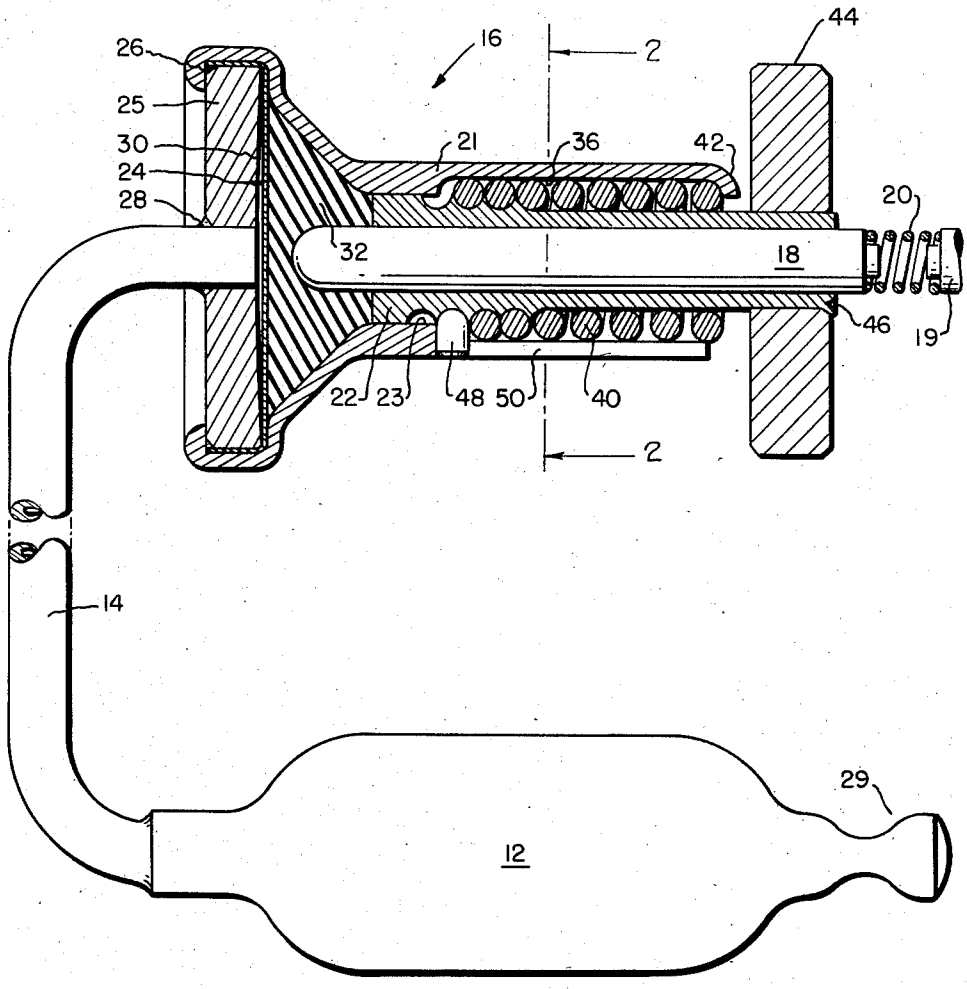
Aug. 12, 1958 W. E. BAKER 2,847,033

ADJUSTABLE TRANSDUCER

Filed July 8, 1955

FIG. 1



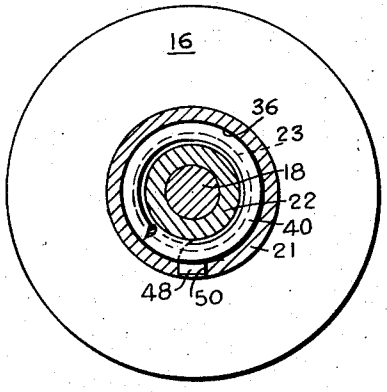


FIG. 2

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ADJUSTABLE TRANSDUCER

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Application July 8, 1955, Serial No. 520,821

3 Claims. (Cl. 137—788)

The present invention relates to pressure-motion transducers. More particularly, it relates to a transducer adapted for control point adjustment and provided with overtravel means.

The principal object of this invention is to provide a temperature or pressure responsive actuator of the general form described in the copending application of Woods, Serial No. 477,528, filed December 24, 1954, the actuator being of simple design and incorporating means for control point adjustment and for overtravel motion.

With the above and other objects in view, a principal feature of the invention resides in a construction utilizing an overtravel spring having turns at one end threaded upon an overtravel member. This member is movable in a sleeve bearing to vary the volume of a chamber having an elastomeric fill through which pressure is applied to the end of the actuator member or pin. Thus, the overtravel member cooperates with the spring to provide control point adjustment in addition to permitting overtravel movement in case of excessive applied pressures.

