Dec. 17, 1957 W. P. GALLAGHER ET AL 2,816,969

CLOCK SWITCH

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Fig. 1.

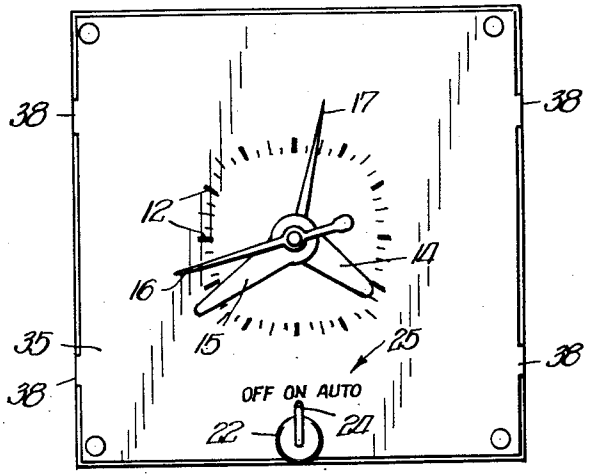


Fig. 2.

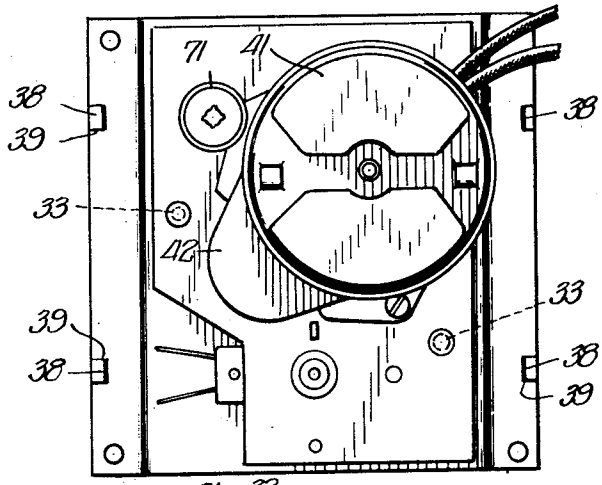
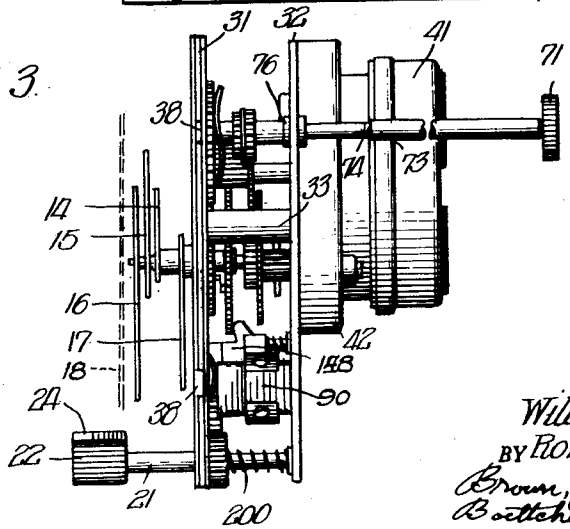


Fig. 3.



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CLOCK SWITCH

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Fig. 4

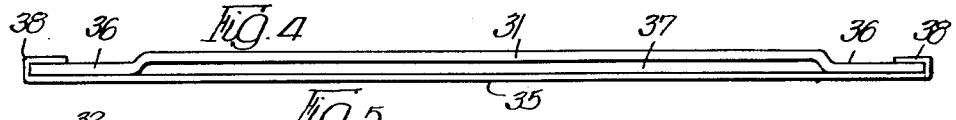
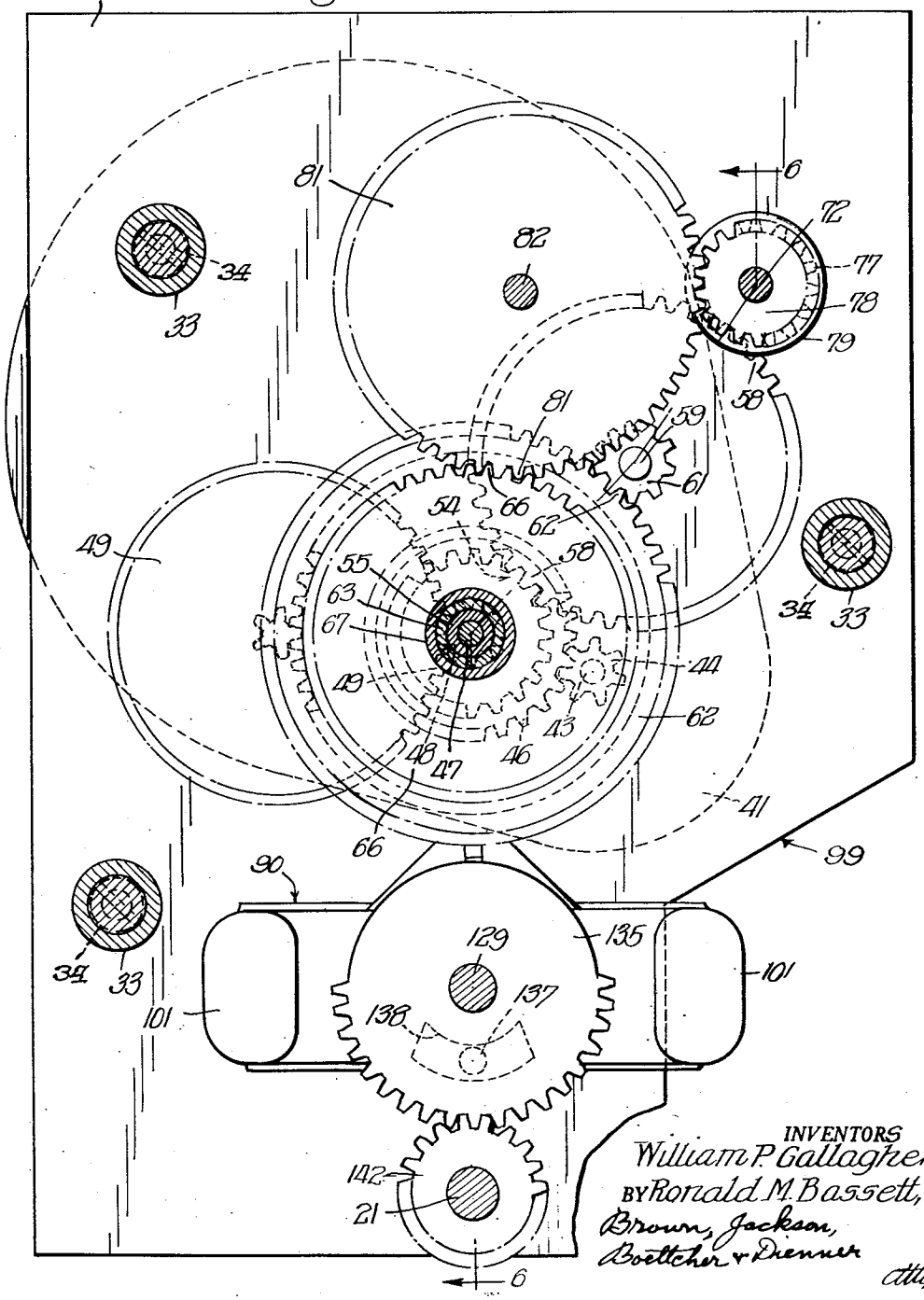


