April 27, 1965 H. L. MILLER 3,180,635

SWINGING DOOR AND GATE OPERATOR

Filed Dec. 6, 1962 5 Sheets-Sheet 1

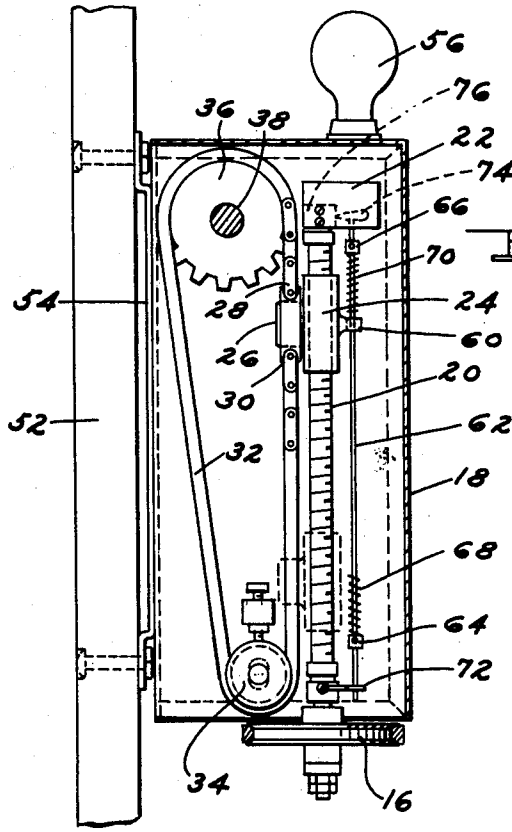

FIG. 1

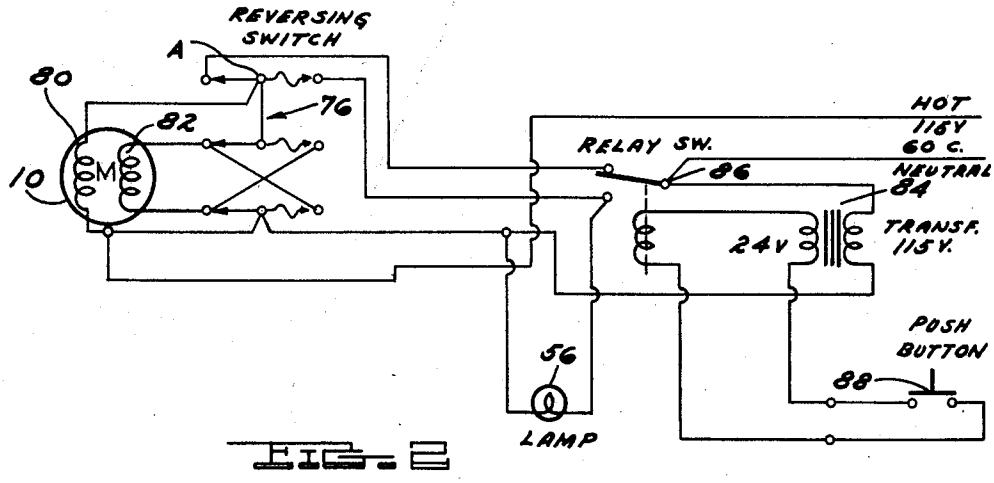

FIG. 2

INVENTOR.
HAROLD L. MILLER
BY
Barnes, Kisselle, Raisch & Choate
