May 8, 1928. 1,668,880

E. J. VALLEN

DOOR OR CURTAIN OPERATING MECHANISM

Filed June 3, 1927 4 Sheets-Sheet 1

FIG-2

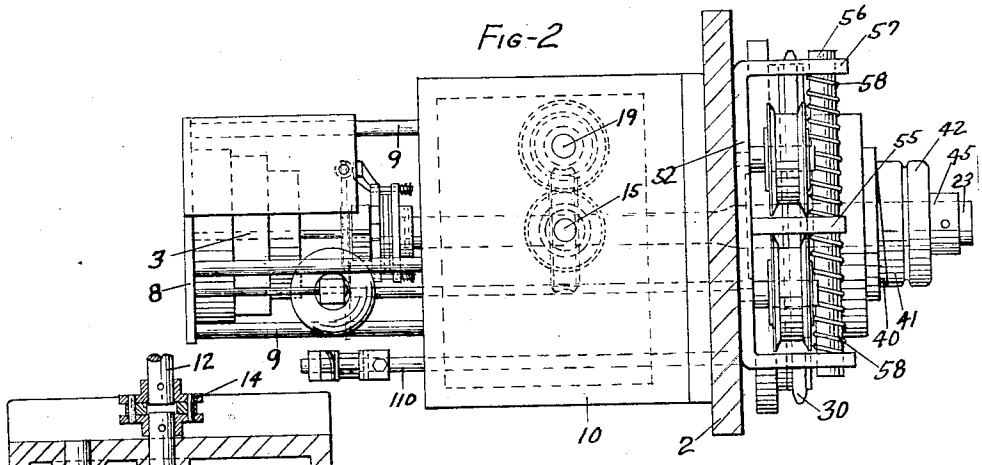
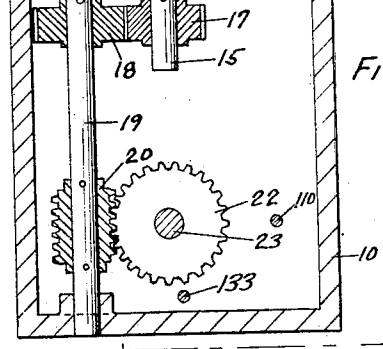


