

July 15, 1952

W. L. DIETRICH

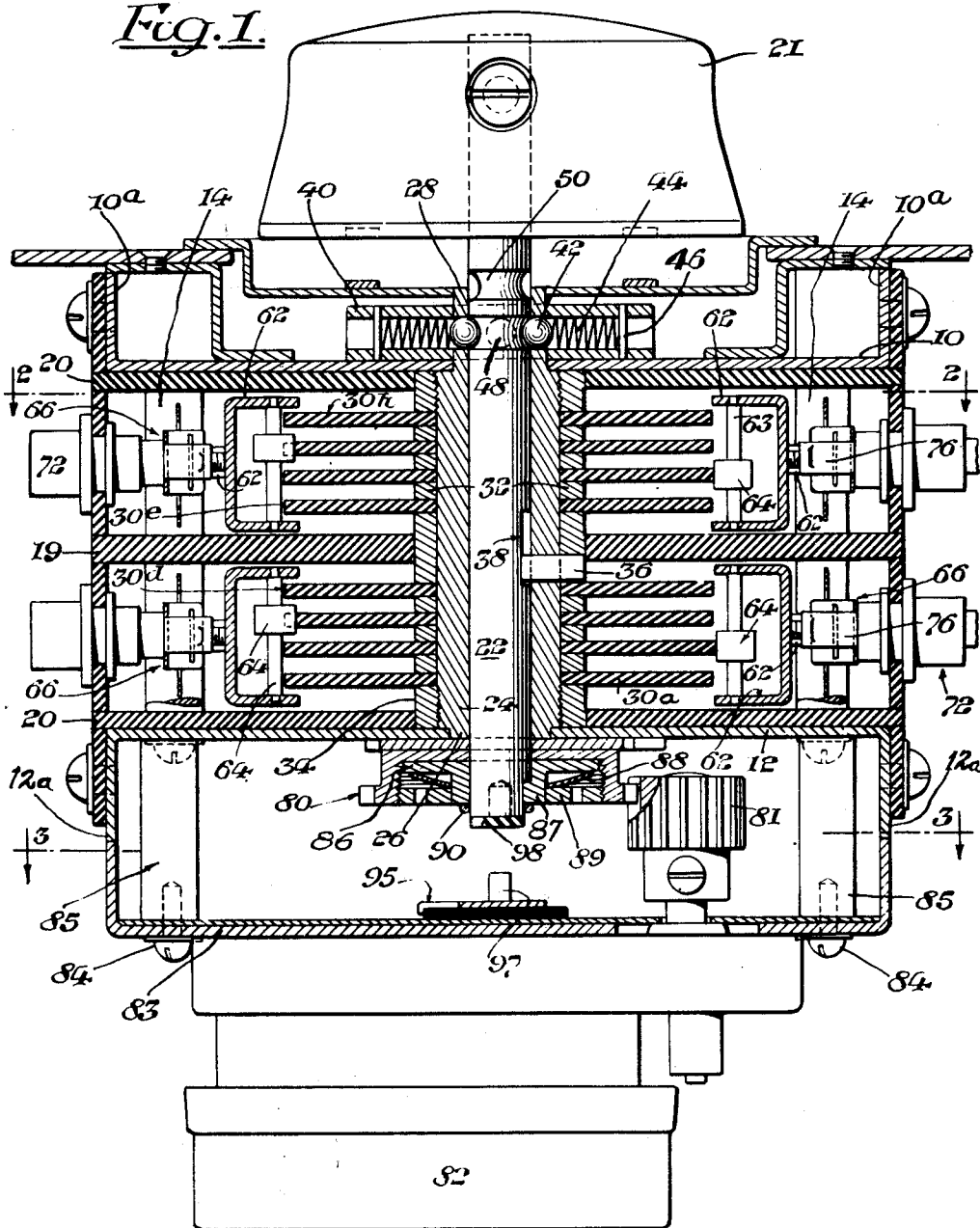
2,603,725

MULTIPLE CIRCUIT CONTROL SWITCH

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5 Sheets-Sheet 1

Fig. 1.