Other features of the invention include details of construction and arrangements of the parts that will be more fully understood from the following description of a preferred embodiment and from the appended drawing illustrating the same, in which Fig. 1 is a longitudinal elevation in section and Fig. 2 is a transverse sectional elevation taken on line 2—2 of Fig. 1.

Referring to the drawing, the invention is described as adapted for use in a remote thermostatic control. A thermal bulb **12** and capillary tube **14** form the external parts of a hermetically sealed system completely filled with a thermal liquid that remains in the same state under all normal conditions existing in storage and use. The bulb **12** is located in the space which provides the control temperature, and the capillary **14** is connected at its opposite end to an actuator **16** that is suitably mounted adjacent the device to be controlled. Control is provided through motion of a rigid metal pin **18** in relation to a fixed abutment **19** against the force of a compression spring **20** to operate a valve, to open or close electrical contacts, to actuate a mechanism, or to perform any other useful function.

The actuator has a rigid metal shell or body portion **21** having a generally conical portion defining a chamber and two generally cylindrical portions on opposite sides thereof, one being of extended length and the other of short length. The pin **18** is slidably received in an overtravel and adjustment sleeve **22** that is in turn slidably received in a sleeve bearing **23** in the body portion. The pin **18** reaches the chamber and is variably protrudable thereinto.

A flexible metallic diaphragm **24**, having an annular peripheral flange and a generally flat or suitably corrugated central portion, is secured adjacent the larger end of the conical portion of the body. A rigid metal disk

25 is secured inside the flange and soldered thereto as indicated at **26**. Alternatively, the seal between the disk and diaphragm may be accomplished by brazing or welding. In any event, the seal is hermetic in the strict sense, that is, an actual metallic fusion.

The disk and diaphragm are preferably assembled, filled, and sealed with the capillary **14** and bulb **12** as a subassembly. The capillary is hermetically sealed to the disk by an annular line of solder as indicated at **28**, or by a weld or brazing. The subassembly is preferably filled in a chamber under high vacuum. To this end, the bulb **12** is provided with a short length of fill tube **29** which is open at the end. Under vacuum the subassembly is immersed in a body of thermal liquid that has been similarly evacuated. After filling, the fill tube **29** is crimped and soldered at the end to insure a hermetic seal.

The filled and sealed subassembly is received within the shorter cylindrical portion of the body **21**, and the ends of the latter are spun over the edges of the disk **25** to hold it securely in place. It is evident that other equivalent provisions for assembly of the parts may be used, for example threaded fittings.

Preferably, the inner surface **30** of the disk **25** is slightly concave, providing freedom for the diaphragm to flex in one direction toward this surface and in the other direction toward the pin **18**.

The entire space between the diaphragm **24** and the pin **18** is filled with a body of elastomeric material **32** such as rubber or a rubber-like substance, this substance being chemically stable, deformable and substantially incompressible in the pressure range anticipated for normal use.

The body **21** has a cylindrical wall **36** of slightly larger diameter than the sleeve bearing **23**. Within the sleeve bearing is received the adjustment and overtravel sleeve **22**. At one end the sleeve **22** lies in contact with the elastomeric body **32**. Adjacent the bearing portion the sleeve has an outside threaded portion consisting of a single thread formed to receive a number of closely wound turns of a compression spring **40**. These threads and the turns of the spring threaded thereonto comprise a threaded control point adjustment device hereinafter more fully described.

The spring **40** is adapted to operate in compression, having a number of spaced turns freely movable axially between the cylindrical wall **36** and the sleeve **22**. With the parts assembled in the relationship shown in the drawing, the spring **40** is constrained at one end by spinning inwardly the end of the body portion **21** as indicated at **42**.

At the outer end of the sleeve **22** is provided an adjustment knob **44** suitably staked to the sleeve as indicated at **46**.

In operation, the device is similar in many respects to that described in the previously mentioned application. The limits of pin travel are defined by the abutment **19** on the one hand, and by the position in which the diaphragm is against the wall **30** on the other hand. Within the range defined by the temperatures corresponding to these limits, the diaphragm **24** is free to deflect to allow for the volumetric expansion and contraction of the thermal liquid fill. Since the elastomeric body **32** is essentially incompressible, this body deforms and applies pressure to the end of the pin **18** which slides within the sleeve **22** to a position in which the forces acting oppositely upon the ends of the pin are equalized.