Fig. 5



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CLOCK SWITCH

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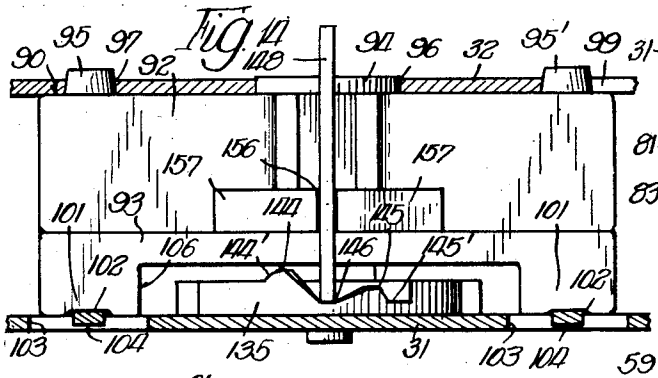


Fig. 11

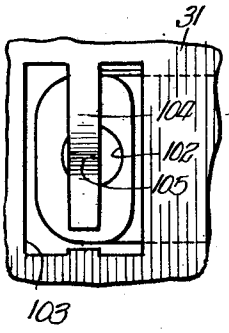


Fig. 15

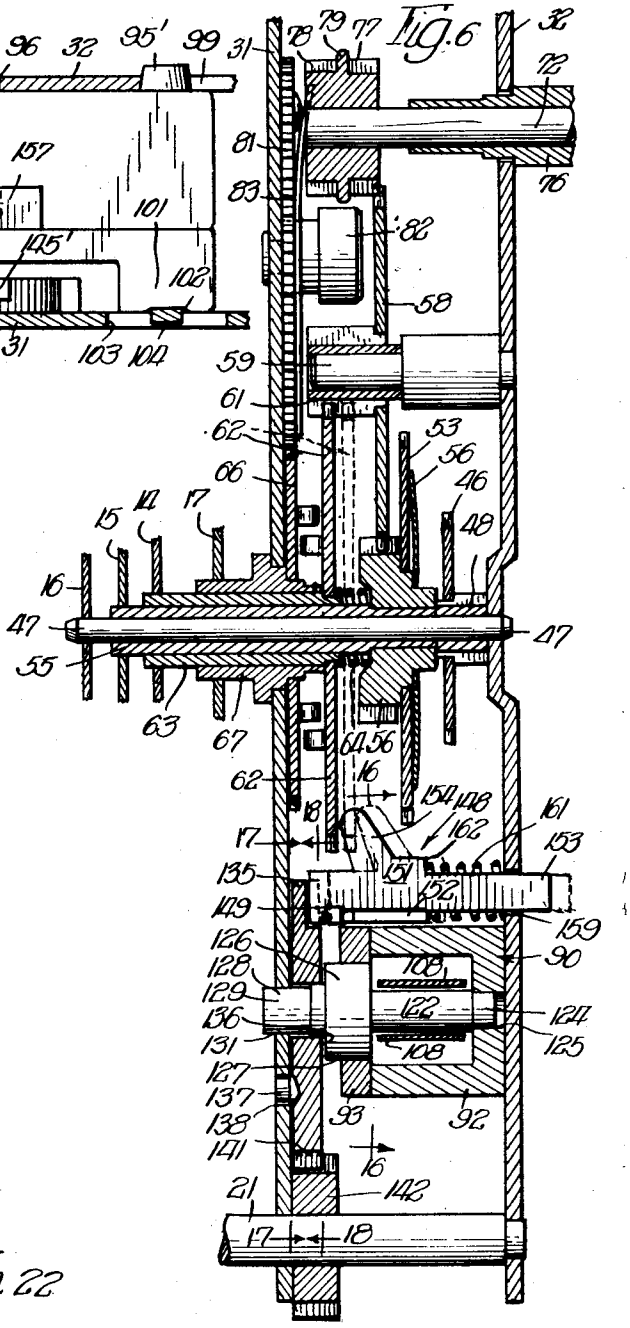


Fig. 6

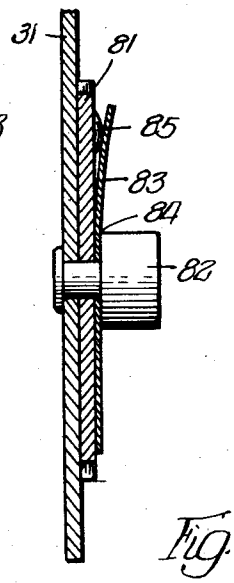


Fig. 13

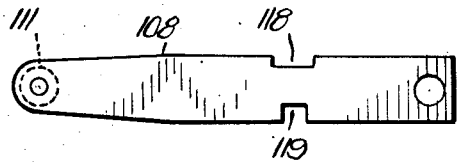


Fig. 22

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CLOCK SWITCH

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Fig. 8.



Fig. 7.

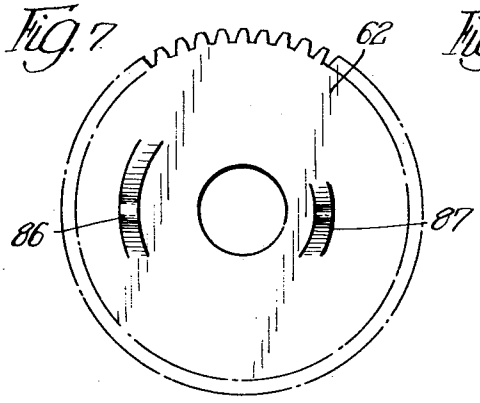


Fig. 9.

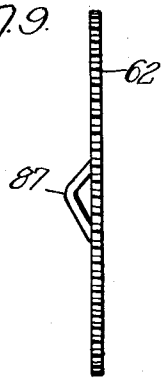


Fig. 11

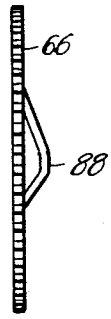


Fig. 10.

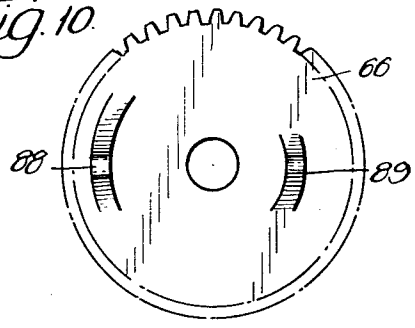


Fig. 12.

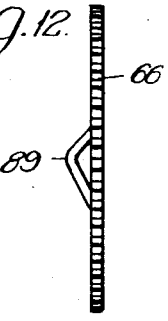


Fig. 20

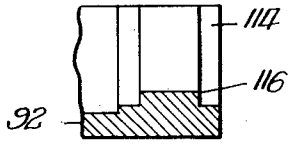
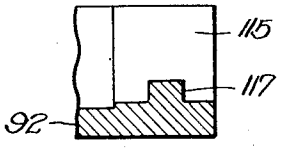


Fig. 21.



