Feb. 14, 1933. F. C. BALL ET AL 1,897,943

SWITCH MECHANISM

Filed Dec. 7, 1929 3 Sheets-Sheet 1

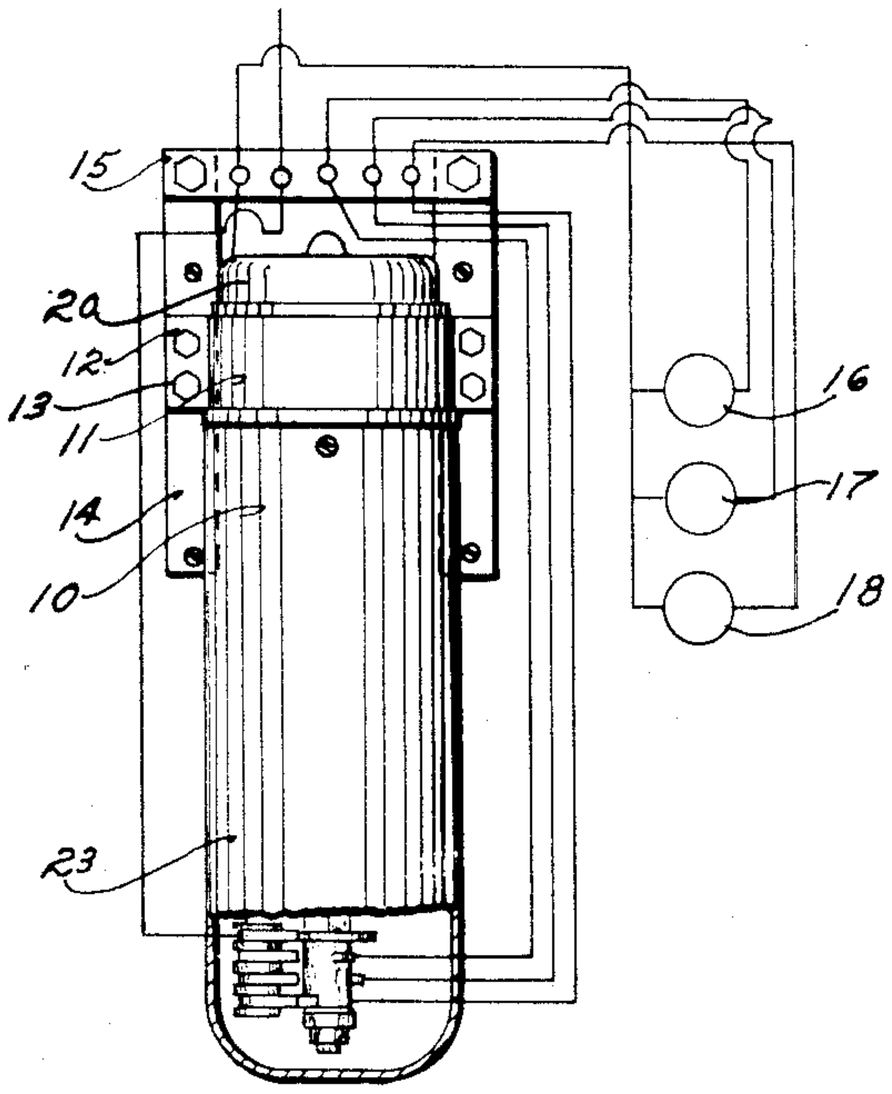

FIG-1

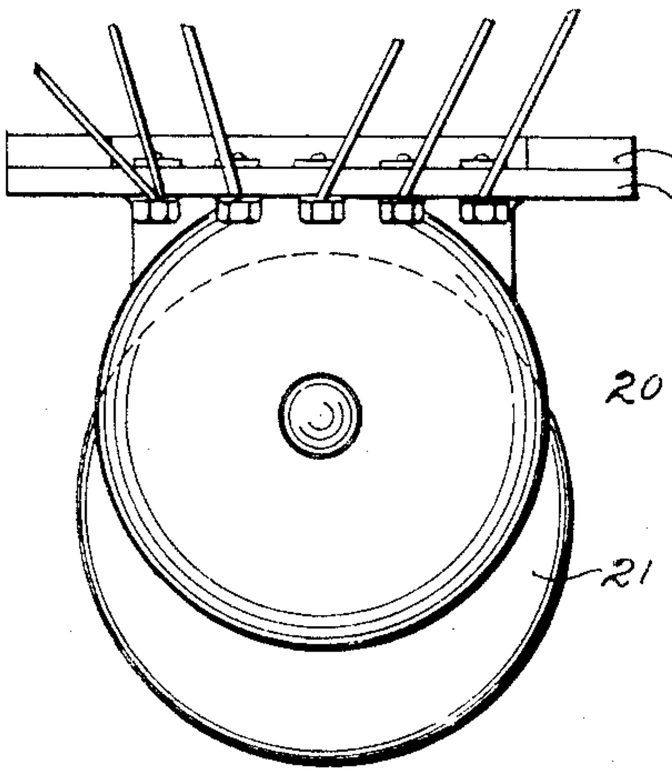

FIG-2

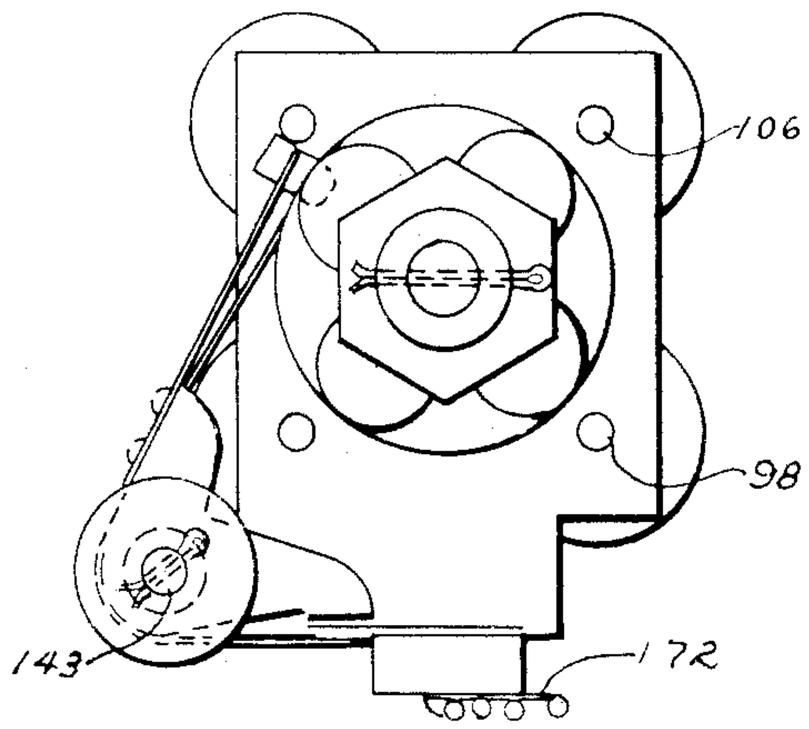

FIG-4