ATTORNEYS

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FIG. 3

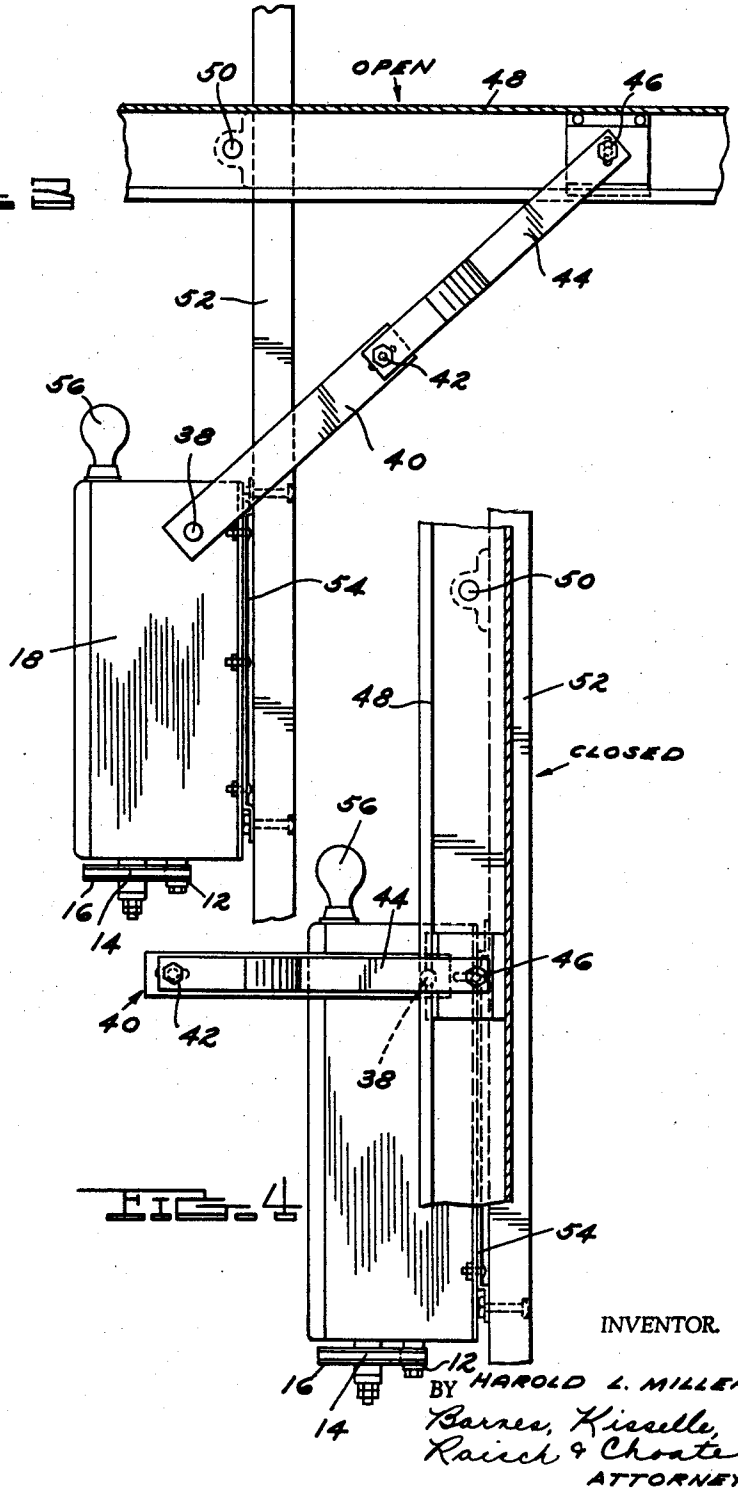

FIG. 4

INVENTOR.
HAROLD L. MILLER
BY Barnes, Kisselle, Raisch & Choate
ATTORNEYS

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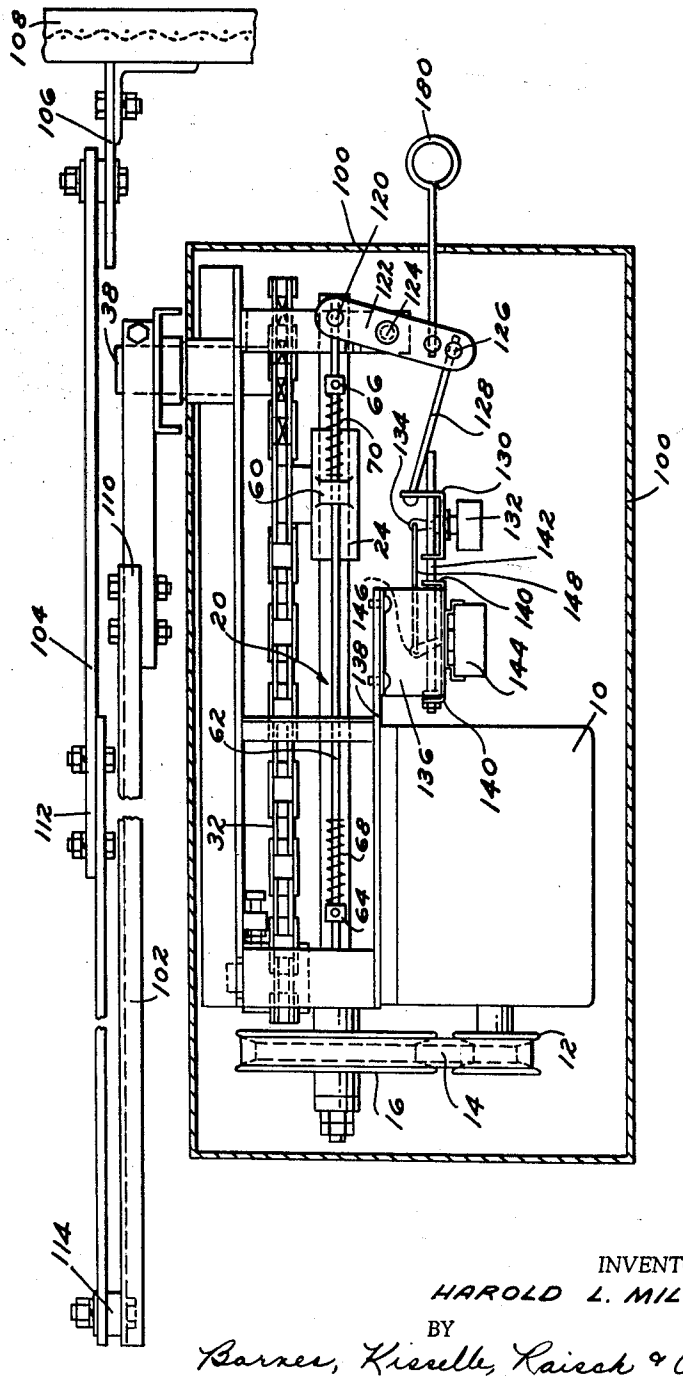
