Feb. 16, 1943. D. S. WILLSON 2,311,193

INTERLOCK MECHANISM

Filed Oct. 25, 1941 2 Sheets-Sheet 1

FIG. I.

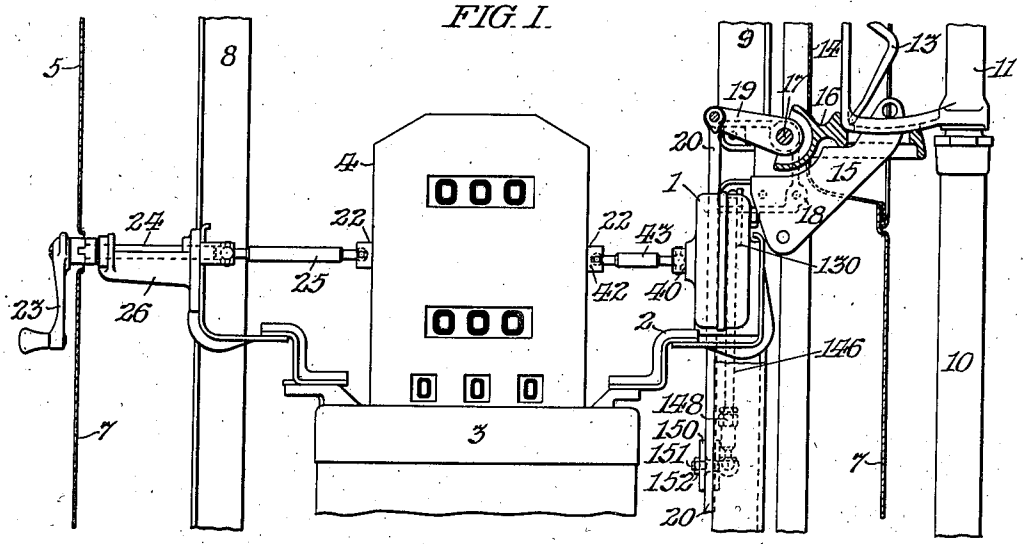


FIG. VII.

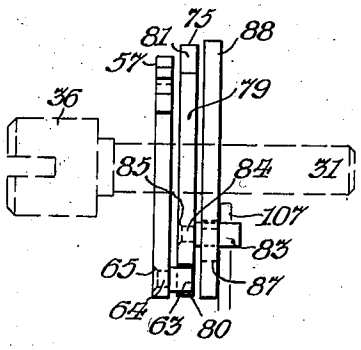


FIG. VI.

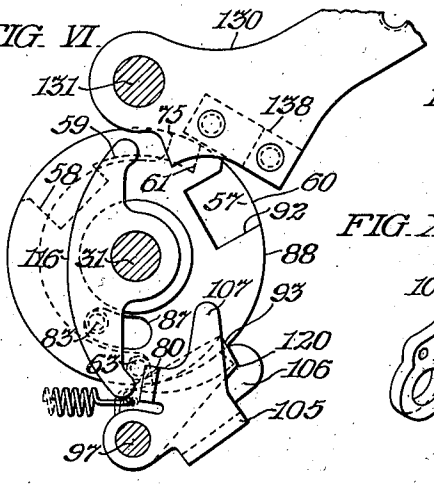


FIG. XII.

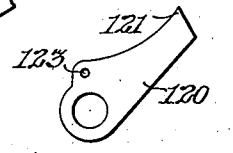


FIG. XI.

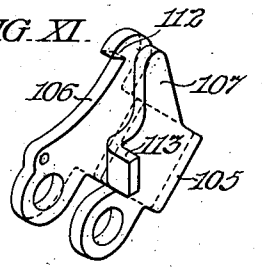


FIG. VIII.

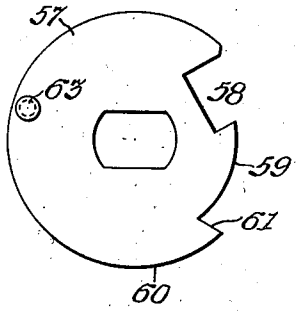


FIG. IX.

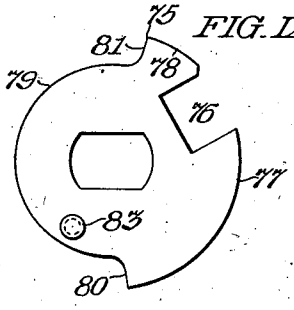
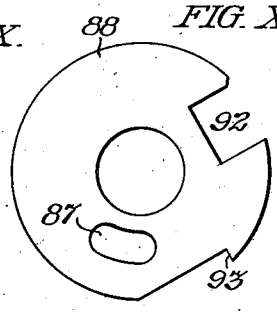


FIG. X.



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Feb. 16, 1943. D. S. WILLSON 2,311,193

INTERLOCK MECHANISM

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FIG. II.

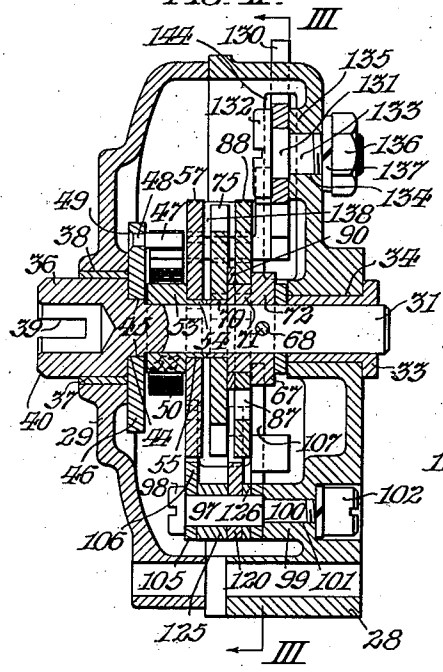


FIG. III.