FIG-4



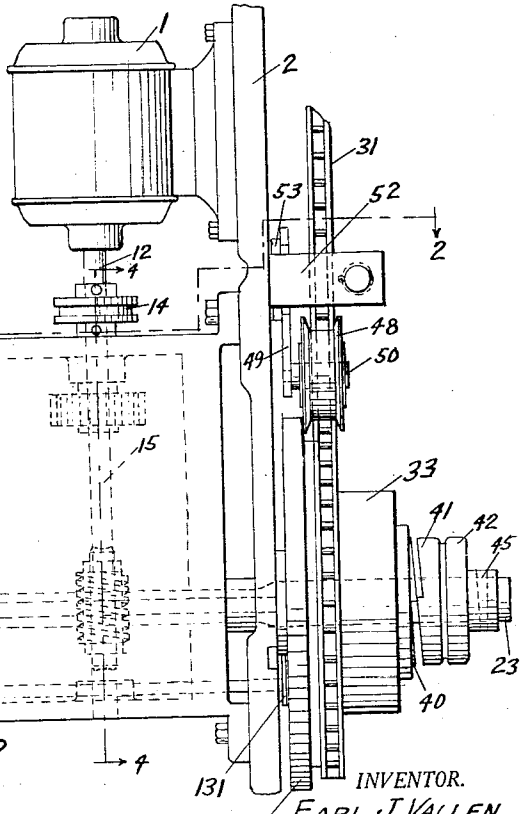


FIG-1

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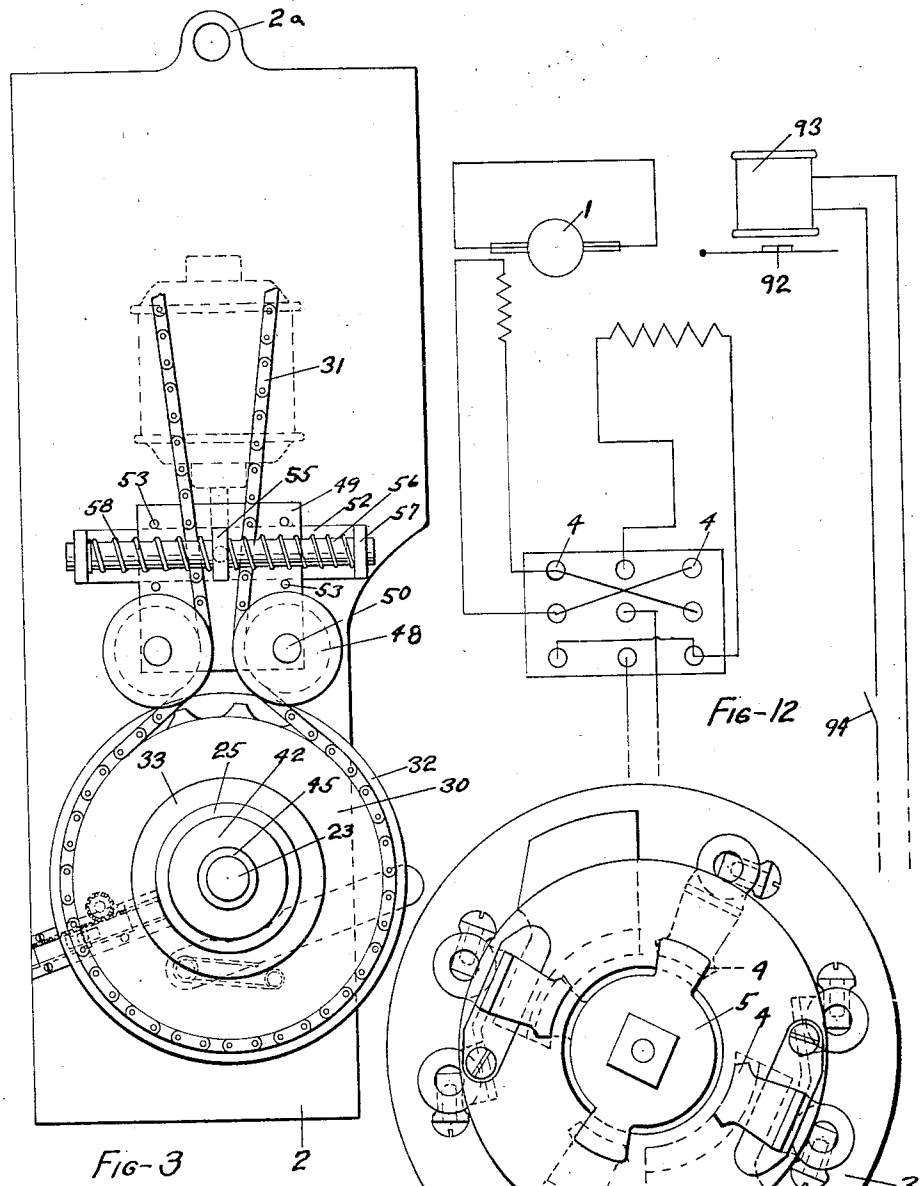