FIG. 3



INVENTOR.
HAROLD L. MILLER
BY
Barnes, Kisselle, Raisch & Choate
ATTORNEYS

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SWINGING DOOR AND GATE OPERATOR

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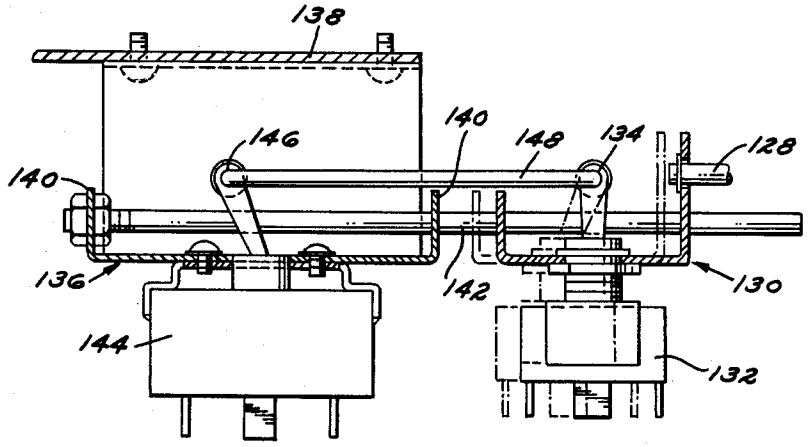

