United States Patent [19]

Wardlaw

[11] **3,853,167**

[45] **Dec. 10, 1974**

[54] **ROLLING DOOR OPERATING MECHANISM**

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[73] Assignee: **The Cookson Company**, San Francisco, Calif.

[22] Filed: **Aug. 1, 1973**

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[52] **U.S. Cl.** ..... **160/133**, 160/188, 192/12 D

[51] **Int. Cl.** **E06b 9/08**

[58] **Field of Search** ..... 160/133, 188, 9; 192/12 D

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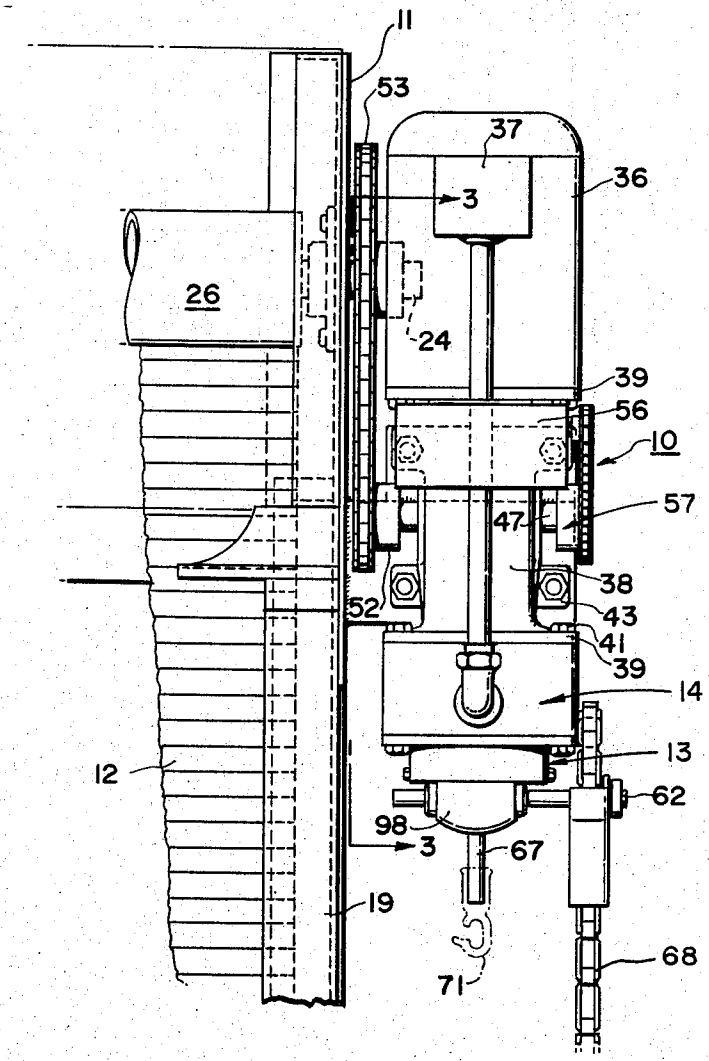
Primary Examiner—Mervin Stein

Attorney, Agent, or Firm—Flehr, Hohbach, Test, Albritton & Herbert

[57] **ABSTRACT**

A rolling door curtain may be raised or lowered by a driving mechanism including a motor driven gearbox which is selectively coupled by an electro-mechanical clutch and a manual operating mechanism. A safety brake coupled between the clutch and manual operator prevents driving of the manual operator by the motor should the clutch fail to disengage and functions as a stopping brake whenever the motor is stopped.

