

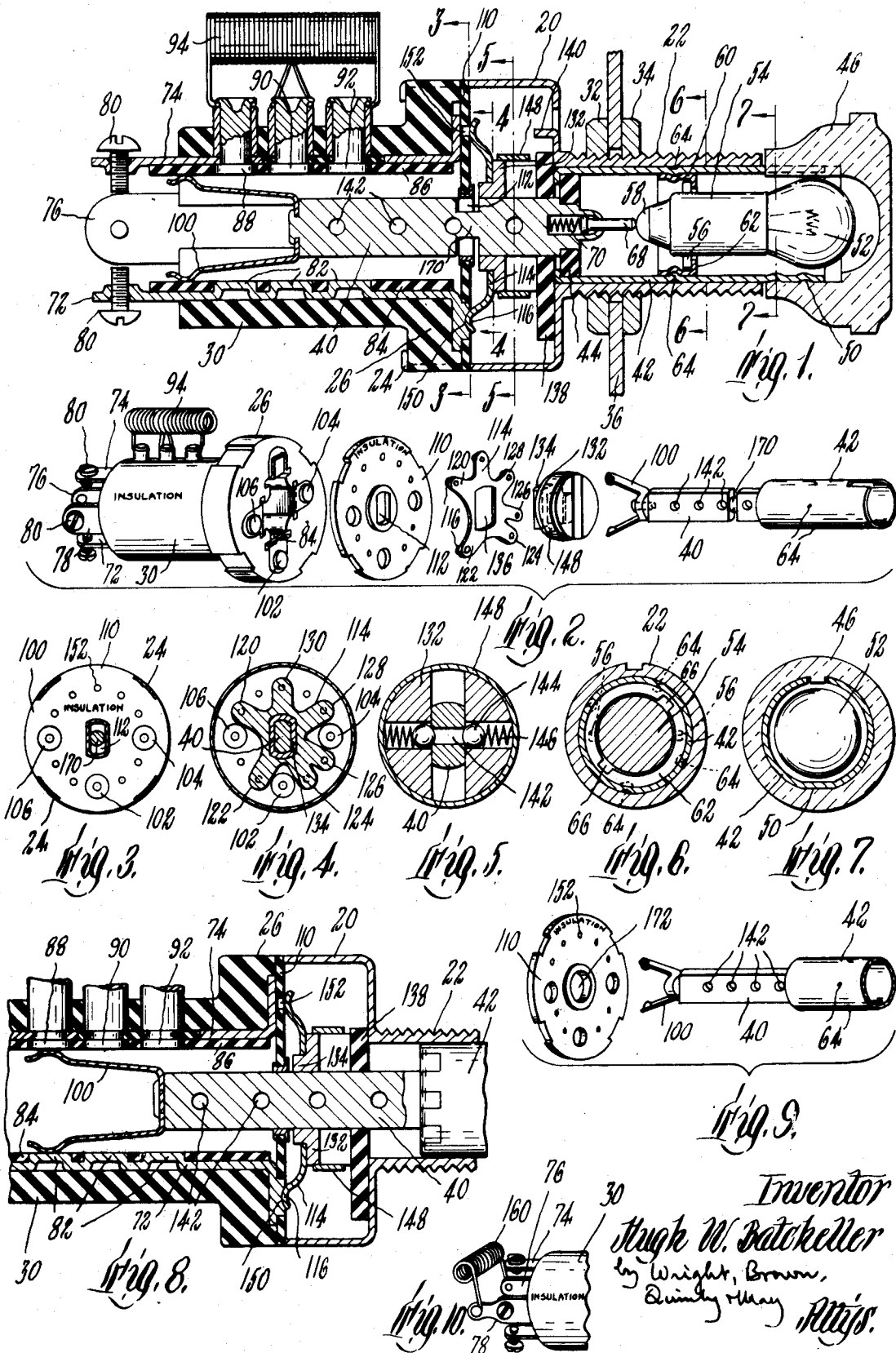
Nov. 25, 1941.

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2,263,754

MULTIPLEX SWITCH

Filed June 16, 1938



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UNITED STATES PATENT OFFICE

2,263,754

MULTIPLEX SWITCH

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Application June 16, 1938, Serial No. 213,958

2 Claims. (Cl. 200-4)

This invention relates to a multiplex electric switch adapted to control a plurality of different circuits by the manipulation of a single knob or handle. The invention is of particular value where a plurality of electrically operable devices are to be controlled from a single location and simplicity of apparatus and economy of space are desired. For example, automobiles are being supplied in rapidly increasing numbers with accessory devices some of which are electrically operated. Among such devices are heaters, defrosting devices and fog-lights. Each of these devices is controlled by a switch. According to the present invention, two or more such devices can be independently controlled by manipulation of a single knob. Furthermore, resistance elements may be included in the structure for varying the voltage impressed on one or more of the devices. In the embodiments of the invention herein shown and described, a knob is connected with a plunger which can be pulled out to operate one or more switches, and with a rotor which is rotated to operate one or more other switches. If desired, the switch is provided with an interlock whereby the knob can be rotated only when it is pushed in, and can be pushed and pulled only when it is in a certain angular position.