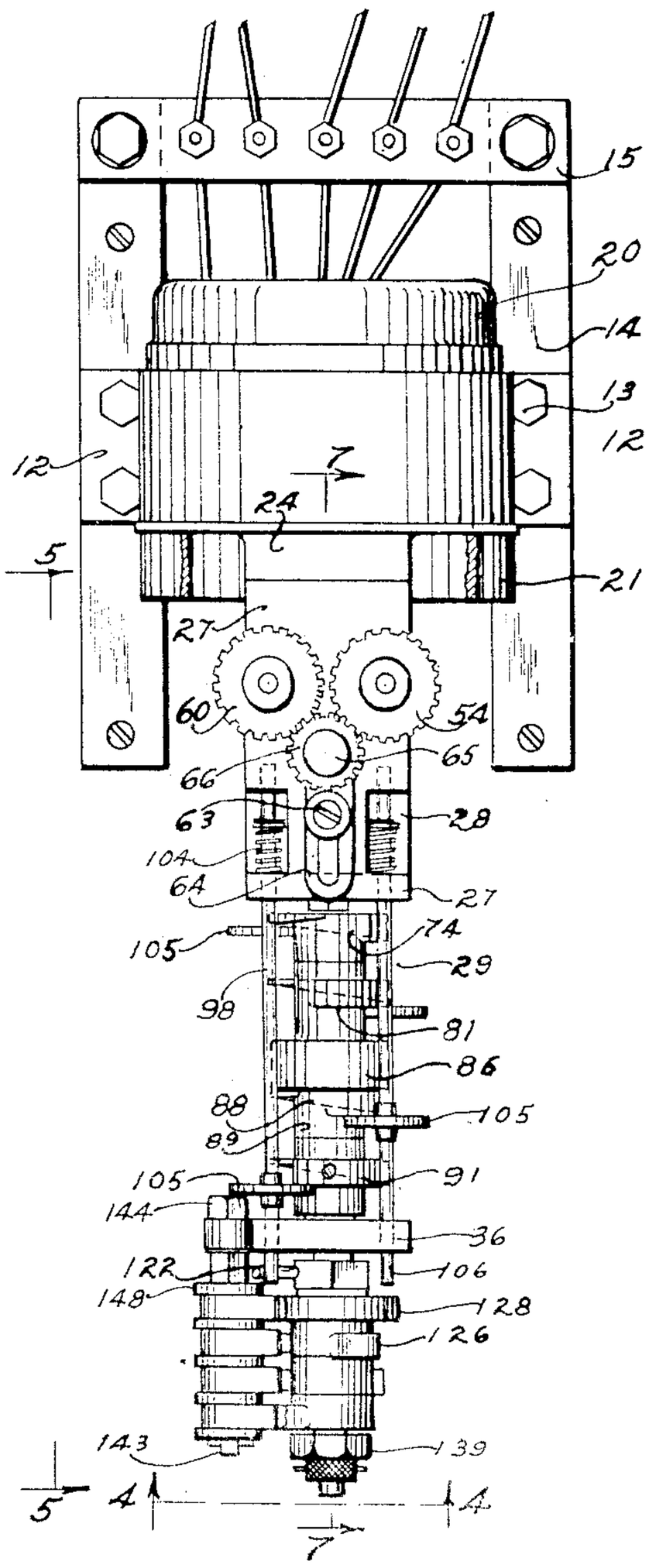

FIG-3

Inventors
Frank C. Ball
Claud C. Salisbury
By Clarence L. Walker
Their Attorney

Feb. 14, 1933. F. C. BALL ET AL 1,897,943

SWITCH MECHANISM

Filed Dec. 7, 1929 3 Sheets-Sheet 2

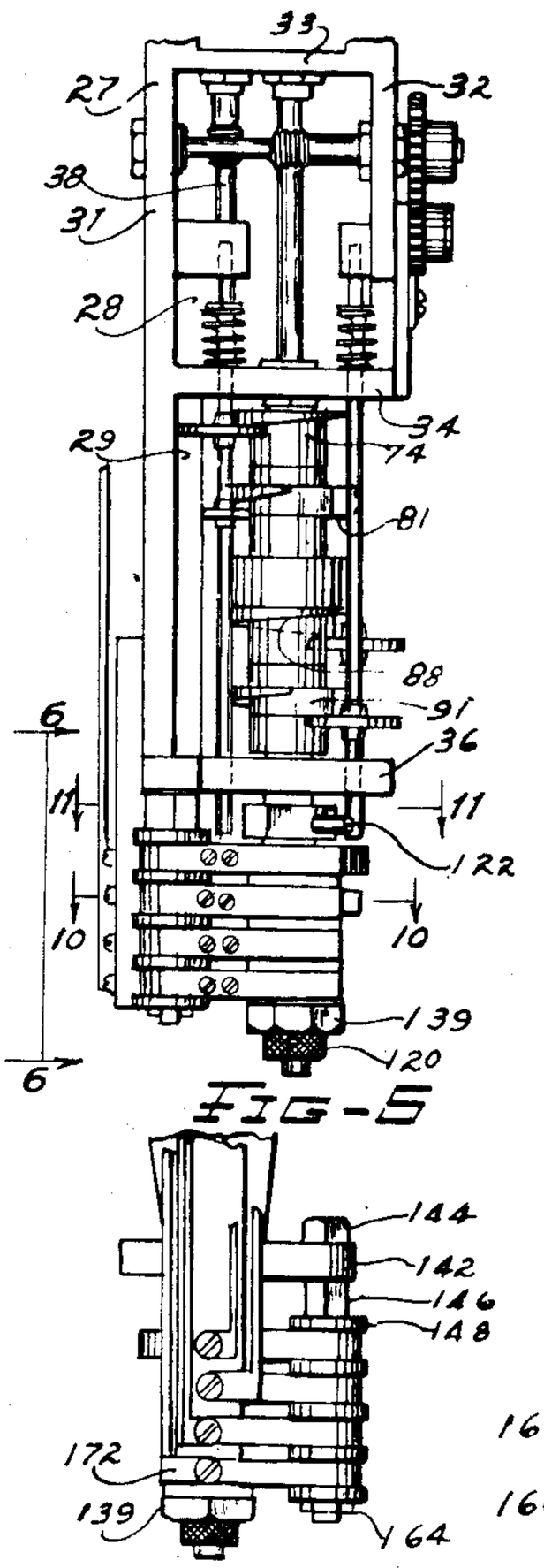