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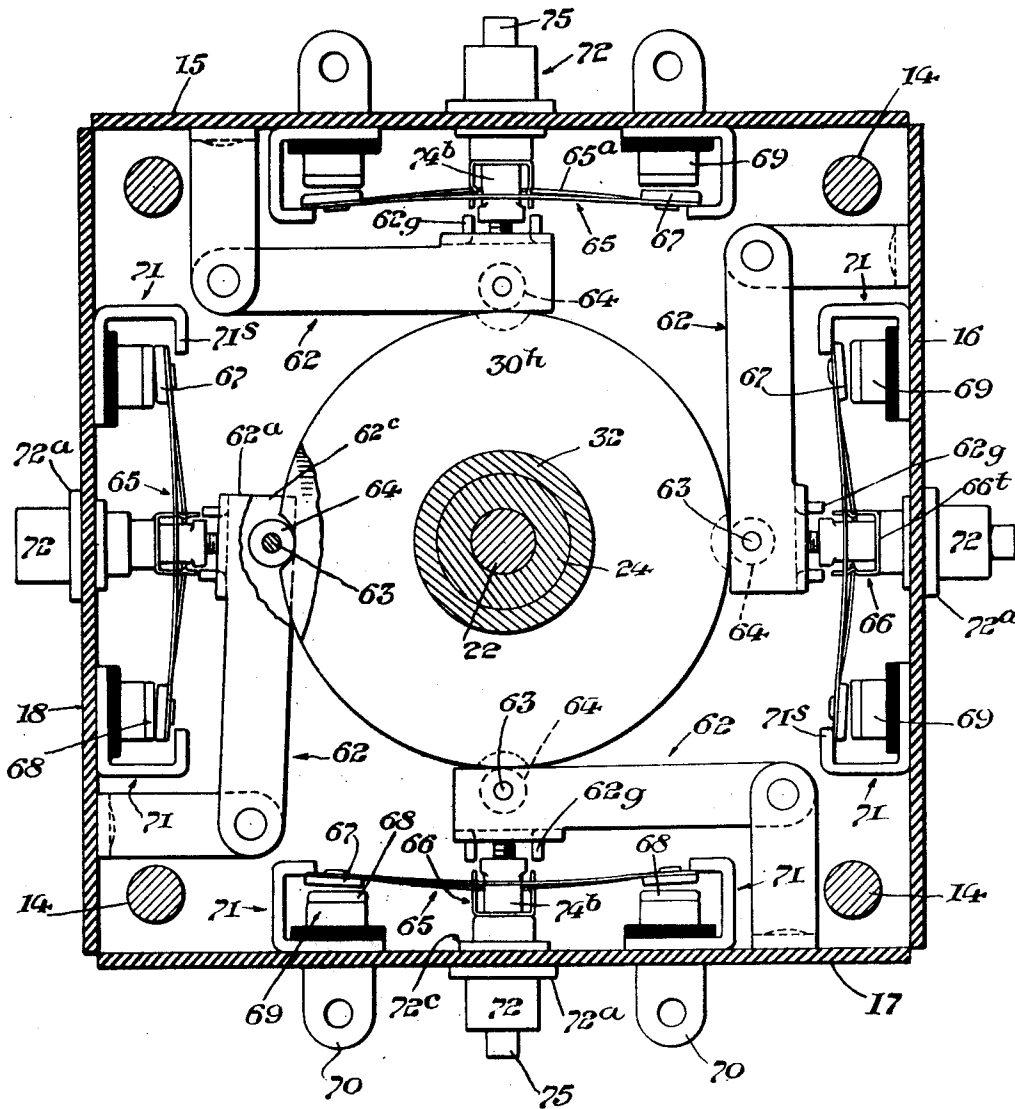
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Fig. 2.



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Fig. 4.

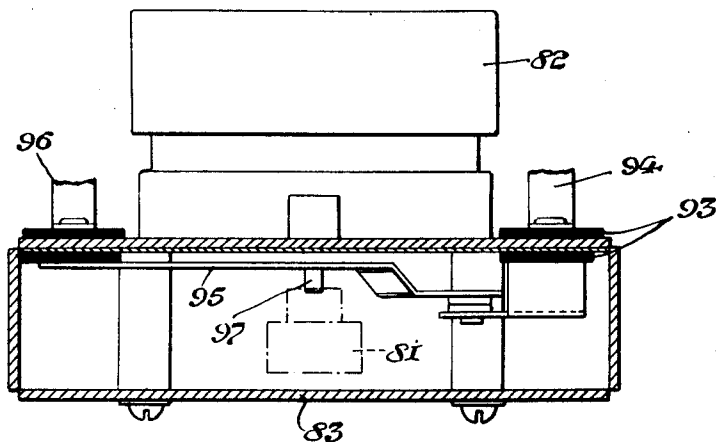
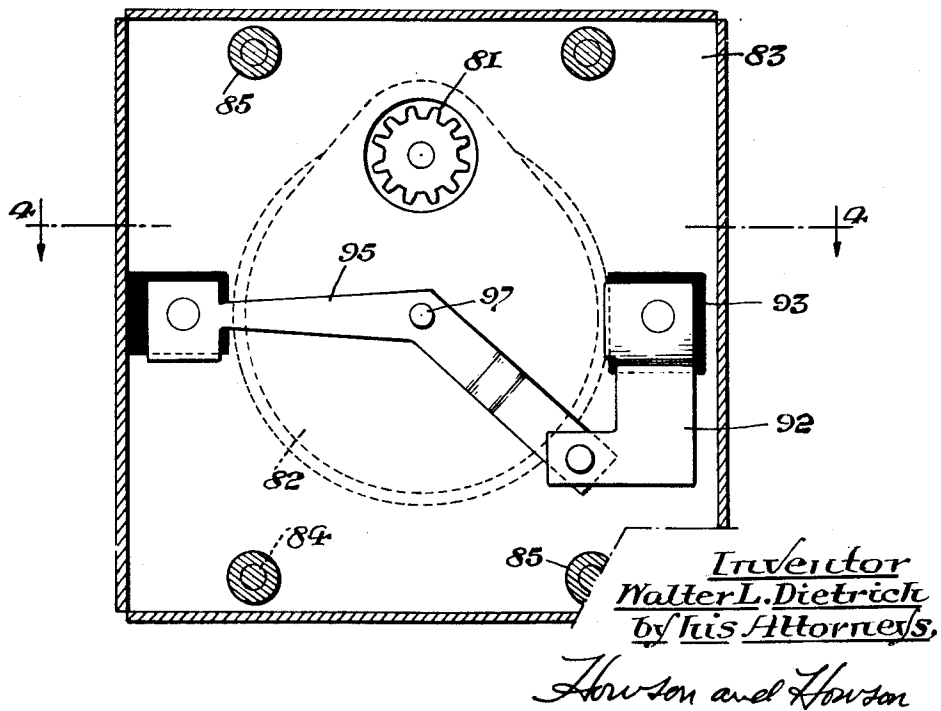