7 Claims, 5 Drawing Figures



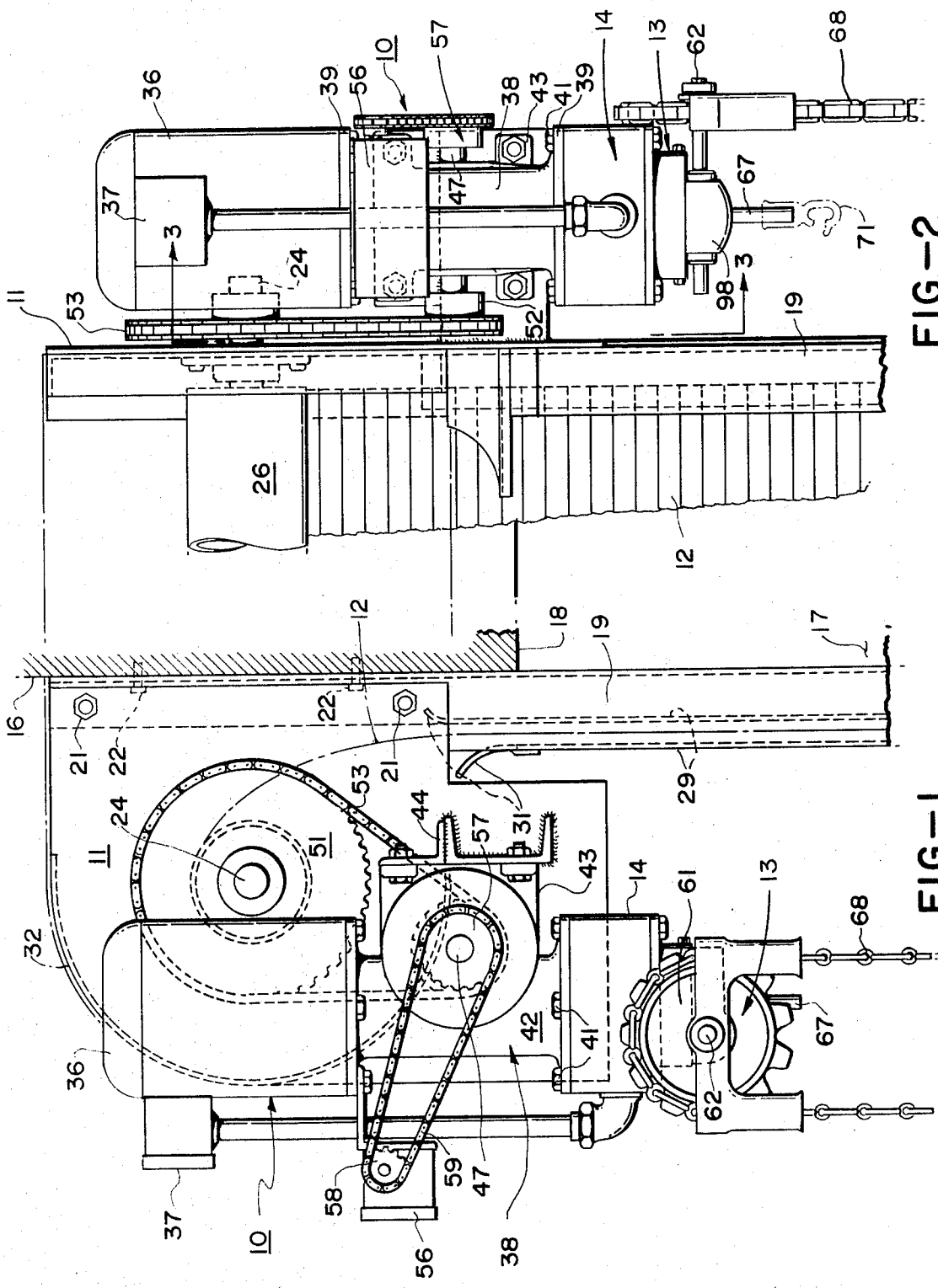


FIG.—2

FIG.—1

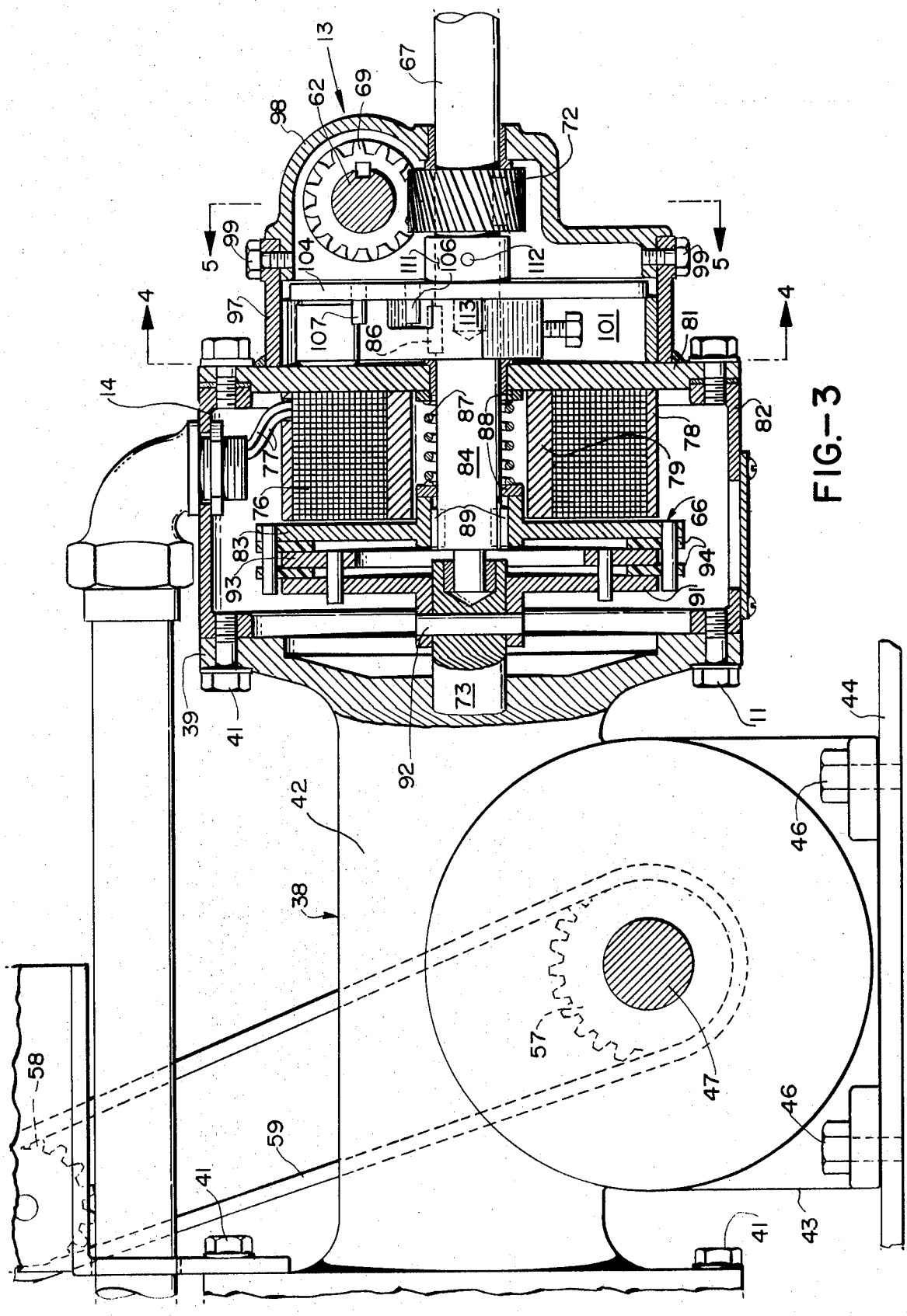

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FIG.-3

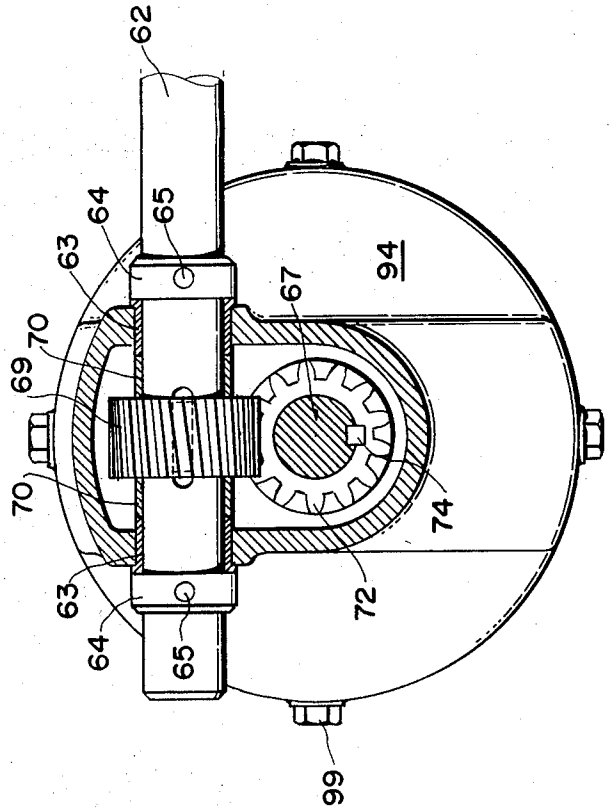

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FIG.—5

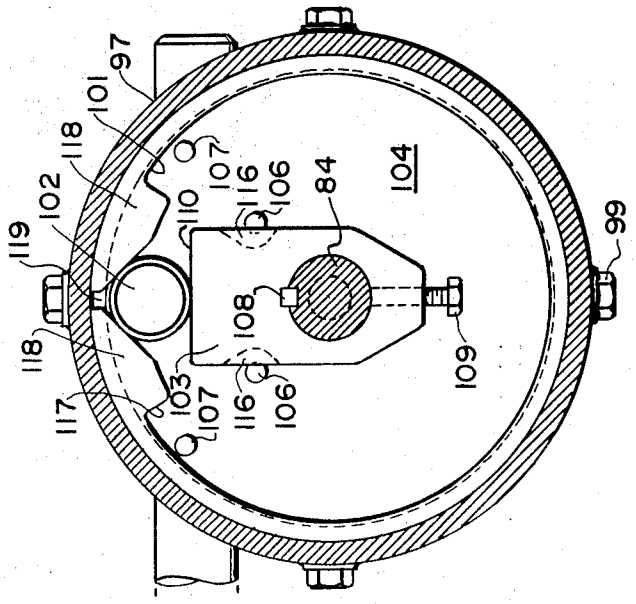

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101
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FIG.—4

ROLLING DOOR OPERATING MECHANISM

BACKGROUND OF THE INVENTION

This invention relates generally to operating mechanisms for rolling doors and the like and particularly concerns and improved operating mechanism having provisions for driving and braking the travel of a rolling door curtain and particularly upon malfunction or disablement of an electro-mechanical clutch coupling the manual operating mechanism to the motor drive mechanism.

Rolling doors consist of an articulated curtain which is adapted to be raised and lowered to open or close an aperture or doorway. The curtain is rolled about or rolled from a barrel mechanism which is rotatably mounted adjacent the top edge of the opening. As the barrel is rotated, the curtain is played off from it to close the door opening or rolled around the barrel to open the door opening. An electric motor driving through a speed reducing transmission or gearbox serves for rotating the barrel in either direction. A manual operator is provided so that the rolling door may