

United States Patent

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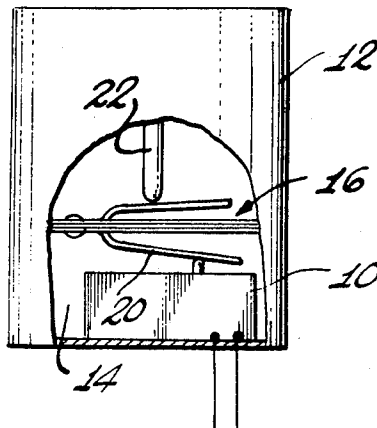
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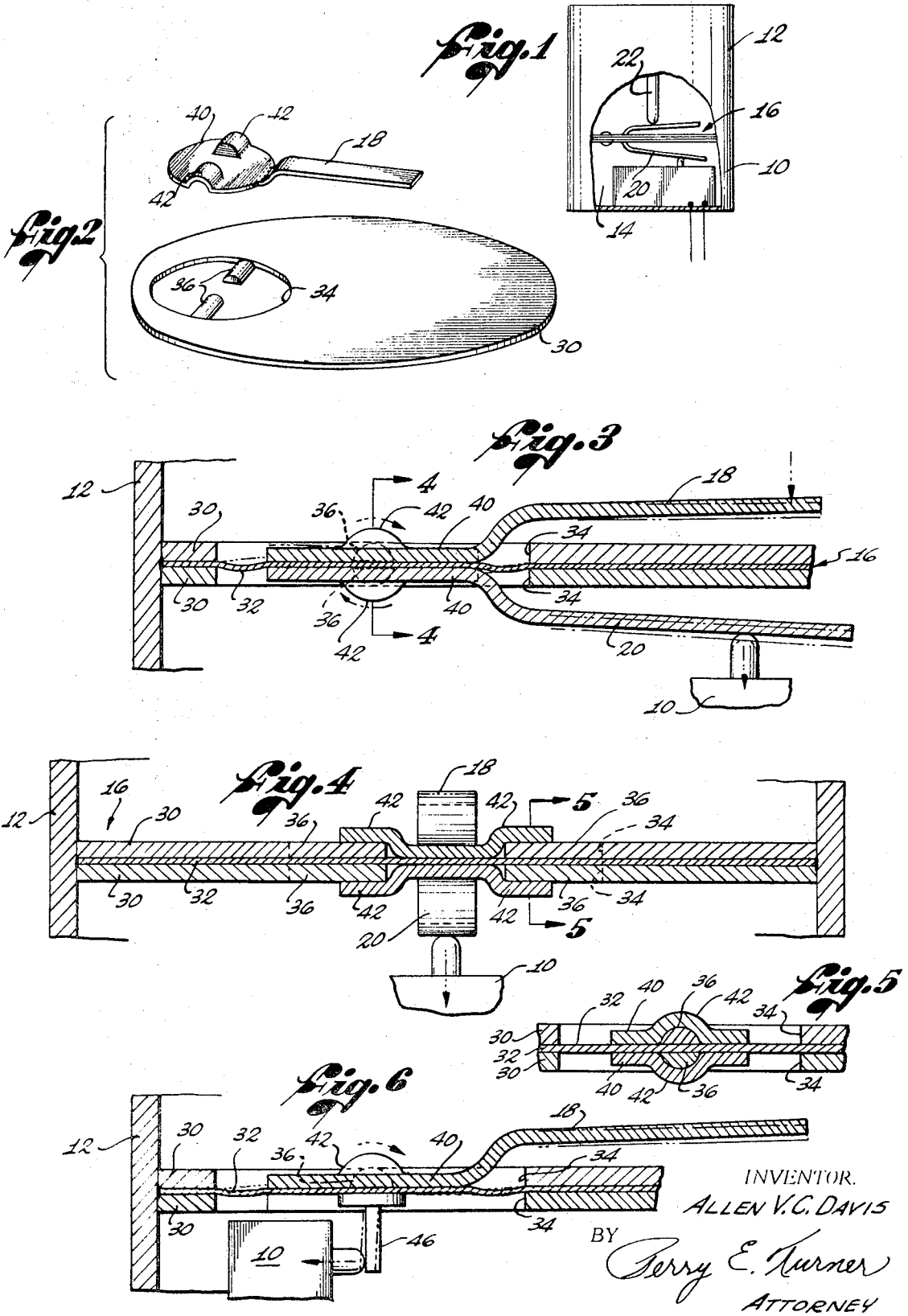
[54] **MOTION TRANSFER MECHANISM**
9 Claims, 6 Drawing Figs.

