

June 17, 1958

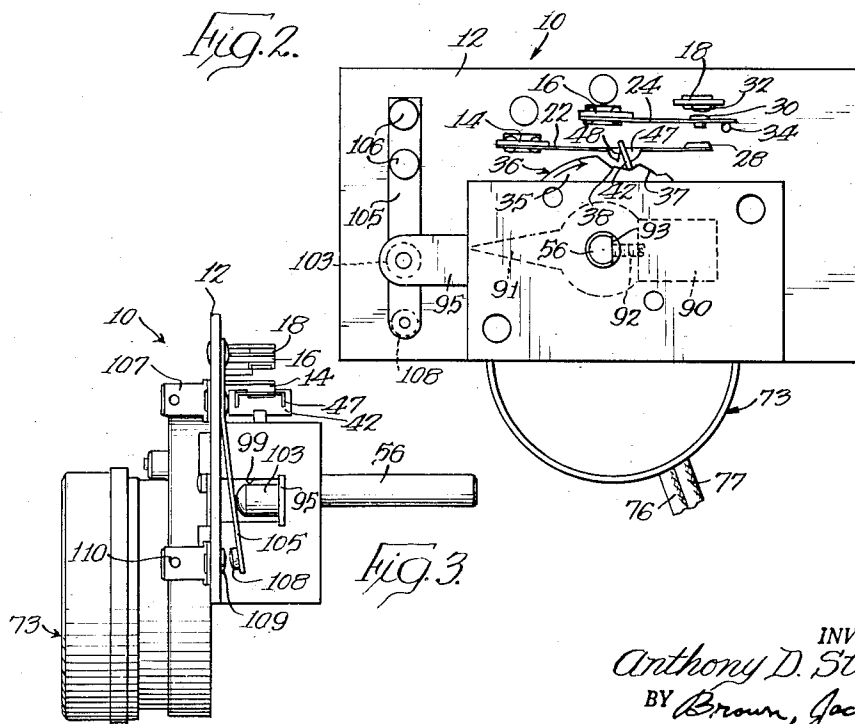
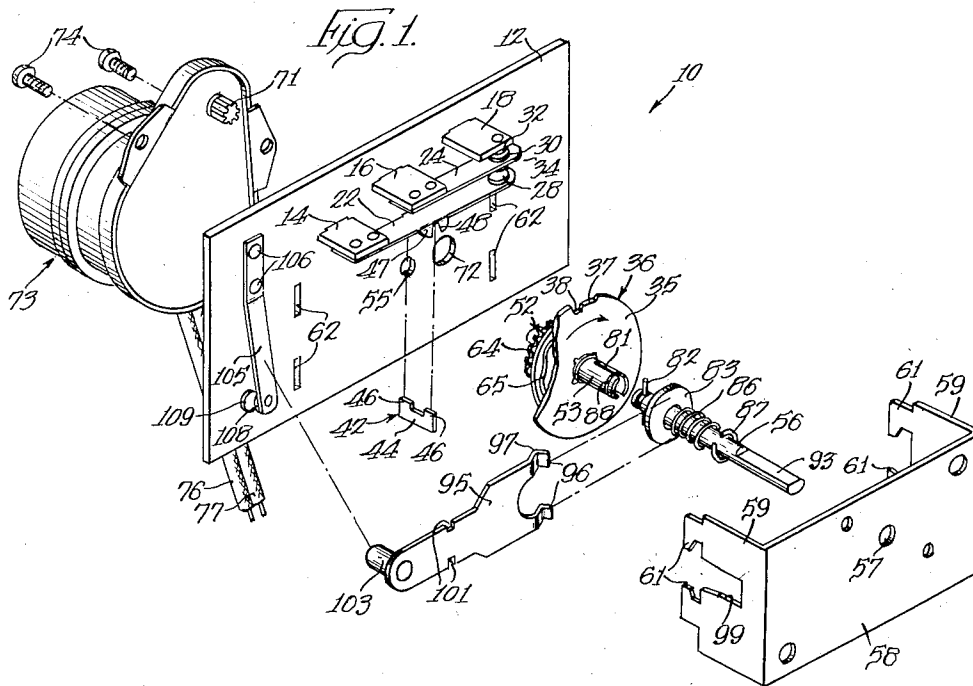
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2,839,623