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CLOCK SWITCH

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Fig. 16

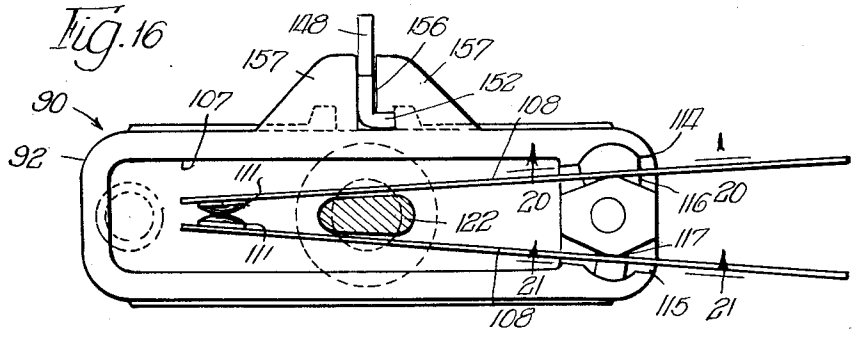


Fig. 17

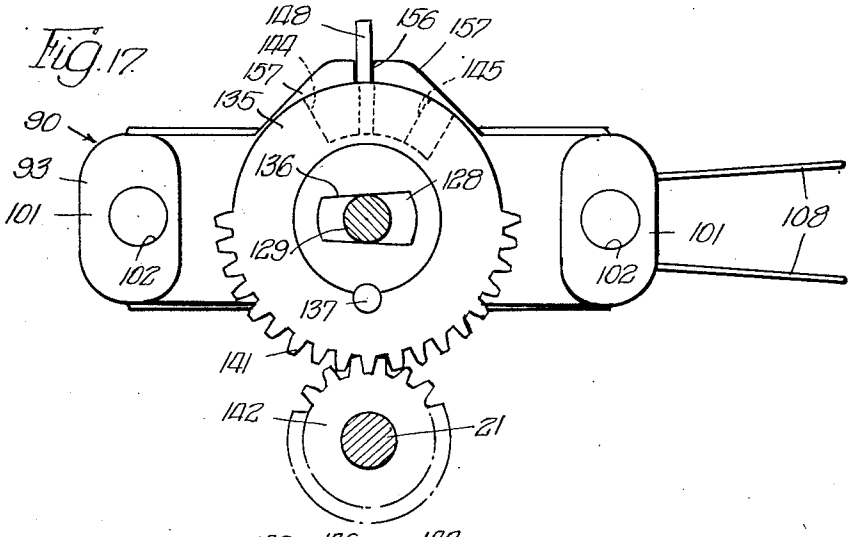


Fig. 18

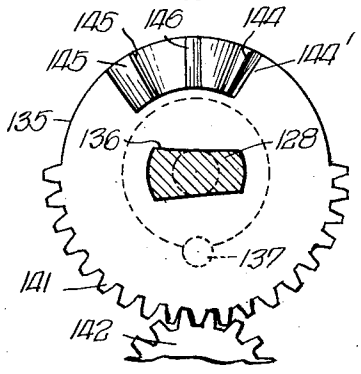
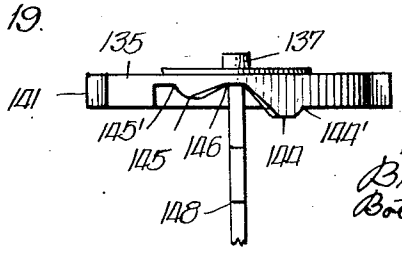


Fig. 19



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CLOCK SWITCH

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Fig. 23

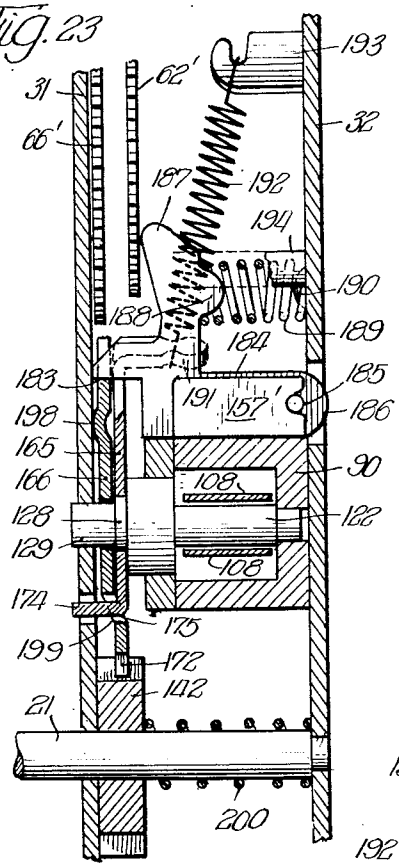


Fig. 24

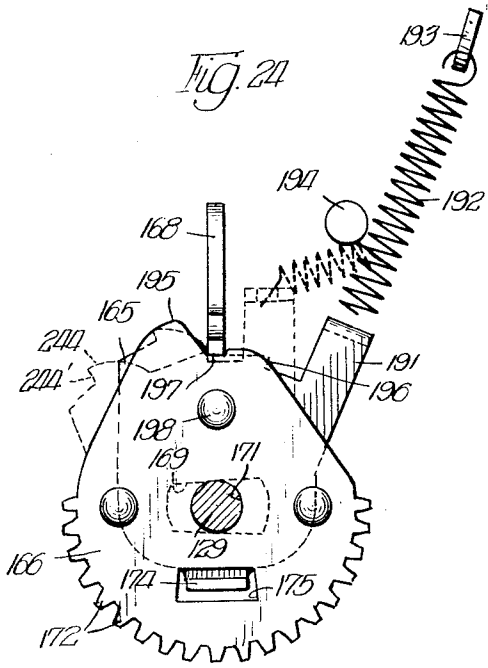


Fig. 25

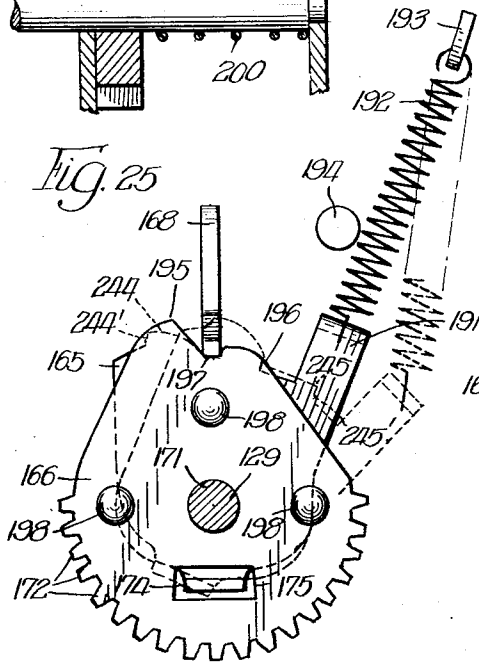


Fig. 28

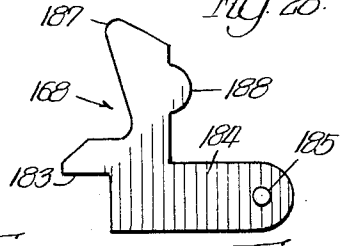


Fig. 26

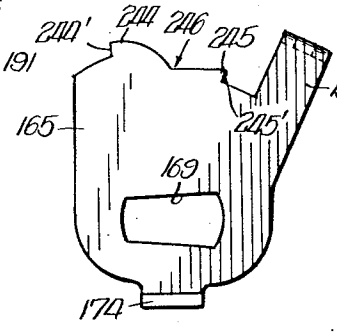
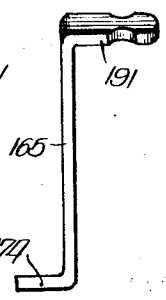


Fig. 27



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United States Patent Office 2,816,969 Patented Dec. 17, 1957

2,816,969

CLOCK SWITCH

William P. Gallagher, River Forest, and Ronald M. Bassett, Chicago, Ill., assignors to International Register Company, Chicago, Ill., a corporation of Illinois

Application April 9, 1956, Serial No. 576,857

11 Claims. (Cl. 200—38)

The present invention relates to clock switches. The invention has been devised primarily as a radio clock switch for automatically turning a radio on at a preselected time, but the invention has other fields of utility for automatically controlling the circuits of other electrical devices at preselected times.

