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SWITCH MECHANISM

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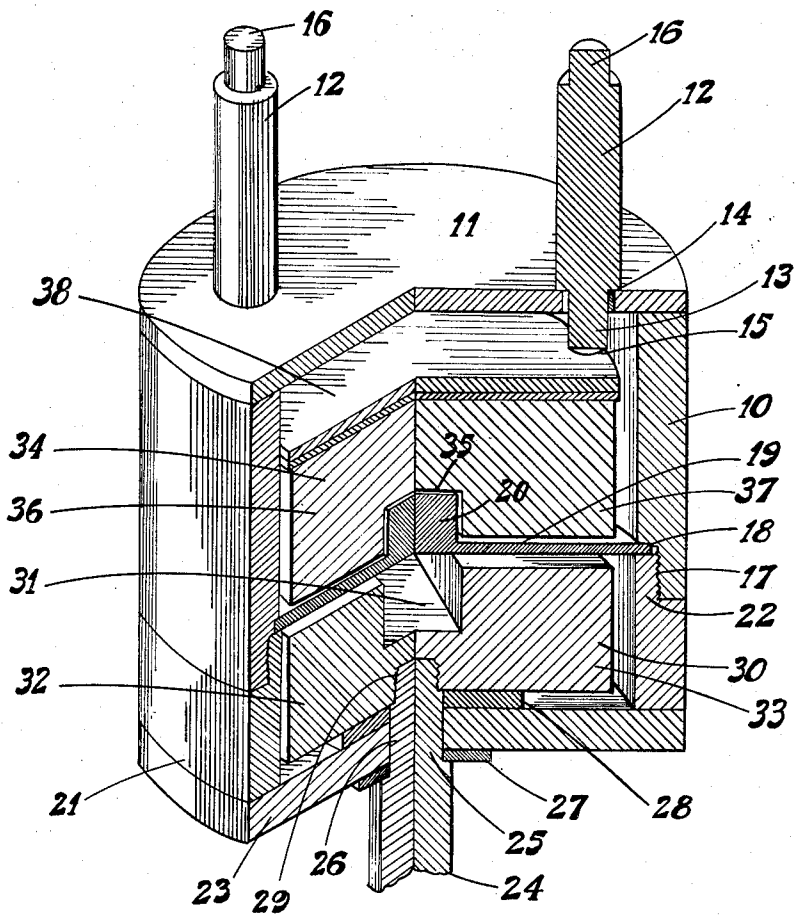

Fig. 1

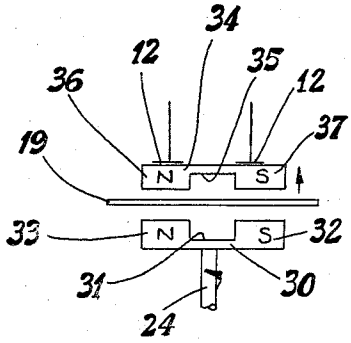

Fig. 2

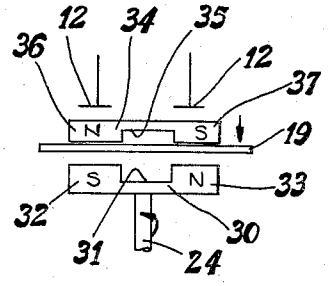

Fig. 3

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SWITCH MECHANISM

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6 Claims. (Cl. 200—87)

This invention relates to switch mechanisms.

It is an object of the present invention to provide an improved switch mechanism which is simple, yet sturdy and durable of construction, and which will operate consistently over a relatively long period of time without repair.

It is another object of the present invention to provide a switch mechanism of the above type wherein the tendency to intermittent circuit interruption owing to vibration is minimized and which embodies a novel snap action which is extremely valuable from an electro-mechanical viewpoint and wherein the life of the contacts is appreciably extended.

It is still another object of the present invention to provide a switch mechainsm of the above type which may be used in connection with flow meters where it is capable of being actuated mechanically and wherein the switch mechanism will function even when submerged in the cavity of the flow meter through which gasoline or other liquid is passing although the switch mechanism itself is not limited to this application and can, in fact, be adapted for use wherever manual operation is required, for example, in switches for walls, or the like.

Further objects of the invention are to provide a switch in which there is only one moving part, namely, the loose magnet; in which the region of the arc made by the opening or closing of the circuit may be hermetically sealed to prevent the possibility of fire hazard; and in which such a mechanism provides the means for an explosion proof relay.

Other objects of the invention are to provide a switch mechanism bearing the above objects in mind which is of simple construction, has a minimum number of parts, is inexpensive to manufacture, and efficient in operation.

For other objects and for a better understanding of the invention, reference may be had to the following detailed description taken in connection with the accompanying drawing, in which:

Fig. 1 is a perspective view shown partly in section of a preferred embodiment of the present invention and shown in a switch opened position;

Fig. 2 is a circuit diagram of the device showing the same in a switch closed position; and

Fig. 3 is a circuit diagram showing the device in a switch open position.

Referring now more in detail to the drawing, and more particularly to Fig. 1, **10** indicates a hollow cylindrical housing of electrically non-conductive material, the upper end of which is closed by a circular top wall **11** of the same material, substantially as illustrated.

12 represents a pair of electrical terminals of elongated cylindrical shape integrally formed at their lower ends with the reduced cylindrical portions **13** forming the shoulders **14**, the terminals **12** being formed of magnetic iron or ferrous material and preferably being silver plated to increase their electrical conductivity. The lower ends of the terminals **12**, as shown in Fig. 1, are suitably mounted in the top wall **11**, with the extensions **13** extending therethrough, the shoulder **14** abutting the upper surface of the top wall **11**. The lower ends of the extensions **13** are preferably provided with the silver contact surfaces **15**. The upper ends of the terminals **12** are integrally formed with the reduced cylindrical extensions **16** adapted to be connected into the circuit of the device which is to be controlled by the switch mechanism forming the subject matter of the present invention.