be opened or closed when the electric motor is inoperative. In the past the manual operators have been coupled to the electric motor and gearbox through a mechanical clutch mechanism with an electrical switch which prevents the motor from being electrically operated while the manual operator was engaged. The elimination of such switch means while retaining the safety function is one objective of the present invention.

SUMMARY AND OBJECTS OF THE INVENTION

In summary, the invention concerns a rolling door operating mechanism for raising and lowering through manual or motor driven means, a rolling door of the type which includes a rotatable axle, a barrel fixed to the axle and a curtain adapted to be rolled onto the barrel, the particular mechanism comprising an electric motor having gearbox means and being operatively coupled to said rotatable axle for raising and lowering the curtain. Manual operator means are included and are provided with electrically actuated clutch means arranged to couple said manual operator means to said motor and gearbox means in the manual drive mode and to uncouple said manual operator means from said motor gearbox means in the motor drive mode. The manual operator means and the electric clutch means include common shaft means and safety brake means are arranged about said shaft and serve to prevent the rotational movement of the shaft by said motor gearbox means should the electric clutch means fail to uncouple the manual operator means from the motor-gearbox means in the motor drive mode and to serve further as a brake means against inertial forces in the operating system.

It is a general object of the invention to provide improved operating mechanism for a rolling door having motor driven and manual operator means wherein novel safety features are provided in the coupling between the manual operator and the motor driven system to arrest movement of the motor drive should the coupling fail to prevent the motor from driving the manual operator mechanism and to arrest movement of the door when the motor drive is inoperative.

Another object is to provide a mechanical safety brake device in a rolling door operating system which

mechanical device will eliminate switch means for sensing the position and the condition of an electro-mechanical clutch coupling the motor operator to the manual operator.

Another object is to provide an improved safety coupling for incorporating in a rolling door operating mechanism wherein the rolling door may be operated from either a motor driven mode or a manual driven mode and eliminating from the unit the need for a mechanical throw out clutch present in other door operators.

Another object of the invention is to provide a door control device of the above character in which should the motor be operated during the time the hand operated means is being utilized, the hand operated means is automatically uncoupled from the operating drive train.