One of the objects of the invention is to provide a clock switch which is extremely compact in its dimensions. These clock switches are used more prevalently in table models of radios, and because of the trend toward smaller sizes of table models, compact dimensions of the clock switch are very important.

Another object of the invention is to provide a clock switch which is very simple and inexpensive. Because of the highly competitive conditions in the radio industry, the cost of the clock switch must be kept to a minimum.

Another object of the invention is to provide a clock switch which is simple and foolproof in its manual setting, and which has a high degree of timing accuracy with regard to turning the radio on accurately at the preselected time.

Other objects, features and advantages of the invention will be apparent from the following detail description of two preferred embodiments thereof. In the accompanying drawings illustrating such embodiments:

Figures 1, 2 and 3 are front, rear and side elevational views respectively of our clock switch;

Figure 4 is an upper edge view on a different scale of the front mounting plate and the face plate;

Figure 5 is a view taken just inside of the front mounting plate showing the gear trains of the clock and showing the electric switch;

Figure 6 is a sectional view through the clock axis, taken approximately on the plane of the line **6—6** of Figure 5;

Figures 7, 8 and 9 are front elevational and opposite edge views of the shiftable hour hand gear which trips the switch;

Figures 10, 11 and 12 are front elevational and opposite edge views of the time settable gear which is given a time setting which predetermines the time of operation of the switch;

Figure 13 is a detail sectional view of the friction disk arrangement which maintains the time settings given the time settable gear;

Figure 14 is a fragmentary horizontal section showing the switch in plan;

Figure 15 is a detail sectional view showing the spring mounting relation between the switch housing cover and the front mounting plate;

Figure 16 is a sectional view taken approximately on the plane of the line **16—16** of Figure 6 showing the interior of the switch housing;

Figure 17 is a sectional view taken approximately on the plane of the line **17—17** of Figure 6 showing the outer side of the switch actuating sector cam;

Figure 18 is a sectional view taken approximately on the plane of the line **18—18** of Figure 6 showing the inner side of the sector cam;

Figure 19 is an edge view of the sector cam;

Figures 20 and 21 are detail sectional views taken on the planes of the lines **20—20** and **21—21** of Figure 16;

Figure 22 is a side elevational view of one of the switch blades on a different scale;

Figure 23 is a fragmentary vertical sectional view through the switch housing showing a modified construction of latching and unlatching cam;

Figure 24 is a fragmentary front elevational view of the modified construction of latching and unlatching cams in one position;

Figure 25 is a similar view of these cams in another position;

Figure 26 is an elevational view of the latching cam alone;

Figure 27 is an edge view of this latching cam, and

Figure 28 is a side elevational view of the latching lever used in this modified embodiment.

Referring to Figure 1, the clock switch comprises a clock dial **11** having hour markings **12**, relatively to which the hour and minute hands **14** and **15** indicate the time of day. Rotating concentrically of the hour and minute hands is a sweep second hand **16** which gives an approximate second indication and which also gives a visual indication as to whether the synchronous electric motor of the clock is running. Also mounted for rotation concentrically of the hour, minute and second hands is the manually settable time switch indicating hand **17** which is adapted to be manually set at the time at which it is desired that the radio be turned on. The clock dial **11** and the four hands **14–17** are enclosed by a cover glass or bezel **18**. Projecting from the front of the radio, either through or outside of the cover glass **18**, is a shaft **21** on which a switch setting knob **22** is mounted. This knob carries an indicating rib **24** which, in conjunction with indicia **25** on the face of the dial, indicates the three positions into which the setting knob **22** can be set. As represented by the indicia **25**, these three positions are respectively "Off—On—Auto," the latter position being the automatic position according to which the clock switch functions to turn the radio on automatically at the time preselected by the manual setting of the time selecting hand **17**.

Referring now to the detailed construction of the clock switch, the assembly comprises a front mounting plate **31** and a rear mounting plate **32** which are secured together in spaced relation by a plurality of spacing posts **33**. These spacing posts are riveted to the rear mounting plate **32**, and are secured to the front mounting plate **31** by screws **34**. A face plate **35** is secured to the front side of the front mounting plate **31**. Formed along the vertical side edges of the front mounting plate **31** are forwardly offset flanges **36** which establish a very shallow channel-shaped space **37** between the vertical medial portions of the front mounting plate **31** and face plate **35**, which channel-shaped space **37** accommodates the heads of the screws **34** and other parts. The face plate **35** is secured to the front mounting plate **31** by edge tabs **38** which extend from the face plate and are bent over at the side edges to engage in notches **39** cut in the forwardly offset side flanges **36** of the front mounting plate.

Mounted on the back side of the rear mounting plate **32** is a synchronous electric motor unit **41** embodying a speed reducing gear train contained within a housing portion **42** of the unit. This speed reducing gear train terminates in a slow speed driving shaft **43** which extends forwardly through the rear mounting plate **32** and carries a drive pinion **44** on its front end. This drive pinion meshes with a gear wheel **46** which is secured fast to an arbor **47** having bearing support in the front and rear

mounting plates. Secured to the front end of this arbor 47 is the clock second hand 16. Secured to the gear wheel 46 is a pinion 48 which meshes with a large gear wheel 49 journaled on a pivot shaft 51 having its rear end mounted in the rear mounting plate 32. Extending forwardly from the large gear wheel 49 is a pinion 52 which meshes with a large gear wheel 53 disposed concentrically of the second hand arbor 47. Disposed on the front side of the large gear wheel 53, and having friction slippage rotation relatively thereto, is a smaller gear wheel 54 which is secured to a minute hand arbor or sleeve 55. This minute hand sleeve 55 surrounds the second hand arbor 47 and carries the clock minute hand 15 on its front end. The motor driven drive from the synchronous motor unit 41 is transmitted from the large gear wheel 53 to the aligned smaller gear wheel 54 through a friction slippage clutch 56 to permit manual setting of the hour and minute hands 14 and 15 relatively to the clock dial. This general type of friction slippage clutch, indicated at 56, is old and well known and need not be described in detail.

Meshing with the smaller gear wheel 54 is a large speed reducing gear wheel 58, mounted on a laterally disposed arbor 59 projecting forwardly from the rear mounting plate 32. Secured to this large gear wheel 58 is a pinion 61 which meshes with a large gear wheel 62 that is mounted on the clock dial axis. This large gear wheel 62 is secured to the rear end of a rotatable and axially shiftable arbor sleeve 63 surrounding the minute hand arbor sleeve 55, the hour hand 14 being secured to the outer end of this axially shiftable arbor sleeve 63. A compression spring 64 is confined between the back side of the shiftable gear wheel 62 and the front side of the gear wheel 54, this compression spring normally tending to hold the shiftable gear wheel 62 shifted forwardly or outwardly toward the clock dial. The pinion 61 with which the shiftable gear wheel 62 meshes is relatively long, so that the shiftable gear 62 will remain in mesh with the pinion 61 in its shifting movement.