FIG-5

FIG-6

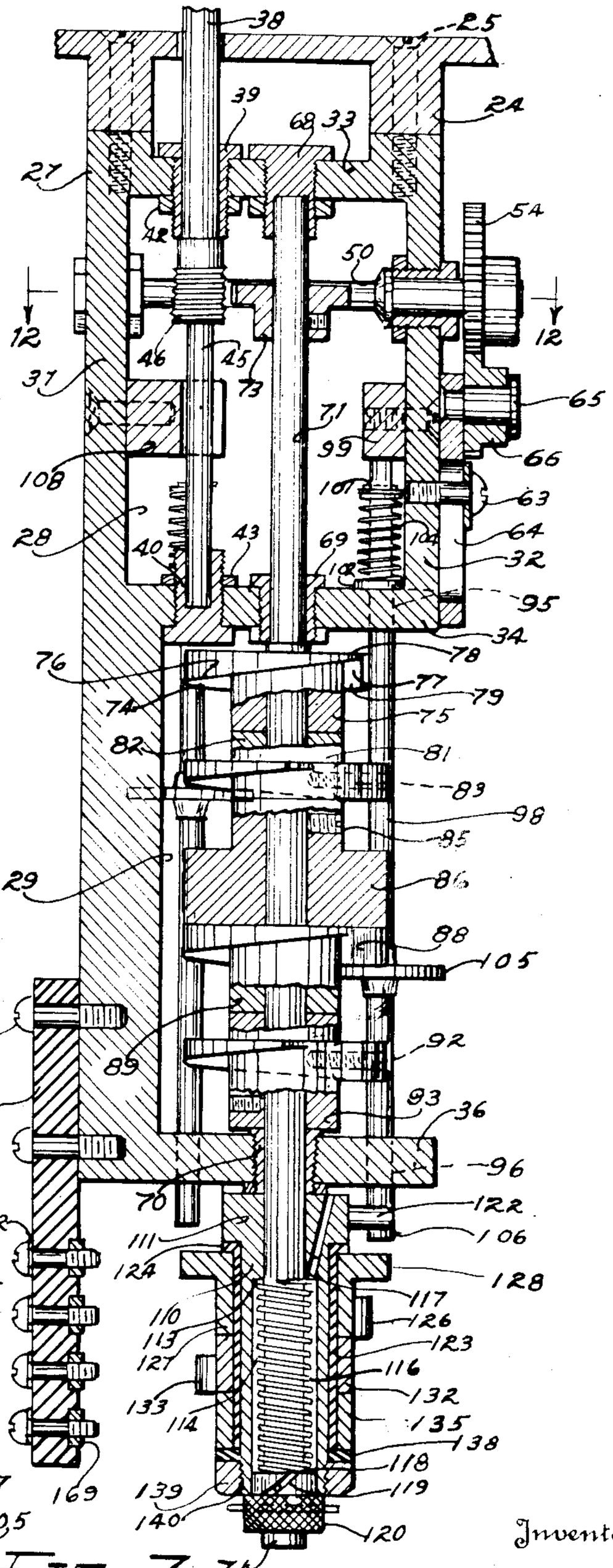

FIG-7

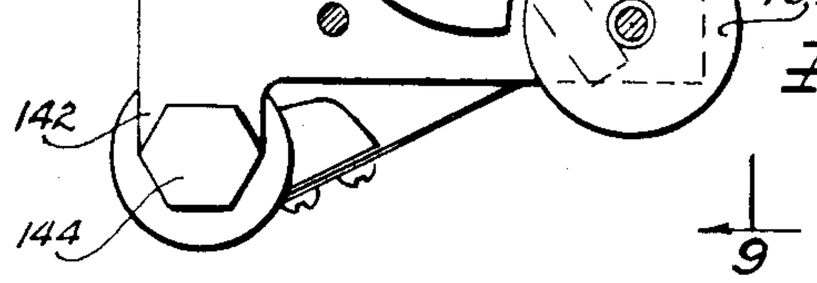

FIG-8

Inventors

Frank C. Ball

Claud C. Salisbury

By Clarence L. Walker

Their Attorney

Feb. 14, 1933. F. C. BALL ET AL 1,897,943

SWITCH MECHANISM

