

June 2, 1931.

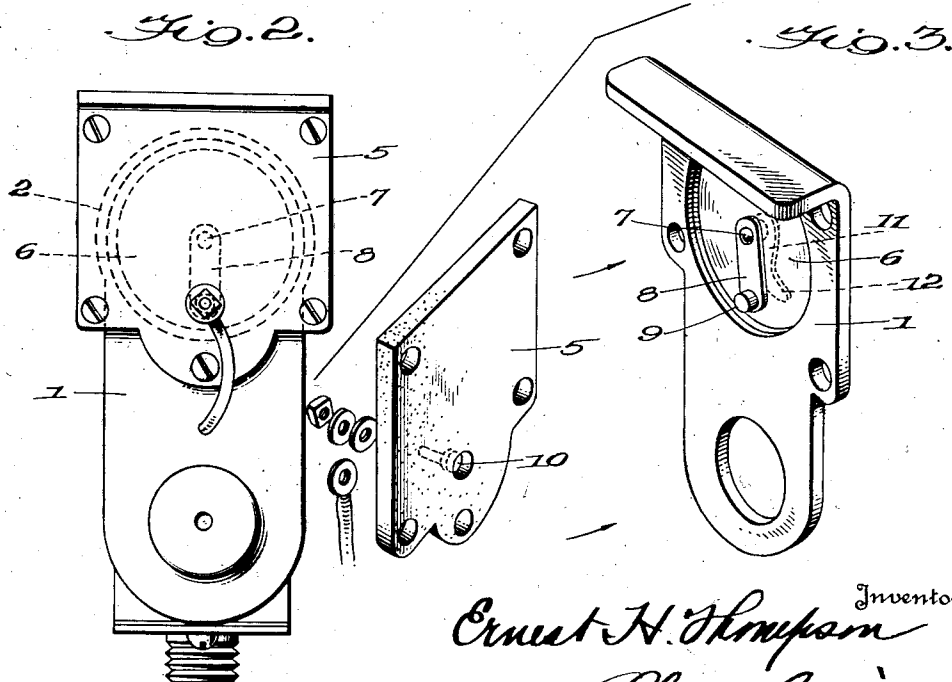
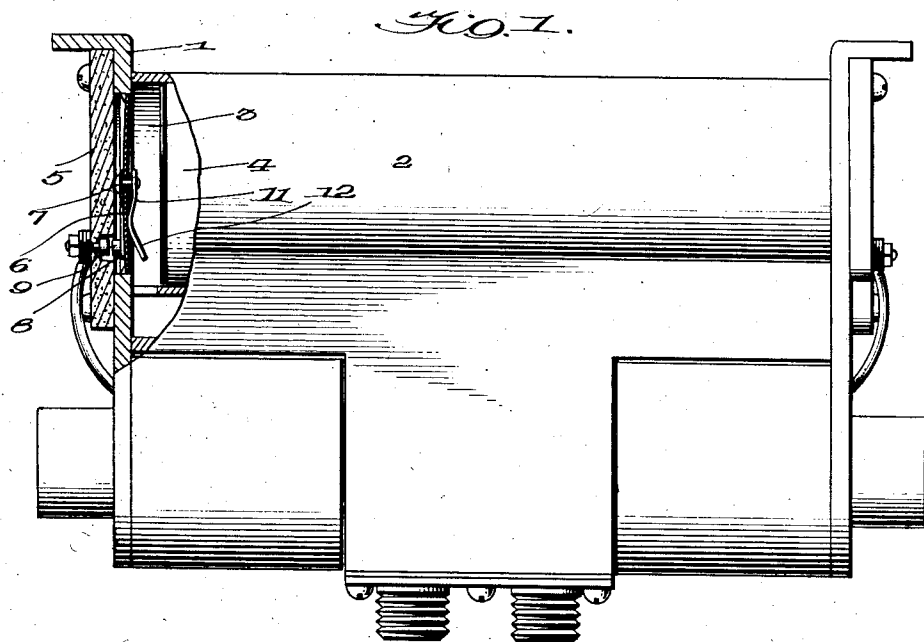
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ELECTRIC SWITCH FOR METERING DEVICES