FIG. 6

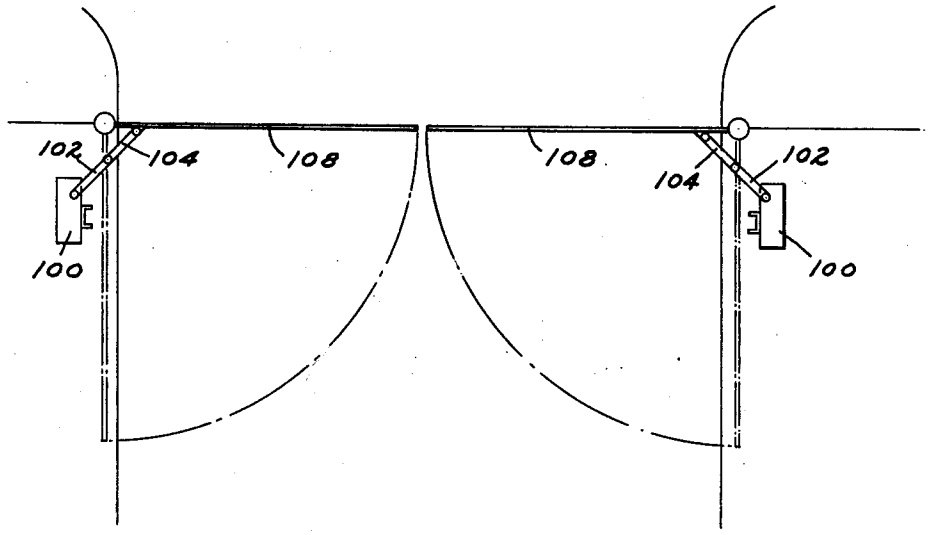

FIG. 7

INVENTOR.
HAROLD L. MILLER
BY
Barnes, Kisselle, Raisch & Choate
ATTORNEYS

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SWINGING DOOR AND GATE OPERATOR

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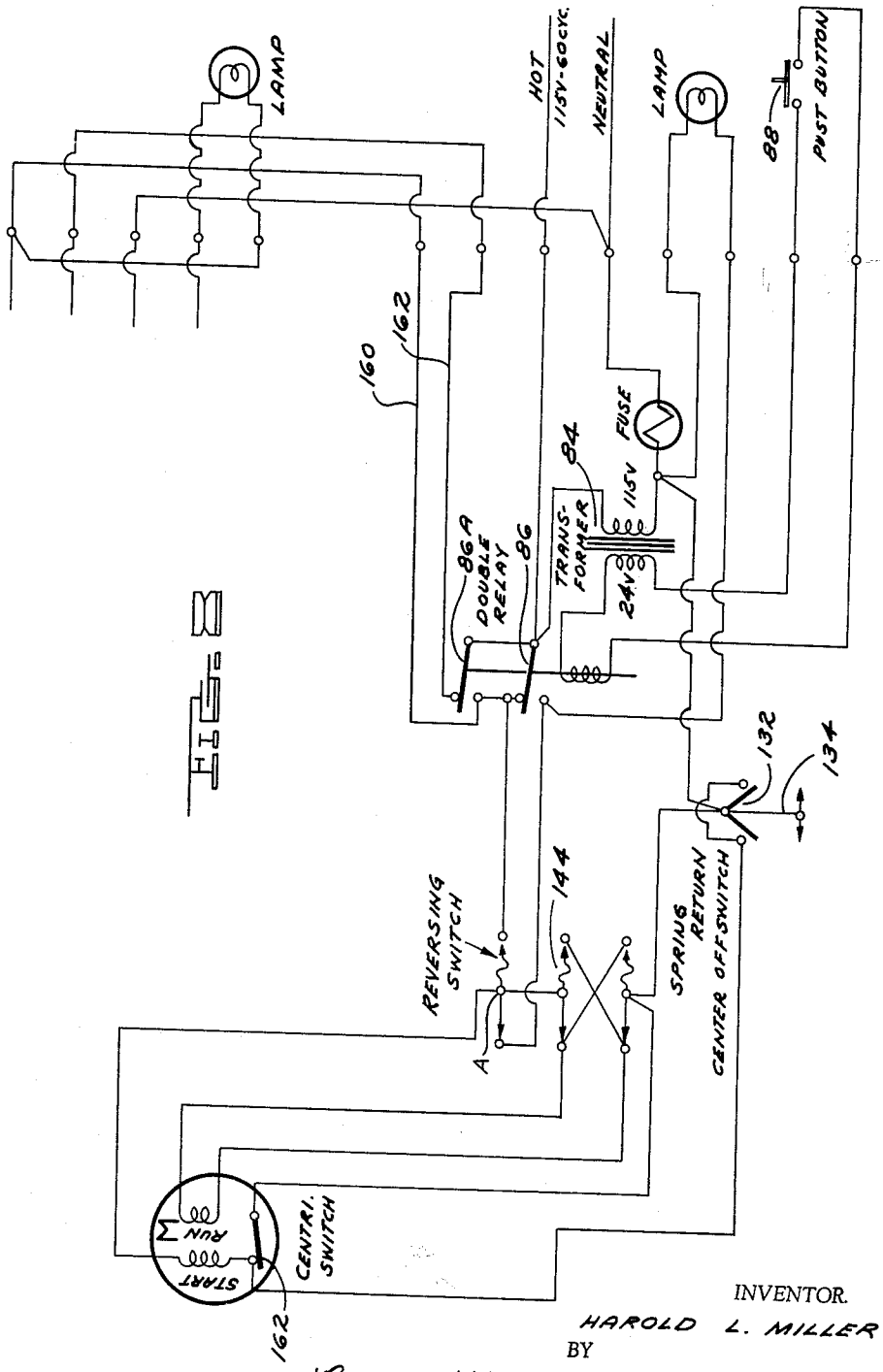