The sleeve **22** remains in fixed position relative to the body portion **21** throughout the range defined by the temperatures corresponding to the limits of pin travel. This position is determined by an outwardly turned end **48** of the spring **40**, this end being axially movable with-

in a narrow slot **50** in the body portion, but abutted against the end of the slot **50** by the force of the spring at all temperatures within this range. The strength of the spring is, therefore, greater than the force exerted by the elastomeric body **32** directly against the end of the sleeve **22** at these temperatures.

An increase in the temperature after the pin **18** reaches its outward limiting position against the abutment **19** results in a rapid increase in the pressure within the elastomeric body **32** to produce a force sufficient to overcome that of the spring **40**. In consequence, the sleeve **22** moves outwardly from the body portion **21** until it has displaced the necessary volume to compensate for the motion of the diaphragm against the substantially incompressible body **32**.

Control of the temperature limits within which the pin **18** is free to move is provided by rotation of the knob **44**. The sleeve **22** is thereby turned in relation to the body portion **21**, but the spring **40** does not turn by reason of its end **48** being constrained by the slot **50**. Movement of the sleeve **22** within the body portion **21** produces a corresponding change in the position of the pin **18**. The position of the diaphragm **22** is wholly determined by the temperature and is not dependent on the adjustment. Since the body **32** is assumed substantially incompressible, the volume displacement produced by movement of the sleeve **22** in relation to the body **32** causes a corresponding volume displacement of the pin.

Thus, it will be seen that a device of simple construction which may be easily and cheaply fabricated has been provided. This device is essentially a pressure-motion transducer by which pressure variations on one side of the diaphragm **24** are used to produce motion of a pin **18** in relation to a fixed abutment. It is obvious that the pressure variations may be produced by other than thermal conditions, as is well understood in the art. By means of a single spring, the device provides not only overtravel protection but also means for adjustment of the temperature range corresponding to the limits of pin motion. Therefore, while the unit is capable of considerable pin motion within this temperature range, temperatures above or below the range do not build up excessive pressures within or cause damage to the device.

Having in mind the foregoing considerations, and others that will occur to one skilled in the art upon a reading of this specification, it is thus apparent that while the invention has been described with reference to a preferred embodiment thereof, such embodiment may be redesigned or modified in many ways by the skilled artisan without departing from the spirit or scope of the invention.

Having thus described the invention, I claim:

1. A pressure-motion transducer having, in combination, a shell member defining a chamber with a communicating tubular portion, said portion having a longitudinal guide therein, a hollow sleeve rotatably and slidably received in said portion and having an outside thread, a rigid pin slidably received in the sleeve, a deformable body within the chamber and lying adjacent the pin and sleeve, means to apply pressure to displace said body and thereby to move the pin, an overtravel compression spring within said tubular portion and around the sleeve, one end of the spring being threaded onto the sleeve and engaged with said guide and the other end being restrained in relation to the shell, and means for adjustably rotating the sleeve within the shell to adjust the position of the pin at a given pressure through displacement of said body, said guide preventing rotation of the spring and the shell limiting extension of the spring while permitting compression thereof.

2. A pressure-motion transducer having, in combination, a shell member defining a chamber with a communicating tubular portion, said portion having a longitudinal guide therein, a sleeve rotatably and slidably received in said portion and having an outside thread, a rigid pin slidably protruding into the chamber, a deformable body within the chamber and lying adjacent the pin and sleeve, means to apply pressure to displace said body and thereby to move the pin, an overtravel compression spring within said tubular portion and around the sleeve, one end of the spring being threaded onto the sleeve and engaged with said guide and the other end being restrained in relation to the shell, and means for adjustably rotating the sleeve within the shell to adjust the position of the pin at a given pressure through displacement of said body, said guide preventing rotation of the spring and the shell limiting extension of the spring while permitting compression thereof.

3. The pressure-motion transducer having, in combination, a shell member defining a chamber with a communicating tubular portion, said portion having a narrow relieved channel parallel with the axis of said portion, a sleeve rotatably and slidably received in said portion and having an outside thread, a rigid pin slidably protruding into the chamber, a deformable body within the chamber and lying adjacent the pin and sleeve, means to apply pressure to displace said body and thereby to move the pin, an overtravel compression spring within said tubular portion and around the sleeve, one end of the spring being threaded onto the sleeve and having a portion extending into said channel and the other end being restrained in relation to the shell, and means for adjustably rotating the sleeve within the shell to adjust the position of the pin at a given pressure through displacement of said body, said channel preventing rotation of the spring and the shell limiting extension of the spring while permitting compression thereof.

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