TIME SWITCH MECHANISM

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2 Sheets-Sheet 1



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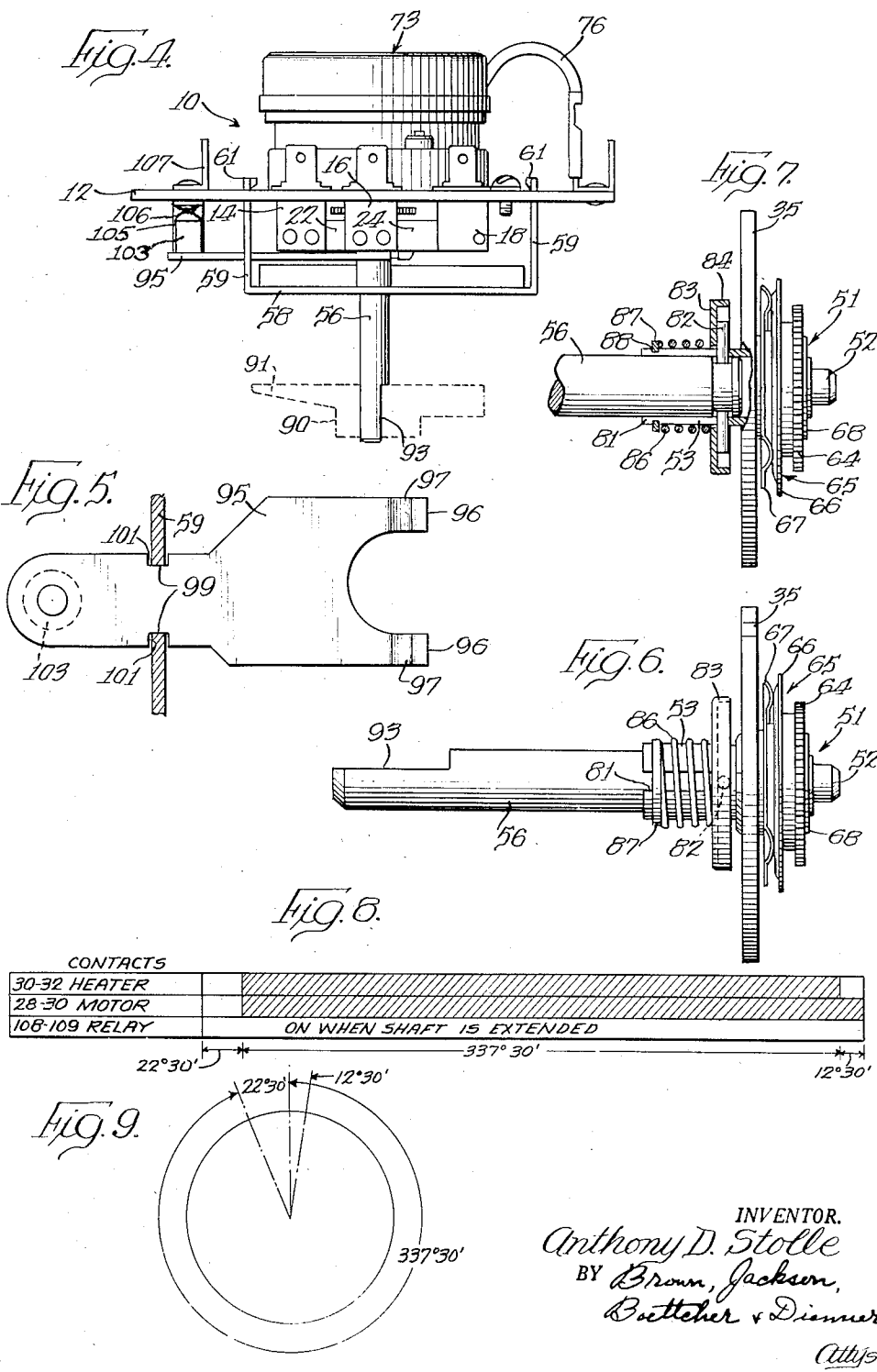
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2 Sheets-Sheet 2