Fig. 3.



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Fig. 5.

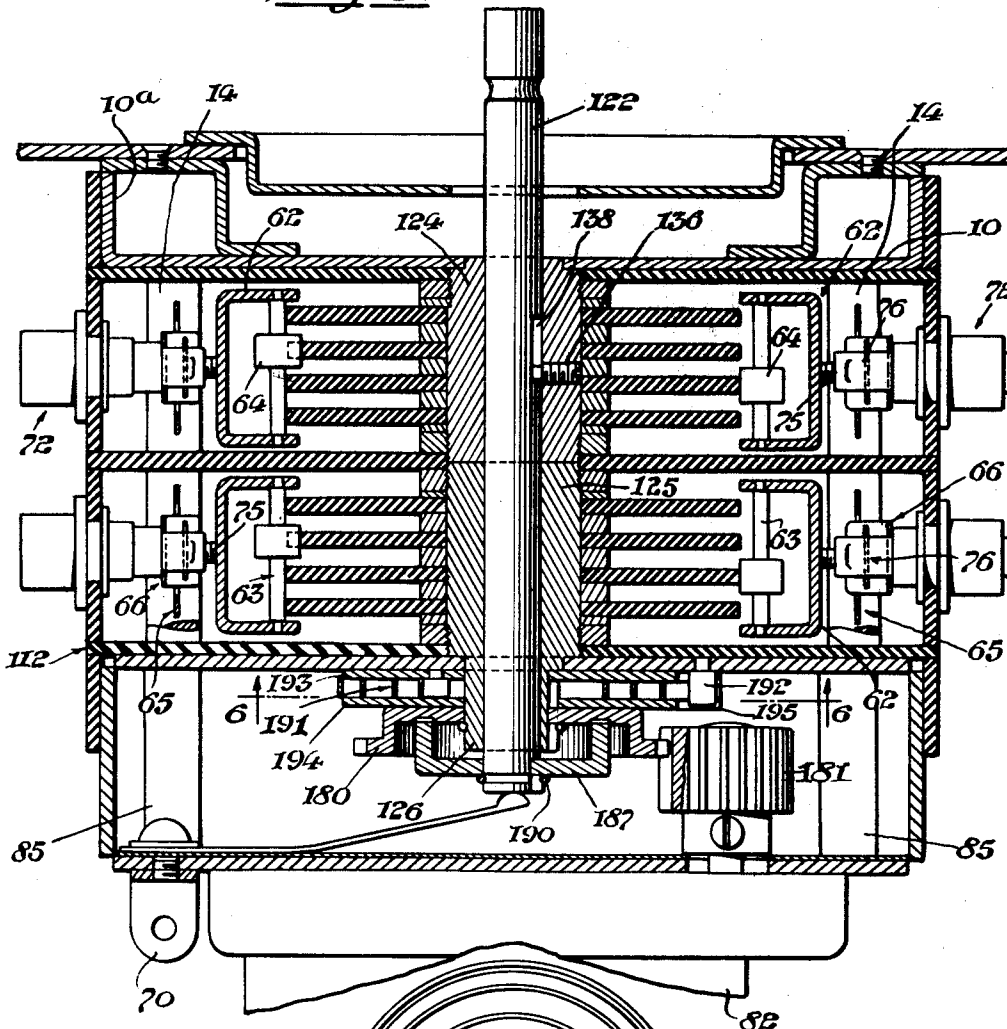
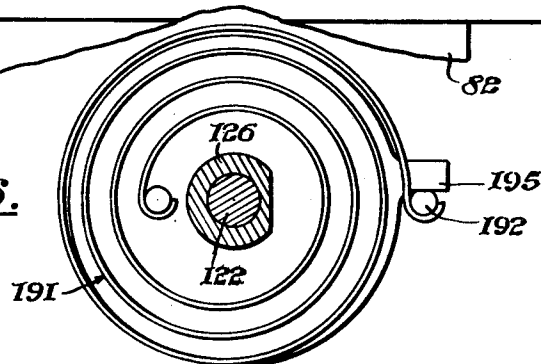


Fig. 6.