FIG-3

FIG-12

FIG-11

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May 8, 1928. 1,668,880

E. J. VALLEN

DOOR OR CURTAIN OPERATING MECHANISM

Filed June 3, 1927 4 Sheets-Sheet 3

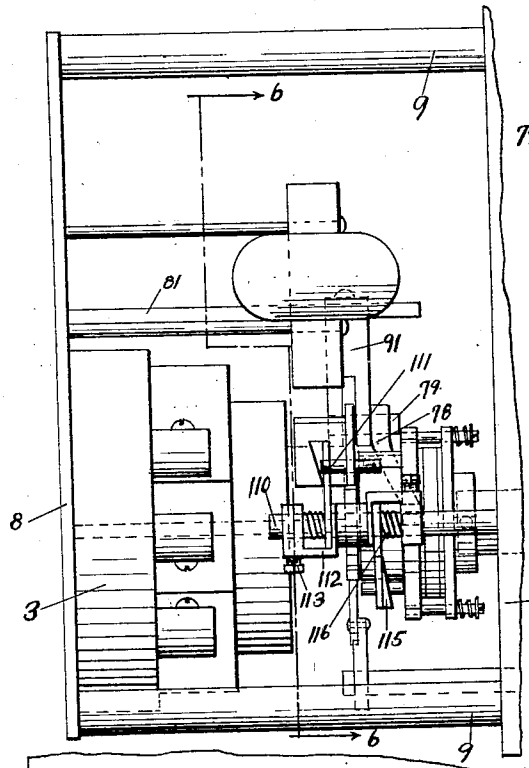


FIG-5

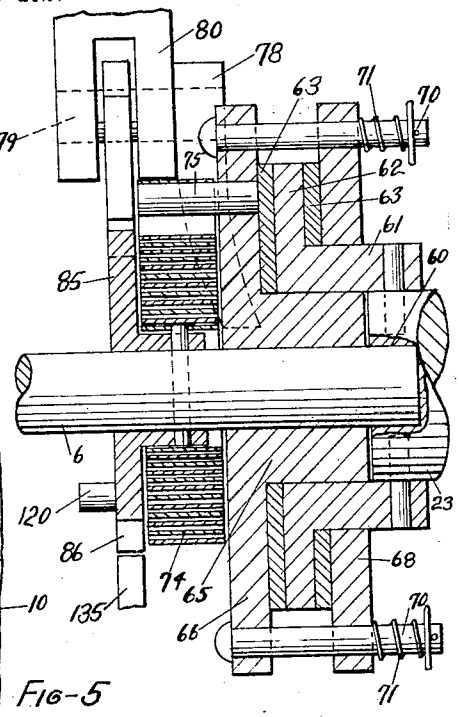


FIG-7

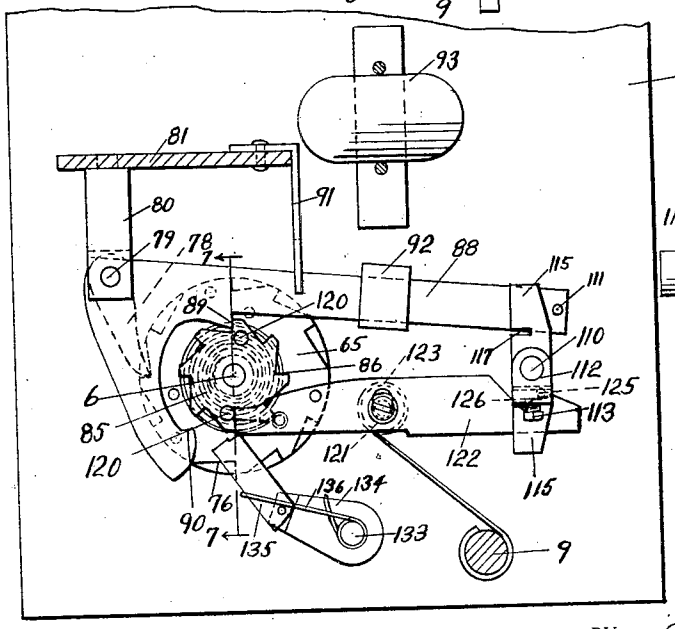


FIG-6

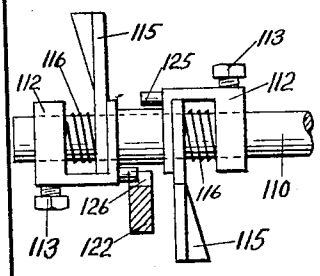


FIG-13

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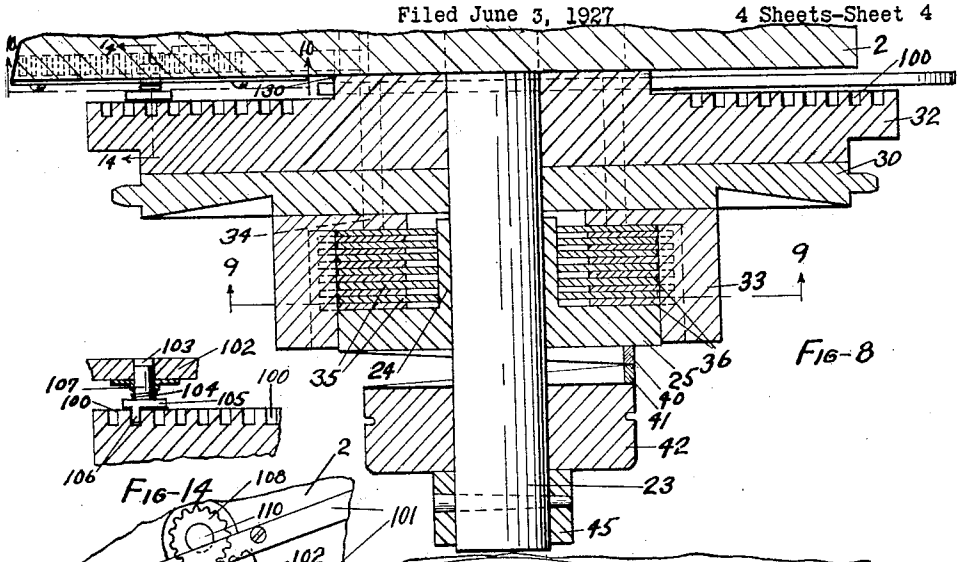
ATTORNEYS.