1

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TIME SWITCH MECHANISM

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Application January 23, 1956, Serial No. 560,574

8 Claims. (Cl. 200—33)

The present invention relates generally to time switch mechanisms, and more specifically has reference to time switch mechanisms of the type wherein a set of main switch contacts is controlled by a manually settable time driven cam. This time driven cam is manually settable by the rotation of a control shaft carrying a control knob.

The general object of the present invention is to provide such a time switch wherein manual rotation of such shaft controls the set of main contacts, and wherein manual shifting of said shaft in an axial direction controls a set of supplemental contacts.

A further object of the invention is to provide such a time switch in which the operation of said supplemental contacts through the manual shifting of said shaft in an axial direction is in opposition to spring means, which immediately restores the supplemental contacts to normal position when the axial shifting force on said shaft is released.

The present invention enables the supplemental contacts to perform a supplemental control function preliminary to the operation of manually setting said cam by the manual rotation of said shaft, or it enables the supplemental contacts to perform a supplemental control function concurrently with the operation of manually setting said cam by the manual rotation of said shaft.

Other objects, features and advantages of the invention will appear from the following detailed description of one preferred embodiment thereof. In the accompanying drawings illustrating such embodiment:

Figure 1 is an exploded view of the time switch mechanism of my present invention;

Figure 2 is a front elevational view of the time switch mechanism;

Figure 3 is a side elevational or edge view of the time switch mechanism;

Figure 4 is a plan view of the same;

Figure 5 is a front elevational view of the supplemental contact actuating lever on an enlarged scale;

Figure 6 is a view on an enlarged scale, partly in section, showing the cam, friction slippage clutch and setting shaft;

Figure 7 is a fragmentary sectional view taken at right angles to Figure 6;

Figure 8 is a chart diagramming the sequence and time duration of the steps of a typical cycle controlled by the time switch; and

Figure 9 is a diagrammatic knob layout showing the sequence and angular duration of these different steps of a typical cycle.

Referring now to Figures 1 to 4 inclusive, there is indicated generally by the reference numeral 10 the time switch mechanism of the present invention. The time switch mechanism 10 comprises a supporting plate 12 which is preferably formed of insulating material and is generally rectangular. Staked in apertures formed in the upper half of the plate member 12 are metallic terminal post members 14, 16 and 18, the ends of which project through the plate member 12 and are adapted to have suit-

2

able connection with various electrical devices for timing the operations thereof. The process by which the terminal post members 14, 16 and 18 are staked to the supporting plate 12 is disclosed and claimed in the copending application of William P. Gallagher, Anthony D. Stolle, and Paul G. Bielik, Serial No. 365,842, filed July 8, 1953.

Secured, as by riveting, to the forward ends of the posts 14 and 16 are the ends of elongated, metallic spring type switch arms 22 and 24. The other ends of the switch arms 22 and 24 have respectively mounted thereon metallic contacts 28 and 30, the latter of which cooperates with a metallic contact 32 secured to the terminal post 18. The contacts 28, 30 and 32 normally stand in separated relation. The downward movement of switch arm 24 for separating contacts 30 and 32 is limited by the engagement of the outer end of the switch arm with a pin 34 projecting forwardly from the supporting plate 12.