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Fig. 7.

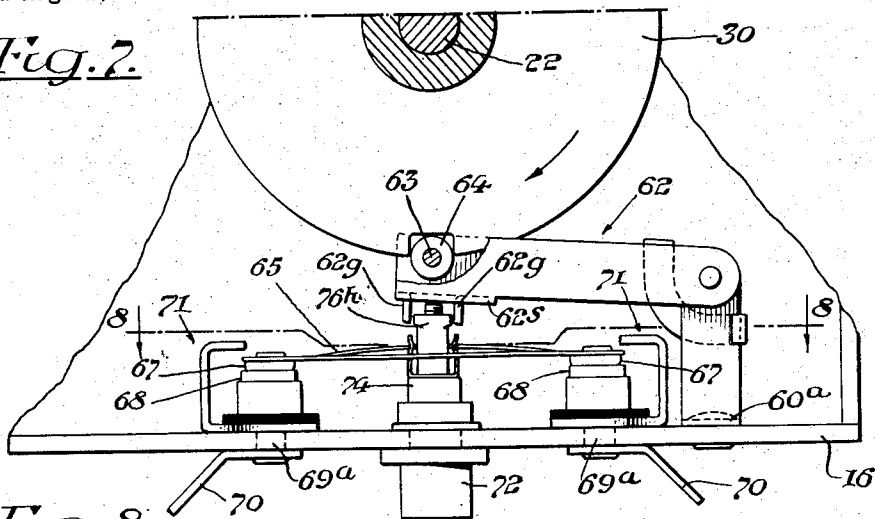


Fig. 8.

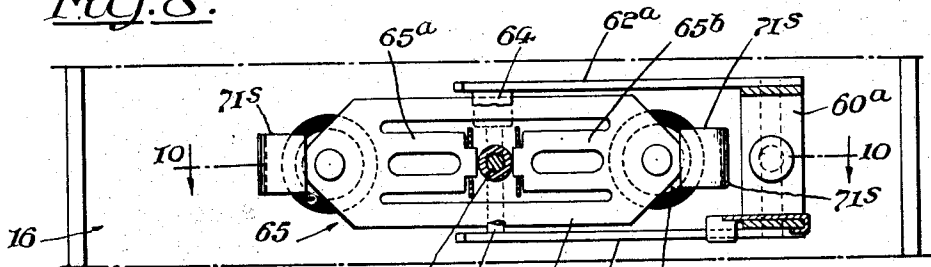


Fig. 9.

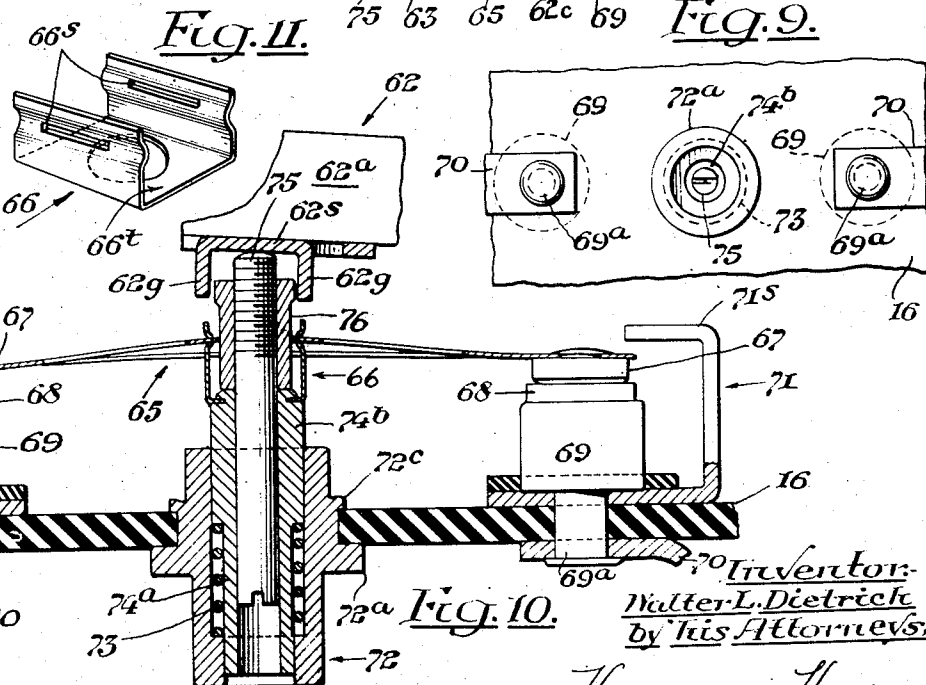


Fig. 10.

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UNITED STATES PATENT OFFICE

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MULTIPLE CIRCUIT CONTROL SWITCH

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Application August 2, 1949, Serial No. 108,185

8 Claims. (Cl. 200—38)

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This invention relates to electric switches for controlling a multiple of circuits. More particularly it relates to a multiple circuit control switch driven by a time mechanism in which the time mechanism or clock motor can be disengaged from the switch to permit operation of the switch manually when desired. Devices of the type to which this invention relates are commonly used now on automatic washing machines and other devices which require time control of multiple circuits and which, additionally, require the switch to be capable of manual operation to shorten or change the sequence.

