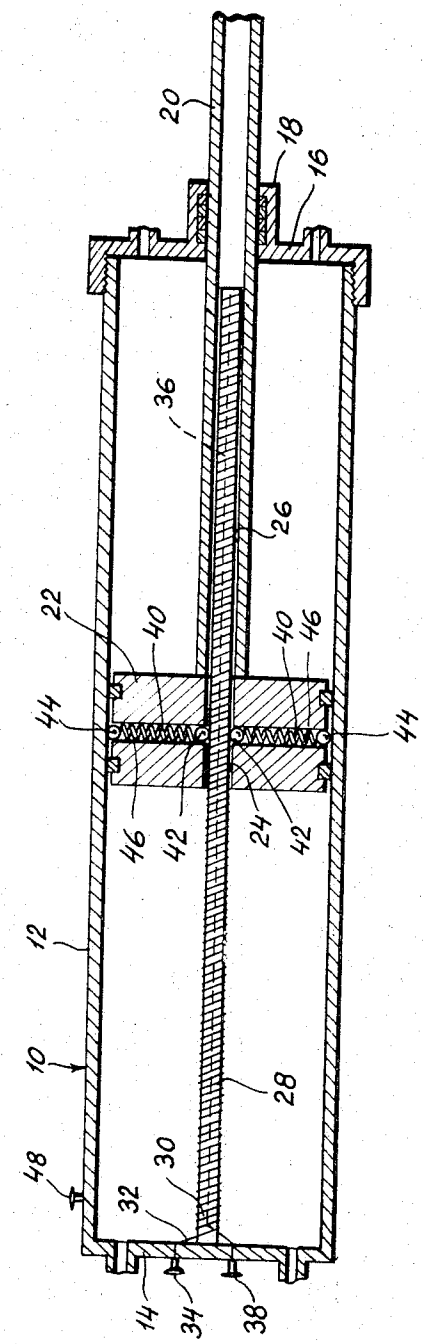
Nov. 28, 1967 L. E. SÖRENSEN ET AL 3,355,690

HYDRAULIC PISTON DEVICES COOPERATING WITH SLIDING POTENTIOMETERS

Filed Nov. 23, 1965



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United States Patent Office 3,355,690 Patented Nov. 28, 1967

3,355,690

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Filed Nov. 23, 1965, Ser. No. 509,297
4 Claims. (Cl. 338—39)

ABSTRACT OF THE DISCLOSURE

A hydraulic piston device cooperating with a sliding potentiometer, comprising a metallic cylinder having a piston slidably disposed within said cylinder, said piston being attached to a piston rod which extends out from said cylinder, said piston and said piston rod together being provided with an axial bore, said bore having an inner wall, a potentiometer coil comprising a core having an outer winding thereon, said core being attached to a cylinder bottom in spaced relationship with said inner bore wall and extending into said axial bore, a potentiometer contact member connected to said piston, means pressing said contact member against said potentiometer coil, and means providing electrical connection between said contact member and the inner cylinder wall, said potentiometer coil having one end connected to a lead extending outside the cylinder in electrically insulated relationship therewith.

This invention relates to hydraulic piston device cooperating with a sliding potentiometer. Such a potentiometer may be used for example in connection with electronic remote control of the member operated by the hydraulic piston device or as an answering potentiometer in an electromechanical control device for the hydraulic piston device.

Hitherto such potentiometers have been arranged thereby that the coil or potentiometer resistor is attached to the outer side of the cylinder of the piston device whereas the tap or sliding contact is connected to the piston rod. Hydraulic piston devices of the kind concerned are, however, often used in exposed positions so that a strong mechanical protection of the potentiometer is required and also in many cases it is necessary to provide against influences on the potentiometer of the weather conditions, for example of moist.

The object of the invention is to provide hydraulic piston device cooperating with a sliding potentiometer which is extremely simple, in which the potentiometer does not require special protection, and does not take up extra space.

In the new device this is achieved by the potentiometer coil being attached to the cylinder bottom extending through an opening in the piston into an axially extending bore in the piston rod, and the sliding contact of the potentiometer being connected to the piston. Hereby is obtained that the potentiometer is well protected within the cylinder itself without taking up extra space. Further the potentiometer is embedded in the hydraulic fluid, so that weather changes can not effect the potentiometer. The additional electric resistance due to the inavoidable thin fluid film between the coil and the sliding contact will in practice be so slight that it is of no importance and at most requires an initial adjustment.

Further it may be advantageous that the piston is provided with at least one transverse bore open into the piston opening, and that a potentiometer contact member is arranged in said bore urged towards the potentiometer coil by resilient means. Hereby a simple arrangement of the potentiometer contact member is obtained without special

connecting members between the contact member and the piston being required and without the contact member hampering the piston travel.

In this case most advantageously the transverse bore extends to the outer side of the piston, and within the bore there is arranged two contact members which are by means of a spring inserted between them pressed inwardly against the potentiometer coil and outwards against the cylinder wall respectively so that the cylinder wall can serve as electrical connection to the sliding potentiometer contact.