Filed Dec. 3 1928

2 Sheets-Sheet 1



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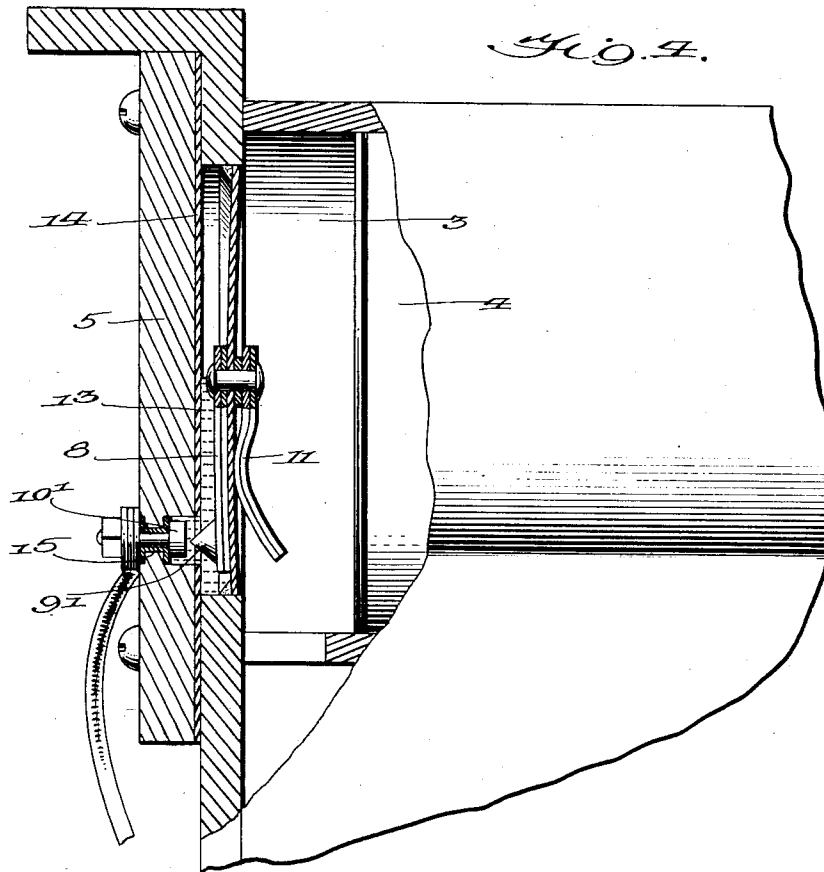
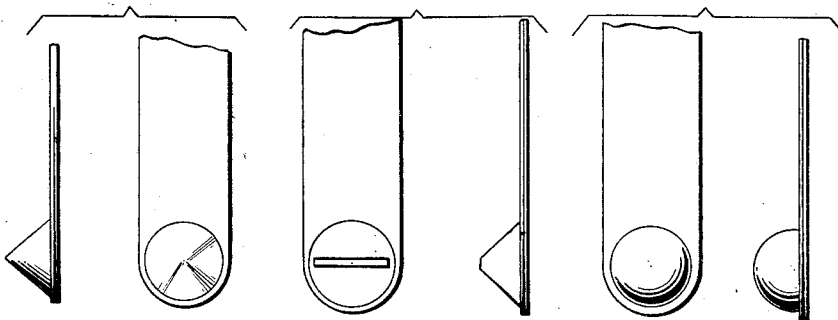


Fig. 5.

Fig. 6.

Fig. 7.



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## UNITED STATES PATENT OFFICE

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## ELECTRIC SWITCH FOR METERING DEVICES

Application filed December 3, 1928. Serial No. 323,541.

This invention relates to an improved type of electrical switch, particularly applicable to the metering device as disclosed in applicant's copending application filed March 5, 1928 Serial No. 259,207 and in other improved meters as covered in certain applications filed concurrently herewith, but it is of course to be understood that the present invention is not necessarily so limited.