The above described contacts 28, 30 and 32 constitute the main time control contacts which are controlled by a manually settable time driven cam 35. This cam is preferably composed of insulating material, and has a cam track 36 in which are formed two recesses 37 and 38 extending inwardly to different radial depths from the cam track 36. Riding on the peripheral edge of the cam 35 is a cam follower 42 which is associated with the adjacent switch arm 22. This cam follower 42 is of metallic C-shaped formation having a body portion 44 and arm portions 46. The cam follower 42 has a floating pivotal mounting on the switch arm 22. To this end, the switch arm 22 is formed at its opposite edges with spaced flanges 47 that project at right angles therefrom and toward the cam 35. Each flange 47 is formed in two parts, which define a substantially V-shaped recess 48 therebetween. The V-shaped recesses 48 at opposite edges of the switch arm 22 floatingly and pivotally receive the C-shaped cam follower 42 when the elements of the switch mechanism are in the assembled relation shown in Figure 2. The arm portions 46 of the cam follower 42 partially envelope the switch arm 22 and intersect the plane of the latter so as to serve to limit endwise movement of the follower 42 relative to the switch arm 22. When the cam follower 42 is riding on the cam track 36 the switch arms 22 and 24 are both flexed upwardly to bring all three contacts 28, 30 and 32 into engagement with each other. On the other hand, when the cam follower 42 has dropped down into the first recess 37 in the surface of the cam, the movable contact 30 on switch arm 24 has separated from the stationary contact 32, but the two movable contacts 28 and 30 on the two switch arms 22 and 24 are still in engagement with each other. Finally, when the cam follower 42 has dropped down into the second recess 38 in the surface of the cam, the movable contact 28 on the first switch arm 22 has separated from the movable contact 30 on the second switch arm 24, leaving all three contacts in the separated relation illustrated in Figure 2.

The time driven direction of rotation of the cam 35 is clockwise, as indicated by the arrows. Attention is directed to the fact that the pivotal axis of the cam follower 42 is offset from the axis of rotation of the cam 35 in this time driven direction of rotation. This causes the cam track 36 and the bottom surfaces of the cam recesses 37 and 38 to present downhill sloping surfaces to the lower edge of the cam follower 42 when the cam follower is engaging one of the surfaces. When the cam follower 42 is engaging one of these surfaces it occupies the angular position shown in Figure 2, with its lower edge sloping downhill in a clockwise direction. This is true irrespective of the direction of rotation of the cam 35 during manual setting of a cycle, the cam follower 42 immediately snapping to this downhill angular position after it has been forced up out of one of the recesses 37 or 38, even in a counter-clockwise direction of rotation of the cam 35, such as may

occur in the manual setting of the cam. As above described, this action of the cam follower 42 results by reason of the fact that the pivotal axis of the cam follower is offset from the axis of rotation of the cam 35. The clockwise direction of slope of the cam follower 42 on the cam surfaces 36, 37 and 38 minimizes wear between the follower and the cam during the motor driven clockwise rotation of the cam 35. Whenever the cam follower 42 drops into either of the recesses 37 or 38 it immediately snaps to the opposite angle of inclination momentarily, which aids in effecting a quick separation of the contacts. This is fully disclosed in the copending application of William P. Gallagher, Anthony D. Stolle, and Robert B. Ellis, Serial No. 393,802, filed November 23, 1953, and in the copending application of Anthony D. Stolle and Robert B. Ellis, Serial No. 450,436, filed August 17, 1954, now Patent No. 2,801,305.

Referring now to the mounting and the drive of the cam 35, this cam is mounted on a bushing or arbor 51 comprising a solid front bearing end 52 and a sleeve-like rear end 53. The front bearing end 52 of said bushing is journaled in a bearing aperture 55 provided in the insulating supporting plate 12. The sleeve-like rear end 53 of said bushing provides a socket in which the inner or rear end of a shaft 56 has a sliding fit. This shaft 56 has rotatable and slidable mounting in an aperture 57 formed in a bridge-like supporting or cover member 58 having side arm members 59 which are anchored to the supporting plate 12. Lugs 61 at the ends of the side arm members 59 are inserted through rectangular openings 62 formed in the supporting plate 12 and are then bent or twisted on the back side of the supporting plate to lock the supporting bridge member 58 in position. The rear end of the sleeve portion 53 of the bushing 51 substantially abuts the back side of the supporting bridge member 58, and the slidable engagement of the shaft 56 in said sleeve portion 53 maintains the bushing 51 and cam 35 in alignment with the aligned bearing holes 55 and 57.

