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DRAWKNOB ORGAN SWITCH

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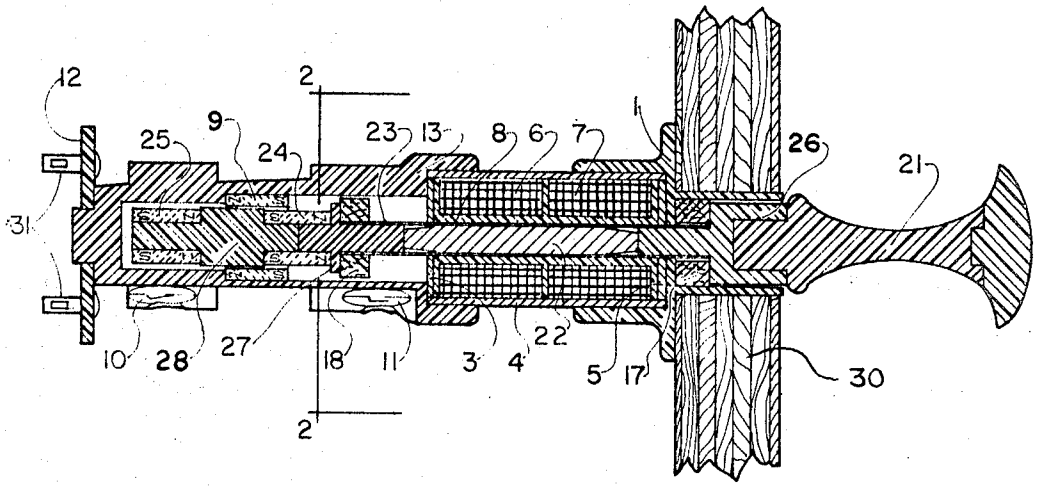


FIG. 1

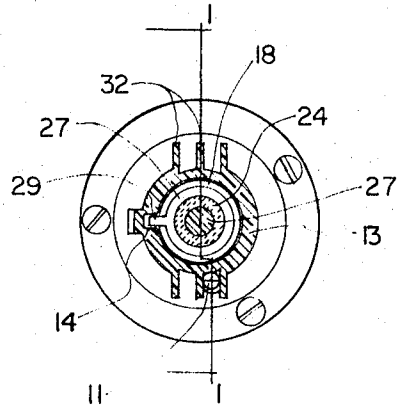


FIG. 2

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DRAWKNOB ORGAN SWITCH

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ABSTRACT OF THE DISCLOSURE

A drawknob organ switch in which overcenter action is provided by a pair of permanent magnets fixed to the drawknob stem and moving through a fixed annular permanent magnet, and in which part of the drawknob stem comprises an iron armature passing through a fixed solenoid coil to permit electrical as well as manual operation of the switch device, and in which one or more stationary reed switches are opened or closed by motion of the permanent magnets fixed to the drawknob stem, making or breaking electrical circuits to achieve the desired selection of organ tone families or related purposes.

In the past, drawknob organ switches have been complex or uncertain in operation or both. The present switch as described in the abstract overcomes the above problems while retaining those qualities which are desirable in a drawknob organ switch. These qualities include: (1) extended travel of the drawknob to permit easy visual determination of the state of the switch, (2) good "feel," that is, proper resistance to the hand when being manually operated, (3) a reliable overcentering action with no possibility of accidentally setting the switch in a halfway position, (4) switch contacts highly resistant to contamination by dust and other atmospheric conditions, (5) capability of providing many sets of switch contacts with no increase of complexity, (6) a minimum number of moving parts, and (7) a shape adapted for the mounting of these switches in closely set groups on a panel, and providing for convenient electrical connections to be made to the switch when it is mounted in such a group.

FIGURE 1 is a longitudinal cross section of the drawknob switch, showing the drawknob in its "in," rearward, position. Except for minor deviations noted below, the switch is symmetrical about its longitudinal axis.

FIGURE 2 is a transverse cross section of the drawknob switch through section 2—2 of FIGURE 1, looking toward the front of the switch, and showing the method of preventing rotation of the drawknob.

The drawknob switch consists of two principal assemblies; a stationary body and an axially movable drawknob stem.

The stationary body includes a mounting flange part **1** for attaching the switch to a vertical panel **30**, a ferromagnetic solenoid housing parts **3**, **4** and **5** enclosing solenoid coils **6** and **7** wound on bobbin **8**, and a rear housing **13** supporting a stationary annular permanent magnet **9**. Glass enclosed ferromagnetic reed switches, for example **10** and **11** are located in longitudinal grooves on the rear housing, and electrical leads from the solenoid and the reed switches are attached to lugs, for example, **31**, on a terminal connector board **12** at which electrical connections to the drawknob switch are made. The four electrical leads from the two solenoid coils are brought out through small holes in the ferromagnetic housing and in the rear housing for attachment to the terminal connector board. All the parts of the stationary body are fastened rigidly together by adhesives or other means. When the rear housing is made of thermoplastic material, the reed switches may be conveniently fastened to the rear housing by using heat to bend fins **32** together to partially enclose the reed switches, as shown in FIGURE 2.