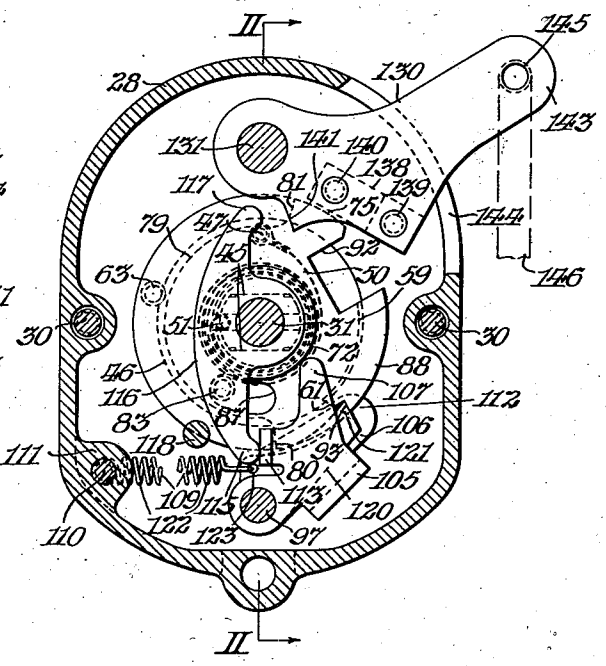


FIG. IV.

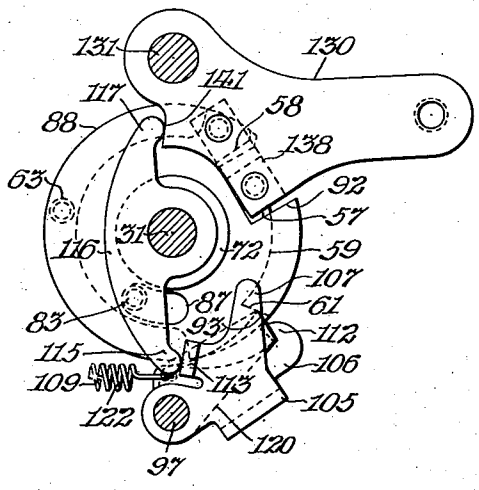
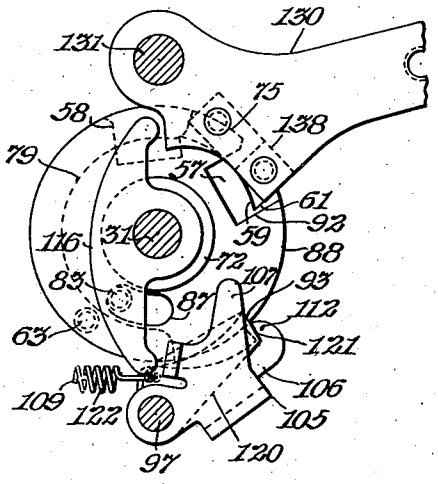


FIG. V.



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Patented Feb. 16, 1943

2,311,193

UNITED STATES PATENT OFFICE

2,311,193

INTERLOCK MECHANISM

David S. Willson, Muskegon Heights, Mich., assignor to John Wood Manufacturing Company, Inc., Philadelphia, Pa., a corporation of Delaware

Application October 25, 1941, Serial No. 416,600

9 Claims. (Cl. 221—95)

My invention relates to interlock mechanisms particularly applicable for use in fluid dispensing pumps. My improved interlock mechanism is adapted to be operatively connected to the resetting shaft of the clock indicating mechanism of a pump and is connected in controlling relation to the motor switch of the pump motor.

One object of my invention is to provide an interlock which is compact, sturdy, simple, and inexpensive to manufacture.

Another object of my invention is to provide an interlock mechanism which prevents the resetting of the pump indicating means when the motor switch is closed.

Another object of my invention is to provide an interlock mechanism which necessitates the resetting of the indicating mechanism to zero position before the motor switch can be moved to closed position.

My invention includes the various novel features of construction and arrangement hereinafter more definitely specified.

Fig. I is a fragmentary vertical sectional view of a fluid dispensing apparatus of a conventional type and showing my improved interlock mechanism connected both to the set-back shaft of the pump indicating mechanism and to the motor switch operating mechanism.

Fig. II is a vertical sectional view of the interlock mechanism shown in Fig. I, taken on the lines II, II in Fig. III.

Fig. III is a vertical sectional view of the interlock mechanism shown in Fig. I, taken on the lines III, III in Fig. II. Fig. III shows the mechanism in the position it assumes when the indicating mechanism has been reset to zero position and with the pump motor switch in open position.

Fig. IV is a partial vertical sectional view of the mechanism shown in Fig. III, but with the switch lever moved to position to close the motor switch.

Fig. V is a partial vertical sectional view of the mechanism shown in Fig. III, and with the switch lever moved partially to open the motor switch.

Fig. VI is a partial vertical sectional view of the mechanism shown in Fig. III, and in the position which it assumes when the switch lever is fully moved with the motor switch opened, but before resetting of the pump indicating mechanism.

Fig. VII is a partial elevation of the shaft and cam assembly shown in Fig. II.

Fig. VIII is an elevation of the cam disk shown at the left hand side of Fig. VII.

Fig. IX is an elevation of the intermediate cam disk shown in Fig. VII.

Fig. X is an elevation of the right hand cam disk shown in Fig. VII.

Fig. XI is a perspective view of the locking dog shown in Figs. II to VI inclusive.

Fig. XII is an elevation of the locking pawl for the cam disk shown in Fig. X.