It is an object of the invention to provide an improved multiple circuit clock-controlled switch which will be of sturdy construction and reliable in operation.

Another object of the invention is to provide a switch of the foregoing type wherein the clock motor may be disengaged from the control mechanism so that the control mechanism may be manually operated to shorten or eliminate any stage of the cycle or to enable the cycle to be started at any point therein as desired.

Another object of the invention is to provide a switch of the foregoing type wherein the entire device is disconnected from the power lines during the manual manipulation of the contacts or the setting of the switch prior to its operation under control of the clock motor.

Another object of the invention is to provide a switch of the foregoing type wherein there are two sets of control contacts in which the operation of one set is adjustable so that it may operate simultaneously or differently than the other set.

Another object is to provide for automatic resetting or return of one of two sets of control contacts when the clock motor is disengaged from the contacts.

Another object is to provide for quick and accurate action of the switch contacts in the type of mechanism wherein control of the contacts is by rotary cams driven by a clock motor.

Other objects and advantages of the invention will become apparent as it is described in connection with the accompanying drawings.

In the drawings:

Fig. 1 is a longitudinal section view taken through a device embodying the invention;

Fig. 2 is a transverse section view taken along line 2—2 of Fig. 1;

Fig. 3 is a transverse section view taken along line 3—3 of Fig. 1;

Fig. 4 is a longitudinal section view taken along line 4—4 of Fig. 3 and illustrating the clock motor

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and its association with the driving and main control switch contacts;

Fig. 5 is a longitudinal section view similar to Fig. 1 of a modified form of the invention;

Fig. 6 is a transverse section view taken along line 6—6 of Fig. 5.

Fig. 7 is an enlarged detail view of a portion of the structure illustrated in Fig. 2;

Fig. 8 is an elevational sectional view taken along line 8—8 of Fig. 7;

Fig. 9 is a fragmentary detail view of the structure illustrated in Fig. 8 viewed from the opposite side from that of Fig. 8 or, in other words, from the outside of the device;

Fig. 10 is an enlarged detail section view taken along line 10—10 of Fig. 8;

Fig. 11 is an enlarged perspective detailed view of the switch spring compression element.

Referring to the drawings, fixed and movable contact elements and cams for selectively operating them are housed within a cubical container comprising a square top plate of metal 10 whose side edges are bent up at right angles to form flanges 10a. A bottom plate 12 also of sheet metal also has its side edges bent down at right angles to form flanges 12a. The top and bottom plates may be spaced apart by rods 14 placed in or near the four corners of the plates. Four insulating plates 15, 16, 17, 18 are at right angles to one another and secured by screws to the flanges 10a and 12a of the top and bottom plates, forming the side walls of the housing.

The casing may be divided, if desired, in two compartments by placing a wall of sheet insulation 19 within the housing, parallel to the top and bottom plates 10 and 12. Also the housing may be entirely insulated inside by placing sheet insulation plates 20 against the interior surfaces of the top and bottom plates 10 and 12.

The operating mechanism for the switch contacts may be set or controlled manually by a rotary handle 21 mounted on one end of a rotary spindle 22 which is movable to a limited extent longitudinally in sleeve 24 within which the spindle is mounted. The sleeve 24 has reduced top and bottom ends or necks 26 and 28 providing shoulders abutting the inner surfaces of the top and bottom plates 10 and 12. These necks form bearings rotating in bearing apertures in the center of the top and bottom plates. The sleeve 24 carries a plurality of sheet insulation cam discs, such as 30a, 30d, 30e and 30h mounted coaxially thereon and spaced apart by spacing washers 32 placed between the discs. For the purpose of illustration eight cam discs are shown

but this number may be increased or decreased as conditions require. The cam discs and washers are secured in place upon the sleeve 24 by nuts 34 screwed upon threads formed on the top and bottom parts of the sleeve adjacent the necks 26 and 28.

To cause the sleeve and spindle to rotate together a radial pin 36 is driven through passage-way or bore in the sleeve so that its end enters a longitudinal slot 38 in the periphery of the spindle, preferably about at its middle. Thus the pin 36 will permit, but limit, the amount of longitudinal or axial motion of the spindle within the sleeve.

In order to hold the spindle in different axial positions a thick metal indexing disc 40 is provided around the neck of the sleeve and spindle just above the upper surface of the top plate 10. This disc contains a diametrical bore within which are coiled compressed springs 44 which press balls 42 into engagement with circumferential or annular grooves 48 and 50 spaced along the spindle but adjacent to one another. Springs 44 may be held within the bores in any suitable fashion such as by small pins 46 driven through the disc and diametrically across the bore near the periphery of the disc.

