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PRESSURE-SENSING CONTROL

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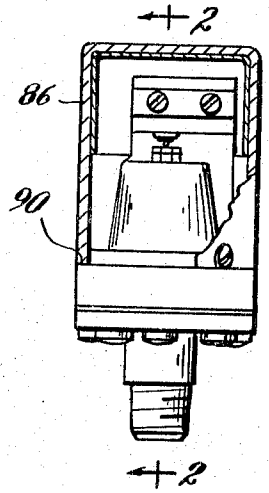


Fig. 1

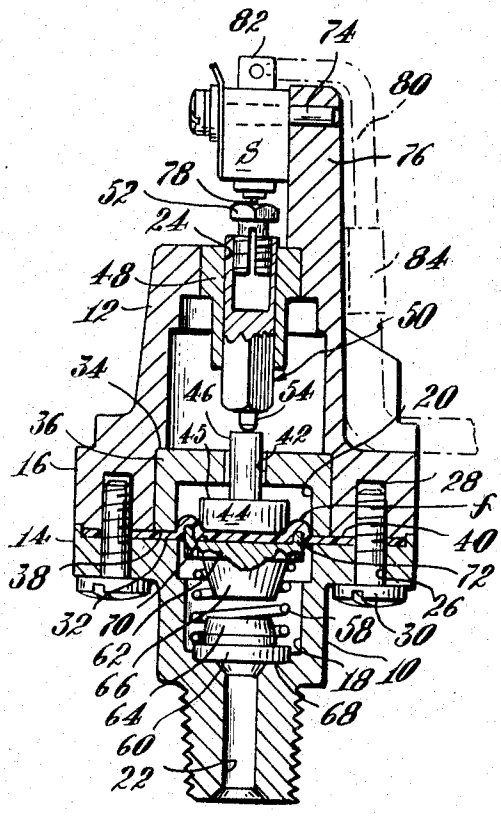


Fig. 2

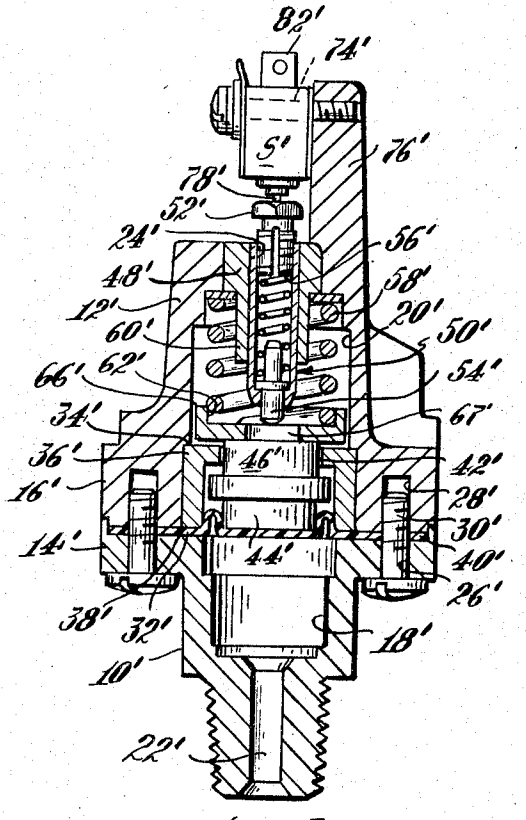


Fig. 3

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PRESSURE-SENSING CONTROL

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1 Claim. (Cl. 92—5)

This invention relates to pressure-sensing controls and has for its principal objects to provide a control which will operate at a number of different pressure ranges; to provide a sensing control which will operate at both negative and positive pressures; to provide a sensing control which will withstand overpressures without damage; to provide a sensing control which is extremely compact; to provide a sensing control which is weatherproof; and to provide a sensing control which is comprised of relatively few operating parts and is easy to manufacture and maintain in operating condition.