May 8, 1928. 1,668,880

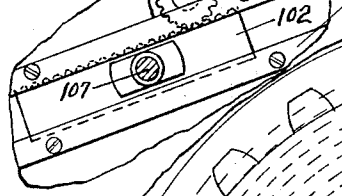
E. J. VALLEN

DOOR OR CURTAIN OPERATING MECHANISM

Filed June 3, 1927 4 Sheets-Sheet 4



F16-8



F16-14

F16-10

F16-9

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Patented May 8, 1928. 1,668,880

UNITED STATES PATENT OFFICE.

EARL J. VALLEN, OF AKRON, OHIO.

DOOR OR CURTAIN OPERATING MECHANISM.

Application filed June 3, 1927. Serial No. 196,258.

This invention relates to a mechanism designed and intended particularly to be used with garage or warehouse doors, theatre curtains, or the like, although the structure may be capable of wider application and more extensive use.

The apparatus is constructed and designed so that the operating mechanism will always be under control of the operator and may be used for starting and stopping the movement of the curtain or door at any time, for stopping the curtain at any point in its upward or downward course, and subsequently continuing the movement of the curtain in the same or opposite direction. The mechanism also includes an automatically operative stop device for arresting the movement of the curtain at its upper and lower limits. With the device there is also associated means by which the curtain may be operated by hand for special purposes or in an emergency, without injury to the mechanical devices.

The mechanism shown herein constitutes a simple and efficient combination of parts to accomplish the results and objects set forth. While the showing which is made is detailed so as to enable those skilled in the art to understand the principles of the invention, it is not intended that the claims herein be restricted to exact conformity to the details as set forth, as having explained the invention, it is possible that modifications or improvements may be made therein which do not depart from the substance of this invention. The claims are therefore to be construed in the light of the prior art, and not unnecessarily restricted as to their scope, nor are they to be limited to the exact method or manner of application.

In the drawings:

Figure 1 is a side elevation of a complete curtain operating unit having the improvements embodied therein;

Figure 2 is a plan view of the unit, the motor being removed;

Figure 3 is an end view of the device looking at the right side of Figure 1;

Figure 4 is a section on the line 4—4 of Figure 1;

Figure 5 is an enlarged side view of the switch operating mechanism;

Figure 6 is a side view of the escapement mechanism taken on the line 6—6 of Figure 5;

Figure 7 is a section on the line 7—7 of Figure 6 enlarged;

Figure 8 is an enlarged horizontal section along the shaft for operating the curtain;

Figure 9 is a section on the line 9—9 of Figure 8;

Figure 10 is a section on the line 10—10 of Figure 8;

Figure 11 is a view showing a type of rotary switch to be used in the device;

Figure 12 is a wiring diagram for the device;

Figure 13 is an enlarged detail of the dogs for automatically stopping the movement of the curtain; and

Figure 14 is a section on the line 14—14 of Figure 8.

The motor for operating the curtain is of the reversible type indicated by the numeral 1, being supported upon the side of a plate or bracket 2, which is attached to any convenient point adjacent the door or curtain to be operated, through lug 2ª. The motor is controlled by a rotary switch 3 having a plurality of contacts 4 and a rotary switch member 5 which is carried upon a shaft 6. Details of the switch are not important to an understanding of the present invention and the showing in Figure 11 and the description are somewhat diagrammatic, it being necessary to state merely that the switch alternately stops and starts the motor, the direction of movement of the motor being reversed at each alternate step.

The switch 3 is carried upon a plate 8 which is supported on rods or pillars 9 extending from the side of a casing 10 attached to the plate 2. The motor shaft 12 is connected to a flexible coupling 14 which drives a shaft 15 mounted in a bearing 16 in the upper side of the casing 10. A pinion 17 is carried by the shaft 15 and meshes with a pinion 18 secured to a vertical jack shaft 19 extending the length of the casing 10. A worm 20 is secured to the shaft 19 and

meshes with a worm gear 22 which is secured to the shaft 23 which extends horizontally through the side walls of the casing. At one end the shaft 23 extends through the plate 2 and is keyed to a hub 24 of an adjustable cap plate 25 which is movable along the shaft for purposes to be described.