INVENTOR.
HAROLD L. MILLER
BY
Barnes, Kisselle, Raisch & Choate
ATTORNEYS.

United States Patent Office 3,180,635 Patented Apr. 27, 1965

3,180,635

SWINGING DOOR AND GATE OPERATOR

Harold L. Miller, Detroit, Mich., assignor to Vemco Products, Inc., Detroit, Mich., a corporation of Michigan

Filed Dec. 6, 1962, Ser. No. 242,808
10 Claims. (Cl. 268—74)

This invention relates to an operating device for a hinged barrier such as swinging doors and gates.

Due to the energy involved and the need for relatively slow motion, it has been common with gate operating mechanisms to use some type of gear reduction or head units to obtain the slow rotary movement required.

It is an object of the present invention to avoid the necessity for gear reduction or a gear head unit by utilizing an extremely simple screw drive mechanism for actuating a chain which in turn actuates a linkage to obtain suitable slow rotary motion and a harmonic action through the linkage which is ideal for the operation of a gate of a swinging door such, for example, as a garage door. With the present device, there is no limit to the degree of rotary motion and thus no possibility of the device locking up.

It is another object of the invention to provide a relatively simple switching mechanism which insures reversal of the system at a proper time.

A still further object is the provision of a device which can be operated in all weather conditions, outside or inside.

Another object of the invention is the provision of a relatively inexpensive and unique mechanism for changing the rotary motion of a relatively inexpensive electric motor into a translatory motion which again is changed into a rotary motion for power operation of a linkage mechanism. This is done with a view to a harmonic action wherein a high starting torque accompanies a low initial speed, the speed increasing in the middle range of the stroke. At the end of the stroke, the speed again decreases and the torque is high. The invention also relates to the circuit which is provided for accomplishing this result with a safety provision for insuring reversal.

Other objects and features of the invention relating to details of construction and operation will be apparent in the following description and claims.

Drawings accompany the disclosure and the various views thereof may be briefly described as:

FIGURE 1, a sectional view of a mechanism used particularly for operation of a door.

FIGURE 2, a circuit for controlling the mechanism.

FIGURE 3, a view showing how the mechanism is associated with an operating linkage.

FIGURE 4, a view of the mechanism showing the linkage in a door closed position.

FIGURE 5, a view of a modified construction particularly adapted for gate operation and including a safety switch mechanism.

FIGURE 6, a detailed view of the switch mechanism.

FIGURE 7, a diagrammatic view of a gate assembly.

FIGURE 8, a diagrammatic view of a circuit for controlling the gate operating mechanism.

Referring to the drawings:

A prime mover of the rotary type, such as a motor **10**, has a starting winding and the usual run windings to drive a small pulley **12** (FIGURE 4) which is connected through a belt **14** to a larger drive pulley **16**. The motor **10** is suitably mounted in a housing **18** in FIGURE 1, or housing **100** in FIGURE 5, which carries suitable bushings for the pulleys. Pulley **16** in FIGURE 1 is connected to a screw shaft **20**, one end of which is suitably journalled in the housing **18** and the other end of which is

journalled in a bearing block **22**. The screw **20** carries a translatable shuttle member **24** which has a side extension **26** attached to ends **28** and **30** of a link roller chain **32** which is mounted around a small adjustable idling post or sheave **34** at one end of the housing and a larger drive sprocket **36** at the other end of the housing. The chain **32**, shown as a link chain, may be any type of endless member such as a belt or timing gear drive. The pitch of the thread on screw **20** can, of course, be varied to control the speed of the belt relative to the prime mover.