The cam 35 is rigidly staked to the bushing 51, and is arranged to be time driven through a gear 64 which is rotatably mounted on the bushing on the back side of the cam 35. A friction slippage clutch 65 is interposed between the gear 64 and the cam 35, such clutch comprising a friction disk 66 which is rigid with the gear, and a spider arm disk 67 which is staked to the bushing 51. The disk 67 has spring acting spider arms which thrust rearwardly against the friction disk 66 and establish a frictional slippage connection between the gear 64 and the bushing 51. A ring or flange 68 on the bushing 51 at the rear side of the gear 64 confines the gear against endwise displacement along the bushing from the pressure of the spring acting spider arms.

Meshing with the gear 64 is a pinion 71 that projects through an aperture 72 formed in the supporting plate 12. The pinion 71 is drivingly connected through reduction gearing with a slow speed synchronous electric motor, the latter assembly being indicated generally by the reference numeral 73. The electric motor and reduction gearing unit 73 is secured by screws 74 to the mounting plate 12, with the electric motor adapted to be placed in communication with an electric power source through lines 76 and 77 which are suitably connected to appropriate switch terminals. The friction slippage clutch 65 enables the cam 35 to be manually set to different angular positions relatively to the drive established through pinion 71 and gear 64.

Two diametrically opposite slots 81, 81 extend axially of the socket-like sleeve portion 53 from the outer end thereof almost to the cam 35. Engaging in these slots 81 are the opposite ends of a pin 82 which extends transversely through the inner end of the rotatable and reciprocable timer shaft 56. Bearing against the outer side of the pin 82 is a thrusting washer 83 which has a sliding fit over the socket-like sleeve portion 53. This thrusting washer or collar 83 has a forwardly projecting confining

lip 84 which prevents endwise displacement of the pin 82 from the shaft 56. A compression spring 86 is confined between the outer side of the thrusting collar 83 and a C-shaped snap retaining ring 87 which snaps into an annular groove 88 formed in the outer end of the sleeve portion 53. This compression spring 86 normally holds the thrusting collar 83 shifted inwardly, with the transverse pin 82 at the inner ends of the slots 81 and the shaft 56 at the inner limit of its shifting movement. Mounted on the outer end of said shaft is a manually actuated setting knob or handle 90 having a pointer 91 which points to different indicia on a dial plate surrounding the shaft 56. The knob 90 is held on the shaft by a set screw 92 which engages a flat spot 93 on the outer end of the shaft. It will be seen that by manual rotation of the knob 90 the cam 35 can be rotated into any desired angular setting relatively to the main contacts 28, 30 and 32. By pulling outwardly on the knob 90 the shaft 56 and thrusting collar 83 are shifted axially outwardly for actuating a set of supplemental contacts, as will now be described.

In such outward shifting, the thrusting collar 83 transmits pivotal motion to one end of a contact actuating lever 95. This end of said lever is bifurcated to provide a pair of fork arms 96 having humps 97 which bear against the thrusting collar 83 on opposite sides of the compression spring 86. The shank portion of this lever passes out through a slot 99 formed in the left hand side arm 59 of the supporting bridge member 58, the slot 99 extending out to the end of the side arm 59 between the lugs 61 (Figure 1), in order to permit insertion of the lever into the slot. The shank portion of the lever is provided with notches 101 in its opposite edges which embrace the top and bottom edges of the slot 99, affording a fulcrum mounting for the lever in the outer end of the slot 99.

Mounted at the outer end of the lever 95 is an insulating peg or button 103 which extends forwardly therefrom for engaging a spring blade type of switch arm 105. The upper end of the switch arm is secured to the insulating panel 12 by a pair of rivets 106, one of which effects anchored attachment to a terminal 107 mounted on the back side of the panel. The lower end of the switch arm 105 carries a contact 108 which is adapted to engage a stationary contact 109 having riveted attachment through the insulating panel 12 with a terminal 110 mounted on the back side of the panel. The outward spring pressure of the switch blade 105 normally holds the actuating lever 95 at the outer closed end of the slot 99, with the bifurcated end of the lever bearing against the thrusting collar 83. It will be seen from the foregoing that outward pull exerted on the knob 90 will operate through the shaft 56, transverse pin 82 and thrust collar 83 to rock the lever 95 in its fulcrumed mounting 99, 101, for flexing the spring blade 105 inwardly, thereby bringing the two supplemental contacts 108, 109 into engagement with each other. This closing of the supplemental contacts 108, 109 can be performed preliminary to the operation of manually setting the cam 35, as by pulling outwardly on the knob 90 and then releasing the knob before rotating it to manually set the cam 35; or this closing of the supplemental contacts can be performed concurrently with the operation of manually setting the cam, as by pulling outwardly on the knob 90 and while the knob is thus pulled outwardly rotating it to manually set the cam 35.

