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DOOR OPERATOR

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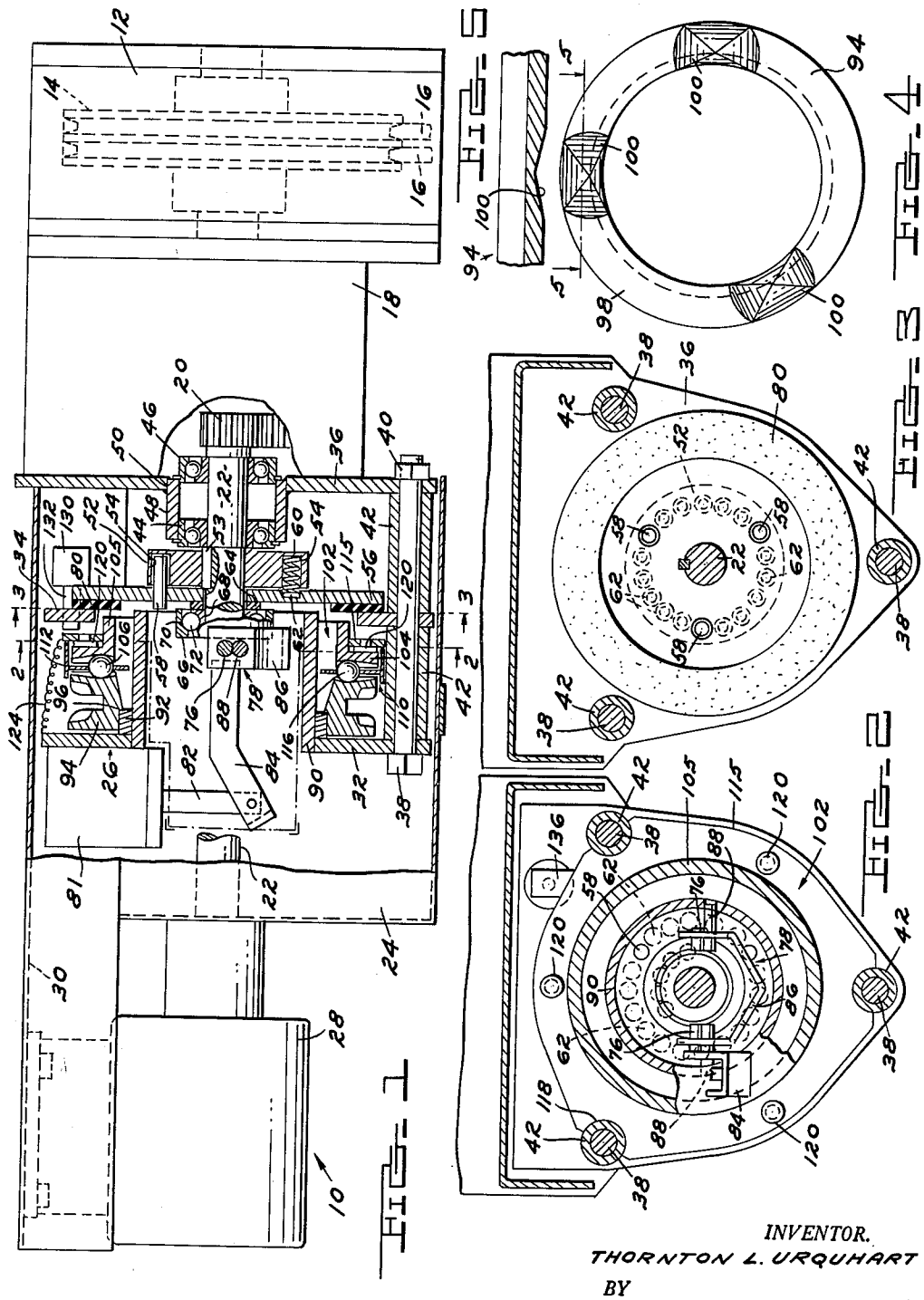

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DOOR OPERATOR

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This invention relates generally to an operator assembly and refers more particularly to a door operator assembly adapted to be operated selectively by power and by hand.

One object of this invention is to provide an operator assembly which is adapted to be operated selectively by power and by hand without the necessity for a gear shift mechanism.

Another object is to provide a manually operated device including a driver for operating a driven member, and a normally disengaged clutch unit between the driver and driven member adapted to be engaged in response to the operation of the driver.

Another object is to provide a manually operated device for driving a shaft including a wheel, and means responsive to the rotation of the wheel for engaging a clutch unit to transmit the rotation of the wheel to the shaft.

Another object is to provide a door operator assembly comprising a motor and a manually operated device selectively operable to drive a shaft for raising and lowering a door, a first clutch member rotatable within the shaft, a second clutch member normally out of engagement with the first, and means responsive to the rotation of the wheel for engaging the clutch members, thereby to transmit the rotation of the wheel to the shaft through the clutch.