In these metering devices above referred to, a substantially free or floating piston is adapted to be reciprocated within a cylinder, said reciprocation being caused by the flow of the liquid being measured, into and out of the cylinder, the liquid acting directly on the piston. The admission and discharge of the liquid into and out of the cylinder, is controlled by a suitable valve mechanism and said valve mechanism is in turn controlled by the movements of the piston, through electrical contacts or switch devices mounted in each end of the cylinder in position to be engaged by the piston when in its two extreme positions.

This is all shown in applicant's prior application above referred to, but in said prior construction the electrical switch device has not proven satisfactory for several reasons. The switch assembly as shown in Figs. 4 and 19 of said application comprise too many small parts for quick assembly and quantity production, and the means for mounting this switch mechanism in the end of the cylinder has also proven unsatisfactory under working conditions for the reason that it was necessary to use packing and this packing would not maintain a fluid tight joint under continuous service.

The switch mechanism as illustrated in Fig. 23 of the drawings of said application produces a much better seal or fluid tight joint and said switch is very simple, but being of the dished diaphragm type and necessarily made of very thin flexible metal, the pressure of the liquid in the cylinder would some times operate this switch prematurely.

The object of the present invention is to produce a switch mechanism of the flexible diaphragm type, of very simple construction, absolutely fluid tight with respect to its

mounting in the cylinder and so designed as to eliminate any possibility of premature operation or in fact any operation other than that caused by a positive or mechanical contact therewith.

Generally stated the improved switch mechanism, which has been devised particularly for use in connection with the type of fluid meter hereinbefore referred to, comprises in part a flexible diaphragm sealing the end of the cylinder, preferably of phosphor-bronze, and this diaphragm may or may not be slightly dished as it has been found that the same works equally well whether flat or concave. It is of course to be understood that the actual head of the cylinder is disposed outside of the flexible disk or diaphragm and preferably made of relatively heavy insulating material.

Secured to the outside of the diaphragm is a relatively rigid arm of thermo metal extending radially thereof, the inner end of the arm being secured to the middle portion of the diaphragm. Similarly secured to the inner side of the diaphragm is another arm of thermo metal slightly curved away from the diaphragm at its outer end, the inner end of this latter arm being not only secured to the center of the diaphragm, but also to the inner end of the first mentioned arm.

With this construction it will be apparent that any pressure exerted on the upper end of the inner arm towards the diaphragm will result in an outward movement of the outer end of the outer arm through the flexing of the diaphragm and force said outer end of the outer arm against a contact member suitably positioned and secured in the insulated head of the cylinder above referred to. It is to be also understood that the curved inner arm is in position to be engaged by the piston as it reciprocates within the cylinder, and the electrical contact is made each time the piston strikes this curved arm in its to and fro reciprocating movement.

The important feature of this particular construction is that should the diaphragm be forced outwardly by fluid pressure, the outer contact end of the outer arm will be pulled away from the contact member carried by

the insulated head, rather than forced into engagement therewith, as in the former construction hereinbefore referred to, all of which will be further elaborated upon in the detailed description of the device to follow.

The invention in its preferred form is illustrated in the accompanying drawings, in which

Fig. 1 is a view partly in elevation and partly in section of the improved switch in operative position, in connection with applicant's fluid meter;

Fig. 2 is an end elevational view;

Fig. 3 is an enlarged view showing the details of the switch per se and

Figs. 4, 5, 6 and 7 are modifications.

Referring to the drawings in detail, the movable contact portion of the improved switch is mounted in an end section 1 of the meter or similar device 2, concentric with a cylinder 3 in position to be engaged by a piston 4, and secured to the outer face of the end section 1 is a substantially thick rigid plate 5 of insulating material, said insulating plate carrying the stationary contact and having a wire connection to an electromagnet controlling a valve mechanism of the meter device, said electromagnet and valve mechanism forming no part of the present invention and therefore requiring no further description in the instant application.