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ABSTRACT: A plate has a circular opening and diametrically opposed pins extending into the opening. A diaphragm is secured to one face of the plate and covers the opening. Secured to the diaphragm in the center of the opening is a disc-like element with portions which nest on and slidably engage the pins. A tongue extending from the disc is actuated to rock the disc, and thereby effect rotational movement of a member secured to the other surface of the diaphragm. Such element may be a pin, or it may be a similar disc which is similarly positioned on pins in an opening of another plate abutting the other surface of the diaphragm.





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MOTION TRANSFER MECHANISM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to devices for transferring motion through a wall via a diaphragm.

2. Description of the Prior Art

The frame of reference for the description of this invention is a precision switch and actuating mechanism therefor. In such arrangements, the switch is mounted in a hermetically sealed chamber, one wall of which has an opening covered by a diaphragm. Extending through the diaphragm, and sealed thereto, is a switch actuating member which is so arranged that pressure applied to the external portion is transferred through the diaphragm to the interior portion for actuating the switch.

Such a diaphragm is a flexible membrane which tends to move into and out of the switch chamber when pressure is applied to the operating member, or when there are changes in the pressure differential on the opposite surfaces of the diaphragm. Because of this characteristic, the pivotal axis of the switch actuator is not constant and results in changes in the operating forces for the switch. Many attempts have been made to provide such a motion transfer device which does not permit the diaphragm to float. In such attempts as heretofore known, however, the devices in operation set up undesirable stresses in the diaphragm and shorten its life.

SUMMARY OF THE INVENTION

My invention embraces a plate having an opening through it, a diaphragm on one surface of the plate covering the opening, an element secured to the diaphragm within the opening, and mean hingedly supporting the element for rotational movement along an axis in the plane of the diaphragm. My invention also embraces a lever or tongue attached to or integral with the element for imparting rotational movement thereto, and a member fixed to the diaphragm opposite said element for actuation upon such rotational movement. With this arrangement, the diaphragm is prevented from absorbing work and being unduly stressed as in the prior art motion transfer devices.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevation view, partly cut away, of a switch wherein a motion transfer device of my invention forms a wall of a hermetically sealed chamber therefor;

FIG. 2 is an exploded view of cooperating parts for a motion transfer device of my invention;

FIG. 3 is an enlarged, fragmentary sectional view of the motion transfer device of FIG. 1;

FIG. 4 is a sectional view taken along the line 4-4 of FIG. 3;

FIG. 5 is a fragmentary sectional view taken along the line 5-5 of FIG. 4; and

FIG. 6 is a fragmentary sectional view, similar to FIG. 3, of a modified form of motion transfer device of my invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to FIG. 1, a switch 10 is positioned in one end of a housing 12. The switch 10 is in a hermetically sealed chamber 14 having an upper wall 16 through which interconnected levers or arms 18, 20 function to actuate the plunger of the switch 10. An element 22 bearing against the upper arm 18 is adapted to be actuated by suitable means in the upper end of the housing 12. If desired, of course, a manually operable switch may be provided by eliminating the element 22 and the upper end of the housing 12.

The wall 16 in one form of my invention (see FIGS. 2-5) employs a pair of rigid plates 30 between which a thin, flexible membrane or diaphragm 32 is sandwiched. As indicated, the plates 30 and diaphragm 32 are of the same diameters, and are secured together at their peripheries as by welding. Each of

the plates 30 has a circular opening 34, and the plates are secured together with their openings 34 aligned.

As best seen in FIG. 2, each plate 30 has a pair of diametrically opposed pins 36 in the opening 34 thereof. And referring to FIG. 5 along with FIGS. 2-4, the pins 36 have confronting flat faces abutting the opposite surfaces of the diaphragm 32. Also, and as best seen in FIG. 5, the pins 36 are shaped with a radius of curvature of a circle having a diameter equal to the combined thicknesses of the plates 30 and diaphragm 32.