Another object is to provide an assembly as described in the preceding paragraph having means responsive to the engagement of the clutch members for rendering the motor inoperative.

Another object is to provide means for preventing rotation of the shaft, releasable in response to the engagement of the clutch.

Another object is to provide an operator assembly wherein the wheel is positioned opposite one of the clutch members and wherein the opposed surfaces of the wheel and clutch member have inclined ramps with balls between and engaging the ramps so that upon rotation of the wheel the balls will climb the ramps and axially move the clutch member in a direction to engage the clutch and thereby transmit the rotation of the wheel to the shaft.

Other objects and features of the invention will become apparent as the following description proceeds, especially when considered with the accompanying drawing, wherein:

FIGURE 1 is a side elevational view, with parts broken away and in section, of an operator assembly constructed in accordance with my invention.

FIGURE 2 is a sectional view taken on the line 2—2 of FIGURE 1.

FIGURE 3 is a sectional view taken on the line 3—3 of FIGURE 1.

FIGURE 4 is an elevational view of one of the parts of the assembly shown in FIGURE 1.

FIGURE 5 is a sectional view taken on the line 5—5 of FIGURE 4.

Referring now more particularly to the drawing, the door operator there shown is generally indicated at 10 and is adapted to be mounted on the jamb above a door opening and to operate a cable for raising and lowering a door for the opening between open and closed positions. A drum housing 12 encloses a pulley or drum 14 around which are trained the cables 16 attached to a door (not shown) for raising and lowering the same. 18 is a gear box which is operated by a pinion 20 on the end of a shaft 22 which extends into the gear box and is rotated either by power or by hand, as will become more apparent hereinafter.

A housing 24 is connected to the gear box and contains the manually operated device 26 for rotating shaft 22. The shaft 22 extends through housing 24 and is connected to a reversible electric motor 28 fixedly secured to a housing extension 30. The manually operated device 26 and motor 28 are provided as alternate means for driving the shaft 22 and hence for raising and lowering the door.

The manually operated device 26 includes a rear plate 32, an intermediate plate 34 and a front plate 36 which may actually be a fixed part of the gear box 18. The plates 32, 34 and 36 are formed with three sets of aligned holes, the holes being spaced apart circumferentially approximately 120°, and a bolt 38 extends through each set of aligned holes. The bolts 38, together with nuts 40 threaded on the ends thereof, secure the plates together. Spacer sleeves 42 between plates 32 and 34 and between plates 34 and 36 surround each bolt to establish the proper spacing between the plates.

The shaft 22 is supported for rotation by bearings 44 and 46. The bearings are carried by a short tube 48 welded to plate 36 in an aperture 50 thereof. The aperture 50 locates the axis of shaft 22. The pinion 20 on the end of the shaft will mesh properly in the gear box if it is properly centered regardless of the precise angular position of the device 26, and hence the bolt holes in the plates 32, 34 and 36 need not be located with great accuracy.

A hub 52 is rigidly secured on shaft 22 by a key 53. The hub 52 is formed with a plurality of recesses or sockets 54 which extend parallel to the axis of the shaft and are arranged in a circle about the shaft axis in circumferentially spaced relation. The recesses 54 are open at the rear end of the hub and are closed at the front end. A clutch plate 56 has a central aperture which loosely surrounds the shaft 22. Accordingly, the clutch plate is concentric with the shaft and is capable of limited axial movement with respect thereto. The clutch plate is connected to the hub by pins 58 which extend from certain recesses 54 of the hub into aligned openings in the clutch plate so that the clutch plate is constrained to rotate as a unit with the hub. The pins fit loosely in the sockets simply because a closer fit is not required, and any slight lost motion provided is incidental. In the remaining recesses 54, compression coil springs 60 are provided which extend from the open rear ends of the recesses into registering sockets 62 in the clutch plate. The springs, being under compression, tend to move the clutch plate 56 to the left as viewed in FIGURE 1, or away from the hub.

Limiting movement of the clutch plate 56 to the left is a thrust washer 64 which is slidable on the shaft and confined on its rear side by a bearing 66. The bearing 66 has an inner race 68, an outer race 70 and balls 72 between the races. The inner race of the bearing 66 is axially slidable on the shaft 22 and is restrained from axial movement to the left by the pins 76 of the rocker 78.

The clutch plate 56 has on its rear side a friction ring 80 which engages the front side of plate 34. The friction ring 80 is pressed into friction contact with the plate 34 by the springs 60. Hence the friction ring 80 when contacting the plate 34 serves as a brake on the shaft 22 to hold it from rotating.