Mounted concentrically of and outwardly beyond the shiftable gear wheel 62 is a manually settable gear 66 which is mounted on a short outer arbor 67 that surrounds the shiftable arbor 63. This outer arbor 67 extends through the base plate 35 and mounts the time settable pointer 17 which indicates the preselected time when the clock switch is to operate. The time settable gear 66 is spaced forwardly from the axially shiftable hour hand gear 62, and projecting towards each other from the opposing faces of these two gears 66 and 62 are coacting humps which, at the preselected time, engage each other and shift the hour hand gear 62 rearwardly for tripping the electric switch, as will be presently described.

The time setting of the hour and minute hands 14, 15, and the time setting of the switch time indicating pointer 17, is performed from the back side of the radio set through a single knob 71. This knob is mounted on the end of a long shaft 72 which is arranged for rotational and shifting movement, and which extends forwardly through the radio cabinet to the clock mechanism. The inner end of the long shaft 72 has a threaded socket 73 which screws over a thread 74 on the outer end of an extension shaft 75, the threaded connection between these two shafts being preferably a left hand thread. The extension shaft is mounted for rotational and axial shifting movement in a bushing 76 secured in the rear mounting plate 32.

Secured to the forward end of the extension shaft 75 is a double pinion 77, 78 in which the teeth of the two pinions are separated by a dividing flange 79. When the manual setting knob 71 is pulled outwardly or rearwardly, the pinion 77 is brought into mesh with the teeth of speed reducing gear 58, the flange 79 engaging the front side of gear 58 and preventing the pinion 77 from being drawn entirely through its position of mesh with the gear 58. In this rearwardly shifted position of the setting knob 71,

the knob is now in position to set the hour and minute hands 14, 15 of the clock. When the knob 71 is pushed forwardly to the limit of its movement, the rear pinion 77 is moved out of mesh with the speed reducing gear 58 and the forward pinion 78 is moved into mesh with an idler gear 81 that meshes with the manually settable gear 66. The idler gear 81 is mounted on an arbor 82 projecting rearwardly from the front mounting plate 31, and this idler gear is held pressed forwardly into firm frictional engagement against the back side of the front mounting plate by a spring disk 83 which is held against the gear 81 by a shoulder 84 on the arbor 82. The peripheral portion of the spring disk 83 is spring flexed by bearing on angularly spaced bumps 85 projecting from the rear face of idler gear 81. This frictional slippage engagement of the idler gear 81 against the back side of the front mounting plate 31 serves to hold the manually settable gear 66 in any of the time setting positions which have been transmitted thereto through manually operated setting knob 71, notwithstanding the rotative torque which the hour hand gear 62 tends to transmit to the manually settable gear 66 when the coacting humps on these two gears interengage, as will now be described.

Referring to Figures 7 to 12, one face of the hour hand gear 62 is provided with two projecting humps 86, 87, and the opposing face of the time settable gear 66 is provided with two cooperating projecting humps 88 and 89. As viewed in profile, these humps 86, 89 are substantially V-shaped, and as viewed in plan they are of arcuate curvature, formed concentric with the axis of their respective gears. These humps are preferably punched directly out of the bodies of their respective gears. The hump 86 on gear 62 and the hump 88 on gear 66 both have the same radius so that they engage each other once in each revolution of gear 62 relatively to gear 66. The hump 87 on gear 62 and the hump 89 on gear 66 are both on the same radius located inside of the radius of the outer humps 86 and 88. Thus, the inner humps 87 and 89 also engage one another once in each revolution of the gear 62 relatively to the gear 66, this interengaging contact occurring at the same time that the outer humps 86 and 88 engage each other. By having the outer humps 86 and 88 engage simultaneously at the same time that the inner humps 87 and 89 engage, and by having both points of engagement occur at diametrically opposite points of the hour hand gear 62, the rearward axial shifting of this hour hand gear 62 occurs without any cocking or biasing action occurring thereon. The leading ends of the humps 86—89 are preferably formed with a more obtuse or gradual slope than the trailing ends. The time established by the setting of the time settable gear 66 through the rotation of the manual setting knob 71 predetermines the time when the humps 86—89 come into cooperative engagement for shifting the hour hand gear 62 rearwardly. This rearward shifting of the hour hand gear is arranged to trip the electrical switch, in a manner which will now be described.

The switch, designated 90 in its entirety, is mounted between the front and rear mounting plates 31, 32, and comprises a long rectangular housing 92 composed of "Bakelite," or any like insulating material. This switch housing 92 has an open front side which is closed by a cover 93 composed of like material. Projecting rearwardly from the base of the housing 92 are a circular central boss 94 and two smaller circular bosses 95, 95' disposed near the ends of the housing. The circular central boss 94 fits into a circular aperture 96 in the rear mounting plate 32; the end boss 95 fits into a registration aperture 97 in the same plate; and the other end boss 95' fits into a cut-away portion 99 of the rear mounting plate.

The cover 93 of the switch housing has two forwardly projecting lugs 101 at the ends thereof formed with depressions 102 in their front surfaces. These lugs 101 fit under rectangular recesses 103 punched out in the front

mounting plate 31, these rectangular recesses 103 being punched out with a resilient tongue 104 extending parallel to the long dimension of each recess. Each of these tongues 104 has a forwardly bent hump 105 therein adapted to have a resilient snap fit into the depressions 102 in the housing cover lugs 101. This spring mounting of the switch housing cover 93 provides for manufacturing tolerances and allows for any shrinkage in the casting of the switch housing and cover. The slot-like space 106 defined between the cover lugs 101 and the front mounting plate 31 receives a segment cam which actuates the switch blades, as we shall presently describe.

Mounted in the rectangular interior space 107 of the switch housing 92 are two switch blades 108, 108 having cooperating contacts 111, 111 on their opposing inner ends. These switch blades diverge outwardly for passage through outwardly divergent slots 114, 115 formed in the end wall of the switch housing 92. Formed in the bottom of the slot 114 is an upwardly extending relatively wide rib 116, and formed in the bottom of the slot 115 is a relatively narrow rib 117. Formed in the opposite edges of each switch blade are a wide recess 118 for fitting over the wide rib 116, and a narrow recess 119 for fitting over the narrow rib 117. The relationship between the ribs 116, 117 and the recesses 118, 119 is such that the two duplicate switch blades cannot be properly assembled in the switch housing 92 unless the contacts 111, 111 face towards each other. The projecting outer ends of the blades are formed with apertures 121 to facilitate the soldering of electrical connections thereto.

Disposed between the switch blades 108, 108 centrally of the ends of the switch housing 92, is a switch operating cam 122, preferably composed of nylon or other like insulating material. This cam 122 is of wedge-shaped cross-section to fit between the converging inner ends of the switch blades 108. A centrally disposed cylindrical bearing lug 124 extends rearwardly from the inner end of the cam wedge 122 for engaging in a bearing aperture 125 formed in the closed bottom of the switch housing 92. The front part of the cam wedge is formed with a cylindrical portion 126 having a diameter equal to the long dimension of the wedge cam, which cylindrical portion extends out through a cylindrical hole 127 in the cover 93 of the switch housing. Above this cylindrical portion 126 is a wedge-shaped keying portion 128, and above this keying portion is a cylindrical bearing extension 129 which is adapted to have a bearing fit in a bearing aperture 131 punched out in the front mounting plate 31.

Mounted on the wedge-shaped keying portion 128, within the slot-like space 106, is a sector cam 135. This cam 135 is formed with a centrally located wedge-shaped keying recess 136 which is adapted to fit down over the wedge-shaped keying portion 128, in only one assembly relation of these parts. Projecting upwardly from the top surface of the sector cam 135 is a pin projection 137 which is adapted to engage in an arcuate slot 138 in the front mounting plate 31, whereby to limit the rotary motion of the sector cam 135. Formed around the lower half of this sector cam is a gear sector 141 with which meshes a pinion 142 which is secured to the inner end of the switch setting shaft 21 on which the switch setting knob 22 is mounted.