The sprocket 30 for driving the curtain operating chain 31 is freely rotatable upon the shaft 23 and is located between the cap plate 25 and the plate 2. On the side of the sprocket 30 next to the plate is located a disk 32, and in the other side of the sprocket is located a cup 33, the three elements being secured together by a series of pins 34. The cup 33 surrounds the cap plate 25. The hub of the cap plate is shown as squared and about the hub are passed a series of friction disks 35 alternately placed between a series of friction rings 36 which are set with the cup and held from rotation therein by a plurality of keys 38 formed in the interior of the cup.

The friction disks constitute a yielding drive between the shaft 23 and the sprocket 30 so as to permit slippage of the sprocket should the curtain or door be stuck at any point in its travel. The frictional drive is regulated by adjustment of the cap plate inwardly along the shaft so as to transmit the drive to the sprocket 30 under normal conditions, by means of a cam face 40 attached to the cap plate 25 and a corresponding cam face 41 secured to a rotatable hand wheel 42 carried on the shaft 23 and confined by a collar 45 fixed to the end of the shaft. When the wheel 42 is rotated so as to bring the high portions of the cams 40 and 41 into register, the disks 34 and 35 will be compressed depending upon the amount of friction required, the drive being transmitted from the shaft 23 to the sprocket 30 through this friction coupling.

The clutch shown and described is made the subject matter of my copending application Serial No. 245,159, filed January 7, 1928.

The device which has just been described constitutes a portion of the mechanism for permitting the hand operation of the chain when required. It will be observed that when the cam faces 40 and 41 are turned so that they are in mating engagement as shown in Figure 2, and not in opposition, the expansion of the friction disks will cause the cup 33 together with the sprocket and disk 32 to move away from the plate 2 and will free the sprocket so that it can be rotated upon the shaft. The purpose and object of thus moving the sprocket and its attached members away from the plate when the door or curtain is to be operated by hand will be explained in connection with the spring operating mechanism. The chain 31 is caused to hug the sprocket by two sheaves 48 bearing upon opposite sides of the chain, and supported upon a carriage 49 by means of bearing pins 50. The carriage is slidably mounted upon a bracket 52 by means of studs 53 located on either side of the bracket, and bearing upon its upper and lower edges. To maintain the carriage at its neutral position when the chain is idle and to permit it to yield slightly upon tightening of either side of the chain, the carriage is provided with a centrally located post 55, the outer end of which is received and slides upon a pin 56. This pin is mounted in the outer ends of parallel arms 57 on the opposite extremities of the bracket 52 and is surrounded by two coil springs 58 bearing on opposite sides of the post 55 and tending to keep the carriage at its neutral position. By this arrangement the chain is kept from jumping off the sprocket.

The rotary switch member 5 is carried upon the shaft 6 which is coaxial with the shaft 23, but somewhat smaller, being received at the end remote from the switch in a socket bearing 60 in the end of the shaft 23. Secured to the inner end of the shaft 23 is a sleeve 61 having a flange 62 which is received between two friction washers 63 of leather or the like. Rotatable upon the shaft 6 and received within the sleeve 61 is a second sleeve 65 having a flange 66. A compression ring 68 is mounted on the sleeve 61 and connected to the flange 66 by pins 70. Springs 71 surround the outer ends of the pins so that the friction washers 63 are compressed against the sides of the flange 62. The mechanism which has been described constitutes a frictional drive for the sleeve 65 which thereby winds and keeps under tension a coil spring 74 by reason of the fact that the sleeve 65 is connected to one end of the coil spring by pin 75. The outer periphery of the flange 66 is formed with ratchet teeth 76 which are engaged by a pawl 78 so that the sleeve can rotate only in the direction to wind up the spring 74. The pawl 78 which is yieldingly urged against the flange 66, is pivoted on a pin 79 in the lower portion of a hanger 80 which depends from a bracket 81 on the plate 8.

The inner end of the spring 74 is attached to a spring drum 85 fixed to the shaft 6. The outer periphery of the drum is provided with ratchet teeth 86 equal to the required number of positions on the rotary switch.