The lower end of the casing **10** preferably is provided with an enlarged internally threaded bore **17** forming a shoulder **18** against which is positioned a diaphragm **19** of substantially circular shape and formed of non-magnetic material, the diaphragm **19** through its center being integrally formed with the raised ridge or barrier **20**.

A lower hollow cylindrical casing **21** may be provided for vertical alignment with the upper casing **10** and secured thereto by means of the reduced externally threaded extension **22** integrally formed at its upper end and which is screwed into the internally threaded bore **17** to secure the diaphragm **19** in place, the casing **21**, when used, being similarly formed of electrically non-conductive material and having secured thereto a circular bottom wall **23** of the same material to complete the housing.

An operating shaft **24** is integrally formed at its upper end with the reduced smooth cylindrical extension **25** which is rotatably mounted in the center opening **26** provided in the bottom wall **23**, the extension **25** extending upwardly and downwardly from the bottom wall to mount thereon the circular washers **27** and **28** to reduce friction. The upper end of the extension **25** is integrally formed with the reduced externally threaded extension **29** which is screw threaded into a substantially cylindrical permanent magnet **30**, the periphery and top of the permanent magnet **30** being freely spaced from the casing **21** and diaphragm **19**. The permanent magnet is provided with a transverse groove **31** extending downwardly from the upper surface thereof and is provided with the south pole **32** and the north pole **33**.

A second cylindrical permanent magnet **34** is positioned within the casing **10** above diaphragm **19**, being provided on its undersurface with a transverse groove **35** which slidably receives therewithin the barrier or ridge **20** whereby to prevent rotational movement of the permanent magnet **34** about a vertical axis, as will be obvious. The permanent magnet **34** is provided with the north pole **36** and the south pole **37**. The upper surface of the permanent magnet **34** may be provided with a silver coated layer **38** to increase the electrical conductivity of the same.

In operation, as the magnet **32** is rotated through 360 degrees by means of the operating shaft **24**, the polarity of the same will alternately attract and repel the permanent magnet **34** which latter is fixed angularly. When the magnets are aligned as shown in Fig. 2, the like poles repel, forcing the magnet **34** and the silver coated surface thereof against the terminals **13** and silver contacts **15** thereof whereby to close the circuit. During this period of repulsion, the magnet **34** is attracted by the iron core of the terminals **12** to minimize the tendency to intermittent circuit interruption due to vibration and to the appreciable mass of the magnet **34**. Upon further rotation of the magnet **32**, to the position of Fig. 3 and Fig. 1, unlike poles attract and the force of the magnetic attraction between the magnets **32** and **34** greatly overcomes the attractive forces of the terminals **12** for the magnet **34** and the circuit is rapidly broken. This snap action is valuable from the electro-mechanical viewpoint and operates to extend the life of the contacts.

It will be noted that the size or shape of the magnets is largely immaterial, in view of a minimum requirement for flux. It will also be noted that the perma-

nent magnet **34** is prevented from aligning itself with the magnet **32** by means of the groove **35** and barrier **20**. Thus, the magnet **34** can only have vertical reciprocating motion within the casing.

If desired, the housing may be filled with a suitable medium such as nitrogen under pressure to provide excellent quenching of the electrical arc between the terminals **12** and their contacts **15**. A gas or liquid may be provided within the housing, as circumstances require. For example, transformer oil may be used. When such an incompressible fluid is provided within the housing, the switch may be operated under conditions of great external pressure, even though the diaphragm **19** is relatively thin (the pressure being equal on both sides).

While various changes may be made in the detail construction, it shall be understood that such changes shall be within the spirit and scope of the present invention as defined by the appended claims.

What I claim as new and desire to protect by Letters Patent of the United States is:

1. A switch mechanism of the character described, adapted for submerged use in the cavity of a fluid flowmeter, comprising an electrically non-conductive housing, a single reciprocable member consisting of a permanent magnet positioned within said housing for high speed vibratory movement therein, said magnet having north and south ploes and a transverse groove therebetween at one end thereof and an electrically conductive surface at the opposite end thereof, a pair of terminals fixedly mounted within one end of said housing and extending into the interior thereof, closely adjacent and adapted directly to be contacted by the electrically conductive surface of said magnet, an electrically non-conductive diaphragm, closing the end of said housing remote from said terminals, having a transverse ridge nested within said groove to prevent angular displacement of said magnet, and a second permanent axially rotatable magnet, having north and south poles, positioned on the opposite side of said diaphragm in spaced relation thereto and freely rotatable at high speed within said housing, alternately to repel and attract said first permanent magnet and to open and close said terminals when said second permanent magnet is rotated, whereby each complete revolution of the rotary magnet is translated into an electric impulse through the medium of the vibratory action of the reciprocating magnet.

2. In a switch mechanism according to claim 1, said terminals being formed of magnetically permeable material and being coated with electrically conductive material, whereby to attract said first permanent magnet to augment the repulsion thereto of said second permanent magnet and to impart a snap action to the switch mechanism.

3. A switch mechanism according to claim 1, said housing being substantially cylindrical, said first and second permanent magnets being substantially cylindrical, said first permanent magnet having said groove intersecting the center thereof, and said second permanent magnet having a transverse groove intersecting the center thereon on the face adjacent said diaphragm.

4. In a switch mechanism as defined in claim 1, and further characterized in that said housing is filled with a fluid.

5. In a switch according to claim 4, and wherein said fluid is an inert gas.

6. In a switch according to claim 4, and wherein said fluid is an incompressible liquid.

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