When the motor 28 is operated, there is a resultant actuation of the rocker 78 to move the clutch plate 56 to the right to remove the friction ring 80 from contact with plate 34 and hence to release shaft 22 for rota-

tion. For this purpose, a solenoid 81 is provided. The solenoid 81 is connected in the motor circuit so as to be energized when the motor is energized. Energization of solenoid 81 raises its plunger 82 which is connected at the lower end to the arm 84 of the rocker. The arm 84 is connected to a yoke 86 of the rocker. The legs of the yoke have aligned pins 88 which are pivotally connected to a tube 90 carried by plate 32, permitting the rocker 78 to oscillate about the axis of the aligned pins 88. The pins 76 are aligned and likewise respectively carried by the legs of the yoke and bear against the outer race of the bearing 66. Hence when the plunger of the solenoid 81 is raised, the rocker 78 is oscillated in a clockwise direction causing pins 76 to move the bearing 66 in a forward direction, producing a similar movement of the clutch plate 56 through the thrust washer 64. In this manner, the friction ring 80 of the clutch is removed from contact with the plate 34, and hence whenever the motor 28 is energized the shaft 22 is free to rotate.

The manually operated device 26 is provided as an alternative means of driving shaft 22 and hence of raising and lowering the door. A circular bushing 92 surrounds and is secured to the tube 90. A wheel 94 is rotatable on the bushing, having a shoulder 96 preventing the wheel from moving axially in a rearward direction with respect to the bushing. A chain (not shown) is adapted to extend over and about the wheel 94 to provide a means for manually rotating the wheel. The wheel is concentric with respect to the shaft and on its front generally radial annular surface 98 (FIG. 4) has a plurality of circumferentially spaced ramps 100. The ramps are inclined as shown in FIGURE 5.

A second annular clutch member, or pressure plate, 102 loosely surrounds the tube 90 in concentric relation to shaft 22 and is located between the wheel 94 and the clutch plate 56. The rear generally radial annular surface of the pressure plate has a plurality of ramps 104 which have the same configuration as the ramps 100 and which are respectively in register or in axial alignment with ramps 100. Balls 106 are positioned between the wheel 94 and pressure plate 102 in engagement with the opposed or registering ramps 100 and 104. A ball retainer 110 is provided having a plurality of circumferentially spaced apertures therein for receiving the balls. The retainer is in the form of a radial ring and at its outer periphery has an annular flange 112 which encircles the wheel 94 and pressure plate 102 to center the retainer.

The pressure plate has an axial extension or flange 105 which projects towards the right or in a forward direction. The flange is circular and normally is spaced from the friction ring 80 on the clutch plate 56.

A circular, axially movable drag plate 115 has a central aperture clearing the annular flange 105 of the pressure plate and is formed with circumferentially spaced notches 118 (FIG. 2) which engage the spacer sleeves 42 on bolts 38 to hold the plate against rotation. The drag plate has on its rear surface a plurality of friction buttons 120 which normally engage the front surface of the pressure plate, being held in engagement therewith by the tension coil springs 124 between the plates 32 and 115. In the normal inoperative position of the parts shown, the flange 112 on the ball retainer is engaged on its front edge by the drag to be positioned thereby.

When the hand wheel 94 is manually operated by the chain, it initially rotates relative to the pressure plate 102. The pressure plate is restrained from rotation by contact with friction buttons 120 on the drag 115. As a result, the ramp surfaces 100 rotate with respect to ramp surfaces 104 so that the balls climb the ramps, that is, approach the circumferential extremities of the ramps, causing the pressure plate to move axially to the right or in a forward direction with respect to the hand wheel 94, so that the annular flange 105 on the pressure plate engages the friction ring 80 of clutch plate 56, disengaging it from the plate 34. The friction contact between the ring 80 and flange 105 on the pressure plate causes the clutch plate 56 and pressure plate 102 to rotate as a unit with wheel 94, producing a corresponding rotation of shaft 22 through pins 58 and a raising or lowering of the door depending on the direction of rotation of the wheel. During this time, the pressure plate of course rotates with respect to the drag so that the friction buttons 120 slip on the engaging surface of the pressure plate. The restraint imposed by the buttons 120 therefore is not of great magnitude and is provided simply to assure that the pressure plate does not rotate during initial rotation of the wheel so that it can be actuated or moved to the right by the camming action of the balls.

A switch 130 is provided having a plunger 132 which extends through a suitable opening in the plate 34 in position to be engaged by an extension 136 of the drag 115. Hence when the manually operated device 26 is operated by rotation of the wheel 94, the movement to the right of the drag by the separating action of the pressure plate will cause the plunger 132 to operate the switch 130. Operation of the switch 130 opens the motor circuit, thereby rendering the motor inoperative. Hence the motor cannot be inadvertently operated while the manually operated device 26 is in use.