Certain embodiments of the invention are illustrated on the drawing, of which—

Figure 1 is a longitudinal section of a switch embodying the invention.

Figure 2 is a perspective view of the working parts of the structure.

Figures 3, 4, 5, 6 and 7 are sectional views on the lines 3-3, 4-4, 5-5, 6-6 and 7-7 of Figure 1.

Figure 8 is a fragmentary sectional view of a modified form of the invention.

Figure 9 is a perspective view of two of the members shown in Figure 8.

Figure 10 is a fragmentary perspective view of the rear end of a modified form of the invention.

As shown in Figure 1, the switch is contained in a housing including a cup-shaped shell 20 having a cylindrical sleeve 22 extending therefrom and coaxial therewith. This sleeve may be integral with the shell 20 or may be permanently secured thereto. The shell is provided with a suitable number of tongues 24 which engage in peripheral recesses in a flange 26 at the forward end of a cylindrical barrel 30 made of insulating material. The ends of the tongues 24

are bent over to engage behind the flange 26 to secure the shell 20 to the barrel.

The sleeve 22 is externally threaded to receive a pair of nuts 32 and 34 by which the switch may be securely attached to a supporting wall 36 such as the dashboard of an automobile, the sleeve 22 projecting through a suitable hole in such supporting wall.

The switch structure illustrated on the drawing comprises two virtually independent switches for controlling three electrical devices, one of the switches being operated by pulling out and pushing in an operating member extending through the sleeve 22, the other switch being operated by rotation of the operating member. As shown, this operating member comprises a stem 40 which is permanently secured to a hollow metal shaft 42 but is insulated therefrom by a disk 44 of insulating material. The shaft 42 fits slidably within the sleeve 22 and projects from the forward end thereof to receive a finger-knob 46 which is preferably of molded insulated material and which is firmly but removably held on the outer end portion of the shaft by suitable lugs 50 in corresponding indentations in the hollow shaft.

Within the hollow shaft 42 is mounted a tell-tale lamp 52 having a base, which, as is usual with small lamps of this kind, is made with a cylindrical metal shell 54 having a pair of short pins 56 projecting radially therefrom, and a metal tip 58, the tip and shell being respectively connected to ends of the filament in the lamp. In order to provide a socket or holding means within the hollow shaft 42 for the lamp 52, I insert in the shaft a metal thimble 60 which consists of a short hollow cylinder fitting within the shaft and having an turned flange 62. This thimble may be secured permanently within the shaft in any suitable manner. As shown, a series of small indentations 64 are made in the outer surface of the shaft 42 with a prick punch or equivalent tool, these indentations being made sufficiently deep to indent the wall of the thimble 60 and thus to secure it in place. As indicated in Figure 6, the flange 62 is provided with a pair of diametrically opposed notches 66 to permit the pins 56 to pass the flange 62 when the lamp is inserted in the socket. The lamp is then turned so as to move the pins 56 out of registration with the notches 66. The lamp is then held in the socket by engagement of the pins against the rear face of the flange 62. This rear face may be indented at diametrically opposite points to receive the pins 56 so

that accidental rotative movement of the lamp is prevented. The pins 56 are pressed against the flange 62 by a plunger 68 which is slidably mounted in a bore in the forward end of the stem 40, a spring 70 being inserted in the bore behind the plunger 68 to press it forward against the tip 58 of the lamp. The plunger 68 also serves as an electrical connection between the tip of the lamp and the stem 40.