Referring to Fig. I, the interlock mechanism, generally indicated by the reference mark 1, is mounted on the bracket 2 which is rigidly fastened to the top of the variator housing 3 of the computing indicating mechanism 4 of the liquid dispensing apparatus, generally indicated by the reference mark 5. The computing clock indicating mechanism shown in Fig. I is of the type shown and described in Letters Patent of the United States No. 2,151,239 granted March 21, 1939, to Slye et al.

Said liquid dispensing apparatus chosen for illustration is the well-known computing pump and includes the housing 7; chassis frame members 8 and 9; and dispensing hose 10 which has at its distal end the dispensing nozzle 11. The nozzle 11 is of the well-known conventional type and includes a valve under control of the manually operative pivoted lever 13. When the nozzle 11 is not in use, it is placed by the operator in the nozzle boot 14, formed in the side of the housing 7, and is positioned on the bracket 15 rigidly mounted on the frame member 9. When the nozzle 11 is positioned in the housing, as shown in Fig. I, the weight of the nozzle rests on the right hand end of the switch lever 16 which is pivotally mounted at 17 on the bracket 18 rigidly connected to the side frame member 9. Said pivoted switch lever 16 includes the arm 19 which is pivotally connected to the depending link 20, the distal end of which is connected in operating relation to the electric switch controlling the pump motor. Clockwise movement of the pivoted arm 16 causes the motor switch to be moved to "off" position, and counterclockwise movement of the pivoted arm 16 causes the motor switch to be moved to "on," or closed, position. Said computing clock mechanism includes the shaft 22 by which the gallons indicating wheels and the dollar value indicating wheels are contemporaneously reset to zero position by manual operation of the crank 23 which extends beyond the housing and is connected to the setback shaft 22, conveniently by the shaft 24 and link 25, the opposite ends of which link 25 are respectively connected to the shafts 22 and 24. The shaft 24 is conveniently supported in the

bracket 26 which is rigidly connected to the frame member 8 and the top of the variator housing 3.

As best shown in Fig. II, the interlock mechanism is enclosed in the casing 28 which is provided with the cap member 29, conveniently rigidly fastened to the casing 28 by a series of screws 30. The interlock mechanism includes the shaft 31, the right hand end of which is journaled in the bearing sleeve 33 which is press-fitted in the opening 34 formed in said casing 28. Said shaft 31 is provided at its left hand end with the enlarged portion 35 which is journaled in the bearing sleeve 37 press-fitted into the opening 38 formed in the cap member 29. The enlarged head 35 of the shaft 31 has the slot 39 which forms the coupling member 40 which is driven by a corresponding coupling member 42, of the computer setback shaft 22, conveniently by means of the drive link 43, the opposite ends of which respectively engage the coupling members 40 and 42. Thus, rotation of the crank 23 will cause rotation of the computing clock setback shaft 22 and corresponding rotation of the interlock mechanism shaft 31. Accordingly, when the interlock mechanism assumes a position, hereinafter described, in which rotation of the interlock shaft 31 is prevented, it is impossible for the operator to turn the crank 23 to effect rotation of the indicating mechanism setback shaft 22.

The shaft 31 has at its left hand end an enlarged portion forming the shoulder 44 which has diametrically opposite flattened sides 45. The spring post retainer disk 46 is provided with an axial opening corresponding to the configuration of the flattened sided shaft shoulder, and said disk 46 is push-fitted on said shoulder 44 and turned with said shaft 31. Said disk 46 carries the spring post 47, which is conveniently rigidly connected to said disk 46 by riveting over the reduced left hand end portion 48 of said post 47 in the opening 49, of the disk 46, into which the reduced portion extends.

One end of the torsion spring 50, wound counterclockwise in Fig. III, encircles and is fastened to the post 47 of the disk 46. The opposite end of said torsion spring 50 is fastened by a hook to an opening 51 formed in the enlarged hub portion 52 of the sleeve 53 which is mounted for freedom of turning movement on the shaft 31. Said sleeve 53 has the reduced annular portion 54 provided with diametrically opposite flattened sides 55. The cam disk 57 is provided with an axial opening corresponding to the configuration of the flattened sided reduced portion 54 of the sleeve 53, and said cam disk 57 is push fitted and riveted on said sleeve 53 and turns therewith.

As shown in Fig. VIII, said cam disk 57 is provided with the notched recess 58 and a cam surface 59 of a lesser diameter than the diameter of the cam surface 60. The junction of said cam surfaces 59 and 60 forms the shoulder 61 in the periphery of said cam 57.

Said cam disk 57 is provided with the pin 63 which is conveniently rigidly connected to said disk 57 by riveting over the reduced left hand end portion 64 of said pin 63 in the opening 65, of the cam disk 57, into which the reduced portion 64 extends.

The shaft 31 has rigidly mounted thereon the sleeve 67 which is fastened to the shaft 31 conveniently by means of the pin 68 extending through said sleeve and shaft. Said sleeve 67 is provided with the reduced portion 70, the intermediate portion 71, and the enlarged portion 72. Said reduced portion 70 is provided with diametrically opposite flattened sides and has rigidly mounted thereon the cam disk 75 provided with an axial opening corresponding to the configuration of the reduced portion 70. Said cam 75 is push fitted and riveted on said shoulder 70 and turned with said sleeve 67 pinned fast to the shaft 31, as above described.