Filed Dec. 7, 1929 3 Sheets-Sheet 3

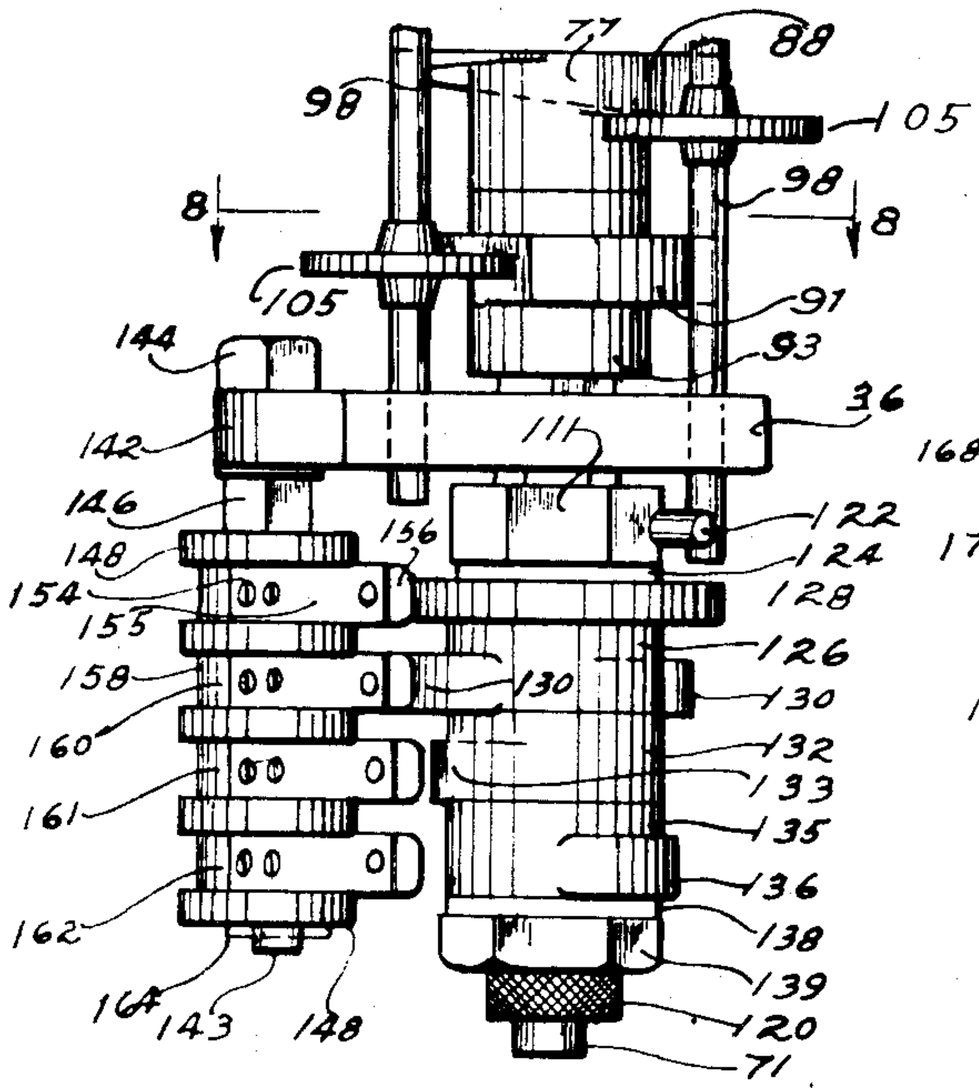

FIG-9

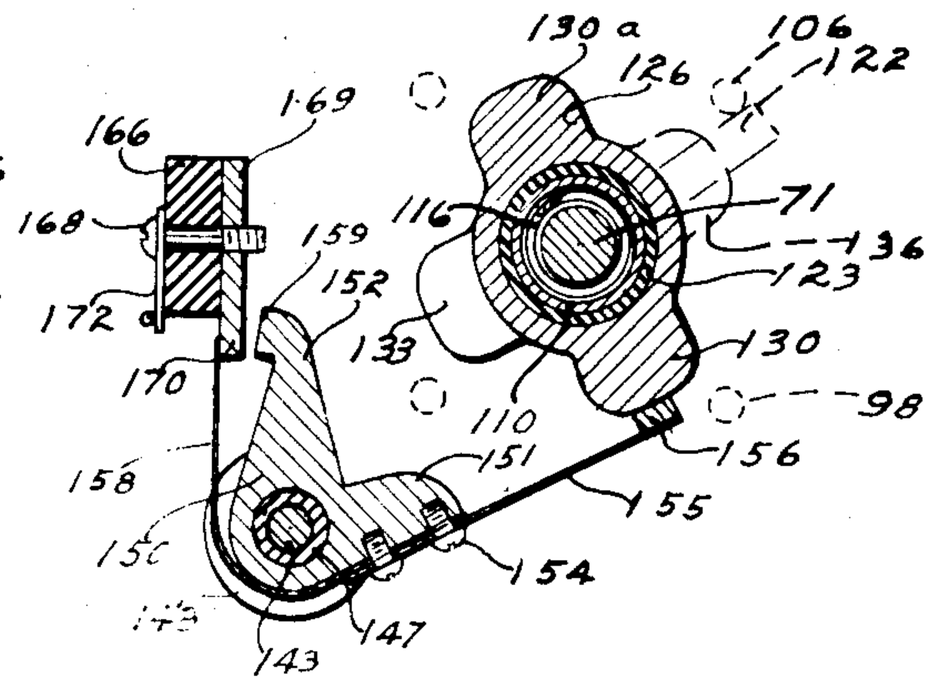

FIG-10

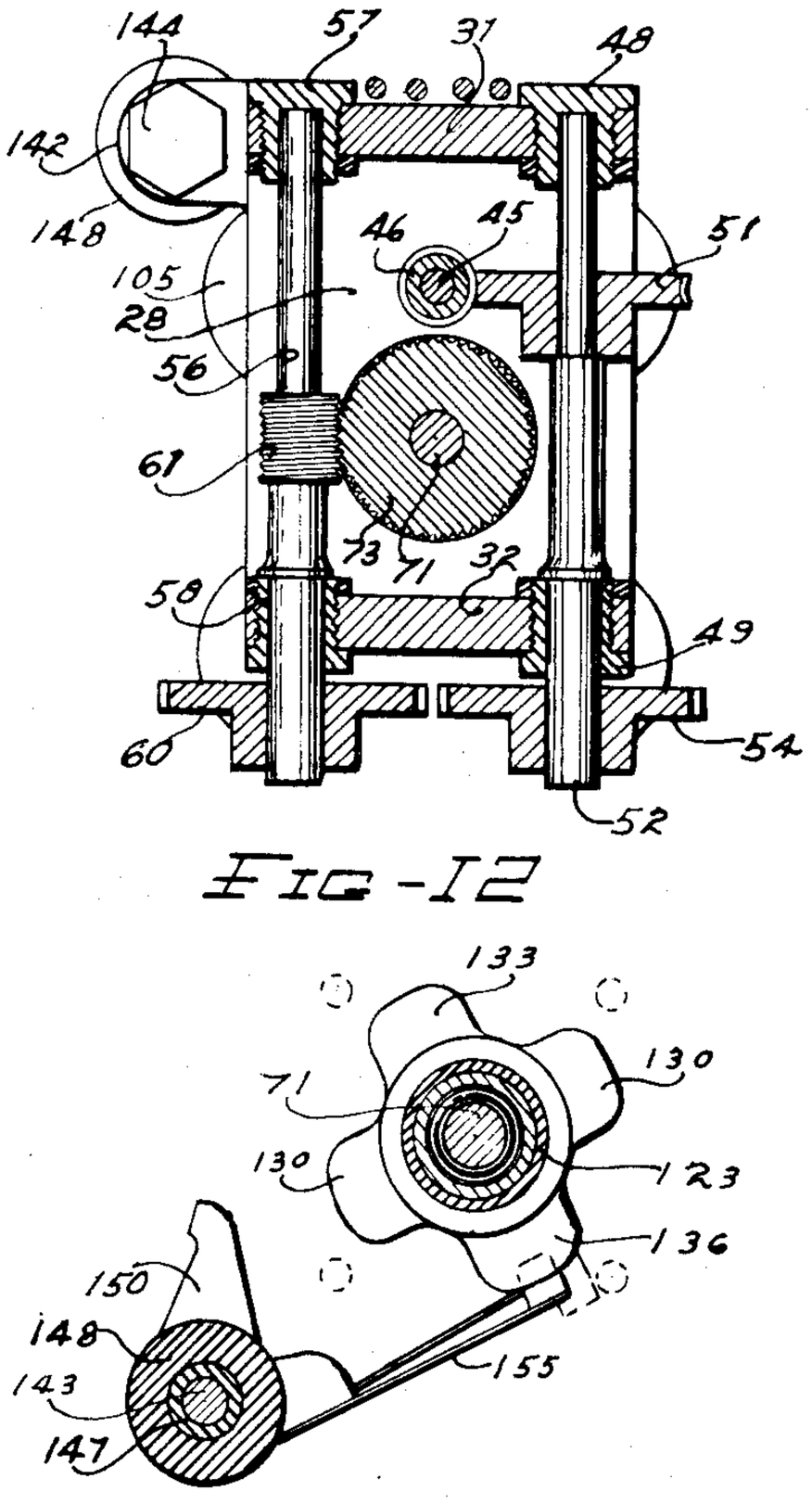

FIG-12

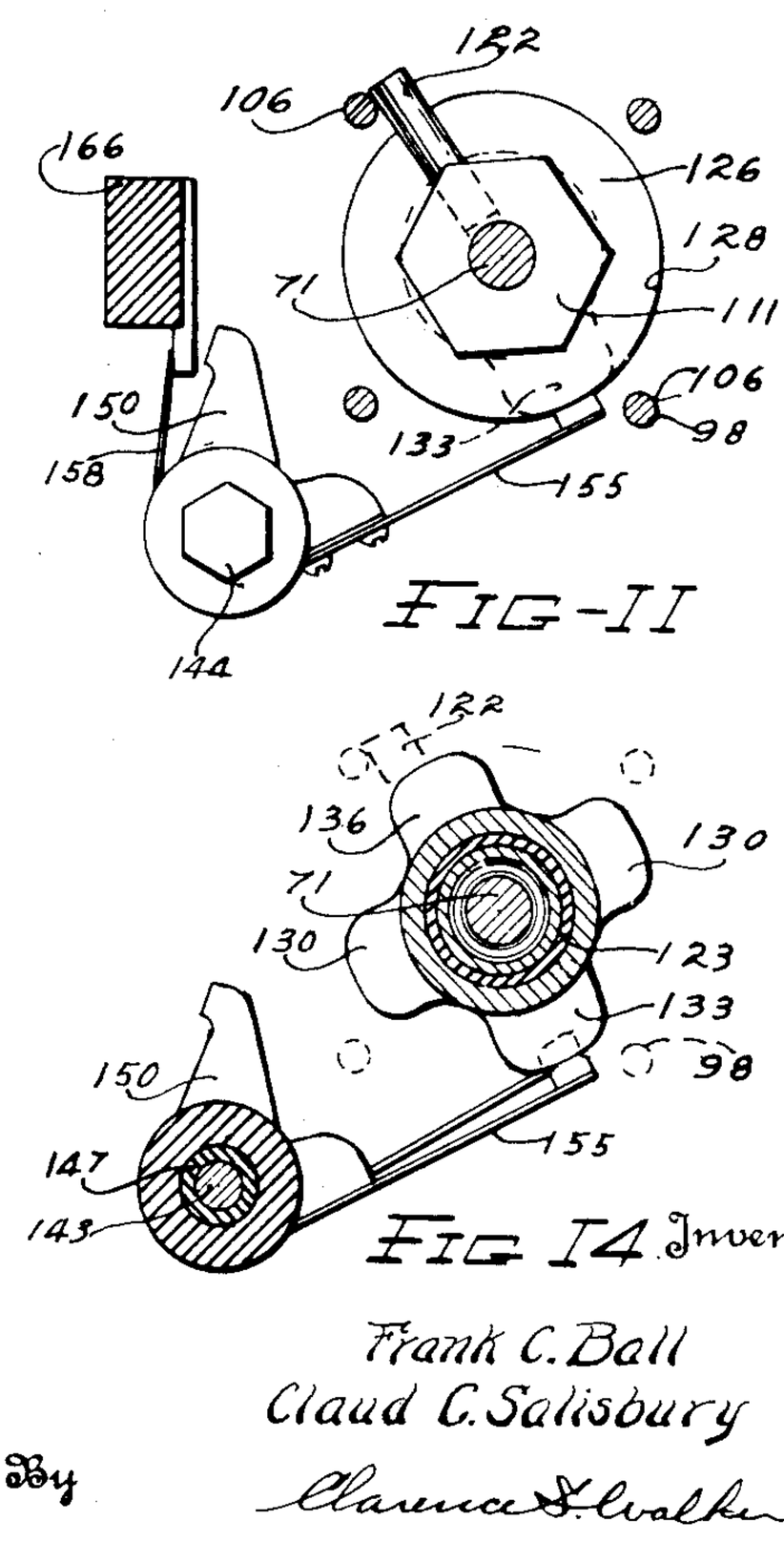

FIG-11

FIG-13

FIG 14.