The drive sprocket **36** is mounted on a drive shaft **38** which projects from the housing **18** to connect rigidly with a link arm **40**. The link arm is connected at an elbow joint **42** to a second link **44** pivotally associated at **46** with a hinged barrier such as a door **48**. The door has a pivot axis **50** suitably mounted in a garage or other structure for motion from a horizontal open position to a vertically closed position. A wall **52** of the structure supports the door and can also support the housing **18** through a mounting bracket **54**. The housing may have a light **56** mounted on the top of the housing for illumination during an operating cycle.

On the shuttle **24** on the side opposite to the extension **26** is a short perforated extension **60** transfixed by an axially shiftable actuating shaft **62**. This shaft has stop blocks **64** and **66** mounted at each end which serve as seats for springs **68** and **70**. The shaft **62** is guided in the lower end (FIGURE 1) by an eye member **72**. The top end of the shaft is connected to a switch arm **74**, this arm projecting from a switch box **76**.

It will be seen that pressure through the projection **60** against the springs **68** and **70**, respectively, will cause a shifting vertically of the actuating shaft **62** which can actuate the switch arm **74** to cause reveral and stopping of the device.

In FIGURE 2, there is shown a circuit for the operation of the door opening mechanism. The motor **10** is shown diagrammatically with a starting coil **80** and a running coil **82**. A transformer **84** provides a 24-volt circuit for the operation of a relay switch **86** upon actuation of a push-button switch **88**. The starting coil **80**, of course, will be cut out by a centrifugal switch in the usual manner in the motor. The running coil **82** can also be the reversing coil since reversal of current flow through this coil will reverse the direction of the motor. The push-button **88** initiates the action causing also actuation of relay switch **86**. The reversing switch **76** actuated by the shaft **62** will cause suitable reversing of the mechanism. The ratchet relay switch **86** is mechanically locked in position after a momentary energization of the coil causes it to shift. It will be noted that lamp **56** is included in the circuit of the motor so that it may be operated when the motor is running. The ratchet relay controls the two pole switch **86** and is of standard type wherein one stroke of the solenoid actuates the relay to a latched position with one pole of switch **86** connected. A similar stroke of the solenoid releases the latch and allows the switch to return to connection with the other pole.

The relay switch **86** in conjunction with one throw A of the reversing switch controls the starting winding and serves also as a limit switch. In FIGURE 2, for example, as the switches are set, the starting winding is connected to the top throw of switch **86**. If the reversing switch is thrown, the starting winding will be connnected to the bottom throw of switch **86** but this will not be in the power circuit until push-button switch **88** actuates the solenoid to release switch **86** to the bottom throw.

Referring to FIGURE 5, a modified structure is shown, the main elements of the structure being basically the same as shown in FIGURES 1 and 2 with the motor **10**,

the pulley 12, belt 14 and pulley 16 driving a threaded shaft 20. Control shaft 62 again carries the blocks 64 and 66 and the springs 68 and 70 and the shuttle 24 moves in the same manner propelled by the chain 32. The gear 36 drives power shaft 38. This mechanism is shown associated with a gate unit as illustrated in FIGURE 7 where the outer housing 100 encloses all of the operating parts, including the pulleys in FIGURE 5, the shaft 38 being connected to a crank member 102 which in turn is connected to a link 104 pivotally associated with the gate plate 106 on a gate 108. Joints 110 and 112 in the respective crank and link permit longitudinal adjustment. The elbow joint for the two parts is located at 114. For clarity of illustration, the linkage in FIGURE 5 is shown rotated 90° out of close position.