Said cam disk 75 has the notched recess 76, the cam surfaces 77 and 78 of the same diameter, and the cutaway surface 79 of lesser diameter than the cam surfaces 77 and 78. The junction of the surfaces 79 and 77 forms the shoulder 80 and the junction of the surfaces 79 and 78 forms the shoulder 81 in the periphery of the cam 75. The pin 63 is positioned in the outer portion of the cam disk 57 so that it is presented in the same path of travel of the shoulder 80 of the cam disk 75. Thus, the disk 57 is permitted to rotate under spring loading within limits defined by the pin 63 and the shoulders 80 and 81 of the disk 75, as hereinafter described in detail.

The cam disk 75 carries the pin 83 which conveniently is rigidly connected to said disk 75 by riveting over the reduced left hand end portion 84 of said pin 83 in the opening 85, of the disk 75, into which the reduced portion 84 extends. Said pin 83 extends into and through the arcuate slot 87 of the cam disk 88 which is mounted to turn freely on the intermediate shoulder 71 of the sleeve 67. Said shoulder 71 has mounted thereon and in axial alinement therewith the spacing ring 90 which is positioned between the disk 75 and the disk 88. As best shown in Fig. X, said cam disk 88 is provided with the notched recess 92 and with the peripheral notch 93.

The screw stud shaft 97, provided with the enlarged head 98, is rigidly mounted in the boss 99 formed in the lower part of the casing 28, and said stud shaft 97 has the screw threaded portion 100 engaging the opening 101 formed in said boss 99. Said stud shaft 97 is conveniently rigidly clamped in said housing 28 by engagement of the nut 102 with the screw threaded end 100 of said shaft 97. The lockout dog 105, having the two arms 106 and 107, is mounted with freedom of turning movement on the stud shaft 97. As best shown in Fig. III, said lockout dog 105 is continually stressed counterclockwise in Fig. III by the spring 109, one end of which extends through an opening in and is fastened to the arm 106 and the opposite end of said spring 109 encircles and is rigidly connected to a stud 110 rigidly mounted in the boss 111 formed in said casing 28. As shown in Figs. II and III, the arm 106 includes at its end the hook portion 112 which is presented in the path of and adapted to engage the shoulder 61 in the periphery of the cam disk 57. As best shown in Figs. III and XI, the other arm 107 of the lockout dog is provided with the ear 113 adapted to be engaged by the lower arm 115 of the throw-out arm 116 which is pivotally mounted on the shaft 31 with freedom of turning movement.

Said stud shaft 97 also has pivotally mounted thereon, with freedom of turning movement, the index pawl 120, the pointed end 121 of which is adapted for latching engagement with the notch 93 of the cam disk 88, as hereinafter described. Said index pawl 120 is continually stressed counterclockwise by means of the spring 122, one end of which is fastened to said index pawl 120, as at 123, and the opposite end of said spring encircles and is fastened to said stud shaft 110. As best shown in Fig. II, I find it convenient to provide

the spacing ring 125 between the hook arm member 106 of the lockout dog 105 and the index pawl 120, and to provide the spacing washer 126 between the index pawl 120 and the arm 107 of the lockout dog 105.

The cam lever 130 is pivotally mounted on the screw stud shaft 131 which has the enlarged slotted head 132 and screw threaded portion 133. Said stud shaft 131 is rigidly mounted by means of the nut 136 and lock washer 137 in an opening 134 formed in the boss 135 at the upper portion of the casing 28. As shown in Fig. III, said lever 130 carries the locking block 138 which is rigidly connected to the lever 130 conveniently by the rivets 139 and 140. Said lever 130 is provided with the extension face 141 adapted to engage the upper arm 117 of the throw-out arm 116 when the lever 130 is moved clockwise, in Fig. III, to motor switch closing position. Clockwise movement, in Fig. III, of said throw-out arm is limited by the lower arm 115 coming into engagement with the stud 118 rigidly mounted in the casing 28.

The lever 130 includes the arm 143 which extends through the slotted opening 144 formed in the upper part of the casing 28. The arm 143 is provided at its outer end with the opening 145 in which is engaged the upper end of the rod 146. Said rod 146 is provided at its lower end with the adjustable coupling member 148, the lower end of which is connected by a ball and socket joint to the member 150 which is rigidly clamped to the switch lever rod 20, conveniently by means of the screw 151 and nut 152, as shown in Fig. I.

Operation

My improved interlock mechanism operates as follows:

Assuming that the indicating mechanism has been reset to zero and the motor switch is in "off" position with the nozzle 11 positioned on the bracket 15 and switch lever 16, as shown in Fig. I; the operator removes the nozzle from the nozzle bracket and switch lever 16 and manually moves the switch lever 16 counterclockwise, in Fig. I, to close the motor switch. The previously performed resetting operation has caused the notched recesses 58, 76, and 92 of their respective cam disks 57, 75, and 88 to be brought into alinement. Said cam disks 57, 75, and 88 are shown in Figs. VIII, IX, and X in the relative positions which the disks assume at the end of the resetting operation. In such position wherein the notched recesses 58, 76, and 92 are in alinement, the hook arm 106, of the lockout dog 105, is in latching engagement with the shoulder 61 in the periphery of the cam 57, and the pointed end 121 of the index pawl 120 is in latching engagement with the notch 93 of the cam disk 88.