Inventors

Frank C. Ball

Claud C. Salisbury

By Clarence L. Walker

Their Attorney

Patented Feb. 14, 1933 1,897,943

UNITED STATES PATENT OFFICE

FRANK C. BALL AND CLAUD C. SALISBURY, OF JAMESTOWN, NEW YORK, ASSIGNORS, BY DIRECT AND MESNE ASSIGNMENTS, TO SALISBURY SIGNAL CORPORATION, OF JAMESTOWN, NEW YORK, A CORPORATION OF DELAWARE

SWITCH MECHANISM

Application filed December 7, 1929. Serial No. 412,401.

This invention relates to an improvement in a mechanism operating and controlling switches or circuit breakers and more particularly to one of the motor actuated type.

Although not necessarily limited thereto, this invention is particularly directed to the provision of automatic means for actuating periodic signal lights, signs, etc., and is of an arrangement such that the periodic opening or closing of circuits may be readily altered without disorganization of the device in any way.

Prior to this invention devices of a similar nature have been produced. For example, switches or circuit breakers for semaphores, electric signs, light beacons, and machines of many types. In some of these devices provision is made to control the duration of time between closing and opening circuits. Provision is also made to vary the time periods of certain of the circuits. In few of these structures, however, it is possible to control or vary the closing and opening of circuits with absolute time precision. Those devices, which are capable of operating on second or minute periods with any precision, are of elaborate construction and necessarily are economically impractical for all ordinary uses.

The principal object of this invention therefore, as disclosed in the following specification, is to produce a device of this class capable of opening and closing circuits intermittently at regularly recurring intervals with clock time precision.

Another object of this invention lies in the provision of a device of this class, the periodic circuit opening or closing of which may be changed as required.

A further object of the invention lies in the arrangement of all moving parts by which it is possible to make use of one means of lubrication.

A still further object of this invention is to produce a device of this class having the precision operation of elaborate devices and yet which may be economically produced and distributed for general use.

Other and further objects of the invention will appear from a consideration of the following specification which is taken in conjunction with the accompanying drawings, and in which

Fig. 1 is a front elevation of one modification of this invention in position of use, a schematic showing of the electrical connections for a system of signal lights also being indicated;

Fig. 2 is an enlarged plan view of the structure in Figure 1, showing the method of making the electric connections between the device and suitable signals;

Fig. 3 is a front elevation of the device with the cover removed and discloses the relative location of the actuating motor, rotating members and circuit breakers;

Fig. 4 is an enlarged bottom plan view of the structure shown in Figure 3, being taken substantially on the line 4—4 of that figure and discloses one of the circuit breakers;

Fig. 5 is a side elevation of the structure in Figure 3 and shows further details of construction;

Fig. 6 is a fragmentary rear elevation, showing the method of connecting the circuit breakers with the signal system;

Fig. 7 is an enlarged vertical sectional view taken substantially on the line 7—7 of Figure 3 and discloses in detail the elements of the device;

Fig. 8 is a horizontal sectional view taken substantially on the line 8—8 of Figure 9 and shows the cam release of one of the triggers;

Fig. 9 is an enlarged fragmentary front elevation showing one of the circuit breakers in contact, one trigger released and another trigger about to be released, to cause change of circuit;

Fig. 10 is a fragmentary horizontal sectional view taken substantially on the line 10—10 of Figure 5, showing the double circuit contact for the short period signal;

Fig. 11 is a horizontal sectional view taken substantially on the line 11—11 of Figure 5 and shows the structure by which the device is caused to move instantly, opening one circuit and closing the next;

Fig. 12 is a horizontal sectional view taken substantially on the line 12—12 of Figure

7 and discloses details of the reduction gearing between the motor and the circuit breaker operator;

Fig. 13 is a fragmentary sectional view taken in the same plane as Figure 10 and shows the circuit closed for one of the full period signals; and

Fig. 14 is a view similar to Figure 13, showing the circuit contact for the other full period signal.

To facilitate a clear understanding of this invention, the device is shown adapted to operate a street signal or semaphore having the usual red, amber and green lights. Because of the provision of an amber light, it is necessary that the contact therefore be actuated twice to every actuation of the contact for the red or green lights. It is contemplated, however, since signal systems vary in different localities, to eliminate the amber light and cause the red lights in different directions to simultaneously function during the light changing period which would correspond to the period of time the amber light was in circuit.

Referring particularly to Figure 1 of the drawings this invention, indicated by the reference numeral 10, is formed with a housing 11, having flanges 12, which are secured by bolts 13 to a supporting member 14. Connecting the uprights of the supporting member is a plate 15 by means of which connection is had with the device from a source of power and with a set of three signal lamps diagrammatically shown and indicated by the numerals 16, 17 and 18. For purposes of description, the lamp 16 is considered the green lamp, lamp 17 amber and lamp 18 red.

The housing 11 is formed to receive a motor 20 and is provided with a depending offset rim 21. The rim 21 has engaged therewith a cover or container 23 within which all the moving parts of the device are housed with the exception of the rotor. The bearings by which the rotor is supported are located within the cover 23. Since this cover is completely filled with oil, when the device is in use every moving part in need of lubricant is completely submerged in oil and as a result none of the working parts of the device will become out of order by reason of lubrication neglect. Inasmuch as oil is a nonconductor of electricity, it is possible to completely submerge the circuit breakers in the lubricant and therefore prevent arcing of the contacts as circuits are opened or closed.

Projecting downwardly from the housing 11 into the rim 21 are shoulders 24. Engaged with the shouders 24 and secured thereto by means of screws 25 is a frame 27. Secured to or mounted in the frame 27 are all the moving parts of the device. The frame 27 is formed to provide compartments 28 and 29. The compartment 28 is created by the full length wall 31 of the frame, short vertical wall 32 and horizontal walls 33 and 34. The compartment 29 is defined by the vertical wall 31 and horizontal walls 34 and 36. Mounted in the compartment 28 is a reduction mechanism by which the high speed of the motor 20 is changed to a slow speed. Within the compartment 29, the timing mechanism is mounted and beneath the horizontal wall 36, the contacts are located.

For the purpose of a clearer understanding of the invention, the structure mounted on the frame 27 will be divided into three parts, namely, the reduction mechanism, timing mechanism and contact mechanism, and will be so described.

As above stated, the bearings by which the motor 20 is supported are located beneath said motor. Referring to Figure 7 of the drawings, it will be noted that the shaft 38 upon which the rotor is mounted extends downwardly through the compartment 28 and is supported in bearings 39 and 40 set in the horizontal walls 33 and 34 of the frame 27. The bearing 39 is of the usual sleeve type being fitted with a collar 42 by which to hold it in place in the wall 33. The bearing 40, however, is a thrust bearing and adapted to support the weight of the rotor and shaft 38, being held in place in the wall 34 by a collar 43. Mounted on the reduced portion 45 of the shaft 38 is a worm gear 46. Supported in bearings 48 and 49, set in the vertical walls 31 and 32 respectively, is a horizontal shaft 50. On the reduced portion of the shaft 50 is mounted a gear 51 which engages and is rotated by the worm 46. Exteriorly of the compartment 28 and mounted on the projecting end 52 of the shaft 50 is another gear 54. In the same horizontal plane with the shaft 50, but on the opposite side of the vertical shaft 45, another shaft 56 is mounted, being supported in the vertical frame walls upon bearings 57 and 58. One end of the shaft 56 projects beyond the bearing 58 and has mounted thereon a gear 60. Centrally of the shaft 56 is a worm gear 61.