The improved switch comprises a circular diaphragm or disk 6 of relatively thin phosphor-bronze, preferably slightly dished, hermetically sealed by solder or the like in a circular opening formed in the end section 1. Secured to the center of the disk 6, by a pin or rivet 7, is a substantially rigid arm 8, preferably of thermo metal, the free end of said arm being provided with a raised contact portion 9 adapted to periodically engage a stationary contact 10 mounted in the insulating plate 5.

The pin or rivet 7 extends through the diaphragm 6 and also acts as a means for securing to the inner face of the diaphragm or disk 6, a substantially rigid arm 11, also preferably formed of thermo metal. The free end of this arm 11 is slightly curved away from the diaphragm as at 12 in position to be periodically engaged by the piston 4 during the operation of the meter or the like.

When the piston 4 engages the projecting free end 12 of the arm 11 forcing the same inwardly, said arm being non-flexible and rigidly secured to the non-flexible arm 8, this will cause an outward movement of the free end of said arm 8 into engagement with the stationary contact 10, said movements being permitted by the flexing of the diaphragm 6, the diaphragm in returning to its normal position when the pressure is relieved from the arm 11, automatically disengaging the contacts 9 and 10. It will therefore be apparent that said switch cannot be prematurely oper-

ated by a fluid pressure within the cylinder, as the operation of the switch requires a positive engagement of the arm 11 by the piston 4.

It is to be understood that the term thermo metal as used in the foregoing specification in speaking of the arms 8 and 11 of the switch mechanism, implies a bimetallic construction generally known and used in thermostats of the bar type, the said bar comprising two superimposed metals one having a different coefficient of expansion than the other. This principle is well known and it is thought unnecessary to go into any further detail description thereof.

To more clearly show this construction as applied to the particular switch mechanism herein disclosed, attention is directed to Figure 4 of the drawings in which it will be noted that the arms 8 and 11 are illustrated in a way to emphasize the bimetallic construction of said arms.

This is a very important feature for the reason that said bimetallic construction of the arms 8 and 11 will provide an automatic adjustment for the switch in order to maintain an accurate operation thereof under all varying heat conditions. It will be noted that in using this switch mechanism in the metering device as contemplated, the gasoline in expanding upon becoming heated during changed weather conditions, will expand and increase the volume within the cylinder 3 without increasing in liquid quantity. Under these conditions the piston 4 would arrive at its extreme positions at the opposite ends of the cylinder 3 before the cylinder was actually full of gasoline as to quantity. Of course, the difference would be very slight and hardly noticeable upon each reciprocation of the piston 4 but upon the continuous use of the apparatus under these conditions over periods of several hours, the slight difference would be sufficient to cause an inaccurate recording of the meter as to the quantity of gasoline passing therethrough.

The present type of switch as shown more clearly in Fig. 4 has been designed to counteract or offset this condition and in forming the bimetallic arm 11, the set curve of said arm is so formed with respect to the characteristics of the two metals of which the arm is constructed, that said arm will have a tendency to straighten out to a sufficient degree under increased heat conditions and thereby cause the piston 4 to travel a slightly increased distance before contacting with the lower end of the arm 11 which obviously will cause a corresponding delay in operating the switch to reverse the movements of the piston, and in this way the variations produced in the curved arm 11 by the change in temperature conditions, will compensate for the slight increase in volume of the gasoline or a similar fluid flowing through the meter to be measured.

In addition the arm 8 is so constructed that it will have a tendency to curve under heat conditions and thereby withdraw the movable contact 9' away from the stationary contact 10' and it will thus require that much additional pressure against the lower end of the curved arm 11 to force the movable contact 9' into engagement with the stationary contact 10'.

By this curving and straightening of the arms 8 and 11 of the switch mechanism under changes of temperature conditions, said switch mechanism will automatically compensate for the expansion and contraction of the gas in the measuring cylinder 3, and by this compensation will insure an accurate recording of the liquid quantity of gasoline passing through the metering device as a whole.