Counterclockwise movement of the switch lever 16 with its integral arm 19 causes the rod 20 to be moved downwardly in Fig. I. Such downward movement of the rod 20 causes the rod 146, connected to the rod 20 by the member 150, also to be moved downwardly, thereby causing the cam lever 130, connected to the upper end of the rod 146, to be moved clockwise in Fig. III. Clockwise movement of the lever arm 130 pivotally about its stud shaft 131, brings the locking block 138, carried by said lever 130, into registry with the alined notched recesses 58, 76, and 92 of the cam disks 57, 75, and 88. When the locking block 138 has moved partially into the alined notched recesses 58, 76, and 92, and the mechanism is in the position shown in Fig. III, the extension face 141 of the cam lever 130 is brought into engagement with the upper arm 117 of the throw-out arm 116. Continued movement of the cam lever arm 130 toward switch closing position moves the throwout arm 116 counterclockwise, in Fig. III, causing its lower arm 115, in contact with the ear 113 of the lockout dog 105, to move the lockout dog 105 clockwise, thereby causing the hook arm 106 to be moved out of latching engagement in the notch 61 of the cam 57. The cam disk 57, thus freed from the restraining engagement of the hook arm 106, is now free to rotate, under spring loading of the torsion spring 50, counterclockwise as in Figs. III and IV, but only to the extent represented by the difference between the dimensions of the notch 58 and the locking block 138, because the locking block 138 is still in the position shown in Fig. IV, with the motor switch closed.

When the operator has terminated the dispensation of fluid through the nozzle 11 by releasing the nozzle lever 13, the operator moves the motor switch to "off" position by clockwise movement of the switch lever 16, effected either manually or by the placing of the nozzle 11 on the outwardly extending arm of said lever 16. Clockwise movement of the switch lever 16 causes the rod 20, and the rod 146 connected thereto, to be moved upwardly, in Fig. I, thereby causing the cam lever 130 to be moved counterclockwise in Figs. IV and V. The first part of such counterclockwise movement of the lever arm 130 moves the locking block 138 out of detaining engagement in the notched recess 58 of the cam disk 57, but not out of engagement with the notches 76 and 92 in the cam disks 75 and 88, and the cam disk 57 is permitted to rotate counterclockwise under spring loading of its torsion spring 50 until its rotation is arrested by the shoulder 61, in the periphery of the cam 57, coming into engagement with the locking block 138. Fig. V shows the position of the interlock parts in the position just described. It is to be noted that with counterclockwise movement of the cam lever 130 to such extent, the motor switch is still in "on" position and slight additional counterclockwise movement of the cam lever 130 is necessary in order to effect movement of the motor switch to "off" position. However, the operator cannot move the switch lever clockwise when the parts have asumed the position shown in Fig. V, without first moving the motor switch to "off" position and fully completing the resetting operation, because such automatic partial counterclockwise rotation of the cam 57, under the spring loading of its torsion spring 50, has presented the cam surface 59 of the cam 57 into the path of the locking block 138 of the cam lever 130, thus preventing any clockwise movement of the lever 130.

Continued counterclockwise movement of the cam lever 130, effected by means of clockwise operation of the switch lever 16, not only frees the locking block 138 from engagement with the notch 61 of the cam 57, but contemporaneously moves said locking block out of engagement with the notched recesses 76 and 92 in the other cam disks 75 and 88. Upon disengagement of the locking block 138 from the notch 61 of the cam 57, said cam 57 is further rotated under spring loading of its torsion spring 50 until the pin 63 comes into engagement with the shoulder 80 formed by the juction of the surfaces 79 and 77 of the cam 75 which is pinned fast to the shaft

31. The interlock parts are shown in Fig. VI in the position just above described, with the motor switch open and the cam lever 130 moved to the full extent of its counterclockwise movement, but with the resetting of the clock not initiated.

The operator then resets the indicating mechanism to zero position by clockwise movement of the setback crank 23, which causes corresponding movement, not only of the indicating mechanism setback shaft 22, but also of the interlock shaft 31 which is directly connected by the coupling link 43 to said setback shaft 22. The direction of rotation to effect such resetting operation would be counterclockwise, as the shaft 31 is viewed in Fig. III. The cam disk 75 being rigidly mounted on the shaft 31 and the shaft 31 in turn being turned contemporaneously with the turning of the setback crank 23, said cam disk 75 is positively rotated counterclockwise by rotation of the cam 23.

Such counterclockwise rotation of the shaft 31 and cam disk 75 causes the cam disk 88 also to be turned counterclockwise because of the engagement of the pin 83, carried by the cam 75, with the end of the arcuate slot 87 in said cam 88. The cam 57 is also moved counterclockwise by such counterclockwise movement of the shaft 31, because the torsion spring 50 is connected at one end of the cam disk 57 and at its other end to the disk 46, which disk 46 is rigidly connected to the shaft 31.

Thus, the shaft 31 and the three cams 57, 75, and 88 are rotated as a unit until the shoulder 61 of the cam 57 arrives in position to be engaged by the hook arm 106 of the lockout dog 105. The hook arm 106 rides on the periphery 60 of the cam 57 until the notched recess 58 of the cam 57 is reached, at which point the spring 109 moves the lockout dog 105 counterclockwise in Fig. III. However, such counterclockwise movement of the dog 105 is limited to prevent said hook arm 106 from engaging the shoulder formed at the junction of the notch 53 and the cam surface 59, by the extension arm 107 coming into engagement and riding on the enlarged portion 72 of the sleeve 67 to maintain the hook arm 106 in a position in which it is just out of the path of the surface 59. Continued counterclockwise rotation of the shaft 31, by continued turning movement of the setback crank 23, brings the shoulder 61 of the cam 57 into engagement with the hook arm 106, thereby arresting further turning movement of the cam 57. In such arrested position, the notch 53 of the cam 57 is lined up in position to be engaged subsequently by the locking block 138 of the cam lever 130. Counterclockwise movement of the shaft 31 thereafter produces counterclockwise movement only of the cam disks 75, 88, and the disk 46, movement of the latter effecting a loading of the torsion spring 50, one end of which is connected to the disk 46 and the other end of which is connected to the cam disk 57 held stationary by the hook arm 106, as above described.