Additional objects and features of the invention will appear from the following description in which a preferred embodiment is set forth in detail and illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view illustrating a rolling door operating mechanism containing the features of the present invention;

FIG. **2** is a fragmentary front elevational view of the structure shown in FIG. **1**;

FIG. **3** is an enlarged view, partially in section taken in the direction of the arrows **3—3** in FIG. **2**;

FIG. **4** is a view in the direction of the arrows **4—4** in FIG. **3**;

and FIG. **5** is a view in the direction of the arrows **5—5** in FIG. **3.**

DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the rolling door operating mechanism **10** of the present invention is shown in FIGS. **1** and **2** and includes a support bracket **11** which serves as a mounting for the rolling door **12** and the operating mechanism **10** which includes a motor **36,** a gearbox **38** and a manual operator **13** coupled to the gearbox by a clutch mechanism **14.** Two support brackets **11** are mounted on the wall **16** on the opposite sides of the opening formed by the door jambs **17** near the lintel level. Mounting can be accomplished by any suitable means such as by fastening the bracket **11** to the wall angles **19** by means of bolts **21.** The wall angle **19** can be fastened to the wall **16** by suitable means such as by lag bolts **22.**

The rolling door **12** may be of conventional construction wherein a main shaft **24** is suitably journalled for rotation with respect to the brackets **11,** and a barrel **26** is fixed to the shaft **24,** coaxially aligned with the same. The rolling door curtain **12** is mounted upon the barrel **26** and the curtain may comprise, for example, an arrangement of interlocking slats fabricated from a suitable material such as cold-rolled steel, or a grill constructed as disclosed in U.S. Pat. No. 2,940,520 issued on an application by Harold W. Cookson, Jr. and Russell Wardlaw. The subject mechanism is also useful on vertical lift and sectional doors as well as on most all types of closures. The sides of the curtain **12** are adapted to run in curtain guides **29** which may be fastened to the wall angles **19** by any suitable means such as bolts. The tops of the guides are well flared as at **31**

to facilitate entry of the curtain. The entire curtain-barrel assembly is enclosed by a hood 32 which can be fabricated from sheet steel and attached to the brackets by means of bolts, sheet metal screws or the like (not shown).

The main shaft or axle 24 is equipped to be rotated by the operating mechanism 10 both in the motor driven mode and in the hand driven mode through operation of the manual operator 13. More particularly, the operating mechanism includes an electric motor 36 having junction box or starter 37, a speed reducing gearbox 38 operatively coupled to the motor, a clutch mechanism 14 and a manual operator 13. The gearbox 38 and motor 36 are joined to the clutch mechanism 14 to form a unit at the mating flanges 39 and secured by machine bolts 41. The housing 42 of the gearbox 38 is equipped with a pedestal 43 (FIGS. 1 and 3) which serves for mounting the motor operator unit to the structural steel bracket members 44 welded to one of the side brackets 11. Machine bolts 46 may be employed to secure the pedestal 43 to the brackets 44.

The gearbox 38 has an output drive shaft 47 extending transversely of the unit and each end of the shaft 47 is provided with a drive sprocket 52, 57, as shown in FIGS. 1 and 2. A main drive sprocket 51 is arranged on the axle 24 of the barrel 26 and the drive sprocket 51 is driven from the shaft 47 from the sprocket 52 arranged thereon and the drive chain 53. Thus rotation of the gearbox drive shaft 47 serves to rotate the main drive sprocket 51 winding the curtain 12 with respect to the barrel 26.

A rotary limit switch 56 serves to sense the upper and lower positions of the curtain 12. The limit switch 56 is driven from the gearbox drive shaft 47 (FIG. 1) through sprockets 57, 58 and chain 59 arranged as shown which serve to permit operation of the rotary limit switch 56 for automatic stopping of the rolling door curtain at either the defined bottommost or topmost portion of its travel.

As indicated previously, the rolling door operating mechanism 10 may be operated in a manual mode through use of the manual operator 13, as well as in the motor driven mode by operating the electric motor 36. More specifically, the manual operator 13 includes a cross shaft 62 (FIGS. 3 and 5) which is journalled in an outer gear housing 98 by means of two flange bearings 63 arranged inwardly of two collars 64. The shaft 62 and the collars 64 are provided with suitable circular openings for receiving pins 65 securing the collars fixedly to the shaft 62. A helical gear 69 is arranged on the shaft 62 between two spacers 70, the gear 69 being disposed for cooperative engagement with a spur gear 72 secured to the operating shaft 67 by a key 74.

Referring now to FIGS. 1 and 2, it will be seen that a sprocket 61 is arranged on the cross shaft 62 and is equipped with a manual chain 68 for rotating the shaft 62 and thereby through the geared connection, the operating shaft 67. Alternatively, a hook 71 may be mounted upon the operating shaft 67 for rotation of the shaft by means of a manual crank (not shown).