The device of FIGURE 5 is altered from that shown in FIGURE 1 in that the actuating shaft 62 is anchored at 120 to a lever 122 pivoted at 124 on a suitable bracket. This lever 122 is connected at its other end 126 to a link 128 which in turn joins with a switch-carrying bracket 130. Mounted on the bottom of the bracket 130 is a small switch box 132, and projecting upwardly from this switch box is a control arm 134. A second stationary bracket 136 is mounted on a projecting plate 138, this being a U-shaped bracket having spaced walls for supporting the bottom plate of the bracket and two turned-up ends 140 which support parallel transfixing rods 142 affixed to the bracket 136. These rods pass through the opposed end walls of the switch-carrying bracket 130 in a sliding relationship. Mounted on the bottom of the bracket 136 is a second reversing switch box 144 having a control arm 146 projecting upwardly into the bracket. A small link 148 connects the two switch arms 134 and 146. The spring (not shown) which controls the resistance of motion of switch arm 134 is stronger than the spring which controls the motion of the switch arm 146.

Under normal circumstances, then, motion of the lever 122 will be transmitted through the link 128, bracket 130 and the switch arm 134 to the switch arm 146 and this motion will normally actuate the switch arm 146. However, if for some reason reversal of the system does not take place at this point upon actuation of the switch arm 146, then override motion of the shuttle 24 will cause further motion of the lever 122 and the link 128, thus putting sufficient pressure on the switch arm 134 that it will actuate switch 132 to cause instant reversal of the system.

FIGURE 6 shows in a little greater detail the construction of the brackets 130 and 136. The dotted lines at the right-hand side of the drawing illustrate the override motion which has caused the switch arm 134 to be actuated to a switch actuating position. Switch 132 is a so-called center-off switch and when moved in either direction has the same effect on the circuit.

In FIGURE 8, a circuit is shown somewhat similar to that shown in FIGURE 2 with certain additions. The transformer 84 receives power from the 115-volt, 60-cycle line and converts to 24 volts for the control of the double throw relay 86 and 86A when the push-button 88 is closed. The relay switch 86A controls lines 160 and 162 which lead to a second circuit (not shown in full) which is identical with the control for motor M in FIGURE 8 where two motors are desired. For example, in FIGURE 7, a double gate unit would use a double motor circuit. The reversing switch 144 can be identical to that shown in FIGURE 2 and the motor has the same starting and running windings. The centrifugal switch 162 in the motor is hooked into a circuit which includes the spring return center-off switch 132 previously referred to in connection with the description of FIGURE 5 and shown diagrammatically in FIGURE 8.

If for some reason the reversing switch 144 is operated and, before the motor slows down to cut in the centrifugal switch, the push-button 88 is actuated, the motor will continue to run without reversal of direction, but the continued motion of the shuttle 60 influencing the lever 122 will cause the ultimate throw of the switch lever 134 on the center-off switch 132. This will by-pass the centrifugal switch to cause reverse flow of current to the high torque starting winding and thus prevent jamming. It will be seen that because of the mechanism shown in FIGURE 5, this switch 132 can operate at either end of the stroke to perform the same function. In this circuit as in FIGURE 2, the throw A of switch 144 in conjunction with relay 86 will serve as the limit switch for the circuit.

The ratio of drive from shaft 38 can be varied, as previously described, by changing the pitch of the thread on shaft 20 and it may also be controlled by the ratio of sheave 34 and gear 36. It will be seen that the shuttle 24 is controlled in its position both by the connection to the chain 32 and to the shaft 62. The lever 122 can also be operated by a hand pull 180 fastened at one end to the lever 122 and extending outwardly through the wall of the enclosing housing.

With the simple arrangement shown, a controlled speed arrangement is obtained without an expensive gear reduction and the resulting system has an extremely high torque at the beginning and end of the stroke when it is neede and also a slow speed at the extremities of the stroke which is ideal for the purpose. In addition, the circuit safety switch arrangement insures positive shut off and reversal at the end of every stroke.

What I claim:

1. A power drive mechanism for a hinged barrier such as a gate or a garage door which comprises:
   - (*a*) a rotary prime mover adapted to be mounted adjacent said hinge,
   - (*b*) a screw shaft journalled adjacent said prime mover and driven by said prime mover,
   - (*c*) a chain mounted adjacent said screw shaft having a run parallel to said shaft,
   - (*d*) pulleys mounting said chain,
   - (*e*) a drive shuttle threadedly mounted on said screw and affixed to said chain in a manner to drive said pulleys upon rotation of said screw,
   - (*f*) a power shaft mounting one of said pulleys, and
   - (*g*) linkage to connect said power shaft to a hinged barrier including a first arm rigidly affixed to said shaft, and a second arm pivotally connected to said first arm and adapted to be pivotally connected to said barrier in such a manner that said first arm is operated in the same direction as it is desired to move the barrier.