The drawknob stem consists of a knob **21**, a ferromagnetic rod **22**, tapered at the ends for maximum efficiency, enclosed for support in a nonmagnetic tube **23**, permanent magnets **24** and **25**, and connecting parts **26**, **27**, and **28**. All these parts of the drawknob armature are fastened rigidly together by adhesives or other means. The permanent magnets are annular, for convenience in fastening them to parts **27** and **28**.

The drawknob stem is laterally supported and prevented from wobbling by the solenoid bobbin, in the bore of which the tube **23** of the stem is a sliding fit. Axial movement of the stem is limited by the interference between the shoulders of parts **1** and **26**, and **8** and **27**, which are separated by felt washers **17** and **18** to absorb impact at the ends of the motion of the drawknob stem. Since labels which may be inscribed on the drawknob should be kept upright, rotation of the drawknob stem is prevented by a tab **29** on connector part **27**, which slides in a longitudinal groove **14** in the rear housing as shown in FIGURE 2.

The spacing between the two stem magnets is approximately equal to the length of the stationary magnet. When these three permanent magnets are so spaced, and polarized axially as in FIGURE 1, a strong overcenter action results. Referring to FIGURE 1, the left hand stem magnet is repelled strongly to the left if its north pole end is slightly to the left of the north pole end of the stationary magnet, but is forced strongly to the right if its north pole end is slightly to the right of the north pole end of the permanent magnet. Similar forces are exerted on the right hand stem magnet, and these forces add to drive the drawknob stem toward the front if it is slightly to the front of the center of its travel, and toward the rear if it is slightly to the rear of the center of its travel. These forces also hold the drawknob stem firmly in its "in" or "out" position.

The drawknob may be moved in or out manually, or by actuation of the solenoid. Energizing the rear coil of the solenoid will cause the ferromagnetic bar, and consequently the whole drawknob stem, to be pulled toward the rear, "in" position, and the front coil similarly can pull the drawknob stem toward its front, "out" position. The forces exerted by the solenoid are sufficient to overcome the retaining forces of the permanent magnets.

Reed switches which are to be closed when the drawknob is in its "in" position are mounted on the rear housing radially opposite the rearmost position of the rear stem magnet, and are actuated by flux from this magnet when it is adjacent to them. Reed switches which are to be closed when the drawknob is in its "out" position are similarly mounted opposite the frontmost position on the front stem magnet. As many reed switches may be used as desired, limited only by the space available around the circumference of the rear housing.

Although the device which I have described includes two permanent magnets on the drawknob stem, and one stationary magnet, it is apparent that the same effects (overcenter forces and reed switch actuation) can be obtained with the use of only one magnet on the drawknob stem. This magnet is to be axially polarized in the same direction as the stationary magnet. In the unstable center position of the switch, the stem magnet is centrally located within the annular stationary magnet, and when displaced from this position in either direction is further repelled from it, providing snap action. If this stem magnet is approximately equal in length to the stationary magnet, then when the drawknob is in its "in" or its "out" position, the stem magnet will extend sufficiently far from the stationary magnet to permit the use of the flux from the stem magnet to operate a reed switch.

However, the device which has been illustrated and described, and which uses two movable magnets, is to be preferred, because of its stronger action and because it permits a much greater tolerance in the positioning and sensitivity of the reed switches.

I claim:

1. A drawknob organ switch device comprising

a tubular body having an axis,

a drawknob having a stem axially movable in said body,

said stem including axially oriented permanent magnet means,

said body including axially oriented annular permanent magnet means through which the first named magnet means may be moved to provide overcenter snap action,

said stem including a ferromagnetic armature axially oriented,

said body including a solenoid coil through which the ferromagnetic armature may be moved,

reed switch means mounted on said body and so located as to be closed by said first named magnet means when said first named magnet means is in one position, and not closed by said first named magnet means when said first named magnet means is in another position,

said reed switch means being adapted for opening and closing electrical circuits in the control system of an organ.

2. A drawknob organ switch device in accordance with claim 1, in which said second named permanent magnet means is an annular permanent magnet.

3. A drawknob organ switch device in accordance with claim 2, in which said first named magnet means is a pair of annular or cylindrical magnets axially oriented and axially spaced from each other a distance substantially equal to the length of said second named magnet means.

4. A drawknob organ switch device in accordance with claim 3, in which one of said pair of permanent magnets is partially enclosed by said second named magnet means while the other of said pair is spaced from said second named magnet means when said pair of permanent magnets is in one position, and the second named of said pair of permanent magnets is partially enclosed by said second named magnet means while the first named of said pair of permanent magnets is spaced from said second named magnet means when said pair of permanent magnets is in another position.

5. A drawknob organ switch device in accordance with claim 4, in which said reed switch means is an elongate reed switch enclosed in glass and said reed switch is mounted on said body parallel to the axis of said body.

6. A drawknob organ switch device in accordance with claim 5, in which said stem includes a tube of rigid nonmagnetic material and said axially oriented ferromagnetic armature is a ferromagnetic rod fixed within said tube.

7. A drawknob organ switch device in accordance with claim 6, in which said body includes another solenoid coil, in addition to said first named solenoid coil, through which said ferromagnetic armature may be moved.

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