It will be understood that the assembly of the switch blades 108, 108 in the mounting slots 114, 115 places the inner ends of the switch blades under an inwardly acting spring bias which normally holds the contacts 111, 111 in circuit closing engagement with each other. This inwardly acting spring bias in the switch blades normally tends to hold the wedge cam 122 in the circuit closing position illustrated. A slight rotation of the wedge cam 122 in either a clockwise direction or in a counterclockwise direction will spread the contact springs 108, 108 into switch opening position. However, as soon as this rotative force in either the clockwise or counterclockwise direction is released the spring bias in the switch blades will restore the wedge cam to its intermediate circuit closing position. When the manual setting knob 22 is in its intermediate "On" position, the wedge cam 122 is in its intermediate switch closing position, in which it is maintained by the spring bias of the switch blades. When the manual setting knob is rotated into its left hand "Off" position, the wedge cam 122 is rotated in a clockwise direction through the sector cam 135 into one of its two switch opening positions. When the manual setting knob 22 is rotated into its right hand "Auto" position, the wedge cam 122 is rotated in a counterclockwise direction through the sector cam 135 into the other of its two switch opening positions.

The wedge cam 122 is releasably held in its "Off" position and in its "Auto" position by two cam humps 144 and 145 formed on the inner upper face of the cam sector 135. Defined between these two cam humps 144 and 145 is an intermediate depression or valley 146 which is recessed into the body of the cam sector 135. The hump 144 projects outwardly from the intermediate valley 146 a greater distance than does the hump 145, the hump 144 terminating in a latching shoulder 144' substantially level with the rear face of the sector cam. The hump 145 terminates in a latching shoulder 145' which is recessed substantially into the body of the sector cam 135. The two humps 144, 145, the intermediate valley 146 and the latching shoulders 144' and 145' all extend radially of the sector cam 135, as illustrated in Figures 18 and 19.

Cooperating with these humps and latching shoulders is a latching detent 148 which is mounted for horizontal sliding motion across the top of the switch housing 92, and which is provided with a front latching edge 149 adapted to ride over the cam humps 144, 145 and into engagement with the latching shoulders 144' and 145'. This latching detent 148 is stamped out of sheet metal to form a flat body portion 151, a laterally extending guide flange 152, a spring confining shank 153, and a forwardly projecting tripping finger 154. The body portion 151 and guide flange 152 are guided for sliding movement in an L-shaped guideway 156 formed between two guide lugs 157, 157 projecting upwardly from the top of the switch housing 92. The shank 153 also has guided sliding engagement in a rectangular aperture 159 punched in the rear mounting plate 32. A compression spring 161 confined on the shank 153 between the rear mounting plate 32 and a shoulder 162 on the detent latch 148 normally holds the latch thrust forwardly with its front latching edge 149 bearing against the humps 144, 145, latching shoulders 144', 145', etc. of the sector cam 135. The spring pressed engagement of the latch edge 149 against the latching shoulders 144' and 145' is adequate to resiliently hold the sector cam 135 in its "Off" position and in its "Auto" position against the spring bias of the switch blades tending to rotate the wedge cam 122 back to "On" position. However, the latching shoulders 144' and 145' have rounded latching surfaces so that the detent action of the spring latch 148 can be overcome by manual rotative force transmitted through the setting knob 22 whenever it is desired to manually return the switch from the "Off" position or from the "Auto" position back to the "On" position.

Referring now to the time controlled tripping of the switch, the tripping finger 154 of the latch 148 extends into a position where it can be engaged by the back side of the shiftable hour hand gear or disc 62—when the switch mechanism has been set in the "Auto" position. In this position, the latching depression 145' is in registry with the detent latch 148, and because of the greater depth of this latching recess 145' in the sector cam 135 the latch 148 can move forwardly further to a position where the tripping finger 154 will be engaged and moved rearwardly by the shiftable gear wheel 62 by the engagement of the humps 86—89 at the time preselected by the setting of the manually settable gear 66. The rearward thrust imparted from the shiftable gear or disc 62 to the

tripping finger 154 slides the latch 148 rearwardly so that the latch edge 149 is moved out of the latching pocket 145', thereby permitting the normal spring bias of the switch to snap the wedge cam 122 from "Auto" position into the "On" position of the switch. Thus, the radio is automatically turned on at the preselected time established by the setting given the time indicating pointer 17. When the other latching depression 144' is in engagement with the latch edge 149, corresponding to the "Off" position of the switch, the tripping finger 154 does not occupy a position advanced sufficiently far to be engaged by the shiftable gear 62 when this gear is thrust rearwardly by the action of the humps 86–89, and hence the switch remains in this "Off" position until it is manually rotated out of that position by turning of the switch setting knob 22.

In Figures 23–28, we have shown a modified construction wherein the sector cam 135 is substituted by an assembly comprising a latching cam 165 and an unlatching cam 166, and wherein the slidable detent latch 148 is substituted by a pivoted detent lever 168. The latching cam 165 has a wedge-shaped opening 169 for fitting down over the wedge-shaped keying portion 128 of cam wedge 122, in the same manner that keying recess 136 of sector cam 135 fitted over this keying portion 128. Mounted above the latching cam 165 is the unlatching cam 166, which has a circular central hole 171 for rotatably fitting over the cylindrical bearing extension 129 of cam wedge 122, the outer end of this bearing extension 129 fitting into bearing aperture 131 in the front mounting plate 31. This upper unlatching cam 166 has sector gear teeth 172 around the outer half of its circumference, which mesh with the pinion 142 on the manual setting shaft 21. The manual rotative movement transmitted to the unlatching cam 166 from pinion 142 is in turn transmitted to the latching cam 165 through a lost motion connection 174, 175. This lost motion connection comprises a tongue 174 bent upwardly from the latching cam 165 passing through a slot 175 in the unlatching cam 166. The tongue 174 has limited lateral play or lost motion in the slot 175 so that the unlatching cam 166 can have a limited amount of rotary movement relatively to the latching cam 165 when the switch is set through the switch setting knob 22.

The latching cam 165 has its upper edge formed with humps 244, 245, latching shoulders 244', 245' and intermediate dwell 246, which function analogously to the humps 144, 145, latching shoulders 144', 145' and intermediate dwell 146 of the sector cam 136. Cooperating with such formations in the edge of latching cam 165 is the latching edge 183 of the pivoted latching lever 168. The shank 184 of this lever has a pivot pin 185 passing transversely through its inner end, this pivot pin passing through slots 186 formed in the rear ends of spaced pivotal guide lugs 157', 175' projecting upwardly from the top side of the switch housing 92. Projecting upwardly from the shank of the lever 168 is a tripping arm 187 which extends into a position directly in back of the shiftable hour hand gear 62' where it can receive tripping motion from the rearward shifting of this hour hand gear 62' when the switch is placed in its "Auto" position. The gears 62' and 66' are similar to the previously described gears 62 and 66 except that they are of smaller diameter. A centering lug 188 projects rearwardly from the tripping arm 186, and centering over this lug is one end of a compression spring 189 which has its other end engaging over a centering stud 190 punched forwardly from the rear mounting plate 32, this spring normally tending to hold the latching lever 168 pressed downwardly into latching position.