2. A power device for a hinged barrier or the like comprising:
   - (*a*) a rotary prime mover adapted to be mounted adjacent said hinge,
   - (*b*) a screw shaft journalled adjacent said prime mover and driven by said prime mover,
   - (*c*) a flexible endless member mounted adjacent said screw shaft, having a run parallel to said shaft,
   - (*d*) translatable means threadedly engaging said screw shaft fastened to and held against rotation by said member whereby rotation of said shaft causes motion of said endless member,
   - (*e*) a power take-off means rotatably supporting and driven by a portion of said endless member,
   - (*f*) said power take-off means including a power shaft, and
   - (*g*) linkage to connect said power shaft to a hinged barrier including a first arm rigidly affixed to said shaft, and a second arm pivotally connected to said first arm and adapted to be pivotally connected to said barrier in such a manner that said first arm is operated in the same direction as it is desired to move the barrier and said arms are substantially aligned when the barrier is in one extreme position and said arms overlie one another when said barrier is in the other extreme position.

3. A power device as defined in claim 2 in which said prime mover is driven electrically,

(*a*) a power circuit for controlling said prime mover,

(*b*) a control switch in said circuit, and

(*c*) means connecting said control switch and said translatable means wherein said circuit may be influenced by predetermined motion of said translatable means.

4. A power device as defined in claim 2 in which said prime mover is driven electrically,

(*a*) a power circuit for controlling said prime mover,

(*b*) a control switch in said circuit,

(*c*) a control on said switch, and

(*d*) means connectng said translatable means and said control to cause actuation of said switch at the extremities of motion of said translatable means.

5. A power device as defined in claim 4 in which the means connecting said translatable means and said control comprises:

(*a*) a control shaft mounted parallel to said screw shaft,

(*b*) means mounting said control shaft for limited axial motion,

(*c*) means connecting said shaft to the control of said switch, and

(*d*) means on said translatable means positioned to contact and actuate said control shaft at predetermined points in the motion of said translatable means.

6. A power device as defined in claim 4 in which the means connecting said translatable means and said control comprises:

(*a*) a control shaft mounted parallel to said screw shaft,

(*b*) means mounting said control shaft for limited axial motion,

(*c*) means connecting said shaft to the control of said switch,

(*d*) stop means adjacent the ends of said control shaft, and

(*e*) means on said translatable means transfixed by said control shaft wherein said stop means are contacted at the extremities of travel to control said switch.

7. A power device as defined in claim 2 in which said prime mover is driven electrically,

(*a*) a power circuit for controlling said prime mover including

(*b*) a main control switch having a control member and a secondary control switch having a control member,

(*c*) means connecting said control members, and

(*d*) means mechanically associating said secondary control switch and said translatable means wherein said circuit may be influenced by motion of said translatable means.

8. A power device as defined in claim 7 in which each of said control members is resiliently biased against motion, the control member of said secondary switch being more heavily biased than the control member of said main switch wherein motion of said translatable means influences first the control member of said main switch and upon further motion may actuate said secondary switch.

9. A power device as defined in claim 2 in which said prime mover is driven by an electric motor having a starting coil,

(*a*) a running coil and a centrifugal switch in the starting coil circuit,

(*b*) a power circuit for controlling said prime mover including

(*c*) a reversing switch controlling said coils,

(*d*) a control member for said reversing switch,

(*e*) a secondary switch in the circuit of said starting coil,

(*f*) a control member for said reversing switch,

(*g*) means physically connecting said control members, and

(*h*) means associating said secondary control switch and said translatable means wherein motion of said translatable means influences first the control member of said main switch and upon further motion may actuate said secondary switch.

10. A power device as defined in claim 9 in which each of said control members is resiliently biased against motion, the control member of said secondary switch being more heavily biased than the control member of said main switch.

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HARRISON R. MOSELEY, *Primary Examiner.*