The present time switch has been devised particularly for controlling a clothes dryer, but its use is not limited thereto. In one typical adaptation to a clothes dryer, the contacts 28 and 30 control the electric motor which drives the clothes drum or tumbler, and the contacts 30 and 32 control the electric heating element directly in an electrically heated embodiment, or control the gas valve solenoid of a gas heated embodiment. Normally, the cam 35 stands in the position illustrated with the main contacts 28, 30 and 32 separated. The timing motor 73 which drives the time switch is usually connected to be

controlled by the tumbler motor contacts 28, 30. When the housewife desires to set the dryer into operation she turns the cam 35 to bring the cam rider 42 up onto the cam dwell 36. This closes both pairs of contacts 28, 30 and 30, 32. The full length of the cam dwell 36 establishes a relatively long drying interval for drying abnormal loads, such as turkish towel material, woolen rugs, etc., this full length drying interval being typically represented as in the neighborhood of 180 minutes. For obtaining a shorter drying interval, as for drying cottons, linens, etc., the housewife turns the cam 35 when initially starting the dryer, so that a shorter length of cam dwell 36 passes under the cam rider 42 before the cam recess 38 returns the cam rider 42 to normal position.

The supplemental contacts 108, 109 govern a control relay which cooperates with contacts 30, 32 in exercising a control function over the electrical or gas heated operation of the dryer. This relay can be connected to the main contacts and to the supplemental contacts in various circuit arrangements. In one circuit arrangement, the main contacts 30, 32 are in series with the relay coil, as well as the supplemental contacts 108, 109. With this circuit arrangement, the housewife is required to turn the knob 90 either before or concurrently with the operation of pulling out the knob, whereby to have the contacts 30, 32 and 108, 109 simultaneously closed for energizing the relay and starting the heating apparatus. In another circuit arrangement wherein the relay is responsive to a thermostat in the dryer, the housewife can pull out and release the knob 90 before she turns the knob 90 for starting the dryer or setting up a particular time on the cam 35. It will be understood that the supplemental contacts 108, 109 can be employed in other circuit controlling relations than those above described.

Figure 8 illustrates a time chart of the above described cycle of the dryer, showing the relative times that the cooperating pairs of contacts are opened and closed.

Figure 9 illustrates a diagrammatic layout of the different positions of the manually actuated setting knob 90 corresponding to the above cycle.

It will be understood that the above described sequence of operations and the time intervals of these operations are merely typical of one arrangement of my improved timing mechanism, and that this sequence of operations and the time intervals thereof may be widely varied as operating conditions require.

While I have shown and described what I regard to be the preferred embodiment of my invention, nevertheless it will be understood that such is merely exemplary and that numerous modifications and rearrangements may be made therein without departing from the essence of the invention.

I claim:

1. In time switch mechanism of the class described, the combination of a set of main contacts, a rotatable circular cam having a cam track adapted to control said main contacts, said cam track having a recess therein rotatable into a contact actuating position where it causes actuation of said main contacts, a rotatable setting shaft connected with said rotatable cam, a manually rotatable and axially shiftable setting knob mounted on said setting shaft and operatively connected with said cam whereby the manual rotation of said setting knob in either direction is operative to rotate said cam in either direction to place said contact actuating recess in a preselected timing position spaced angularly from said contact actuating position, time driven means connected for rotating said cam in one direction at a timed rate from said preselected timing position which has been established through said knob into said contact actuating position, means mounting said setting knob for axial shifting movement from an inner position adjacent to said cam to an outer position more removed from said cam, a lever disposed adjacent to said setting shaft, pivot means defining a pivot axis for said lever extending substantially at right angles