At a point beyond the latching shoulder 245', the latching cam 165 is formed with a rearwardly bent arm 191 to which is connected one end of a tension spring 192. The other end of this tension spring is anchored to a lug 193 projecting from the rear mounting plate 32, and the intermediate portion of this spring is adapted to flex around a stationary pin 194 projecting forwardly from the rear mounting plate 32. When the latching cam 165 has been revolved clockwise into the "Off" position of the switch, the tension spring 192 acts directly between the arm 191 and the lug 193, tending to bias the latching cam 165 in a counterclockwise direction. On the other hand, when the latching cam has been revolved counterclockwise into its "Auto" position, the tension spring 192 has been drawn around the bottom side of the stationary pin 194 so that at this time the spring tends to bias the latching cam 165 in a clockwise direction. The tension spring 192 is a helper spring which functions in conjunction with the spring action of the switch blades 108 in tending to return the cam 122 to its neutral or "On" position. By pivoting around the pin 194, the spring 192 is given a greater tension, by reason of fewer active coils, and exerts its force along a line of more direct action when the switch is in its "Auto" position, i. e. it works substantially at right angles to the direction of rotation of the latching cam 165.

The unlatching cam 166 is formed with a releasing cam surface 195 cooperating with the latching shoulder 244', and is also formed with a releasing cam surface 196 cooperating with the latching shoulder 245'. Intermediate these two cam releasing surfaces 195 and 196, the unlatching cam 166 is formed with a depression 197 which cooperates with the intermediate dwell 246 of the latching cam 165. The releasing cam surfaces 195 and 196 function through the lost motion relation between the unlatching cam 166 and the latching cam 165 to release the latching edge 183 of the latching lever 168 from the latching shoulders 244' and 245', when the switch setting knob 22 is turned to change the setting of the switch. For example, when the latching edge 183 of the latching lever 168 is engaging with the latching shoulder 244', corresponding to the "Off" position of the switch, and it is desired to turn the switch out of this position, the clockwise rotation of the setting knob 22 will first be transmitted as a preliminary counterclockwise rotation of the unlatching cam 166. Because of the lost motion relation between the unlatching cam 166 and the latching cam 165, this counterclockwise rotation of the unlatching cam 166 will carry the releasing cam surface 195 into engagement with the latching edge 183 of the latching lever 168 for camming the lever out of engagement with the latching shoulder 244', whereupon the latching cam 165 will be free to rotate. Similarly, when the switch is in the "Auto" position with the latching lever 168 engaging with the latching shoulder 245', the rotation of the setting knob 22 in a counterclockwise direction will impart preliminary rotation to the unlatching cam 166 in a clockwise direction, before transmitting turning movement to the latching cam 165. This preliminary rotation of the unlatching cam 166 will carry the releasing cam surface 196 into engagement with the latching edge 183 of the latching lever 168 for camming this latching edge upwardly out of engagement with the latching shoulder 245', whereupon the latching cam will be free to rotate. The front surface of the unlatching cam 166 is provided with a plurality of forwardly projecting protuberances 198 for bearing against the back surface of the front mounting plate 31. The lower part of the tooth sector portion 172 of unlatching cam 166 is bent or offset rearwardly, as indicated at 199, to insure meshing relation with the pinion 142, notwithstanding misalignment of parts. A light compression spring 200 confined on the shaft 21 between the rear mounting plate 32 and the back side of the pinion 142 normally holds the pinion 142 pressed forwardly against the back side of the front mounting plate 31 to prevent the shaft 21 from picking up vibrations from the radio component.

In this modified embodiment, the automatic operation at the preselected time occurs in substantially the same manner previously described. The switch is set in the "Auto" (automatic) position, with the latching shoulder 245' hooking against the side of the latching edge 183 of pivoted latching lever 168. This latching lever 168 now

pivots downwardly and forwardly to the point where the tripping arm 187 of said lever occupies a position where it can be engaged by shiftable hour hand gear 62. Hence, when this hour hand gear 62 is shifted rearwardly at the preselected time, it engages arm 187 and swings latching lever 168 upwardly and rearwardly to the point where latching edge 183 clears latching shoulder 245', thereby permitting the switch to snap into closed circuit position.

While we have illustrated and described what we regard to be the preferred embodiments of our invention, nevertheless it will be understood that such are merely exemplary and that numerous modifications and rearrangements may be made therein without departing from the essence of the invention.

We claim:

1. In a clock switch, the combination of a switch normally tending to remain closed, a switch actuator having a normal switch closing position and having two switch opening positions, one on each side of said normal switch closing position, said switch actuator being normally biased from each of said switch opening positions back to said normal switch closing position, a pair of latching shoulders on said switch actuator, a latching detent adapted to engage one of said latching shoulders when said switch actuator is in one of said switch opening positions, and adapted to engage the other of said latching shoulders when said switch actuator is in the other of said switch opening positions, a manually settable control operable to move said switch actuator from said switch closing position into either of said switch opening positions, and operable to move said switch actuator from either of said switch opening positions into said switch closing position, and time settable means for causing said latching detent to move to releasing position for causing said switch actuator to restore automatically from one of said switch opening positions into said normal switch closing position at a preselected time.

2. In a clock switch, the combination of a switch normally tending to remain closed, a switch actuator having a normal switch closing position, and also having an "Off" switch opening position and an "Auto" switch opening position, said switch opening positions being disposed on opposite sides of said switch closing position, said switch actuator being normally biased from each of said switch opening positions back to said normal switch closing position, a pair of latching shoulders on said switch actuator, a latching detent adapted to engage one of said latching shoulders when said switch actuator is in its "Off" position, and adapted to engage the other of said latching shoulders when said switch actuator is in its "Auto" position, a manually settable knob operable to move said switch actuator from said switch closing position into either of said switch opening positions, one of said latching shoulders permitting said latching detent to move into an automatic tripping position, and time settable means for tripping said latching detent at a preselected time when it is in said automatic tripping position.

3. In a clock switch, the combination of a time driven member, a time settable member cooperating therewith, means operative when said time driven member reaches the set time which has been set up on said time settable member for causing shifting movement of one of said members, a switch, a rotatable actuator for said switch normally biased into a switch closing position, manual means operative to rotate said switch actuator in one direction from said switch closing position into a first switch opening position, and also operative to rotate said switch actuator in the opposite direction from said switch closing position into a second switch opening position, a first latching shoulder on said switch actuator for holding the latter in said first switch opening position, a second latching shoulder on said switch actuator for holding the latter in said second switch opening position, and latch means adapted to engage each of said latching shoulders when said switch actuator is in either of said switch opening positions, said latch means being disposed outside the range of shifting movement of said shiftable member when engaging said first latching shoulder, and being disposed inside the range of shifting movement of said shiftable member when engaging said second latching shoulder, whereby said shiftable movement of said member automatically releases said latch means from said second latching shoulder at the time preset on said time settable member.

4. In a clock switch, the combination of a time driven member, a time settable member cooperating therewith, means operative when said time driven member reaches the set time which has been set up on said time settable member for causing shifting movement of one of said members, a switch, a rotatable actuator for said switch normally biased into a switch closing position, manual means operative to rotate said switch actuator in one direction from said switch closing position into a first switch opening position, and also operative to rotate said switch actuator in the opposite direction from said switch closing position into a second switch opening position, a first latching shoulder on said switch actuator adapted to be presented into latching position when said switch actuator is in said first switch opening position, a second latching shoulder on said switch actuator adapted to be presented into latching position when said switch actuator is in said second switch opening position, and a latch slidably mounted for movement into and out of said latching position, said first latching shoulder holding said latch outside the range of shifting movement of said shiftable member, said second latching shoulder holding said latch inside the range of shifting movement of said shiftable member, whereby said shiftable member actuates said latch to release said second latching shoulder at the time preset by said time settable member.