Figure 4 also illustrates at 9' a slightly different form of contact member carried by the movable contact 8 whereby a point contact is produced in conjunction with the stationary contact 10'. In the form illustrated in Figs. 1 and 3 this contact portion is formed with a flattened face and is not as efficient and accurate as the point contact above referred to. This point contact may be constructed as shown in the various modifications illustrated in Figs. 5, 6 and 7.

To prevent any possibility of arcing at the switch points, these switch points may be submerged in oil as shown at 13 in Fig. 4 in which event the insulating plate 5 is provided with a packing or the like 14. Likewise there is also a packing 15 used in conjunction with the mounting of the stationary contact 10' all of which is clearly shown in Fig. 4.

Aside from the operative advantageous features, the complete switch is simple in construction, forms an efficient seal for the end of the cylinder and said switch parts can be prearranged in such a manner as to admirably adapt the same to quantity production and ease and simplicity in assembling. Furthermore the switch after being assembled and secured in operative position, is capable of continuous and accurate service for an indefinite period without any attention whatsoever.

Obviously the present invention is capable of many minor changes and applicant is not to be limited to the specific construction as illustrated and described in the instant application.

What I claim is:

1. In an electrical switch, the combination with a stationary contact, of a movable contact, a member for moving said movable contact into engagement with the stationary contact, and a common mounting for said movable contact and member, the free ends of said movable contact and member respec-

tively, being eccentrically disposed with respect to said mounting.

2. In an electrical switch, the combination with a stationary contact, of a movable contact, a member for moving said movable contact into engagement with the stationary contact, and a common flexible mounting for said movable contact and member, the free ends of said movable contact and member respectively, being eccentrically disposed with respect to said mounting.

3. In an electrical switch, the combination with a stationary contact, of a movable contact, a member for moving said movable contact into engagement with the stationary contact and a common flexible diaphragm mounting for said movable contact and member, the free ends of said movable contact and member respectively, being eccentrically disposed with respect to said mounting.

4. In an electrical switch, the combination with a stationary contact, of a movable contact, a member for moving said movable contact into engagement with the stationary contact, and means for positively securing one end of each, the movable contact and member, to each other and said mounting, the free ends of said movable contact and member respectively, being eccentrically disposed with respect to said mounting.

5. In an electrical switch, the combination with a stationary contact, of a movable contact, a member for moving said movable contact into engagement with the stationary contact, and a common means for positively securing one end of each, the movable contact and member, to each other and said mounting, the free ends of said movable contact and member respectively, being eccentrically disposed with respect to said mounting.

6. In an electrical switch, the combination with a stationary contact, of a movable contact, a member for moving said movable contact into engagement with the stationary contact, and a common flexible mounting for said movable contact and member, said movable contact and member being oppositely disposed each side of the flexible mounting and extending radially from the intermediate portion thereof in one direction, and means for positively connecting the inner ends of the movable contact and member to each other and to the intermediate portion of said mounting.

7. In an electrical switch and operating means therefor, the combination with a stationary contact, of a movable contact, a member for moving said movable contact into engagement with the stationary contact, and a common flexible mounting for said movable contact and member, said movable contact and member being oppositely disposed each side of the flexible mounting and

extending radially from the intermediate portion thereof in one and the same direction, means for positively connecting the inner ends of the movable contact and member to each other and to the intermediate portion of said mounting, means formed on the outer end of the movable contact for engaging the stationary contact and means formed on the outer end of the aforesaid member to be engaged by the operating means for the switch.

8. In an electrical switch, the combination with a stationary contact, of a movable contact, an operating member for said movable contact, a flexible diaphragm, said movable contact and operating member each comprising substantially rigid arms disposed each side of said diaphragm and radiating from a central portion thereof, and means for positively securing the inner ends of said arms to each other and to the center of the diaphragm.

9. In an electrical switch, the combination with a stationary contact, of a movable contact, an operating member for said movable contact, a flexible diaphragm, said movable contact and operating member each comprising substantially rigid arms disposed each side of said diaphragm and radiating from a central portion thereof, and means for positively securing the inner ends of said arms to each other and to the center of the diaphragm, said operating member being disposed at an angle to the face of said diaphragm.