The pins 36 of the plates 30 function like hinge pins for respective elements 40 from which the arms 18, 20 extend. The element 40 is shown by way of example in the form of a disc having diametrically opposed portions 42 struck therefrom to slidably and matingly fit the pins 36. With the parts thus formed, the element 40 comes to rest against the adjacent surface of the diaphragm 32 when the struck portions 42 are positioned on the ends of the pins 36. The center portion, marked x in FIG. 2, is welded to the diaphragm.

With the parts assembled as shown, and with the peripheries of the plates 30 and diaphragm 32 welded to the inner surface of the housing 12, thereby to form the upper wall 16 of the hermetically sealed chamber 14 as above described, the normally higher pressure above the chamber causes portions of the diaphragm 32 to pouch inwardly. However, since the upper element 40 is welded to the diaphragm, and rides on the pins 36, no such inner movement of the diaphragm can take place which will cause the arm 20 to actuate the plunger of the switch 10. Furthermore, the element 40 is shaped to be symmetrical with respect to a line through the pins 36, whereby the element 40 cannot undergo movement without applying a force to the arm 18 thereof.

When a force is applied to the end of the arm 18, the element 40 rocks on the pins 36 (clockwise in FIG. 3), and the free portions of the diaphragm, i.e., those portions that are pouched inwardly due to a pressure differential, accommodate the motion imparted to the element 40. The parts are preferably adjusted so that the plunger of the switch 10 is actuated within the range of movement permitted by the diaphragm before it becomes taut.

In the embodiment of FIG. 6, the lower element 40 and its arm 20 are replaced with a headed pin 46. As shown, the head of the pin is welded to the lower surface of the diaphragm 32, and the shank of the pin engages the plunger of the switch 10. When a force is applied to the arm 18, the same rocking movement of the element 40 takes place as above described for the embodiment of FIGS. 1-5. The corresponding movement imparted to the pin 46 causes the switch 10 to be actuated as previously.

It will be apparent that my invention embraces a variety of modifications of the arrangements illustrated and described. For example, while it is preferred that the arms 18, 20 extend from the peripheral edges of the elements 40, they may readily be attached to the outer surfaces of the elements and in fact may be welded to the centers thereof. Also, the elements 40 need not be formed with arms 18, 20, but may be provided with pins which extend vertically therefrom as in the manner of the pin 46 in FIG. 6.

While I have illustrated my invention as one in which the elements 40 are slidable on pins 36, it should be noted that my invention embraces any means for supporting the element for rotational movement. For example, ball bearings may be mounted on the pins, such bearings having semicylindrical inner and outer races. The elements then roll instead of sliding when they undergo rotational movement. Other means to achieve rolling action may also be employed, e.g., one or more wires having one end of each fixed to the associated plate 30, such wires having free ends interposed between the pins and the portions 42 of the elements.

I claim:

1. In combination:

a plate having an opening therein;

an element positioned in said opening,

said opening being larger than said element;

a diaphragm secured to one surface of said plate and spanning said opening,
said element being secured to said diaphragm;
interconnecting means on said element and said plate supporting said element for rotational movement along a line in the plane of said diaphragm;
a member secured to said diaphragm opposite to and movable with said element; and
an arm attached to said element for effecting rotational movement thereof,
said movement being transferred through said diaphragm to said member.

2. The combination of claim 1, wherein said interconnecting means includes diametrically opposed pins of said plate in said opening and pin mating portions on said element.

3. The combination of claim 2, wherein said pins have flat surfaces coplanar with said one surface of the plate, said pins in cross section being substantially semicylindrical.

4. The combination of claim 3, including a second plate, said plates and diaphragm being secured together with the diaphragm between the plates, said second plate having an opening, said plates openings being of the same dimensions and aligned.

5. The combination of claim 4, wherein said member is identical to said element, wherein said second plate has pins in the opening thereof, the pins of both plates being identical and in alignment, and wherein said member has pin mating portions identical to those of said element.

6. The combination of claim 4, including:

a switch having a plunger; and

a pin on said member engaging said plunger,

said pin actuating said plunger upon rotational movement of said element.

7. The combination of claim 6, wherein said element is disc-like, and said arm extends from the periphery of said element along a line substantially at right angles to the axis of rotational movement of said element.

8. The combination of claim 5, including:

a switch having a plunger; and

an arm on said member adapted to actuate said plunger upon rotational movement of said element.

9. The combination of claim 2, including bearing means between said pins and pin mating portions and rollable by said pin mating portions during rotational movement thereof.

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