5. In a clock switch, the combination of a time driven member, a time settable member cooperating therewith, means operative when said time driven member reaches the set time which has been set up on said time settable member for causing shifting movement of one of said members, a switch, a rotatable actuator for said switch normally biased into a switch closing position, manual means operative to rotate said switch actuator in one direction from said switch closing position into a first switch opening position, and also operative to rotate said switch actuator in the opposite direction from said switch closing position into a second switch opening position, a first latching shoulder on said switch actuator for holding the latter in said first switch opening position, a second latching shoulder on said switch actuator for holding the latter in said second switch opening position, and a pivoted latch mounted for pivotal swinging movement into a latching position to engage each of said latching shoulders when said switch actuator is in either of said switch opening positions, and tripping means on said pivoted latch arranged to be disposed outside the range of shifting movement of said shiftable member when said latch is engaging said first latching shoulder, and arranged to be disposed inside the range of shifting movement of said shiftable member when said latch is engaging said second latching shoulder, whereby the shifting movement of said member operates through said tripping means to release said latch from said second latching shoulder at the time preset by said time settable member.

6. In a clock switch, the combination of a time driven disk, a coaxially aligned time settable disk, one of said disks being axially shiftable relatively to the other, outer deflecting humps projecting from outer radii of both of said disks, inner deflecting humps projecting from inner radii of both of said disks, said outer humps and said inner humps being adapted to engage once each revolution of said time driven disk for axially shifting said shift-

able disk, a switch, a switch actuator normally biased into one switch controlling position, manual means for moving said switch actuator into another switch controlling position, a latching shoulder moving with said switch actuator into a latching position when said actuator is moved into said second switch controlling position, latching means adapted to engage said latching shoulder when in said latching position, and tripping means responsive to shifting movement of said shiftable disk for releasing said latching means.

7. In a time control switch, the combination of a time driven disk, a time settable disk axially aligned therewith, one of said disks being axially shiftable relatively to the other, means operative when said time driven disk reaches the preselected time which has been set up on said time settable disk for causing shifting movement of said shiftable disk, a switch comprising two normally contacting switch blades, a cam between said blades having a normal switch closing position, said cam being operative to effect separating motion between said blades when rotated in either direction from said normal switch closing position, a rotatable switch actuator connected to said cam, said switch actuator having a neutral dwell and having first and second latching shoulders formed in its peripheral portion, one to each side of said neutral dwell, manual means for rotating said switch actuator for presenting said first and second latching shoulders selectively into latching position, a latching detent, spring means normally urging said latching detent into said latching position to engage said first and second latching shoulders selectively, and tripping means associated with said latching detent adapted to coact with said axially shiftable disk, said first latching shoulder holding said latching detent and tripping means out of the range of shifting movement of said shiftable disk, said second latching shoulder permitting said latching detent and tripping means to assume a position within the range of shifting movement of said shiftable disk, whereby said latching detent is automatically released by said shiftable disk at the preselected time set up on said time settable disk.

8. In a clock switch, the combination of a clock dial having hour and minute hands, an hour hand gear concentric of said clock dial and connected to said hour hand, a time settable gear concentric of said clock dial and said hour hand gear, one of said gears being axially shiftable relatively to the other, means for manually setting said settable gear to a preselected time for switch operation, humps on the opposing faces of said gears adapted to engage at the preselected time for causing shifting movement of said shiftable gear, a switch positioned below the axis of said clock dial, a rotatable actuator for said switch having a normal switch closing position and having a first switch opening position rotated in one direction from said normal position, and having a second switch opening position rotated in the opposite direction from said normal position, a switch setting knob projecting outwardly of the clock dial below the clock dial axis and operatively connected with said rotatable switch actuator for placing said actuator in either of said three positions, a first latching shoulder on said switch actuator presented into latching position when said switch actuator is in said first switch opening position, a second latching shoulder presented into latching position when said switch actuator is in said second switch opening position, a spring biased latch adapted to engage each of said latching shoulders when said shoulders are presented into latching position, said switch setting knob being operative to release each of said latching shoulders from said latch for manually turning said switch actuator from either of said switch opening positions back into said normal switch closing position, and tripping means associated with said latch adapted to be engaged by said shiftable gear for tripping said latch at the time preselected by the setting of said time settable gear.

9. In a clock switch, the combination of a time driven member, a time settable member cooperating therewith, means operative when said time driven member reaches the set time which has been set up on said time settable member for causing shifting movement of one of said members, a switch, a rotatable switch actuator for said switch normally biased into a switch closing position, a manual control knob operative to rotate said switch actuator in one direction from said switch closing position into a first switch opening position and also operative to rotate said switch actuator in the opposite direction from said switch closing position into a second switch opening position, a first latching shoulder on said switch actuator for holding the latter in said first switch opening position, a second latching shoulder on said switch actuator for holding the latter in said second switch opening position, and latch means adapted to engage each of said latching shoulders when said switch actuator is in either of said switch opening positions, said latch means being disposed outside the range of shifting movement of said shiftable member when engaging said first latching shoulder, and being disposed inside the range of shifting movement of said shiftable member when engaging said second latching shoulder, whereby said shiftable movement of said member automatically releases said latch means from said second latching shoulder at the time preset on said time settable member, the automatic return of said switch actuator from said second switch opening position back to switch closing position also automatically indexing said control knob back to its switch closed position.

10. In a clock switch, the combination of a time driven member, a time settable member cooperating therewith, means operative when said time driven member reaches the set time which has been set up on said time settable member for causing shifting movement of one of said members, a switch, a rotatable latching cam for said switch normally biased into a switch closing position, a latching shoulder on said latching cam adapted to be presented into latching position when said latching cam actuates said switch into a switch opening position, a latching detent adapted to engage said latching shoulder when said latching cam is in said switch opening position, tripping means on said latching detent adapted to be engaged by said shiftable member to release said latching detent from said latching shoulder at the time preset by said time settable member, an unlatching cam movable relatively to said latching cam and operative to unlatch said latching detent from said latching shoulder, manual means operative to actuate said unlatching cam, and lost motion means operative to transmit motion from said unlatching cam to said latching cam.

11. In a clock switch, the combination of a time driven member, a time settable member cooperating therewith, means operative when said time driven member reaches the set time which has been set up on said time settable member for causing shifting movement of one of said members, a switch, a rotatable actuator for said switch normally biased into a switch closing position, manual means operative to rotate said switch actuator in one direction from said switch closing position into a first switch opening position, and also operative to rotate said switch actuator in the opposite direction from said switch closing position into a second switch opening position, a first latching shoulder on said switch actuator for holding the latter in said first switch opening position, a second latching shoulder on said switch actuator for holding the latter in said second switch opening position, latch means adapted to engage each of said latching shoulders when said switch actuator is in either of said switch opening positions, tripping means responsive to said shiftable member for tripping said latch means when one of said latching shoulders is in latching position, a

tension spring connected to said switch actuator and operative when said switch actuator is in one switch open position tending to impart a return torque in one direction to said switch actuator tending to return it to switch closed position, and a projection around which said tension spring is drawn when said switch actuator is in the other switch open position tending to impart a return torque in the opposite direction to said switch actuator tending to return it to switch closed position.

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