10. In an electrical switch, the combination with a stationary contact, of a movable contact, an operating member for said movable contact, a flexible diaphragm, said movable contact and operating member each comprising substantially rigid arms disposed each side of said diaphragm and radiating from a central portion thereof, and means for positively securing the inner ends of said arms to each other and to the center of the diaphragm, said operating member being disposed at an angle to the face of said diaphragm, the parts being so constructed and arranged whereby a pressure upon the outer end of the operating member toward the diaphragm will cause a movement of the outer end of the movable contact arm away from said diaphragm through the flexing of the diaphragm.

11. The combination with a cylinder and a piston adapted to be reciprocated therein, of a flexible head comprising a diaphragm for said cylinder, a substantially rigid arm comprising a movable contact having one end secured to the outside intermediate portion of said diaphragm, a stationary contact, an operating member for said movable contact secured to the inside intermediate portion of said diaphragm adjacent the point of attachment of the switch arm thereto, and the free end of the operating member being

so disposed as to be in position to be engaged by said piston, said parts being so constructed and arranged, whereby such engagement will cause an outward movement of the free end of the movable contact into engagement with the stationary contact.

12. The combination with a cylinder and a piston adapted to be reciprocated therein, of a flexible head comprising a diaphragm for said cylinder, a substantially rigid arm comprising a movable contact having one end secured to the outside intermediate portion of said diaphragm, an insulating plate providing a substantially rigid head for the cylinder outside of said flexible diaphragm, a stationary contact mounted in said insulating plate, an operating member for said movable contact secured to the inside intermediate portion of said diaphragm adjacent the point of attachment of the movable contact thereto, and the free end of the operating member being so disposed as to be in position to be engaged by said piston, said parts being so constructed and arranged, whereby such engagement will cause an outward movement of the free end of the movable contact into engagement with the stationary contact.

13. The combination with a cylinder and a piston adapted to be reciprocated therein, comprising a flexible head for said cylinder, a substantially rigid arm comprising a movable contact having one end secured to the outside intermediate portion of said diaphragm, an insulating plate providing a substantially rigid head for the cylinder outside of said flexible diaphragm, a stationary contact mounted in said insulating plate, an operating member for said movable contact secured to the inside intermediate portion of said diaphragm adjacent the point of attachment of the movable contact thereto, and the free end of the operating member being so disposed as to be in position to be engaged by said piston, said parts being so constructed and arranged, whereby such engagement will cause an outward movement of the free end of the movable contact into engagement with the stationary contact.

14. The combination with a cylinder and a piston adapted to be reciprocated therein, of an electric switch comprising a stationary contact, a movable contact, an operating member for said movable contact, a flexible diaphragm, said movable contact and operating member each comprising substantially rigid arms disposed each side of said diaphragm and radiating from a central portion thereof, means for securing the inner ends of said arms to each other and to the center of the diaphragm, the free end of the operating member being so disposed as to be in position to be engaged by said piston, and means for sealing the diaphragm in the head of the cylinder, said parts being so constructed and arranged, whereby the aforesaid

engagement will cause an outward movement of the free end of the movable contact into engagement with the stationary contact.

15. In an electrical switch, the combination with a stationary contact, of a movable contact member comprising an arm of thermo metal, means carried by the free end of the movable contact member for producing a point contact with said stationary contact member, a curved thermo metal member for moving said movable contact member into engagement with the stationary contact member and a common flexible mounting for said movable contact member and curved member.

16. In an electrical switch, the combination with a stationary contact member and a mounting therefor, of a movable contact member comprising an arm of thermo metal, a tapered projection carried by the free end of said movable contact member for producing a point contact with said stationary contact member, a curved thermo metal member for moving said movable contact member into engagement with the stationary contact member and a common flexible mounting for said movable contact member and curved member, said stationary and movable contacts being submerged in oil.

In testimony whereof I affix my signature.

ERNEST H. THOMPSON.