In order that the balls 42 may engage the circumferential grooves, the sleeve 24 has bored in its neck 28 openings in alignment with the diametrical bore in the disc 40, within which openings the balls 42 are normally located. Because the balls 42 are of greater diameter than the thickness of the neck of the sleeve, the indexing disc 40 is maintained by the balls in its axial position upon the neck of the sleeve, it being impossible to remove the disc axially along the neck of the sleeve without first removing the balls and their biasing springs from the diametrical bore in which they are located. That is because the balls protrude into the spring bore of the disc while being held against axial movement by the sleeve neck 28.

Although two circumferential grooves 48 and 50 are shown, the invention is not limited to that number. If it should be desirable to have the spindle take additional positions, additional circumferential grooves can be provided.

In the event that a different thickness of ball and neck be employed, the indexing disc 40 may be held in place upon the sleeve by providing a set screw (not shown) radially entering the disc and engaging the neck 26 or depression or radial bore therein.

The cam discs have high parts and depressions to cause operation of individual switches. The individual switches may comprise movable contacts to engage and disengage fixed contacts. The switch may be of any suitable form but preferably are of the snap-acting type known as sensitive switches in which a small amount of movement of the operating members of such a switch suffices to actuate the movable contact. It is desirable to use the snap-acting sensitive switches because as hereinafter described, the cams are rotated by a clock motor and hence move slowly. Thus, the opening and closing of the contacts is most satisfactory with the snap-action type of switch.

Each cam disc controls one switch in the example of the invention as illustrated. The switches are identical and hence description of one will suffice.

Referring particularly to Figs. 7-11 the switch mechanisms each comprise a stamped U-shaped

metal supporting member 60 having its transverse part 60a riveted to a side plate (such as 16) of the housing. Pivotaly mounted upon the ends of the parallel arms of the supporting member 60 is a lever member 62 comprising parallel legs 62a, 62c, joined transversely at their free ends by an integral strut 62s.

Extending between the legs 62a, 62c and journaled in them just above the strut 62s is axle 63 upon which there is an integral roller 64. The roller is positioned along the axle so as to engage one of the cam discs as may be seen in Fig. 1. By varying the position of the roller any one of the cam discs can be selected to engage that roller, and thus to control the movement of the lever 62 and the individual switch which it operates. The strut 62s is engaged by an adjustable plunger arrangement which reciprocates when moved by the lever 62 so as to control the operation of the movable contact. The movable contact comprises a thin, flexible leaf spring member 65 which is stamped from sheet metal with an H-shaped opening therein as illustrated in Fig. 8. Flexible apertured arms 65a and 65b, formed by the stamping out of the movable contact member are in the plane of the contact member as stamped. However they are later stressed or bowed upwardly by the insertion between them of a compression member 66 of substantially U-shape and stamped from thin flexible sheet metal with slots 66s in its arms to receive the ends of the arms 65a, 65b. The compression member 66 is mounted on the plunger as hereinafter more fully described.

Movement of the arms 65a and 65b through the plane of the contact member 65 from one side to the other thereof—causes snap action movement of the ends of the contact member 65 also with a snap-action in a manner now well understood by those familiar with the art. At the ends of the contact member are contact buttons 67 to engage and disengage fixed contact buttons 68 mounted on fixed contact members 69. The fixed contact members have rivet extensions 69a passing through the insulating plate 16 and through a metal terminal plate 70 on the outside of the insulating plate. Between the fixed contact member 69 and the inside surface of the insulating plate 16 is located one leg of a rigid stop member 71 stamped from sheet metal into substantially J-shape. By peening over the ends of the rivet portion 69a, the stop member 71, fixed contact 69 and terminal member 70 are thus secured to the plate 16. The portion 71s of the stop member 71 overlies the end of the movable contact to limit the switch opening or disengaging movement of the movable contact member at each end, it being understood that similar fixed contact structure and stop members are provided at each end of the movable contact as well illustrated in Figs. 2, 7 and 10.

It is desirable to be able to adjust for accuracy the position of the movable switch contact and thus its action from the outside of the switch housing. For this purpose the plunger device is constructed in the following manner. A support or bearing member 72 is mounted in the insulating plate 16. This bearing member has a flange 72a abutting the outside surface of the plate 16 and a similar interior flange 72c which is stamped down upon the interior surface of the plate 16 to secure the bearing member permanently in place. The bearing member has a bore which is reduced near its outer end to

form a shoulder against which presses one end of a compression spring 73. The other end of such spring 73 presses against a shoulder on a sleeve member 74 whose outwardly facing end 74a is of reduced diameter and slides in the smaller part of the bore in the bearing member 72. The inner end of the sleeve member 74 slides within the larger portion of the bore in the member 72.

Upon the larger or inner end 74b of the sleeve member is secured the compression member 66. The compression member is secured by upsetting an extending neck of the sleeve end 74b onto the inside surface of the transverse portion 66t of the compression member.