The barrel 30 is formed with a central bore for the stem 40 of the operating member. The barrel also carries a number of conductors which are arranged to serve as switch elements and which are connectible to circuit wires. These conductors can be formed and arranged in various ways. For convenience in assembling, the barrel as illustrated on the drawing may be made with a plurality of shallow undercut channels which are parallel to the central bore and open thereinto. These channels are four in number and receive conductors consisting of metal strips 72, 74, 76 and 78. Each of these strips is provided with a suitable terminal such as a screw 80 by which it may be connected to a circuit wire. The strip 72 is intended for connection to a source of electrical energy such as a battery. Portions 82 of the strip 72 are exposed to the interior of the barrel through a row of holes in an insulating strip 84 which overlies the strip 72 and is fitted therewith into one of the channels in the interior of the barrel. In the opposite channel, which contains the strip 74 and a covering strip 86 of insulating material, are a series of separate contact elements 88, 90 and 92 which are arranged in a row parallel to the axis of the barrel and which are exposed through the insulating strip 86 to the interior of the barrel and respectively opposite to the contact elements 82. The contact elements 88, 90 and 92 may conveniently be heads of rivets which project through the wall of the barrel 30. The element 88 is electrically connected with the metal strip 74 and with one end of a resistance element 94. The elements 90 and 92 are insulated from the metal strip 74 but are respectively connected to the resistance element 94 at an intermediate point thereof and at the opposite end thereof. A bridging conductor 100 is provided to move into successive contact with the elements 88, 90 and 92 so as to connect each of these elements with the element 82 which is opposite thereto. Thus, by means of the bridging conductor 100, the strip 72 which is connectible to a battery can be connected to the strip 74 either directly through the contact element 88 or through a portion of the resistance element 94 by connection with the contact element 90 or through the entire resistance element 94 by contact with the element 92. For operating the bridging conductor 100, it is swivelly attached to the stem 40 of the operating member so that there is an electrical connection between the conductor and the stem but the two parts are relatively rotatable. Thus the operator, by pulling on the knob 46, may draw the shaft 42 and stem 40 forward for a limited distance, causing the bridging conductor 100 to move into successive contact with the elements 88, 90 and 92 so as to connect these elements successively with the strip 72. This rheostat switch is designed for use in controlling the motor of a heating unit for an automobile but obviously can be put to other uses if desired.

A second switch is provided by arranging a series of contact elements 102, 104 and 106 at

the forward end face of the barrel 30. These contact elements may be suitably formed on the forward end portions of the strips 72, 76 and 78, respectively, which may be bent to engage the front end face of the barrel. The latter may be covered by a suitable disk 110 of insulating material which is held in fixed position against the end face of the barrel by the shell 20, the rear edge of which bears against the margin of the disk 110. The disk is provided with holes in which are disposed the contact elements 102, 104 and 106, these elements being in the form of bosses on the end portions of their respective strips filling the holes in the disk 110 so that the exposed faces of these contact elements are substantially flush with the forward face of the disk. The disk is also provided with a central aperture 112 through which the stem 40 slidably extends. In order to connect the elements 102, 104 and 106 selectively one with another, the bridging conductor 114 is provided which, as indicated in Figures 2 and 4, has a number of radially projecting fingers. Each finger has near its end a small boss 116 riding on the forward face of the disk 110. In the embodiment of the invention illustrated in Figures 2 and 4, the bridging conductor 114 has six fingers 120, 122, 124, 126, 128 and 130. Five of these fingers are designed for contact with one or another of the contact elements 102, 104 and 106, the finger 130 being merely for mechanical balance of the conductor against the face of the disk. The conductor 114 is preferably stamped from a sheet of springy brass or copper and is keyed to the operating member so as to rotate therewith. To this end, the stem 40 is preferably made with a non-circular cross section. On the stem is slidably fitted a circular member or disk 132 having a boss 134 on the rear face thereof which is non-circular and which fits into a central aperture 136 in the conductor 114. The stem 40 also projects through a disk 138 of insulating material (Figure 1) which rotates therewith. These members, through which the stem projects, are held together in assembled relation by the shell 20 as indicated in Figure 1. Thus the stem 40 is free to slide through the apertures in the conductor 114, the disk 132 and the disk 138, but these members must rotate with the stem when the stem is rotated by manipulation of the knob 46. The marginal portion of the disk 138 is cut away to provide a pair of radial shoulders adapted to engage a tongue 140 struck inward from the metal shell 20 so as to limit the angle of rotation of the disk 138 and thus of the stem 40.

Yielding detent means are provided for both switches to hold the operating member in its several positions for use so that the bridging conductors can be held in proper positions in contact with respective contact elements. To this end the stem 40 is provided with a number of holes or lateral recesses 142 which, as indicated in Figure 5, are adapted to receive spring-pressed detent elements such as balls 144 pressed by springs 146, these balls and springs being mounted in a transverse bore in the disk 132. The disk is surrounded by a collar 148 which holds the balls and springs in position. The recesses 142 are so arranged that the balls 144 enter them whenever the bridging conductor 100 is in contact with a pair of contact elements within the barrel. For a similar purpose, the contact elements 102, 104 and 106 are indented as indicated at 150 in Figure 1 so that the bosses

116 on the fingers of the conductor 114 may enter these recesses and thus act as detent elements. In order to make the detent action more effective, the disk 110 may be provided with a series of holes or depressions 152 to receive the bosses 116. These recesses are arranged at equal distances from the axis of the disk 110, as are also the contact elements 102, 104 and 106, so that the fingers of the conductor 114 engage these recesses and contact elements as the conductor is rotated.