It is to be noted that the setback shaft 22 of the type of indicating mechanism shown in Fig. I cannot be turned continuously, as described in said Slye et al. Patent No. 2,151,239. The indicating mechanism illustrated is so constructed that the setback shaft 22 can turn only approximately 45° more than a complete revolution, at which point further turning movement is prevented. Upon release of the setback crank 23 by the operator, the setback shaft 22 is turned under spring action in the indicating mechanism to a stopping point which is equivalent to one complete revolution of 360° from the start of the setback operation. As stated in said Slye et al. Letters Patent No. 2,151,239, the purpose of such overthrow motion is to assure a correct lining up of the number of wheels of the indicating mechanism at zero position.

Thus, counterclockwise rotation of the cams 75 and 88 continues until further movement of the setback crank 23 by the operator is prevented by the operation of the elements of the indicating mechanism. The cam disk 88 tends to hang back because the index pawl 120 rides on the periphery of the cam 88. Just prior to the time when the indicating mechanism has reached the end of its maximum travel, the index pawl 120 drops into latching position with the notch 93 in the periphery of the cam 88. With the pointed end 121 of the index pawl 120 in the notch 93 of the cam 88, when the crank 23 is carried slightly farther and thereafter returned automatically by the clock mechanism when the crank 23 is released by the operator, the cam disk 88 is held in position wherein its notched recess 92 is in alinement in the path of travel of the locking block 138 of the cam lever 130.

When the operator releases the setback crank 23, the arcuate slot 87 of the cam 88 permits the cam 75, with its pin 83 extending through said slot 87, to reverse its previous direction of rotation, and move clockwise, by automatic operation of the indicating mechanism, to the extent of the overthrow.

Thus, the notched recesses 58, 76, and 92 of their respective cams 57, 75, and 88 again are in alined position in the path of travel of the cam block 138 of the cam lever 130 by reason of the fact that the hook arm 106 assures the proper alinement of the notch 58 of the cam 57; the notched recess 76 of the cam 75 is properly positioned because said cam is rigidly fastened to the shaft 31 connected directly to the setback shaft 22; and the pointed end 121 of the index pawl 120 in latching engagement with the notch 93 of the cam disk 88 assures that the notch 92 of said cam disk 88 is likewise in proper position.

The type of indicating mechanism shown may be recycled over and over again, as described in said Slye et al. Patent No. 2,151,239, by operation of the setback crank. Accordingly, if the operator should again recycle the clock mechanism after the indicating wheels have been restored to zero position and no closure of the motor switch has been effected since a previous recycling, my improved interlock mechanism goes through the first part of the cycle of operation as hereinabove described, but of course the hook arm 106 of the lockout dog 105 has not been thrown out of engagement with the notch 61 of the cam 57 because the cam lever 130 would remain unmoved from its uplifted position in which the motor switch is "off." Under such circumstances, when the operator has turned the setback crank 23 approximately 55° to 60°, the pin 83, carried by the cam 75, comes into engagement with the upwardly extending arm 107 of the lockout dog 105 and causes the lockout dog 105 to be moved clockwise, in Fig. III, to throw the hook arm 106 out of its latched engagement with the notch 61 of the cam 57. As shown in Fig. VII, the pin 83 extends through the arcuate slot 87 to a sufficient extent so as to be presented during its course of travel in the plane of the arm 107 of the lockout dog 105.

It is to be noted from the foregoing descrip-

tion of operation that my improved interlock mechanism has the following functional features of operation:

First.—If the motor switch has been moved to "on" and then to "off" position, the motor switch cannot be moved again to closed position by the operator until the clock indicating mechanism has been reset to zero position, because the notched recesses 58, 76, and 92 of the respective cams 57, 75, and 88 are brought into alinement to receive the locking block 138 only when the clock indicating mechanism has been zeroized subsequent to the last cycle of turning the motor switch to "off" position.

Second.—Upon closure of the motor switch and reverse movement thereafter of the cam lever 130 to an extent slightly greater than the position shown in Fig. V which moves the motor switch to open position, the operator cannot again close the motor switch without a recycling of the indicating mechanism, because movement of the cam lever 130 to the extent indicated in Fig. V causes the cam surface 59 of the cam 57 to be presented as an impedance preventing such clockwise movement of the cam lever 130 as would be necessary to close the motor switch.

Third.—The clock mechanism cannot be recycled by the operator when the motor switch is closed, because the cam 75 is rigidly connected to the shaft 31 which, in turn, is connected directly to the setback shaft 22 and crank 23, and the locking block 138 of the cam lever 130 is positioned in the notch 76 of said cam 75 when the motor switch is closed, thereby preventing movement by the operator of the setback crank 23 and setback shaft 22.

It is to be noted that when my improved mechanism is operated in the normal manner and when the spring loaded cam disk 57 is tripped by turning the motor switch to "on" position by movement of the pivoted lever 16 into the alined notches of the cams, the shock of the spring loading of the cam 57 is taken up by the locking block 138 of the cam lever 130 in two steps. The first step is when the side of the notch 58 snaps against the locking block 138, and the second step is when the surface of the notch 61 comes into engagement with said locking block 138. After the cam 57 is released from this latter position, the spring loading of the cam disk 57 is substantially expended and said cam disk 57 travels but a short distance before its pin 63 comes into contact with the notched surface of the cam 75. Thus, before engagement of the pin 63 with the cam 75, the spring loading of the cam 57 has been very considerably reduced, as well as the amount of travel, so that at such point its kinetic energy is comparatively small.