to the axis of said setting shaft, means responsive to axial shifting movement of said setting knob from said inner position to said outer position for imparting swinging movement to one end of said lever, a set of supplemental contacts responsive to swinging movement of the other end of said lever and movable to closed circuit position in response to axial shifting movement of said setting knob into its outer position, and spring means continuously opposing the axial shifting movement of said setting knob from said inner position to said outer position, whereby through the axial shifting movement of said setting knob said supplemental contacts can be moved to closed circuit position either preliminary to or concurrently with the rotative setting adjustment of said cam effected by manual rotation of said setting knob, but, whereby after said setting knob is released upon completing the cam setting operation said supplemental contacts are automatically restored to open circuit position by the action of said spring means operating to axially shift said setting knob back to its inner position.

2. In time switch mechanism of the class described, the combination of a set of main contacts, a rotatable circular cam having a cam track adapted to control said main contacts, said cam track having an undulation therein rotatable into a contact actuating position where it causes actuation of said main contacts, a rotatable setting shaft connected with said rotatable cam, a manually rotatable setting knob mounted on said setting shaft and operatively connected with said cam whereby the manual rotation of said setting knob is operative to rotate said cam to place said contact actuating undulation in a preselected timing position spaced angularly from said contact actuating position, time driven means connected for rotating said cam in one direction at a timed rate from said preselected timing position into said contact actuating position, means mounting said setting knob for axial shifting movement between an inner position adjacent to said cam to an outer position more removed from said cam, a lever, pivot means defining a pivot axis for said lever adjacent to said setting shaft, means responsive to axial shifting movement of said setting knob between said two positions for imparting swinging movement to said lever, a set of supplemental contacts responsive to such swinging movement of said lever, and movable into a predetermined circuit controlling position in response to such manual shifting movement of said setting knob, and spring means continuously opposing such manually operated shifting movement of said setting knob, whereby through the axial shifting movement of said setting knob said supplemental contacts can be moved to said predetermined circuit controlling position either preliminary to or concurrently with the rotative setting adjustment of said cam effected by manual rotation of said setting knob, but whereby after said setting knob is released upon concluding the cam setting operation said supplemental contacts are automatically moved out of said predetermined circuit controlling position by the action of said spring means operating to axially shift said setting knob back to its normal position.

3. In a switch assembly, the combination of a revolvable cam provided with a track having a recess therein, switch arm means having a first main contact adapted to move into and out of engagement with a second main contact, a floating cam follower associated with said switch arm means and engageable with said cam track for moving said first main contact into and out of engagement with said second main contact, time driven means for driving said cam, a manually operable control knob mounted for rotary and reciprocal movement, means for transmitting rotary movement from said knob to said cam, a thrust collar responsive to reciprocal movement of said knob, a helically coiled spring mounted concentrically of said thrust collar and

tending constantly to reciprocate said knob and thrust collar in one direction, a lever actuated by reverse reciprocation of said thrust collar, and supplemental contacts operated by said lever.

4. In a switch assembly, the combination of a revolvable cam provided with a track having a recess therein, switch arm means responsive to said cam, said switch arm means having a first main contact adapted to move into and out of engagement with a second main contact, time driven means for driving said cam, a bushing mounting said cam, said bushing having a socket-like sleeve portion provided with an axial slot, a manually actuated rotatable and reciprocable control shaft entering said sleeve portion, a pin carried by said shaft engaging in said axial slot for transmitting rotary motion from said control shaft to said bushing and cam, a thrusting collar actuated by reciprocal motion of said control shaft, a helically coiled spring surrounding said shaft and normally tending to shift said shaft and thrusting collar in one direction, a setting knob carried by said shaft for rotating said shaft in either direction and for shifting said shaft and thrusting collar in the direction in opposition to the action of said spring, a lever operated by said thrusting collar, and supplemental contacts responsive to said lever.