The unwinding of the spring is controlled by an escapement shown in Figure 6. This consists of a bent lever 88 pivoted on the pin 79 and having two teeth 89 and 90 on opposite sides of the ratchet to release the ratchet for movement the distance of a single tooth. The lever 88 is guided by means of a forked plate 91 which is attached to the bracket 81 and carrier near its outer end the armature 92 which is arranged so as to

be attracted by a solenoid 93 when the latter is energized. The solenoid is energized through a snap switch 94 under control of the operator so that as the snap switch is closed momentarily the lever 88 is raised releasing the ratchet for rotation a single step. If the switch is off, its rotation will close the circuit to the motor and the door or curtain will be operated until the lever 88 is raised again. If the motor is to be stopped by the operator, closing of the snap switch 94 will rotate the ratchet a further step and throw the switch 5 to off position. The next movement of the switch 94 will start the motor again, but in the reverse direction. By manipulation of the switch 94, the operator can control the movement of the curtain or door and stop, reverse, or by a rapid succession of impulses through the switch, continue its movement in the same direction.

It is desirable to associate with the manual control mechanism, an automatically operative device to stop the operation of the motor at either limit of movement of the door or curtain. This is accomplished in the following manner:

On the rear face of the disk 32 is cut a spiral groove 100 and on the plate 2 are arranged parallel guideways 101 which are located at one side of the center of the disk. Slidably mounted in the guideways is a rack 102 having teeth along its upper edge. On the rack 102 in opening 103 is slidably mounted a pin 104. The outer end of the pin is provided with a head 105 having an arc-shaped flange 106 adapted to fit and be held in the scroll or spiral groove 100 by a spring 107 surrounding the pin. As the gear 30 and the disk 32 are rotated, the rack 102 will be moved in and out along its guideways by the pin 104 through its engagement with the scroll.

The teeth of the rack are in mesh with a small pinion 108 secured to the end of a shaft 110 which passes through the casing 10 and terminates adjacent the end of the lever 88. The end of the lever is provided with a pin 111 which projects on either side thereof, the ends of the pin preferably being slightly beveled. On the end of the shaft 110 on either side of the lever 88 are located two substantially U-shaped keepers 112 which are rotatable about the shaft but held in adjusted position by set screws 113. Mounted within the keepers 112 so as to slide upon the shaft 110 are dogs 115 which are yieldingly held against adjacent sides of the keepers by light coil springs 116 surrounding the shaft 110. The dogs are arranged so that they will strike the ends of the pin 111 as the shaft is rotated and lift the end of the lever 88 upwardly to release the tooth 89 and permit the rotation of the switch to "off" position. In order to enable the dogs to pass over the pin 111 on the return movement of the shaft each dog is slotted at 117 and the tail of the dog bent outwardly so that it will ride over the pin, the springs 116 yielding to permit the movement of the dogs. The adjustment of the keeper about the shaft determines the limits of travel of the door or curtain.

In order to prevent accident by the operator in closing the switch 94 before either the dog has cleared the pin and is in position to stop the motor on reversal, mechanism is provided to hold the ratchet against rotation until the dog has cleared. This is illustrated in Figure 6. The ratchet 85 is provided on its outer face with pins 120 and on the plate 8 is located a post 121 on which is pivoted a lever 122. One end of the lever is located below the shaft 110 and the other adjacent the ratchet. A spring 123 urges the right hand end of the lever toward the shaft 110. On the side of each keeper 112 is located a pin 125 and on the end of the lever are provided arc-shaped bearing surfaces 126, against which the pins 125 bear when the keepers and dogs are directed upwardly, or toward the lever 88. The arc-shaped surfaces are each somewhat longer than the width of the dogs so that during the time each dog is over the pin 111, and for a short period thereafter, the pin 125 will be in contact with the surface 126, which will raise the other end of the lever within the path of one of the pins 120. This will prevent rotation of the ratchet 85 until the dog has passed beyond the pin 111, notwithstanding the energizing of the solenoid through the switch 94. This device, therefore, constitutes a safety precaution to prevent reversal of the door or curtain before either dog is in position to actuate the lever 88.

If the curtain or door is to be operated by hand it is necessary to provide means for holding the rotary switch inoperative. For this purpose the disk 32 is provided upon its rear face with a reduced hub 130 and on the side of the plate 2 is pivoted a lever 131 forced upwardly by a spring 132 so that the lever bears against the hub. When the hand operation is to take place, the sprocket and disk move away from the plate 2 as has been described, whereupon the lever 131 is moved upwardly by the spring 132 behind the hub 130. The lever 131 is fixed upon a shaft 133 which extends through the casing 10 and carries at its outer end an arm 134, carrying a pawl 135 having a limited movement and yieldingly retained by a spring 136. When the shaft 133 is rocked by the movement of the lever 131 the pawl 135 engages a tooth of the ratchet 85 and prevents rotation of the ratchet. In this way, the spring release for the switch is held and the operation of the curtain or door through the motor cannot

take place while the hand operation is being performed.

