in a simple manner for any size of working range.

According to the invention this object is achieved by constituting the resistor element of the potentiometer of a helical coil of spring wire, the ends of which are held in retaining means, one at least of which is adjustable.

By adjusting one of the retaining means, the lengths of the potentiometer is altered, while retaining the total resistance. The length of the potentiometer can therefore be adapted to any working range. When the length is altered in this way, the distances between successive turns of the spring-wire coil are increased or reduced. Since this change in distance is uniformly distributed over the entire length however, it can be ignored for practical purposes, e.g. when tapping by means of a sliding contact.

Preferably, the retaining means also act as members for actuating a limit switch. Since the limit switches normally limit the working range within which the output member can move, adjustment of the potentiometer automatically takes place when the working range is adjusted.

In this connection it is of advantage for the retaining means for the spring-wire coil to be mounted on the output member and for an associated sliding contact and, if required, the limit switches to be stationary. In this way, the important electrical connections can be made within a stationary group of components, whilst only the potentiometer connections are required to permit movement.

Expediently, the coil of spring wire is fitted in a groove and pressed against converging sidewalls of the groove. In such an arrangement, the length of the coil of spring wire can be readily altered; nevertheless, each individual turn is adequately fixed in the nonoperating position.

In a preferred embodiment concerned with a servomotor having a rotatable output shaft, the coil of spring wire is laid around part of the peripheral surface of a disc which is concentric with the output shaft. Here, the inherent tension of the spring-wire coil also caters for its being pressed on to the peripheral surface of the disc or into a groove provided in said surface.

In the case of an output member, displaceable rectilinearly, an advantageous arrangement is one wherein a clamping element is associated with the spring-wire coil, this element extending over the length of the coil and containing a slot through which the sliding contact passes. After the clamping element has been loosened, the length of the spring-wire coil can be altered and its position fixed by tightening the clamping member.

The invention will now be described in more detail by reference to an embodiment illustrated in the drawing, in which:

FIG. 1 is a front view of a restoring potentiometer according to the invention, used on a rotatable output member,

FIG. 2 is a cross section, at right angles, through FIG. 1,

FIG. 3 is a schematic side elevation, partly in section, of a restoring potentiometer according to the invention, used on an axially displaceable output member, and

FIG. 4 is a cross section, on a greater scale, through the restoring potentiometer shown in FIG. 3.

In the arrangement shown in FIGS. 1 and 2, a servomotor, not illustrated, is provided with an output shaft 1, upon which a gear wheel 2 is mounted to rotate therewith. A disc 3 is connected to the gear wheel to rotate therewith, by means of pins 4. The disc has a circumferential groove 5 having converging sidewalls, and a clamping flange 7.

Fitted in the groove 6 is a helical spring-steel coil 8 of a potentiometer, the two ends of which coil are held by retaining means 9 and 10.

Each retaining means consists of a piece of sheet-metal, the lower web 12 of which engages below the clamping flange 7, the middle web 17 of which is soldered to a connecting tab 13 for a supply wire, and the upper web 14 of which mechanically secures and electrically contacts the coil 8 by extending between individual turns thereof, said sheet-metal part also being able to actuate a limit switch 16 by means of its bent-up tab 15. The retaining means is held on the clamping flange 7 with the help of a screw which engages a thread in the upper web 14.

The limit switch 16 is stationary. It is assumed that the switch in question is a double limit switch, which can be actuated on one side by the tab 15 of the retaining means 9, and, on the other side, by the tap 15 of retaining means 10. Like the potentiometer sliding contact 18 the switch is stationary. In FIG. 2, the position of the switch 16 and of the sliding contact 18 is shown in broken lines.

In operation, the output shaft 1 can rotate through somewhat less than 180° from the position illustrated in FIG. 1 before the tab 15 reaches the limit switch 16 as it moves from the left. The full resistance of the spring-wire coil of the potentiometer is distributed over this angular range. The working range of the output shaft, i.e. the angle of rotation to be swept, is simply altered by moving one of the retaining means 9 and 10 in the peripheral direction, after loosening the screw 17, and by tightening up again. This operation not only alters the angle of rotation determined by the movement into contact with the limit switch 16, but the length of the coil 8 is also adapted to suit this new angle of rotation.

In the embodiment shown in FIGS. 3 and 4, there is provided a cylinder 19, a piston 20 and a piston-rod 21, which can reciprocate in the directions indicated by the arrow 22. The piston-rod carries a sliding contact 23. Again, the spring-steel coil 24 of a potentiometer is fitted between two retaining means 25 and 26. The coil 24 bears against the converging sidewalls 27 of a groove 28 in a lower part 29. The retaining means 25 and 26 are clamped in a channel 30 in the floor of the groove 28 or secured in some other way; above, there is fitted an upper part 31 which acts as a clamping member and contains a slot 32 and also has converging sidewalls 33. The upper and lower parts are held together by screw-bolts and therefore clamp the coil 24 in a position determined by the retaining means 25 and 26. After the clamp has been loosened, the length of the coil 24 can be altered.

This restoring potentiometer is suitable for any servomotors irrespective of whether they are actuated electrically, hydraulically, pneumatically or by a medium that expands under heat, or the like.

I claim:

1. A restoring potentiometer for a servomotor having a movable output member, comprising, a contact, a helical coil spring having relative movement with respect to said contact, and retaining means for adjusting the length of said spring to adjust the working range thereof.

2. A restoring potentiometer according to claim 1 including a limit switch, said retaining means comprising at least two members, at least one of said members being an actuating member for said switch.

3. A restoring potentiometer according to claim 2 wherein said retaining means and said spring are mounted on said movable member.

4. A restoring potentiometer according to claim 2 including a mounting member having a groove, said spring being disclosed in said groove.

5. A restoring potentiometer according to claim 4 wherein said movable output is rotatable, said mounting member having the form of a disc and said groove being concentric relative to the axis of said disc.

6. A restoring potentiometer according to claim 4 wherein said movable output has rectilinear movement, said mounting member having a rectangular form and a slot above said groove through which said contact passes.