The manual operator 13 is operatively coupled and decoupled with respect to the gearbox 38 through means of an electro-mechanical clutch 66 (FIG. 3) so that rotation of the shaft means 67, 84 by means of the hand chain 68 and sprocket 69, or through rotation of a hook 71 will cause the gearbox input shaft 73 to rotate when the clutch 66 is in a "clutching" or "engaged"condition. It will be understood that the gearbox input shaft 73 is arranged to rotate in synchronization with the gearbox drive shaft 47 being coupled thereto by internal gears (not shown).

The clutch mechanism 14 includes an electro-mechanical clutch 66 having a coil 76 of annular configuration which is electrically connected by the wires 77 into the electrical junction box 37 of the motor so that actuation of the motor simultaneously energizes the coil 76. The coil 76 is arranged within an annular space defined by an outer sleeve 78 and an inner sleeve 79 each of which is fixedly secured at one end to an end wall 81 of a clutch housing 82. One annular face of the coil 76 is disposed adjacent to a pressure plate 83 of the clutch which is permitted to slide axially along a brake shaft 84. The pressure plate 83, in the inoperative condition of the coil 76, is urged to the left as viewed in FIG. 3 by a coil spring 87 acting between spaced thrust bearings 88 arranged about the shaft 84. Here it will be understood that the strength of the coil 76 in relationship to the strength of the spring 87 is such that the coil is sufficiently strong to shift the pressure plate 83 towards the right as viewed in FIG. 3 against the forces in the spring 87 for "declutching" the manual operator 13 from the speed reducing gearbox input shaft 73. The pressure plate is maintained on the shaft 84 against rotation by key members 89.

A drive plate 91 of the clutch is fixedly secured to the gearbox input shaft 73 by means of a drive pin 92 so that the pressure plate will rotate with the shaft 73. A center plate 93 of the clutch is interposed between the drive plate 91 and pressure plate 83 and friction materials 94 are interposed between the spaces between the pressure plate and center plate as well as between the center plate and the drive plate so that when the clutch plate members are urged by the spring 88 to the left, as viewed in FIG. 3, a driving connection will be effected between the shaft 84 and the gearbox shaft 73 for the manual drive mode. Conversely, when the coil 76 is energized in the motor driven mode, the pressure plate would be retracted from frictional engagement with the drive plate and the shaft 73 and the drive plate will rotate freely with respect to the pressure plate connected to the brake shaft 84.

Means are provided in the operating mechanism 10 to prevent movement of the manual chain 68 should a driving connection be established unexpectedly between the gearbox shaft 73 and manual operator shaft 67 when the operator is operating in the motor driven mode. Such unexpected driving connection could be due to possible failure of the coil 76 or from drag between the clutch plates and friction materials which would tend to cause undesirable rotation of the shaft 67.

More specifically, a brake drum 97 is rigidly secured to the end wall 81 of the clutch housing and the other end of the drum is closed by the gear housing 98 fixedly secured thereto by cap screws 99. A brake ring 101 (FIGS. 3 and 4) is arranged radially inwardly of the brake drum 97 and is caused to rotate with the shaft 67 by a brake drive plate 104 carrying two pairs of axially inwardly projecting pins 106 and 107, shown best in FIG. 4. The brake drive plate 104 is equipped with a hub 111 (FIG. 3) which receives a drive pin 112, fixedly securing the drive plate 104 so that it may rotate with the operating shaft 67. A rotatable cam 103 is rigidly secured to the brake shaft 84 (FIG. 4) by means of

a key **108** and set screw **109** and engages a cam roller **102.** It will be understood that the operating shaft **67** is arranged coaxially with the brake shaft **84** and is mated thereto during the assembly operating such that a necked-down guide portion **113** of the shaft **67** (FIG. 3) is rotatably received within a complementary cavity formed within an end of the shaft **84,** thus permitting a measure of relative rotary motion between the shafts **84, 67** within the limits defined by the brake assembly.

In view of the above, and referring particularly to FIGS. **3** and **4,** it will be observed that rotation of the operating shaft **67** serves to rotate the brake drive plate **104** carrying the drive pins **106, 107** one of each pair engaging respectively the cam **103** and brake ring **101** so that the cam **103** and shaft **84** will be rotated by the shaft **67** and the brake ring **101** will be rotated within the brake drum **97.** It will be observed from FIG. **4** that the cam drive pins **106** are disposed to engage alternately, depending upon the direction of rotation, the cam **103** in drive pockets **116** formed in the sides of the cam. The brake ring drive pins **107** engage the brake ring **101** alternately, depending upon the direction of rotation, at a shoulder **117** provided on a ramp-shaped body **118** furnished on each side of a peripheral slit **119** in the brake ring **101.** In the normal driving condition of a manual operator (which may be operated either to raise or to lower the rolling door curtain) one each of the drive pins **106** and **107** will be in operation at a time, one of the drive pins **106** engaging the cam while a drive pin **107** engages the shoulder **117** of the brake ring. In this condition, the roller **102** is carried between the bodies **118** and the cam to rotate with the brake ring and cam.