The adjustment of the position of the movable contact is accomplished by manipulating a screw bolt 75 which slides within the sleeve 74 and has its inner end extending inwardly of the switch housing to engage the lever 62. A square-headed nut 76 is threaded upon the end of the screw bolt 75 to fix the adjustment and to determine the inward movement or location of the screw bolt into or relatively to the sleeve member. The abutment of the nut 76 against the sleeve 74 thus limits the movement of the screw bolt 75 into the sleeve. To maintain the adjustment, parallel lugs 62g are struck down from the lever strut 62s in position to embrace the sides of the nut. A slot is provided in the head of the bolt. This slot is available from the outside of the plate 16 by use of a small screw driver inserted in the sleeve 74. By turning the bolt a relatively fine adjustment can be obtained of the action of the switch. Since the clockwork rotates the controlling cams a relatively fine adjustment is desirable in order that the switch contacts shall not separate or engage before or after they should.

In the embodiment illustrated there are eight switch mechanisms of the sort just described. Two switches are mounted on each of the four side plates of the housing, one set of switches being above another in position for the upper four to be controlled by the four upper cams and the lower four to be controlled by the four lower cams. The rollers of each switch are located at four different places on their axles so that one cam is in the plane of one roller of each switch and thus controls that switch.

If it is desired to have one cam control two switches, their rollers will be in the same plane or on the same level as the controlling cam. If the two cams are to control one switch, then two rollers will be formed on one axle of that switch in planes of the two controlling cams. It will be obvious of course that the number of cams and switches can be varied to suit the particular conditions.

For driving the spindle 22 and sleeve 24, a gear 80 (Fig. 1) is mounted on the end of the spindle in mesh with a pinion 81 (Figs. 1 and 3) driven by a clock mechanism 82. The clock mechanism is preferably electrically driven. Since its details form no part of this invention they need not be specifically described. The clock mechanism is mounted on a plate 83 whose sides are bent up so as to be coplanar with the planes of the bent-down sides of the bottom plate 12 of the housing. Plate 83 is secured to the bottom plate 12 in spaced relation thereto by bolts 84 threaded into hollow internally-threaded posts 85 mounted upon and extending from the bottom plate 12.

In order that the clock mechanism not be

damaged by turning the spindle 22 nor the controlling mechanism damaged by attempts to operate it contra the clock motor and also in order to permit turning of the spindle manually while the gear 80 and pinion 81 are in mesh, a friction clutch is provided between the spindle and the gear 80. The gear 80 is cup-shaped and internally threaded. It has therein a driving disc 86 having a collar 87 non-rotatably mounted on and turning with the spindle 22. A concave flexible spring disc 88 lies against the driving disc 86 and it is pressed thereagainst by a circular cover member 89 screwed into the gear member 80. The spindle 22 may be flattened on one side of its end portion to receive and cooperate with a similar flat interior surface within the collar 87. The forming of the flat surface on the spindle provides a shoulder so that the collar and driving disc are thus limited in the amount of axial movement onto the end of the spindle. To hold the clutch member mechanism in place a spring ring 90 fits into a circumferential groove in the spindle near its end, although the clutch mechanism might be maintained on the spindle in any other suitable fashion.

It is desirable in some uses of the invention that all the electric circuits be open while the switch is being manually set or manipulated from one position to another. One example of such use is in electric automatic washing machines.

To permit accomplishment of this objective, disconnect contacts are mounted on the back plate 83. They may comprise a fixed contact member 92 stamped from sheet metal and secured in insulated relation upon the back plate 83 by the use of insulating washer members 93 on opposite sides of the back plate. A rivet may secure a terminal member 94 on the opposite side of the plate from the contact member 92 on top of the outer insulating washer while at the same time securing the contact member on top of the inner insulating disc 93 and connecting the contact and terminal.

The movable contact member may comprise a flat V-shaped flexible metallic stamping riveted at one end to the backplate 83 in insulated relation similar to the securing of the fixed contact. A terminal member 96 may similarly be held in place by the same rivet that secures the movable contact member.

The free end of the movable contact is located and positioned for engagement with the fixed contact. It is normally stressed by inherent springiness to engagement with the fixed contact. In order to cause separation of the contacts there is mounted upon the movable contact a pin 97 in alignment with the spindle 22; and an insulating tip member 98 is mounted upon the end of the spindle for engagement with the pin 97 when the spindle is pressed inwardly, thereby to cause separation of the movable and fixed contacts. These contacts 95 and 92 may be in the main control circuit of the device whose operations are to be under main control by the individual switches housed in the main portion of the switch. Thus when the contacts 92 and 95 open they cause the power supply into the circuit to be cut off. Since the circuits for this arrangement form no part of this invention and are well known to those skilled in the art, they need not be illustrated or further described.

In the alternative construction illustrated in Fig. 5 (described and claimed in my divisional application Serial No. 274,025, filed February 28, 1952, entitled "Multiple Circuit Control Switch")

the sleeve upon the spindle instead of being made in one part as was sleeve 24, is made in two parts, 124 and 125, both of which are mounted upon the spindle 122. Insulation cams are mounted on the sleeve parts in the same manner as previously described. In this form of the invention the upper four operating cams are carried by the sleeve part 124 and the lower four cams are carried by the sleeve part 125. In order to cause the sleeve part 124 and the operating cams carried thereby to turn with the spindle, the spindle 122 has a slot 130 therein engaged by the end of a radial pin 136 mounted in the sleeve part 124. The sleeve part 125 is caused to turn with the spindle by a clutch mechanism between them.