Data collected has shown that the operator of the type of liquid dispensing apparatus for which my invention is particularly applicable will unnecessarily recycle the indicating mechanism after a previous cycling and without closure of the motor switch perhaps not more than fifty times in a year, and in all probability no more than that number of times during the life expectancy of ten years or more of the apparatus. Tests made on my improved interlock mechanism have demonstrated that its operation remains unimpaired after as many as 35,000 continuous cycling operations, even if the mechanism be subjected to extreme shock by reason of the tripping of the hook arm 106 by the pin 83 coming in contact with the arm extension 107, instead of said lockout dog being tripped in the normal manner, and the spring load of the disk 57 being taken up in two steps, as above described.

However, I do not desire to limit myself to the precise details of construction and arrangement herein set forth, as it is obvious that various modifications may be made therein without departing from the essential features of my invention, as defined in the appended claims.

I claim:

1. In interlock mechanism adapted to be connected in operating relation both to the resetting means of the indicating mechanism of liquid dispensing apparatus and to an electric switch controlling the electric motor of said liquid dispensing apparatus; the combination with a shaft operatively connected to said resetting means; of a first cam rigidly mounted on said shaft and turned therewith; a second cam mounted for freedom of turning movement on said shaft; means carried by said first cam for effecting rotation of said second cam; a third cam mounted for freedom of turning movement on said shaft; a disk rigidly mounted on said shaft; a torsion spring, having one end connected to said disk and the other end to said third cam; a notched recess in each of said three cams; means effecting alinement of said three notched recesses when the indicating mechanism is moved to initial, or zero, position; a lever operatively connected in controlling relation to said electric switch; a cam block carried by said lever for engagement in said three notches when alined; whereby said lever may be moved to switch closing position only when said cam block is in engagement with said three alined cam notches; and means effecting movement of said cams into non-alining cam notch position upon movement of said lever from switch closing to switch opening position.

2. In interlock mechanism adapted to be connected in operating relation both to the resetting means of the indicating mechanism of liquid dispensing apparatus and to an electric switch controlling the electric motor of said liquid dispensing apparatus; the combination with a shaft operatively connected to said resetting means; of a first cam rigidly mounted on said shaft and turned therewith; a second cam mounted for freedom of turning movement on said shaft; means carried by said first cam for effecting rotation of said second cam, including a pin carried by said first cam in engagement with an arcuate slot formed in said second cam; a third cam mounted for freedom of turning movement on said shaft; a disk rigidly mounted on said shaft; a torsion spring, having one end connected to said disk and the other end to said third cam; a notched recess in each of said three cams; means effecting alinement of said three notched recesses when the indicating mechanism is moved to initial, or zero, position, including a locking dog adapted to engage a notch in the periphery of said third cam and an index pawl adapted to engage a notch in said second cam; a lever operatively connected in controlling relation to said electric switch; a cam block carried by said lever for engagement in said three notches when alined; whereby said lever may be moved to switch closing position only when said cam block is in engagement with said three alined cam notches; and means effecting movement of said cams into non-alining cam notch position upon movement of said lever from switch closing to switch opening position.

3. In interlock mechanism adapted to be connected in operating relation both to the resetting

means of the indicating mechanism of liquid dispensing apparatus and to an electric switch controlling the electric motor of said liquid dispensing apparatus; the combination with a shaft operatively connected to said resetting means; of a first cam rigidly mounted on said shaft and turned therewith; a second cam mounted for freedom of turning movement on said shaft; means carried by said first cam for effecting rotation of said second cam; a third cam mounted for freedom of turning movement on said shaft; a disk rigidly mounted on said shaft; a torsion spring, having one end connected to said disk and the other end to said third cam; a notched recess in each of said three cams; means effecting alinement of said three notched recesses when the indicating mechanism is moved to initial, or zero, position; a lever operatively connected in controlling relation to said electric switch; a cam block carried by said lever for engagement in said three notches when alined; whereby said lever may be moved to switch closing position only when said cam block is in engagement with said three alined cam notches; and means effecting movement of said cams into non-alining cam notch position upon movement of said lever from switch closing to switch opening position, including a cam surface formed on said third cam to prevent said lever from movement to closed position.

4. In interlock mechanism adapted to be connected in operating relation both to the resetting means of the indicating mechanism of liquid dispensing apparatus and to an electric switch controlling the electric motor of said liquid dispensing apparatus; the combination with a shaft operatively connected to said resetting means; of a first cam rigidly mounted on said shaft and turned therewith; a second cam mounted for freedom of turning movement on said shaft; means carried by said first cam for effecting rotation of said second cam, including a pin carried by said first cam in engagement with an arcuate slot formed in said second cam; a third cam mounted for freedom of turning movement on said shaft; a disk rigidly mounted on said shaft; a torsion spring, having one end connected to said disk and the other end to said third cam; a notched recess in each of said three cams; means effecting alinement of said three notched recesses when the indicating mechanism is moved to initial, or zero, position, including a locking dog adapted to engage a notch in the periphery of said third cam and an index pawl adapted to engage a notch in said second cam; a pivoted lever operatively connected in controlling relation to said electric switch; a cam block carried by said lever for engagement in said three notches when alined; whereby said lever may be moved to switch closing position only when said cam block is in engagement with said three alined cam notches; and means effecting movement of said cams into non-alining cam notch position upon movement of said lever from switch closing to switch opening position, including a cam surface formed on said third cam to prevent said lever from movement to closed position.