As herein illustrated, the control comprises a chamber, a diaphragm dividing the chamber into two parts, the part at one side of the diaphragm being in communication by way of a passage with the pressure to be sensed, means loading the diaphragm in a direction opposing movement thereof in response to a pressure change in the chamber at the one side, a guide in the part of the chamber at the opposite side of the diaphragm, a piston supported by the guide with one end in contact with the diaphragm, and a plunger supported in the chamber at the opposite side of the diaphragm with one end opposite the other end of the piston and the other end protruding from the chamber, the piston being operative in response to movement of the diaphragm in opposition to the loading means to move the plunger. The plunger is movable through a limited distance for operating a switch and embodies means operative to take up movement of the piston in excess of the predetermined distance. Specifically, the aforesaid means comprises a sleeve, a part adjustably threaded into the end extending from the chamber into engagement with the switch, a second part supported in the other end opposite the piston, and a spring situated between the parts. The guide has an annular end which engages the diaphragm and the part at the other side of the diaphragm has an annular shoulder against which the diaphragm is held clamped by the annular end of the guide. The guide contains a central hole concentric with the annular end face, and the piston has a stem extending through the hole, a shoulder which limits its movement relative to the guide and a head of smaller diameter than the annular end of the guide which has contact with the diaphrgam so that there is an annular space between the guide and the piston within which is situated a fold of the diaphragm. The loading means is alternatively a compression spring in the part of the chamber at the one side of the diaphragm, loading the diaphragm in a direction opposing a negative pressure change in the chamber at the one side or a compression spring in the chamber at the other side of the diaphragm, loading the diaphragm in a direction opposing movement thereof in response to a positive pressure change in the chamber at the one side.

The invention will now be described in greater detail with reference to the accompanying drawings wherein:

FIG. 1 is an elevation of the pressure-sensing device provided with a hood, the latter being broken away in part;

FIG. 2 is a vertical section taken diametrically at 2—2 of FIG. 1, with some parts shown in elevation designed for negative pressure; and

FIG. 3 is a corresponding view designed for positive pressure.

Referring to the drawings, the control comprises two hollow parts **10** and **12** having at their adjacent ends coextensive flanges **14** and **16** and providing axially aligned concentric chambers **18** and **20** at the remote ends of which are passages **22** and **24**. The flanges **14** and **16** are provided with a plurality of registering holes **26** and **28**, the latter being threaded so as to receive clamping screw bolts **30**. The part **10** has an annular shoulder **32** inwardly of the bolt holes **26** which lies in the plane of the base of the flange and the part **16** has a shoulder **34** which lies inwardly of the bolt holes, but is axially spaced from the face of the flange. A part **36**, corresponding in diameter to the open end of the part **12**, is seated therein against the shoulder **34** and has an annular end face **38** which lies opposite the shoulder **32** and concentric thereto and provides, in conjunction with the shoulder **32**, clamping means for clamping a flexible diaphragm **40** therebetween when the parts are bolted together so as to provide a seal between the chambers **18** and **20**. The part **36** contains an axial hole **42** for supporting and guiding a piston comprising a head **44** of smaller diameter than the inside diameter of the part **36** which engages the diaphragm and a stem **46** which extends slidably through the hole **42**. A shoulder **45** limits movement of the piston by engagement with the end of a guide.

The diaphragm **40**, as illustrated, has a fold *f* therein which extends into the annular space between the head **44** and the inside of the guide part **36**.

A bushing **48** is situated in the passage **24** at the end of the part **12** and slidably holds a plunger assembly **50**, one end of which protrudes from the chamber and has adjustably mounted in it a threaded part **52** and the other end of which is opposite the stem **46** of the piston and has a yieldable pin **54** extending therefrom. The pin **54** is held distended from the assembly by a compression spring (not shown). The spring sets into an axial bore and bears against the inner end of the pin **54**.

A coiled compression spring **58** is mounted in the chamber **18** with its ends supported by guides **60** and **62** so that it applies pressure to the diaphragm **40** in a direction opposing movement of the diaphragm in response to a pressure change in the chamber **18** of a negative sense. The guides **60** and **62** have tapered portions **64** and **66** which enter the ends of the spring. The guide **60** rests on a shoulder **68** concentric with the passage **22**. The guide **62** has a flat face **70** which bears against the portion of the diaphragm opposite the head **44** of the piston and an annular axially projecting rim or rib **72** which projects into the fold *f* of the diaphragm.

The pressure-sensing device is adapted by a change in pressure to actuate a switch S fastened by screw bolts **74** to a post **76** formed integral with the part **12**, which holds the switch with its actuator **78** in alignment with the end of the adjustable part **52**. Electric conductor wires **80** are secured by suitable means to binding posts **82** on the switch and are led down one side of the post **76** to the flange **16** and then outwardly at right angles thereto. A screw clamp **84** provides for holding the conductor in place and a hood **86** is applied over the part **12** so as to enclose the switch and conductors, the lower edge of the hood resting on a shoulder **90** of the part **12**.

In operation pressure to be sensed is connected by suitable means to the passage **22** leading to the chamber **18**. The compression spring **58** in the chamber resists movement of the diaphragm in response to a change in pressure in the chamber **18** which is of a negative sense, that is it resists compression due to a negative pressure connected to the passage **22**. A reduction in pressure forces the diaphragm downwardly, compressing the spring and lowering the piston **44** and the plunger assembly **50** and

this, in turn, actuates the switch S. The switch S in this instance is actuated by extension of its actuator.