The clutch mechanism comprises a cup-shaped gear member 187 having teeth formed on its peripheral edge facing in an axial direction. Gear 187 is non-rotatably mounted on the end of the spindle 122 by having the spindle end flattened on one side to cooperate with a similar flat space in a spindle-receiving aperture in the gear 187. A spring ring 190 holds the gear 187 on the end of the spindle against the shoulder formed by adjacent flat portion of the end of the spindle.

The cup gear 187 can mesh with a drive gear 180 which is non-rotatably mounted on the end of an extension 126 of the sleeve part 125 in a fashion similar to the mounting of the gear 187 on spindle 122. Engagement of the gear 187 with the gear 180 is by a ring of teeth formed in the face of gear 180 to engage with the axially-positioned tooth of the gear 187. The gear 180 also has peripheral teeth meshing with a driving pinion 181 of the clock mechanism as hereinbefore described. A spring ring is or may be employed to hold the gear 180 on the end of the sleeve part 125.

Since spindle 122 can be moved axially, it is possible to disengage the gear 187 from the ring of the teeth in the face of gear 180. The sleeve part 124 and spindle 122 can therefore be rotated separately from the sleeve part 125.

In order to automatically return the sleeve part 125 and cams which it carries when the clutch is disengaged, a flat spring 191 is coiled spirally around the extension 126 of the sleeve part 125, one end of the spring being attached to that sleeve part and the other end of the spring being anchored to a pin 191 mounted on and extending from the bottom face of the housing part 112. The spring 191 may be housed in a cage comprising parallel disc plates 193, 194, on each side of the spring. These plates may be keyed to the sleeve extension 126. Stop arms 195 extending radially, in register, from the spring cage plates 193, 194 abut against spring pin 192 which also serves as a stop pin to locate the spring cage and sleeve part 125 with reference to the housing part 112 in expanded position of the spring. Thus, when the clutch is engaged the clock mechanism causes rotation of both gears 180, 187. Hence both sleeve parts 124 and 125 and their cams are driven together. During this rotation the spring 191 is wound up. The clock mechanism in the alternative just described (Fig. 5) is known as a gear shift motor and is available on the market. When it is deenergized the motor of the clock mechanism is automatically disconnected by means (not visible) within the clock housing, from the driving pinion 181. Hence the pinion 181 can turn freely when the spring 191 returns the parts to their starting position.

Thus the upper set of cams are manually adjustable by rotation of the spindle on merely pushing the spindle. The lower set of cams are not adjustable for they are constantly connected with the clock motor while it is energized; when deenergized the lower cams are returned at once by the return spring to original starting position. This arrangement can be used where an adjustable wash period, for example, is desired in automatic washing machines, although the invention obviously has other uses.

Many modifications within the scope of my invention will occur to those skilled in the art. Therefore I do not limit it to the specific embodiments illustrated and described.

What is claimed is:

1. In a time-controlled switching device, a plurality of rotary cam members, a sleeve member carrying said cam members, a manually-operable spindle slidable in said sleeve member, means connecting said sleeve member and spindle and permitting axial movement of the spindle within the sleeve and causing rotation of the sleeve with the spindle, separable contact means whose engagement and disengagement is controlled by rotation of said cam members, and disconnect switching means including contact means engaged by the end of said spindle as it is moved axially to cause engagement and disengagement of said disconnect switch contact means, and means insulating said spindle from said disconnect switch contact means, in combination with an electric clock motor having a driving pinion, a gear coaxial with said spindle and driven by said pinion, and clutch means between said gear and spindle to permit adjustment of said cam members independently of said clock motor, said clutch means including a member on and always turning with said spindle and engaging with said gear member.

2. A device as claimed in claim 1 wherein the clutch means includes a resilient member providing a frictional connection between said gear member and said spindle carried member.

3. A device as claimed in claim 1 wherein the gear member is cup-shaped and said spindle-carried member fits therein.

4. A device as claimed in claim 3 having a resilient member within said gear providing frictional connection between said gear member and spindle-carried member.

5. A device as claimed in claim 1 having indexing means associated with said spindle and said sleeve member to maintain said spindle in different axial positions relative to the sleeve member.

6. A device as claimed in claim 5 wherein the sleeve member is mounted rotatably in a housing but held against axial movement by engagement with said housing.

7. A device as claimed in claim 1 having an indexing member mounted non-rotatably on said sleeve member, and indexing means carried by said indexing member and engaging with said spindle to maintain said spindle in different axial positions relative to the sleeve member.

8. A device as claimed in claim 1 having an indexing member mounted on said sleeve member, a spring pressed ball in a passage in said indexing member and passing through a passage in said sleeve member and engaging said spindle to maintain the spindle in different axial positions relative to the sleeve member, said balls and said passages in said sleeve and indexing member being of relative dimensions such that the ball

in all normal positions is at least partly in both said passages whereby the indexing member is maintained in a fixed axial position on said sleeve member.

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