The contact element 102 is connectible with a battery or other source of electrical energy. The contact elements 104 and 106 may be connected to two different pieces of apparatus such as a windshield defroster and a fog-light. Since it may be desirable on some occasions to employ one of these pieces of apparatus alone, and on other occasions to employ both together, the conductor 114 is designed to connect the element 102 with either or both of the elements 104 and 106. Referring to Figure 4, it may be seen that, if the conductor 114 is rotated 30° to the left, all three contact elements will be connected together. If the conductor is rotated 30° to the right, the element 102 will then be connected to the element 104 but not to the element 106. The rotation of 60° to the right will connect the element 102 with the element 106 but not to the element 104. Thus the element 102 may be connected with either of the other two elements alone, or with both together as desired.

Instead of utilizing the rotary switch for two different pieces of apparatus, a resistance element may be employed to change it into a rheostat switch for use with a single piece of apparatus. Thus, as illustrated in Figure 10, a resistance element 160 may be permanently connected across the strips 76 and 78, the apparatus being connected to one or the other of these strips. In such case there would be no need for connecting all three of the elements 102, 104 and 106 together at the same time. Hence a simpler form of conductor 114 could be employed having two fingers extending from the axis at right angles to each other. For example, the fingers 120, 124 and 128 of the conductor 114 could be cut off, leaving active fingers 122 and 126, with the finger 130 for mechanical balance.

If the switch is to be employed for the control of different pieces of apparatus which should not be simultaneously operated, an interlock may be provided to prevent the closing of either switch when the other is closed. To this end, the aperture 112 in the disk 110 may be made to fit the stem 40, which, as hereinbefore mentioned, has a non-round cross section. Since the disk 110 is non-rotatably secured in the casing, the stem 40 can be longitudinally moved through the aperture 112 but cannot be rotated. In order to make possible the operation of the rotatable switch, the sides of the stem 40 may be notched to form a neck 170 so that the stem may be rotated when the disk 110 registers with the neck 170. This neck is located so that it

registers with the disk only when the bridging conductor 110 is not in contact with any of the elements 82, 88, 90 and 92. Thus, when the push-and-pull switch is "off", the rotary switch may be operated. Likewise, the fingers of the conductor 114 are so related to the aperture 136 and hence to the aperture 112 and the disk 110 that the stem 40 can be longitudinally moved through the aperture 112 only when the rotary switch is in the "off" position.

Where it is desirable to be able to use simultaneously all of the various pieces of apparatus controlled by the switches, independent operation of the push-and-pull switch or of the rotary switch regardless of the position of the other can be provided for. Such structure is illustrated in Figures 8 and 9, the disk 110 having a circular central aperture 172 in which the stem 40 is rotatable regardless of its longitudinal position. The stem can also be pushed and pulled at any time regardless of its angular position. Thus the various switches included in the multiplex switch can be independently and simultaneously operated.

It is evident that various modifications and changes may be made in the embodiment of the invention herein illustrated and described without departing from the spirit or scope thereof as defined in the following claims.

I claim:

1. In a multiplex electric switch, a cylindrical barrel of insulating material having a central bore therethrough and a plurality of shallow undercut channels opening into said bore, a strip of metal fitted into each said channel and projecting from the rear end of said barrel, the forward end portions of said strips being bent to engage the front end face of said barrel, a disk of insulating material secured against said front end of the barrel, said disk having a central aperture and openings equally distant from said aperture to expose portions of said strips, a bridging conductor slidable in said bore into simultaneous contact with two of said strips, an operating member having a portion extending through the central aperture in said disk and rotatably attached to said conductor, a second bridging conductor rotatable with said operating member and provided with contact points movable into contact with said exposed portions of the strips, and means pressing said second bridging member against said disk.

2. In a multiplex electric switch, a cylindrical barrel of insulating material having a central bore therethrough and a plurality of shallow undercut channels opening into said bore, a strip of metal fitted into each said channel and projecting from the rear end of said barrel, the forward end portions of said strips being bent to engage the front end face of said barrel, means for retaining said strips in place in said channels, movable switch elements adapted to engage certain of said strips within the barrel, and movable switch elements adapted to engage certain of said forward end portions of the strips.

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