Should the electro-mechanical clutch fail in the motor operating mode tending to place the shaft **84** in a rotatable condition, the cam **103** will rotate out of engagement with the pin **106** and urge the roller **102** radially outwardly against the ramp-shaped surfaces of the bodies **118** tending to spread apart the brake ring thereby locking the brake ring to the brake drum and effectively halting further rotation of the shafts **67, 84** and **73.** This then prevents movement of the hand chain should the coil **76** fail to effectively disengage the clutch. This braking action may be released upon rotation of the shaft **67** in the manual mode whereby the drive pins are again brought into engagement with the associated drive pocket **116** and shoulder **117.**

OPERATION

The operation of the unit may now be briefly described as follows:

When the rolling door operating mechanism **10** is operated in the motor driven mode either for opening or closing an opening, a switch (not shown) is actuated energizing the circuit through the junction box **37** for the electrical motor **36** and energizing the coil **76** electrically coupled to the junction box by the connections **77.** Energization of the coil of the electro-mechanical clutch serves to retract, against the bias of the spring **88,** the clutch pressure plates. This renders the clutch in a "declutching" condition so that rotation of the gearbox input shaft **73** will not serve to rotate the brake shaft **84** or operating shaft **67.** With operation of the motor **36** the rolling door curtain **12** may be either raised or lowered and the limit of its travel will be sensed by the rotary limit switch **56** which will serve to break the circuit and halt operation of the motor.

At this point the magnetic field of the coil **76** collapses and the spring **87** acts to place the clutch **66** into a clutching condition. This also serves to couple mechanicaly the brake shaft **84** carrying the cam **103** with the gearbox input shaft **73.** It will be understood that inertial forces remain in the door opening and closing system after the motor circuit is placed in the "off" condition. These forces would include any unbalanced forces from the weight of the door acting in relation to a door counterbalance system (not shown). These inertial forces tend to rotate the brake shaft **84** driving the cam **103,** roller **102** and brake ring **101** into operative braking action upon the brake drum **97.** This arrests travel of the door curtain until the clutch and motor are again energized, or alternatively, the hand operator actuated.

When operating the rolling door mechanism **10** in the manual mode, the operator causes the sprocket **61** to revolve by using the hand chain **68** thereby causing rotation of the cross shaft **62,** and through the gears **69, 72,** the operating shaft **67.** Being that the motor **36** and coil **76** are not energized, the electro-mechanical clutch **66** is urged by the spring **88** into the engaged condition so that rotation of the shafts **67, 84** also serve to rotate the gearbox input shaft **73** which is coupled to the drive shaft within the gearbox **47** for rotating the barrel shaft **24** by means of the sprocket and chain drive, shown best in FIG. **1.** The operating shaft **67** drives the shaft **84** through the safety brake as previously described, and as disclosed and claimed in U.S. Pat. No. 3,637,004 issued Jan. 25, 1972 and assigned to The Cookson Company, San Francisco, California.

Should the electro-mechanical clutch become disabled, such as through failure of the coil **76** to effectively retract the clutch plates, or through drag of the clutch plates be permitted, during motor operation the gearbox shaft **73** will tend to rotate the brake shaft **84** which will thereby rotate the cam **103** carrying the roller **102.** Shifting of the cam by the shaft **84** will cause the roller **102** to ride up along the flat surface **108** of the cam which surface **108** will act as a wedging surface. The effect will be to force the brake ring **101** into frictional engagement with the brake drum **97** thereby locking up the shaft **84** and shaft **67** from rotation. This will prevent rotation of the motor **36** from causing the manual chain **68** mounted on the cross shaft **62** from moving. The brake action is released upon rotation of the sprocket **61** to bring the drive pins **106, 107** into engagement with their associated abutments **116, 117.**

It will be noted that the motor operator **10** is operable in either direction, and that the subject safety brake is quick operating being that the cam follower is driven into a wedging relationship with the brake band in less than one quarter of a revolution of the cam **103.** From the above it will be understood that the improved operating mechanism disclosed herein functions in a manner that when the electric circuit is broken the clutch mechanism **66** is engaged and the safety brake **101–103** is engaged to stop to travel of the door. Therefore, the mechanism **10** serves the following principal functions.