The same pressure-sensing control with a very slight modification internally may be employed to sense positive pressure. Referring to FIG. 3, the device comprises the parts **10'** and **12'** having coextensive flanges **14'** and **16'** which provide chambers **18'** and **20'**. The flanges **14'** and **16'** contain registering holes **26'** and **28'**, the latter being threaded to receive screw bolts **30'** for fastening the parts together. The part **10'** has an annular shoulder **32'** inwardly of the circular bolt holes and the part **16'** a shoulder **34'** also inwardly of the circular bolt holes and axially spaced from the face of the flange **16'**. The part **36'** is seated in the part **12'** against the shoulder **34'** and has an annular end face **38'** which is opposite the shoulder **32'** and provides means, in conjunction with the shoulder **32'**, to clamp a diaphragm **40'** between the parts to seal the chamber **18'** from the chamber **20'**. The part **36'** has a hole **42'** in axial alignment with the hole **24'** and a piston comprising a head **44'** and a stem **46'** is supported in the part **36'** with the head engaged with the diaphragm and the stem extending through the hole **42'**.

A bushing **48'** is mounted in the hole **24'** which slidably supports a plunger assembly **50'**, one end of which projects from the chamber and has an adjustable part **52'** threaded into it and the other end of which has projecting from it a pin **54'**. A coiled spring **56'** situated in the part with one end bearing against the part **52'** and the other end against the part **54'** holds the pin extended with its projecting end opposite the stem of the piston. A coiled spring **58'** is mounted in the chamber **20'** in concentric relation to the plunger assembly so as to apply pressure to the diaphragm in a direction to oppose movement thereon in response to a pressure change in the chamber **18'** which is positive in character. Spring guides **60'** and **62'** support the ends of the spring **58'**, the support **60'** being provided by an inwardly projecting portion of the bushing **24'**. The spring guide **62'** has an annular flange **66'** which emcompasses the end of the spring, rests upon the end of the stem **46'** and contains a central hole **67'** through which the pin **54'** is adapted to have contact with the stem of the piston.

A switch S' is fastened by bolts **74'** to a post **76'** integral with the part **12'** with its actuator pin **78'** opposite the part **52'**. Electric connectors (not shown) are attached to the binding posts **82'** as described with respect to FIG. 2, and a hood **86** is applied to the part, the switch and the conductors.

In this form of the invention, a positive pressure applied through the passage **22'** to the chamber **18'** will move the diaphragm and hence the piston in a direction to compress the spring **58'** and thus to force the piston upwardly against the pin **54'** so as to move the plunger assembly upwardly and actuate the switch S'. The switch in this instance is actuated by depression of its actuator.

It is evident from the foregoing that the two sensing devices are similar in construction except for the disposition of the springs **58** and **58'** so that by a very simple assembly operation the valve may be suited for either purpose, to wit, by removing the spring **58** and guides **60** and **62** and inserting the spring **58'** and guide **62'** the device may be converted from sensing negative pressures to sensing positive pressures, and vice versa.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claim.

I claim:

In a pressure-responsive device, a housing containing a chamber, a diaphragm dividing the chamber into two parts, the part at one side of the diaphragm containing a passage in communication with the pressure to be sensed, a guide supported in the part of the chamber at the opposite side of the diaphragm, said guide containing an opening concentric with the diaphragm, a piston supported by the guide with one end bearing against the diaphragm, spring means loading the piston and hence the diaphragm in a direction opposing movement thereof in response to a pressure change in the part of the chamber at the one side, said part of the chamber at the other side containing an opening concentric with the piston, a switch supported externally of the housing adjacent the opening in said other of the part of the chamber with the actuator confronting the opening, a plunger slidably supported in the opening with one end internally of the part of the chamber within which the piston is located and yieldably engaged with the piston, and the other end projecting exteriorly therefrom and in contact with the switch actuator, said plunger transmitting the motion of the piston directly to the actuator and comprising an elongated part, a spring pressed pin yieldably supported at its inner end, which pin engages the piston, and a nub threaded into the outer end, which nub has contact with the switch actuator, said spring being more resistant to displacement than the actuator, and said nub being adjustable to determine the operation of the switch in response to the movement of the piston.

References Cited

UNITED STATES PATENTS

1,370,193	3/1921	Crocker	200—83.5
1,938,327	12/1933	Green	200—83.51
2,351,817	6/1944	Johnson	92—99 X
3,043,929	7/1962	Guthrie	200—83.51
3,119,910	1/1964	Meisenheimer et al.	200—83.51
3,216,332	11/1965	De Chambeau	92—5
3,217,309	11/1965	Parker	200—83.5
3,244,191	4/1966	Grunau et al.	92—59 X

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