What I claim as my invention is:

1. An operator assembly adapted to be operated selectively by power and by hand, comprising a shaft, a manually operable device for driving said shaft including a wheel rotatable relative to said shaft, a first rotatable clutch member having a driving connection with said shaft such that rotation of said first clutch member will effect rotation of said shaft, a fixed brake member, said first clutch member being axially movable toward and away from a normal position in which it engages said brake member to hold said shaft from rotation, means urging said first clutch member toward said normal position, a second clutch member rotatable relative to said shaft, said second clutch member being positioned opposite said first clutch member for axial movement relative thereto, means for axially shifting said second clutch member toward and into driving engagement with said first clutch member in response to initial rotation of said wheel and for thereafter rotating said second clutch member with said wheel, said first clutch member being moved from engagement with said brake member by said second clutch member when engaged thereby, to permit the transmission of the rotation of said wheel to said shaft, power means operative to rotate said shaft, and means for automatically moving said first clutch member from engagement with said brake member when said power means is operated.

2. An operator assembly adapted to be operated selectively by power and by hand, comprising a shaft, a manually operable device for driving said shaft including a wheel concentric with and rotatable relative to said shaft, a first clutch member concentric and rotatable as a unit with said shaft, a fixed brake member, said first clutch member being axially spaced from said wheel and axially movable toward and away from a normal position in which it engages said brake member to hold said shaft from rotation, means urging said first clutch member axially toward said normal position, a second clutch member concentric with said shaft and rotatable relative to said shaft, said second clutch member being normally disengaged from said first clutch member and positioned between said wheel and said first clutch member for axial movement relative thereto, cam means for axially shifting said second clutch member toward and into driving engagement with said first clutch member in response to initial rotation of said wheel and for thereafter rotating said second clutch member with said wheel, said first clutch member being axially moved from engagement with said brake member by said second clutch member when engaged thereby, to permit transmission of the rotation of said wheel to said shaft, power means operative to rotate said

shaft, and means for automatically axially moving said first clutch member from its normal position away from said brake member free of engagement therewith when said power means is operated.

3. The operator assembly defined in claim 2, wherein said second clutch member is rotatable relative to said wheel, circumferentially spaced opposed inclined ramp surfaces are provided on said wheel and second clutch member, and balls are provided between and in engagement with said opposed ramp surfaces so that initial rotation of said wheel relative to said second clutch member will cause said balls to climb said opposed ramp surfaces and axially shift said second clutch member into driving engagement with said first clutch member as aforesaid, said balls and ramp surfaces transmitting the rotation of said wheel to said second clutch member after engagement of said second clutch member with said first clutch member.

4. The operator assembly defined in claim 3, including a retarding device preventing rotation of said second clutch member with said wheel until said second clutch member engages said first clutch member, said retarding device comprising a retarding member frictionally engaging said second clutch member on the side thereof away from said wheel, and spring means urging said retarding member axially toward said second clutch member.

5. An operator assembly adapted to be operated selectively by power and by hand, comprising a shaft, a manually operable device for driving said shaft including a wheel concentric with and rotatable relative to said shaft, a first clutch member concentric and rotatable as a unit with said shaft and having a radial friction face, a fixed brake member concentric with said shaft and having a radial friction face opposed to the friction face of said first clutch member, said first clutch member being axially spaced from said wheel and axially movable toward and away from a normal position in which its friction face engages that of said brake member to hold said shaft from rotation, means urging said first clutch member axially toward said normal position, a second clutch member concentric with said shaft and rotatable relative to said shaft and said wheel, said second clutch member having

a radial friction face opposed to the friction face of said first clutch member, said second clutch member being normally disengaged from said first clutch member and positioned between said wheel and said first clutch member for axial movement relative thereto, cam means for axially shifting said second clutch member toward and into driving engagement of its friction face with that of said first clutch member in response to initial rotation of said wheel and for thereafter rotating said second clutch member with said wheel, said first clutch member being axially moved from engagement of its friction face with that of said brake member by said second clutch member when engaged thereby, to permit transmission of the rotation of said wheel to said shaft, said cam means including circumferentially spaced opposed inclined ramp surfaces on said wheel and second clutch member, and balls between and in engagement with said opposed ramp surfaces, whereby initial rotation of said wheel relative to said second clutch member will cause said balls to climb said opposed ramp surfaces and axially shift said second clutch member into driving engagement of its friction face with that of said first clutch member as aforesaid, said balls and ramp surfaces transmitting the rotation of said wheel to said second clutch member after engagement of the friction face of said second clutch member with that of said first clutch member, power means operative to rotate said shaft, and means for automatically axially moving said first clutch member from its normal position away from said brake member free of engagement therewith when said power means is operated.

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