Supported centrally of the outer face of the vertical wall 32, and by means of a screw 63, is a slotted bracket 64. Mounted on a pin 65, fitted in the upper end of the bracket 64, is an idler gear 66, (see Figure 3) which is adapted to engage gears 54 and 60 transmitting power from the shaft 50 to the shaft 56. Obviously, the slower the speed of the timing mechanism, the longer the periodic signals may be made to hold. Through the use of gears 54 and 60, a complete cycle of the timing mechanism consumes approximately one minute of time. Should it be desired to extend that time to permit illuminating certain signals for a longer period, the gear 54 may be removed and a smaller gear substituted in its place. If a considerable change is desired, both gears 54 and 60 may be removed and replaced with a very

small and very large gear. The idler gear 66, being mounted on the adjustable bracket 64 may be made to transmit the power from gear 54 to gear 60 regardless of size difference.

Mounted in the frame 27 and supported in the horizontal walls 33, 34 and 36, through bearings 68, 69 and 70, is a shaft 71. Beneath the wall 33 and secured to the shaft 71 is a gear 73 which is engaged with and adapted to be rotated by the worm 61 mounted on the shaft 56. It will be understood that the shaft 71, by reason of the reduction gearing above described, rotates at a very low speed.

Attention is now directed to the compartment 29 between the horizontal walls 34 and 36. In this compartment is located the timing mechanism which controls the circuit breakers located therebeneath. Directly beneath the horizontal wall 34 and mounted on the shaft 71 is a cam 74 which is formed with a collar 75 adapted to act as a spacer to the cam mounted therebeneath. The flange 76 constitutes the actuating surface of the cam 74 and is formed with an arcuate recess 77. The reduced portion 78 of the flange 76 bounds one side of the recess 77 and the other side of the recess is bounded by the wall 79 which is the full depth of the flange 76. Since the cam 74 rotates in a counter clock-wise direction, it will be readily understood that the reduced portion 78 first contacts with a trigger, moving said trigger vertically downward as the thickness of the flange 76 increases. When the cam has rotated a full revolution the trigger, being of a size adapted to pass through the recess 77, moves upwardly. It will be understood that the cam 74, in the present showing, defines the lighted period of the amber light 17 when, in the lighting cycle, the signal changes from green to red. Directly beneath the cam 74, is a cam 81 having a collar 82 which abuts the collar 75. This cam is secured to the shaft 71 by means of a set screw 83. The cam 81 is formed with a recess similar to the recess 77 of the cam 74 and is mounted on the shaft 71 in a manner such that the recess therein is directly beneath the reduced portion 78 of the cam thereabove. This cam controls the contact of the circuit for the green light 16. Beneath the cam 81 and secured to the shaft 71, by the set screw 85, is a spacing collar 86. Beneath this collar, and secured to the shaft 71 by means of a set screw, is a cam 88 similar to the cams above described but mounted in inverted position. This cam is adapted to control the circuit of the amber light 17 during the cycle when the signal is changing from red to green. A collar 89, formed integral with the cam 88, spaces said cam from a cam 91 therebeneath. The cam 91 is similar in all respects to the above described cams, being secured to the shaft 71 by a set screw 92. This cam controls the circuit of the red light 18. Occupying the space between the lower edge of the cam 91 and the top edge of the bearing 70 of the shaft 71, is a collar 93.

In each corner, of the horizontal wall 34, are drilled openings 95. On center with the openings 95, similar openings 96 are made in the horizontal wall 36. Mounted in each pair of openings 95 and 96 is a trigger shaft 98. The upper end of this shaft projects through the horizontal wall 34 and engages a plate 99 secured to the inner face of the vertical wall 32 of the frame. Encircling the upper end of the shaft and secured thereto is a collar 101. Between this collar and a second collar 102, also mounted on the shaft, is a spring 104. By means of the spring 104 any downward movement of the trigger rod 98 is resisted, since said spring is compressed during this movement. Secured to the rod 98 is an annular trigger 105. The rim of the trigger, shown in Figure 7 of the drawings, is engaged with the under face of the cam 88 which controls the amber light 17. Four trigger rods are mounted in the openings 95 and 96 provided therefore in the horizontal walls 34 and 36, one trigger being actuated by one of the four cams 74, 81, 88 and 91. Attention is directed to the fact that the lower end 106 of each trigger rod 98 projects beneath the horizontal wall 36. The extent of this projection is governed by one of the cams through the trigger 105. The purpose of extending the ends of the trigger rods beneath the wall 36 will later be described in connection with the contact mechanism. Secured to the full length wall 31 of the frame 27, within the compartment 28 and in the same horizontal plane as the plate 99 is a plate 108. This plate extends the full width of the wall 31, being recessed, however, to clear the reduced portion 45 of the rotor shaft 38. Openings in each end of the plate receive the upper ends of two of the trigger rods 98.

The shaft 71, upon which are mounted the circuit control cams, extends beneath the horizontal wall 36. Mounted on this portion of the shaft and free to rotate relative thereto is a sleeve 110 having a collar portion 111 which abuts the lower face of the bearing 70. Extending from the shoulder 113 in the sleeve 110 is an annular recess 114. When the sleeve 110 is mounted on the shaft 71, a coil spring 116 is fitted over said shaft and into the recess 114. The upper end 117 of said spring is secured to the sleeve 110, whereas, the lower end 118 is engaged in the slot 119 formed in the collar 120. This collar is secured against rotation on the shaft 71 by means of a cotter pin which penetrates both the shaft and the collar. Secured to the collar 111 of the sleeve 110 and projecting outwardly therefrom is a pin 122. As shown in Figure 7 of the drawings, this pin abuts one of the trigger rods 98. Encircling the sleeve 110 is

a sleeve 123 formed from any suitable non-conducting material such as fiber. Mounted on the fiber sleeve, adjacent the rim 124, is a contact cam 126 which is formed with a sleeve portion 127, an annular flange 128 and a pair of oppositely disposed cam faces 130, (Figure 10). Beneath the cam 126 is another cam 132 from which projects a cam face 133. A still further cam 135, having a projecting face 136, is mounted on the fiber sleeve 123 beneath the cam 132. A fiber washer 138 is placed against the lower edge of the cam 135 and fiber sleeve 123. A nut 139 engages the threaded portion 140 of the sleeve 110 and, when rotated, draws the cams 126, 132 and 135 into close engagement.