It is believed that the operation of the mechanism will have been understood from the description which has been given, it being necessary merely to review briefly the essential features of the device. The primary control of the mechanism is through the hand operated switch 94, which upon closing momentarily, energizes the armature 93 and lifts the lever 88 to release the ratchet for a single revolution. If the door or curtain is stationary, the motor will be started at once raising or lowering the curtain. If the operator chooses to stop the curtain before it reaches the upper or lower limit of its movement, closing of the switch will again lift the lever 88 and the switch 5 will be thrown to "off" position, starting the motor. The next movement of the switch will reverse the operation of the curtain. Should it be desired to continue the movement of the curtain in the same direction, instead of closing the switch once, three operations of the switch in rapid succession will start the curtain in the same direction as its original movement. The curtain is automatically stopped at the upper and lower limits of its travel by the operation of the scroll 100 and rack 102 which brings the dogs 115 in contact with the arm 88 to release the ratchet 85 for a single step, the adjustment of the dogs 115 determining the limits of movement. Injury to the mechanism by too rapid operation of the switch after starting or stopping is prevented by the arm 122, and hand operation is provided for by adjustment of the hand wheel 42 which releases the friction drive members 35 and 36, this action also bringing the safety catch 135 into operation through the lever 131.

It will be observed that the switch is turned by the energy stored in the coil spring 74 and that this coil spring is maintained under tension from the main drive shaft 23 through the friction clutch illustrated in Figure 7.

The mechanism shown and described constitutes an efficient and easily operated device for the purpose specified. The sole attention which has to be given by the operator is in the movement of the switch 94, the operation being controlled automatically, and without danger of faulty operation. Should the curtain or door be clogged or its operation interfered with so that it should be operated by hand, the mechanism provides for an easy and safe manipulation which will not interfere in any manner with the operability of the mechanism. In the claims wherever the curtain operating mechanism is referred to it will be understood that the device is capable of other and more extended uses and the claims are not necessarily confined to the particular purpose set forth.

What is claimed is:

1. An apparatus for the purposes specified comprising a reversible motor, a rotary switch having a step by step movement to control the motor, a spring mechanism to rotate the switch, a main drive shaft, a friction drive device between the main drive shaft and the spring, and an escapement to release the spring for movement of the switch a single step.

2. An apparatus for the purposes specified comprising a reversible motor, a rotary switch having a step by step movement to control the motor, a spring mechanism to rotate the switch, a main drive shaft, a friction drive device between the main drive shaft and the spring, an escapement to release the spring for movement of the switch a single step, and a manually operated device for actuating the escapement.

3. An apparatus for the purpose specified comprising a reversible motor, a rotary switch having a step by step movement to control the motor, a spring mechanism to rotate the switch, a main drive shaft, a friction drive device between the main drive shaft and the spring, an escapement to release the spring for movement of the switch a single step, and magnetic control devices for actuating the escapement.

4. In an apparatus for the purposes specified, a motor, a rotary switch having a step by step movement to control the motor, a spring mechanism to rotate the switch, an escapement for the switch, a manually operated control for the escapement, and an automatically operated control for the escapement definitely limiting the operation of the motor.

5. In an apparatus for the purposes specified, a motor, a rotary switch having a step by step movement to control the motor, a spring mechanism to rotate the switch, an escapement for the switch, a manually operated control for the escapement, an automatically operated control for the escapement definitely limiting the operation of the motor, and a detent for preventing operation of the escapement when the motor is inactive.

6. In an apparatus for the purposes specified, a reversible motor, a rotary switch having a step by step movement to stop and reverse the motor, means to rotate the switch, means for actuating the switch at the limit of movement of the curtain, and a safety detent operative during a portion of the operation of the motor for preventing rotation of the switch.

7. In an apparatus for the purposes specified, a reversible motor, a main shaft driven by the motor, a rotary switch, a spring for rotating the switch held under tension by

the shaft, escapement mechanism for the spring, means to release the escapement under control of the operator, and a second means to limit the rotation of the shaft in two directions.

8. In a device of the character specified, a rotary switch having a shaft, a spring to rotate the shaft in one direction, means to maintain the spring under tension, a ratchet on the shaft, an escapement for the ratchet, and an electric magnet to actuate the escapement.