5. In interlock mechanism adapted to be connected in operating relation both to the resetting means of the indicating mechanism of liquid dispensing apparatus and to an electric switch controlling the electric motor of said liquid dispensing apparatus; the combination with a shaft operatively connected to said resetting means; of a first cam rigidly mounted on said shaft and turned therewith; a second cam mounted for freedom of turning movement on said shaft; means carried by said first cam for effecting rotation of said second cam; a third cam mounted for freedom of turning movement on said shaft; a disk rigidly mounted on said shaft; a torsion spring, having one end connected to said disk and the other end to said third cam; a notched recess in each of said three cams; means effecting alinement of said three notched recesses when the indicating mechanism is moved to initial, or zero, position; a lever operatively connected in controlling relation to said electric switch; a cam block carried by said lever for engagement in said three notches when alined; whereby said lever may be moved to switch closing position only when said cam block is in engagement with said three alined cam notches; and means effecting movement of said cams into non-alining cam notch position upon movement of said lever from switch closing to switch opening position, including a pivoted throw-out arm actuated by movement of said lever and adapted to disengage said locking dog from engagement with said third cam when said lever is moved to switch closing position.

6. In interlock mechanism adapted to be connected in operating relation both to the resetting means of the indicating mechanism of liquid dispensing apparatus and to an electric switch controlling the electric motor of said liquid dispensing apparatus; the combination with a shaft operatively connected to said resetting means; of a first cam rigidly mounted on said shaft and turned therewith; a second cam mounted for freedom of turning movement on said shaft; means carried by said first cam for effecting rotation of said second cam; a third cam mounted for freedom of turning movement on said shaft; a disk rigidly mounted on said shaft; a torsion spring, having one end connected to said disk and the other end to said third cam; a notched recess in each of said three cams; means effecting alinement of said three notched recesses when the indicating mechanism is moved to initial, or zero, position; a lever operatively connected in controlling relation to said electric switch; a cam block carried by said lever for engagement in said three notches when alined; whereby said lever may be moved to switch closing position only when said cam block is in engagement with said three alined cam notches; and means effecting movement of said cams into non-alining cam notch position upon movement of said lever from switch closing to switch opening position, including a pivoted throw-out arm actuated by movement of said lever and adapted to disengage said locking dog from engagement with said third cam when said lever is moved to switch closing position, and a cam surface formed on said third cam to prevent said lever from movement to closed position.

7. In interlock mechanism adapted to be connected in operating relation both to the resetting means of the indicating mechanism of liquid dispensing apparatus and to an electric switch controlling the electric motor of said liquid dispensing apparatus; the combination with a shaft operatively connected to said resetting means; of a first cam rigidly mounted on said shaft and turned therewith; a second cam mounted for freedom of turning movement on said shaft; means carried by said first cam for effecting rotation of said second cam, including a pin car-

ried by said first cam in engagement with an arcuate slot formed in said second cam; a third cam mounted for freedom of turning movement on said shaft; a disk rigidly mounted on said shaft; a torsion spring, having one end connected to said disk and the other end to said third cam; a notched recess in each of said three cams; means effecting alinement of said three notched recesses when the indicating mechanism is moved to initial, or zero, position, including a locking dog adapted to engage a notch in the periphery of said third cam and an index pawl adapted to engage a notch in said second cam; a lever operatively connected in controlling relation to said electric switch; a cam block carried by said lever for engagement in said three notches when alined; whereby said lever may be moved to switch closing position only when said cam block is in engagement with said three alined cam notches; and means effecting movement of said cams into non-alining cam notch position upon movement of said lever from switch closing to switch opening position, including a pivoted throw-out arm actuated by movement of said lever and adapted to disengage said locking dog from engagement with said third cam when said lever is moved to switch closing position.

8. In interlock mechanism adapted to be connected in operating relation both to the resetting means of the indicating mechanism of liquid dispensing apparatus and to an electric switch controlling the electric motor of said liquid dispensing apparatus; the combination with a shaft operatively connected to said resetting means; of a first cam rigidly mounted on said shaft and turned therewith; a second cam mounted for freedom of turning movement on said shaft; means carried by said first cam for effecting rotation of said second cam, including a pin carried by said first cam in engagement with an arcuate slot formed in said second cam; a third cam mounted for freedom of turning movement on said shaft; a disk rigidly mounted on said shaft; a torsion spring, having one end connected to said disk and the other end to said third cam; a notched recess in each of said three cams; means effecting alinement of said three notched recesses when the indicating mechanism is moved to initial, or zero, position, including a locking dog adapted to engage a notch in the periphery of said third cam and an index pawl adapted to engage a notch in said second cam; a lever operatively connected in controlling relation to said electric switch; a cam block carried by said lever for engagement in said three notches when alined; whereby said lever may be moved to switch closing position only when said cam block is in engagement with said three alined cam notches; and means effecting movement of said cams into non-alining cam notch position upon movement of said lever from switch closing to switch opening position, including a pivoted throw-out arm actuated by movement of said lever and adapted to disengage said locking dog from engagement with said third cam when said lever is moved to switch closing position, and a cam surface formed on said third cam to prevent said lever from movement to closed position.

9. In interlock mechanism adapted to be connected in operating relation to the resetting means of the indicating mechanism of liquid dispensing apparatus and to an electric switch controlling the electric motor of said liquid dispensing apparatus; the combination with a shaft operatively connected to said resetting means; of a first cam rigidly mounted on said shaft and turned therewith; a second cam mounted for freedom of turning movement on said shaft; means carried by said first cam for effecting rotation of said second cam; a third cam mounted for freedom of turning movement on said shaft; a torsion spring, having one end operatively connected to and turned by movement of said shaft and the other end connected to said third cam; a notched recess in each of said three cams; means effecting alinement of said three notched recesses when the indicating mechanism is moved to initial, or zero, position; switch operating means connected in controlling relation to said electric switch; a cam block operated by said switch operating means for engagement in said three notches when alined; whereby said switch operating means may be moved to switch closing position only when said cam block is in engagement with said three alined cam notches; and means effecting movement of said cams into non-alining cam notch position upon movement of said switch operating means from switch closing to switch opening position.

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