The horizontal wall 36 of the frame 27, adjacent the vertical wall 31, is formed with an outwardly projecting lug 142 having an opening therethrough. Mounted in the lug and extending downwardly therefrom is a bolt 143, the head 144 of which rests upon the upper face of the lug. In threaded engagement with the bolt 143 and beneath the lug 142 is a nut 146 which is adapted, when rotated, to firmly secure the bolt to said lug. Mounted on the bolt 142 is a fiber or other insulating sleeve 147. Abutting the nut 146 and mounted on the sleeve 147 is a fiber washer 148. Between this washer and a similar one therebeneath and mounted on the sleeve 147 is a contact member 150 which is comprised of two directional arms 151 and 152. Secured by screws 154 to the arm 151 is a flexible contact strip 155 which is formed at the end with a contact tip 156. Also secured by screws 154 is a spring metal strip 158 which curves around the rear of the contact member 150 and projects substantially parallel to the arm 152. The end of the arm 152 is formed with a contact head 159. The member 150 is adapted to pivot freely about the bolt 143. Three other contact members 160, 161 and 162, similar to the member 150, are mounted upon the sleeve 147. The lowermost of the washers 148, mounted on the bolt beneath the contact member 162, is held in place by means of a cotter pin 164 which projects through an opening in the bolt. Secured to the outer face of the frame wall 31 by screws 165 is a fiber or other composition strip 166. The lower end of this strip projects well below the horizontal frame wall 36 and has secured thereto by screws 168, contact elements 169, the ends 170 of which project horizontally beyond the edge of the strip 166. Secured to the opposite vertical face of the strip 166, by screws 168, are wire connection tabs 172. The strip 166 is so arranged that the projecting contact elements 169, mounted thereon, are located between the free end of the metal strip 158 and the head 159 of the arm 152. The purpose of this arrangement will be set forth in the description of the operation of the device.

To assemble and arrange the above described device for operation, the following steps are to be observed. Subsequent to joining the frame 27 to the housing 11 by screws 25, the motor 20 is installed, the rotor shaft 38 of which projects through the bearing 39 and terminates in the thrust bearing 40. Shafts 50 and 56 are now mounted, the shaft 50 bearing the gear 51 and the shaft 56 the worm gear 61. The gears 54 and 60 may now be mounted on the outer end of the shafts 50 and 56 and the bracket 64 supporting the idler gear 66 adjusted to engage said idler gear with the gears directly thereabove.

The shaft 71 is mounted in the frame 27 and as it is moved upwardly into the compartment 28, the timing mechanism, which is comprised of cams 74, 81, 88 and 91, and coliars 86 and 93, is mounted thereon. As the shaft is moved upwardly into the compartment 28, the gear 73 is secured thereon and made to engage the worm gear 61. The trigger rods 98 are each engaged within the openings 95 and 96 provided therefore in the horizontal walls 34 and 36. The triggers 105 may be mounted on the rods 98 either prior or subsequent to installing said rods. The timing mechanism cams in the compartment 29 must be adjusted to control the length of time each of the lights is to be illumined. Assuming that it is desired to cause the red and green signals to be illumined an equal length of time, the cams 81 and 91 are rotated to positions such that the recesses 77 therein are in vertical alignment. It is also assumed, for the purpose of explanation, that the amber signal during changes from red to green and green to red will be the same. Since cams 74 and 88 control the amber signal, the recesses 77 of these cams will be centered. It will be noted that the recesses in the amber signal cams 74 and 88 are slightly in advance of the recesses for the green and red signal cams. The advanced distance or space between the recesses of the amber signal cams and the red and green signal cams constitutes the period through which the amber signal will be illumined. As arranged on the drawings, this period is approximately one-sixth the period of the green and red signal periods. Should it be decided to increase the duration of the amber signal period, the cams 74 and 88 are advanced still farther. As a result of this advancement, the green and red signal periods are decreased to the extent of the increase in the amber signal periods.

It is often found necessary to arrange a street signal or semaphore so that one green signal will be illumined for a greater period of time than the green signal at right angles thereto. This irregularity of signal periods may be had by rotating in a clock-wise direction the green signal cam and following

amber signal cam, 81 and 74 respectively. This direction is contrary to the normal direction of rotation of the cam and consequently, when said cams are set back and secured by set screws, their time periods will be advanced. It will be noted that in order not to alter the duration of the amber signal following the green signal, the cam 74 must remain in the same relative position to the cam 81 as the other amber signal cam 88 is positioned relative to the red signal cam 91.

To meet certain traffic conditions it might be found desirable to increase the time periods of the red and green signals without decreasing the period of the amber signal. This may be accomplished by removing gear 60 on the shaft 56 and substituting a larger one therefore and removing gear 54 on the shaft 50 and substituting a smaller one. In this manner the shaft 56 would be rotated more slowly than the shaft 50, whereas, in the present instant they rotate at the same speed.

After mounting the timing mechanism, the contact mechanism is made fast to the lower end of the shaft 71 beneath the horizontal frame wall 36. The sleeve 110, insulating sleeve 123 and cams 126, 132 and 135 are joined and held together by engagement of the nut 139 with the threaded portion 130 of the sleeve 110. The coiled spring 116 is mounted in the recess 114 in the collar 110 in a manner such that the upper end 117 thereof engages the collar portion 111. These assembled elements are now fitted on the shaft and the collar 120, through the slot 119 is engaged with the lower end 118 of the spring. The collar 120 is rotated several turns in a clock-wise direction to place a tension upon the spring 116, being held in this position by means of a cotter pin which penetrates both the shaft and the collar. By securing the collar 120 against rotation relative to the shaft 71, a rotating spring tension is created between the shaft 71, and the cams 126, 132 and 135 on the sleeve 110. The sleeve would obviously immediately rotate to relieve the tension of the spring 116 were it not for the fact that the pin 122 secured thereto contacts with the end 106 of one of the trigger rods 98. When the device is in operation, the shaft 71 is continually in motion. The contact mechanism, however, is held against rotation by engagement of the pin 122 with the end of one of the trigger rods 98 until said trigger rod is raised by action thereon of one of the cams in the timing mechanism. At this time the contact mechanism will rapidly rotate, due to tension of the spring 116, until the pin 122 strikes the next adjacent trigger rod 98. In this manner the contacts are held through the full lighting period controlled by each cam in the timing mechanism and caused to instantly make and break contacts.

To prevent overloading the motor through the timing mechanism by reason of abnormal tension upon the spring 116, the cotter pin, by which the collar 120 is joined to the shaft 71, is formed from material insufficient to withstand the tension of the spring when it is completely wound up. The pin will therefore break allowing said collar to rotate freely relative to the shaft 71. In the practical use of this device it has been noted that on occasion certain of the elements fail to function properly, for instance, the timing cams may become loosened thus slowing up or preventing raising the trigger rods by which the contact mechanism is permitted to rotate. With rotation of the contact mechanism prevented by failure of a trigger rod and the continued rotation of the shaft 71 and collar 120, the spring 116 is completely wound up about the shaft 71 preventing rotation of said shaft and functioning of the motor. The cotter pin breaks under the abnormal spring tension, frees the collar 120 of engagement with the shaft 71 and permits no damage to occur in the working parts of the device. Obviously it is a simple matter to remove the cover 23, adjust the tension of the spring and insert a new cotter pin by which to prepare the device for further use.

The circuit connectors mounted on the bolt 143, secured to the frame lug 142, are next installed. The contact members are mounted one beneath the other, being spaced apart by washers 148 and are adjusted with the free end of the metal strip 158 on one side of the contact elements 169 and the arms 152 on the other side of said elements. The flexible contact strip 155 projects toward the contact mechanism mounted on the shaft 71 and the tips 156 are adapted to engage the contact cams as said cams are permitted to rotate. Connection with the contact elements 169, through the tabs 172, may be had in any suitable manner, as by wires, shown in Figure 6 of the drawings, which project upwardly through the device and end in terminals supported on the plate 15. From this plate connection is had with a source of power and with the signal lamps 16, 17 and 18.