5. In a switch assembly of the class described, the combination of a rotating mounting bushing, a revolvable cam mounted thereon provided with a track having a recess therein, a gear mounted on said bushing, a friction slippage clutch transmitting rotation from said gear to said cam, time driven means for driving said gear, switch arm means having a first main contact adapted to move into and out of engagement with said second main contact, cam follower means adapted to ride on said cam and to actuate said switch arm means, said bushing having a sleeve-like socket in one end, said socket having a longitudinal slot therein, a manually actuated control shaft having slidable mounting in said socket, a pin carried by said shaft engaging in said longitudinal slot, a thrusting collar bearing against said pin, a helically coiled spring surrounding said socket and bearing against said collar, a retainer ring mounted on said bushing for retaining the opposite end of said spring, a lever having a forked end bearing against said thrusting collar, second switch arm means actuated by said lever, and supplemental contacts operated by said second switch arm means.

6. In a switch assembly of the class described, the combination of a mounting panel, a revolvable cam rotatably supported on said panel and provided with a cam track having a recess therein, switch arm means carried by said mounting panel and arranged to respond to said revolvable cam, said switch arm means having a first main contact adapted to move into and out of engagement with a second main contact, a U-shaped supporting member having its side arms secured to said mounting panel, a manually operable control shaft mounted for rotary and reciprocal movement in said U-shaped supporting member, a knob mounted on said shaft on the outer side of said U-shaped supporting member, a helically coiled spring mounted on said shaft between said U-shaped supporting member and said mounting panel, said spring tending constantly to reciprocate said shaft and knob in one direction; means for transmitting rotary movement from said shaft to said cam, a lever having rockable mounting in one of the side arms of said U-shaped supporting member, means for

transmitting reciprocal movement of said shaft to said lever in opposition to the action of said spring, and supplemental contacts operated by said lever.

7. In a switch assembly of the class described, the combination of a mounting panel, a revolvable cam rotatably supported by said panel, said cam having a varying cam track in its periphery, switch arm means carried by said panel and arranged to respond to the periphery of said cam, said switch arm means having a first main contact adapted to move into and out of engagement with a second main contact, time driven means for driving said cam, a U-shaped supporting member having its side arms secured to said panel, a manually operable control shaft mounted for rotary and reciprocal movement in said supporting member, means for transmitting rotary movement from said shaft to said cam, a spring tending constantly to reciprocate said control shaft axially in one direction, a thrust collar responsive to reciprocal movement of said shaft, a lever arranged to be actuated by said thrust collar, a slot in one of the side arms of said U-shaped supporting member, notches in the opposite edges of said lever engaging in said slot and establishing a rockable mounting of said lever in said side arm, second switch arm means responsive to movement of said lever, and supplemental contacts responsive to said second switch arm means.

8. In a switch assembly of the class described, the combination of an insulating mounting panel, a cam rotatably mounted on said panel, said cam being provided with a peripheral cam track having a recess therein, first switch arm means having a first main contact adapted to move into and out of engagement with a second main contact, a floating cam follower associated with said switch arm means and engageable with said cam track for moving said first main contact into and out of engagement with said second main contact, time driven means for driving said cam, a bushing for said cam having a sleeve-like socket in one end, said socket having a longitudinal slot therein, a manually operable control shaft arranged for rotary and reciprocal movement, the inner end of said shaft having slidable mounting in said socket, a pin carried by said shaft engaging in said longitudinal slot, a thrusting collar bearing against said pin, a spring surrounding said socket and bearing against said collar, a retainer ring carried by said bushing against which the outer end of said spring bears, a U-shaped supporting member having its side arms anchored to said mounting panel, the outer portion of said shaft having slidable and rotatable bearing mounting in said supporting member, a lever arranged to be actuated by said thrusting collar, a slot in one of the side arms of said U-shaped supporting member, notches in the opposite edges of said lever engaging in said slot and affording a rockable mounting of said lever in said supporting member, second switch arm means arranged to be actuated by the outer end of said lever, and supplemental contacts responsive to said second switch arm means.

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