Other aspects, objects and the several advantages of this invention will be apparent from a study of this disclosure, the accompanying drawing and the appended claims.

The drawing shows a schematic axial sectional view of a device that embodies the invention.

10 indicates a hydraulic cylinder comprising a cylinder wall **12**, a cylinder bottom **14** and a cylinder top **16** provided with a stuffing box **18** for a piston rod **20**. The piston rod **20** is attached to a piston **22** slidably arranged within the cylinder **10** and provided with a through center opening **24** continuing into an axial bore **26** in the piston rod **20** which bore **26** is closed at the outer end, not shown, of the piston rod.

In the middle of the cylinder bottom **14** is a linear hollow potentiometer coil **28** provided with an outer winding **30** is attached. The coil **28** has a length only slightly shorter than the inner length of the cylinder wall **12** and extends through the piston opening **24** into the bore **26** of the piston rod **20**. The one end of the winding **30** is connected to a terminal **34** outside the cylinder bottom **14** by means of a lead **36** pressure-proof passed through the cylinder bottom **14**, whereas the other end of the winding **30** is by means of a lead **36** extending through the inner of the coil **28** and pressure-proof passed through the cylinder bottom **14** connected to another terminal **38**.

The piston **22** is provided with at least one transverse bore **40** extending between the cylinder outer face of the piston and the piston opening **24**. In the drawing two such bores **40** are shown. In each bore **40** a first contact ball **42** is slidably arranged at the end of the bore **40** communicating with the piston opening **24** and a second contact ball **44** is slidably arranged at the end of the bore open towards the cylinder wall **12**. A compression spring **46** is inserted between the two contact balls **42** and **44**. Thus the contact ball **42** serving as a sliding potentiometer contact is pressed against the winding **30** of the potentiometer coil **28** and is by means of the spring electrically connected to the contact ball **44** pressed against the cylinder wall **12**, which is provided with a terminal **48** thus electrically connected to the potentiometer contact ball **42**. Depending on the use to be made of the potentiometer either the terminal **48** and one of the terminals **34** and **38** may be inserted in a single electrical circuit or the terminals **34** and **38** may be connected to a pole each of an electric power source and a control or checking voltage derived from the terminal **48**.

It will be understood that this invention is susceptible to modifications in order to adapt it to different usages and conditions; and, accordingly, it is desired to comprehend such modifications within the invention as may fall within the scope of the appended claims.

We claim:

1. An hydraulic piston device cooperating with a sliding potentiometer, comprising a metallic cylinder provided with a cylinder bottom and a cylinder top and having an inner cylinder wall, a piston slidably disposed within said cylinder, a piston rod attached at one end to said piston and extending out from said cylinder through said cylinder top, said piston having an end face facing said cylinder bottom, said piston and said piston rod together being provided with an axial bore extending from said end face into

said piston rod said bore having an inner wall, a potentiometer coil comprising a core and an outer winding, said core being attached to said cylinder bottom in spaced relationship with said inner bore wall and extending into said axial bore, a potentiometer contact member connected to said piston, means pressing said contact member against said potentiometer coil, means providing electrical connection between said contact member and said inner cylinder wall, said potentiometer coil winding having two ends, one of said ends being connected to a lead extending outside the said cylinder electrically insulated therefrom.

2. An hydraulic piston device cooperating with a sliding potentiometer as defined in claim 1, said piston being provided with a transverse bore open into said axial bore, said potentiometer contact member being slidably arranged in said transverse bore, said means being a pressure spring disposed within said bore and adapted to press said contact member against said coil.

3. An hydraulic piston device cooperating with a sliding potentiometer as defined in claim 2, said piston having a circumferential side face, said transverse bore being open also at said side face, a second contact member being slidably arranged in said bore at the end thereof open at said side face, said compressions spring being inserted between said two contact members thereby pressing said potentiometer contact member against said coil and said second contact member against the inner side of said cylinder.

4. An hydraulic piston device cooperating with a sliding potentiometer, comprising a metallic cylinder provided with a cylinder bottom and a cylinder top, a piston slidably disposed within said cylinder, a piston rod attached to said piston and extending out from said cylinder through said cylinder top, said piston being provided with an axially extending center opening, said piston rod being provided with an axially extending bore open at one end into said center opening, closed at the other end and having an inner wall, a potentiometer coil comprising a core and an outer coil winding, said core being attached to said cylinder bottom at the center thereof and extending axially of said cylinder through said center opening into said axial bore in spaced relationship to said inner wall, said piston having a circumferential side face, said piston being provided with a transverse bore extending from said side face to said center opening, a first contact member being slidably arranged in said transverse bore at the end thereof open into said center opening, a second contact member being slidably arranged in said transverse bore at the end thereof open at said side face, a compression spring being inserted between said two contact members thereby pressing said first contact member against said coil and said second contact member against the inner face of said cylinder.

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