After the above connections have been made the device is ready for operation. Referring to Figure 3, it will be noted that the lowermost trigger 105 is engaged and held in the position shown by contact with the timing cam 91 which controls the circuit of the red signal 18. During the period the trigger is held down by the cam 91, contact of the member 162 is made through the portion 156 with the face 136 of the cam 135 and also through the metal strip 158 with the element 169 which in turn is connected through the screw 168 and tab 172 with the wire leading to the signal 18. The uppermost contact strip 155, as shown in Figure 11, is at all times in engagement with the annular flange

128 of the cam 126. As the timing cam 91 is rotated by the shaft 71, the recess 77 of said cam will vertically align with the trigger 105. Since the trigger and trigger rod 98 are held down by the cam 91 against tension of the spring 104, as soon as the recess 77 aligns itself with the trigger, said trigger will move upwardly. As a result of the instant upward movement of the trigger rod, the lower end thereof will move toward the horizontal frame wall 36 and permit the pin 122 to rotate until it engages the projecting end of the next adjacent trigger rod 98. As stated above the pin 122 is integral with the contact cam elements and as a result, when rotated by the spring 116, the cam surface 136 will move out of engagement with the contact member 162 and one of the contact faces 130 of the cam 126 will be caused to engage the contact member 160 at which time the amber signal 17 will be illumined (see Figures 9 and 10).

During the time which the red light was illumined, the timing cam 88 was causing one of the triggers 105 to be depressed and, in fact, immediately after one circuit is opened and another closed, three of the four triggers are being depressed in order that the rods 98 upon which they are mounted will act as stops to rotation of the pin 122. When the cam 88 has rotated a sufficient distance, the recess 77 therein will align with the trigger 105, permitting said trigger to move upwardly. The pin 122 is free to rotate until it strikes the next adjacent trigger rod. Rotation of the contact cams causes the circuit through the cam surface 130 and contact 160 to be broken and brings the face 133 of the cam 132 into engagement with the contact member 161, thus illumining the green signal 16 (see Figures 11 and 14). The timing cam 82 now controls the system and, when this cam has rotated sufficiently to align the recess therein with the adjacent trigger, said trigger moves upwardly, freeing the pin 122, permitting a one-quarter rotation of the contact cams, causing the face 133 of the cam 132 to move from the contact member 161 and at the same time the other face 130*a* of the cam 126 to contact with the member 160, thus again illumining the amber light 17. At this point it is well to note that the timing mechanism is provided with four cams, two of which control the amber circuit, whereas, there are only three contact cams, one of which, however, being provided with two oppositely disposed contact faces (see Figure 10). The timing cam 74 now controls the duration of the amber light 17. At the end of the amber light period, the recess 77 of the cam 74 registers with the trigger 105, permitting the trigger rod 98 to move upwardly. The pin 122, being freed, now rotates causing the contact cam 130*a* to break and the contact cam 136 to again make the circuit complete to illumine the red signal 18.

This invention, although shown adapted to actuate a signal system for traffic control, may be readily utilized to control other signal or lighting systems or to control the operation of machines and therefore applicants do not intend to be limited in the spirit and scope of this invention other than as defined by the hereunto annexed claims.

Having thus set forth our invention what we claim as new and for which we desire protection by Letters Patent is:

1. A motor driven circuit control mechanism comprising a housing, a motor in said housing, a frame mounted externally of said housing, a reduction unit mounted in said frame, bearings in said frame supporting the rotor shaft of said motor, timing and contact units in said frame and a cover removably joined to said housing, said cover being adapted to completely enclose said mechanism and further adapted to be filled with lubricant whereby to lubricate said mechanism.

2. In a motor driven circuit control mechanism, a frame having compartments therein, a timing unit in one of said compartments, said timing unit having a plurality of cams mounted for rotation, a trigger in contact with each of said cams, means causing an upward pressure of said triggers on said cams and further means at regular intervals, permitting upward travel of said triggers whereby to open or close the circuits in a contact unit.

3. In a motor driven circuit control mechanism, a frame having compartments therein, a reduction unit mounted in one of said compartments and having a low speed shaft extending downwardly therefrom into the other of said compartments, a timing unit in the other of said compartments having a plurality of cams mounted on said shaft, triggers engaged with said cams, trigger rods supporting said triggers, and means controlled by the vertical reciprocation of said triggers adapted to open and close circuits at regular intervals.

4. In a motor driven circuit control mechanism, a contact unit comprising a plurality of cam surfaces and contact arms, a rotatable shaft supporting said cams, means yieldably engaging said cams with said shaft and further means preventing rotation of said cams with said shaft except at predetermined intervals.

5. In a motor driven circuit control mechanism, a timing unit, a motor driven shaft in said unit, time phase cams mounted on said shaft, means permitting relative adjustment of said cams whereby to change their relative time phase, rods in said unit, triggers mounted on said rods contacting with said cams, said cams being adapted to alternately depress and release said rods.

6. In a motor driven circuit control mecha-

nism, a timing unit, a shaft in said unit, cams mounted on and secured to said shaft, spring supported rods in said unit, triggers on said rods contacting with the underface of each of said cams and means on said cams alternately depressing and releasing said triggers.

7. In a motor driven circuit control mechanism, a timing unit, a contact unit, reciprocable rods mounted in said timing unit and projecting into said contact unit, a motor driven shaft projecting into said contact unit, a plurality of contact cams mounted on said shaft and rotatable relative thereto, a spring yieldably connecting said cams with said shaft, a pin connected with said cams and engageable with said rods, and means in said timing unit releasing said rods, one at a time, whereby said pin is disengaged from successive rods and under tension of said cam spring rotates to engage the next successive rod.

8. In a motor driven circuit control mechanism, a contact unit, a motor driven shaft projecting into said unit, a sleeve loosely mounted on said shaft, cams on said sleeve, spring means yieldably connecting said shaft with said sleeve, a pin on said sleeve, rods projecting into said unit and engageable with said pin, and means withdrawing each of said rods in turn from contact with said pin whereby said pin, under tension of said spring means, is caused to rotate about said shaft to engage the next successive pin at a speed greater than the speed of rotation of said shaft.

9. In a circuit control mechanism having a motor, a rotor shaft projecting from said motor, a frame joined to said motor and receiving the projecting portion of said shaft in suitable bearings, said frame having mounted thereon progressively arranged and operating reduction, timing and contact units operatively connected with said rotor shaft, and a cover enclosing all of said units, said cover, when filled with lubricant, constituting a single means for lubricating all moving parts of said mechanism.

10. In a circuit control mechanism having a motor, a frame joined to said motor, reduction, timing and contact units on said frame, said units being arranged progressively downwardly of said frame each having operative connection with the adjacent unit, and a cover enclosing all of said units, said cover, when filled with lubricant, constituting a single means for lubricating all moving parts of said mechanism.

11. In a circuit control mechanism having a motor, a rotor shaft, a frame secured to said motor, said rotor shaft projecting into said frame, bearings in said frame supporting said shaft, reduction, timing and contact units on said frame, said units being progressively arranged for progressive functioning of said mechanism and lying substantially within the lateral limits of said frame, and a cover enclosing said frame, said cover, when filled with lubricant, constituting a single means for lubricating all moving parts of said mechanism.

12. In a motor driven circuit control mechanism a timing unit, a shaft in said unit, relatively adjustable cams on said shaft, a trigger rod in contact with each of said cams, means releasing said rod from contact with said cam and further means moving said rod axially of said cam when released from contact therewith, whereby said rod will release a contact unit for operation.

13. In a motor driven circuit control mechanism, a timing unit, a driven shaft in said unit, relatively adjustable cams on said shaft, a trigger rod in contact with each of said cams, means moving said rod axially of said cam when said cam contact is released during operation of said mechanism, whereby said rod will release a contact unit for operation.

In testimony whereof we have affixed our signatures.

FRANK C. BALL.
CLAUD C. SALISBURY.