9. In a device of the character specified, a rotary switch, having a shaft, a spring to rotate the shaft in one direction, means to maintain the spring under tension, a ratchet on the shaft, an escapement for the ratchet, an electric magnet to actuate the escapement, a motor controlled by the switch, and automatically operative means to limit the rotation of the motor through actuation of the escapement.

10. In an apparatus of the type described, a reversible motor, a main shaft actuated by the motor, curtain operating mechanism driven by the shaft, a switch for controlling the motor, a spring to rotate the switch, an escapement for the spring, limiting devices to release the escapement at the upper and lower limits of travel of the curtain, and a manually controlled magnet to release the escapement under control by the operator.

11. In an apparatus of the type described, a reversible motor, a main shaft actuated by the motor, curtain operating mechanism driven by the shaft, a switch for controlling the motor, a spring to rotate the switch, an escapement for the spring, limiting devices to release the escapement at the upper and lower limits of travel of the curtain, a manually controlled magnet to release the escapement under control by the operator, and means to maintain tension on the spring from the main shaft.

12. A mechanism for the uses and purposes set forth comprising a motor, a switch for the motor, a main shaft driven by the motor, a wheel for operating a curtain or the like, a scroll carried by the wheel, a follower in the scroll, a rack movable by the follower, a second shaft rotated by the rack, and a dog carried by the second named shaft operating to open the switch.

13. A mechanism for the uses and purposes set forth comprising a motor, a switch for the motor, a main shaft driven by the switch, a sprocket on the main shaft, means for connecting and disconnecting the sprocket and the main shaft, and locking mechanism for the switch operable upon disconnection of the shaft and the sprocket.

14. A mechanism for the uses and purposes set forth comprising a motor, a switch for the motor, a main shaft driven by the switch, a sprocket on the main shaft, a friction clutch between the sprocket and the main shaft, means for adjusting the clutch, a detent for the switch, and automatically actuated mechanism to bring the detent into operation upon release of the clutch.

15. In a door or curtain operating mechanism, a motor, a main shaft driven by the motor, a switch for starting, stopping and reversing the motor, said switch comprising a rotary contact member, a spring to drive the contact member, a friction clutch between the main shaft and the spring to maintain the latter under tension, and an escapement for the spring.

16. In a door or curtain operating mechanism, a motor, a main shaft driven by the motor, a switch for starting, stopping and reversing the motor, said switch comprising a rotary contact member, a spring to drive the contact member, a friction clutch between the main shaft and the spring to maintain the latter under tension, an escapement for the spring, a magnet for actuating the escapement, and a manually operated switch for energizing the magnet.

17. In a door or curtain operating mechanism, a motor, a main shaft driven by the motor, a switch for starting, stopping and reversing the motor, said switch comprising a rotary contact member, a spring to drive the contact member, a friction clutch between the main shaft and the spring to maintain the latter under tension, an escapement for the spring, and a manually controlled device for actuating the escapement.

18. In a door or curtain operating mechanism, a motor, a main shaft driven by the motor, a switch for starting, stopping and reversing the motor, said switch comprising a rotary contact member, a spring to drive the contact member, a frictional clutch between the main shaft and the spring to maintain the latter under tension, an escapement for the spring, a manually controlled device, and an automatically actuated device for actuating the escapement.

19. In a door or curtain operating mechanism, a motor, a main shaft driven by the motor, a switch for starting, stopping and reversing the motor, said switch comprising a rotary contact member, a spring to drive the contact member, a friction clutch between the main shaft and the spring to maintain the latter under tension, an escapement for the spring, a manually controlled device, and an automatically actuated device for actuating the escapement, the latter device being adjustable for varying ranges of travel of the curtain.

20. In an apparatus for the operation of a door or curtain, a motor, a main shaft driven by the motor, a secondary shaft in alignment with the main shaft, a switch for starting, stopping and reversing the motor carried by the secondary shaft, a coil spring

attached to the secondary shaft, a friction drive from the main shaft to the spring, and an escapement for the spring.

21. In an apparatus for the operation of a door or curtain, a motor, a main shaft driven by the motor, a secondary shaft in alignment with the main shaft, a switch for starting, stopping and reversing the motor carried by the secondary shaft, a coil spring attached to the secondary shaft, a friction drive from the main shaft to the spring, an escapement for the spring, and manual and automatically operated mechanism for actuating the escapement.

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