1. Provides manual drive operator
2. Provides a safety device and replaces an electrical interlock switch

3. Provides and replaces a stopping disc brake that is necessary in other types of rolling door operators whenever the motor is stopped

4. Eliminates a mechanical throwout clutch which is standard on virtually all prior art door operators

I claim:

1. In a rolling door operating mechanism for raising and lowering through manual or motor driven means, a rolling door of the type which includes a rotatable axle, a barrel fixed to the axle and a curtain adapted to be rolled onto the barrel, the mechanism comprising an electric motor and having gearbox means operatively coupled to such rotatable axle serving to raise and lower the curtain, manual operator means and including electric clutch means arranged to couple said manual operator means to said motor gearbox means in the manual drive mode when said motor means is operative and to uncouple said manual operator means from said motor gearbox means in the motor drive mode, said manual operator means and electric clutch means including common shaft means, safety brake means arranged about said shaft and operative to halt door travel when said motor is switched to the "off" condition and serving to prevent rotational movement of said shaft means by said motor gearbox means should said electric clutch means fail to uncouple the manual operator means from the motor gearbox means in he motor drive mode.

2. The subject matter of claim 1 wherein said safety brake means includes cam means movable with said common shaft means in the manual drive mode, a stationary brake drum arranged concentrically of said shaft means, radially expandable brake band means mounted within said brake drum, cam follower means arranged on said cam means and engaging said brake band means, and brake drive means operative in the manual drive mode only for driving, rotating engagement of said brake band means and said cam means.

3. The subject matter of claim 2 wherein said common shaft means includes first and second shaft sections, said cam means being mounted on said first shaft section, said safety brake drive means being mounted on said second shaft section, driving connection means on said safety brake drive means engaging said cam means serving to drive said first shaft section from said second shaft section in the manual mode.

4. The subject matter of claim 3 wherein said first shaft section carrying said cam means in rotatable with respect to said second shaft section, driving rotation of said first shaft in the motor drive mode serving to disengage said driving connection means from said cam means, and to rotate said cam means and cam follower means with respect to said brake band means for expanding the same into locking frictional engagement with said brake drum.

5. The subject matter of claim 3 wherein said electric clutch means includes a first clutch section rotatable with said cam means, a second clutch section rotatable with said motor gearbox means, spring means urging said clutch sections into driving engagement for operation in the manual drive mode, magnetic coil means operable in the motor drive mode for disengaging said clutch sections permitting said second clutch section to rotate independently of said cam means.

6. In a rolling door operating mechanism for raising and lowering through manual or motor driven means, a rolling door of the type which includes a rotatable axle, a barrel fixed to the axle and a curtain adapted to be rolled onto the barrel, the mechanism comprising a motor driven gearbox having an output shaft operatively coupled to such rotatable axle serving to raise and lower the curtain, such gearbox also including an input shaft operatively coupled to said output drive shaft and rotatable therewith, manual operator means and including drive shaft means and safety brake means, clutch means serving to couple and uncouple said drive shaft means to the gearbox input shaft for operating, respectively, in the manual and motor driven modes, said clutch means including pressure plate means, drive plate means and friction means interposed between said plate means to effect a driving connection therebetween, means yeildably urging together said plate and friction means for driving said gearbox input shaft with said manual operator drive shaft, clutch plate retraction means responsive to motor operation of said gearbox serving to move apart said clutch plate means and friction means against the force of the yieldable means for operation of the gearbox in the motor driven mode without rotation of the manual operator drive shaft, said safety brake means being arranged for coaction with said drive shaft means and being responsive to rotation of the said drive shaft means by said gearbox input shaft upon disfunction of said clutch plate retraction means, and serving to lock the drive shaft means against rotation by said gearbox input shaft means.

7. The subject matter of claim 6 wherein said clutch plate retraction means includes means permitting generation of a magnetic force serving to retract one of said clutch plate means with respect to the other when said motor driven gearbox is operated in the motor drive mode.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,853,167

DATED : December 10, 1974

INVENTOR(S) : Russell (nmi) Wardlaw

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 7, line 17, delete "when said motor means is operative".

Signed and Sealed this

seventh Day of October 1975

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks