March 24, 1959 E. J. MANLEY 2,878,865

SAFETY STOP FOR ROLL-UP DOOR

Filed Feb. 9, 1956 3 Sheets-Sheet 1

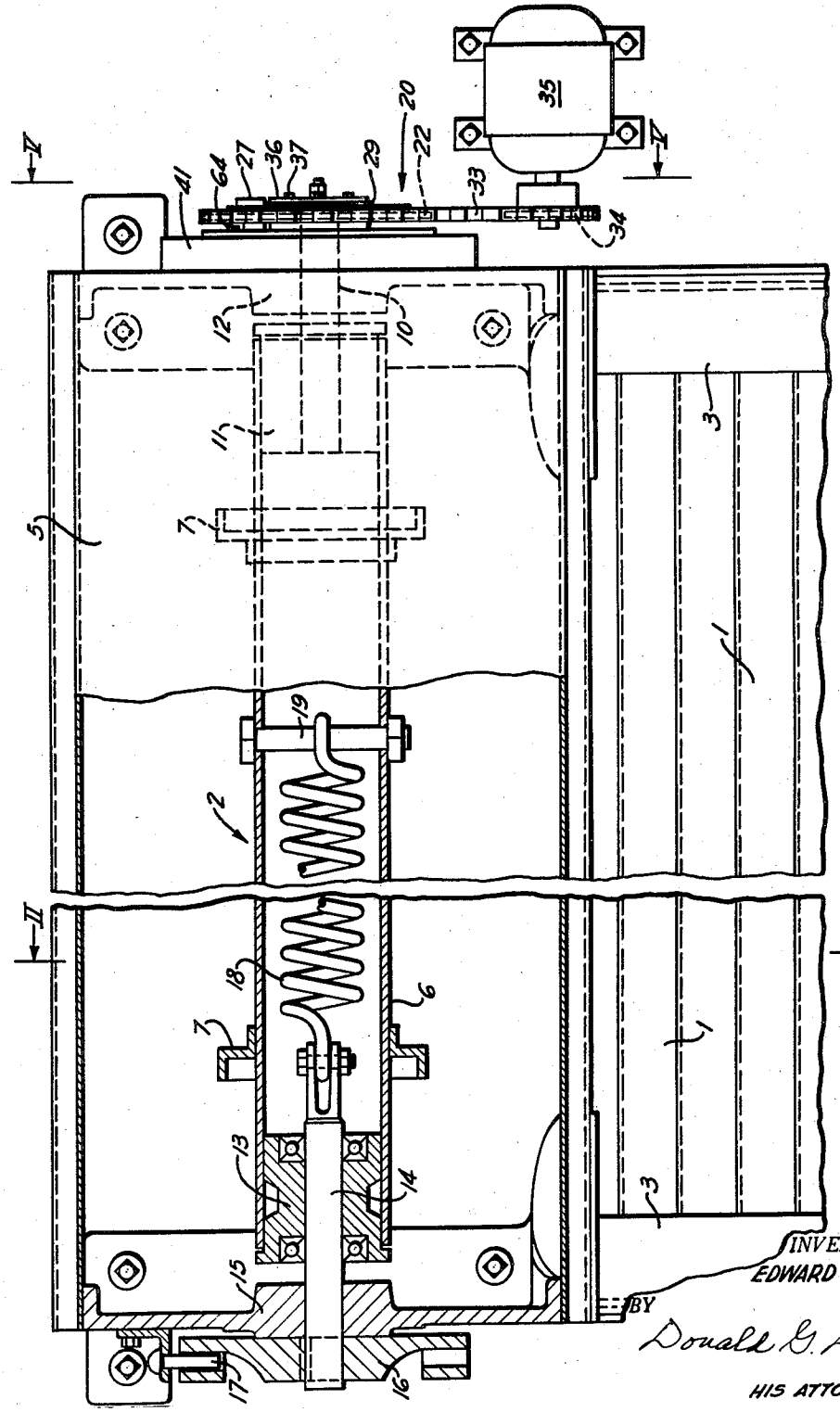

Fig. 1

INVENTOR.
EDWARD J. MANLEY
BY
Donald G. Dalton
HIS ATTORNEY

March 24, 1959 E. J. MANLEY 2,878,865

SAFETY STOP FOR ROLL-UP DOOR

Filed Feb. 9, 1956 3 Sheets-Sheet 2

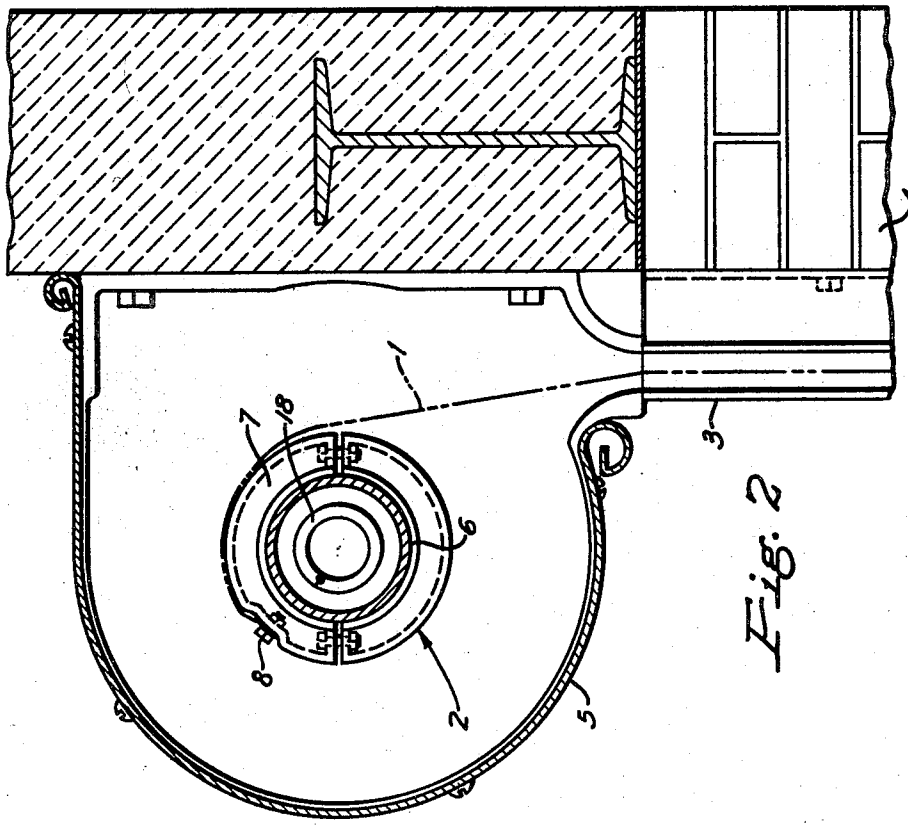

Fig. 2

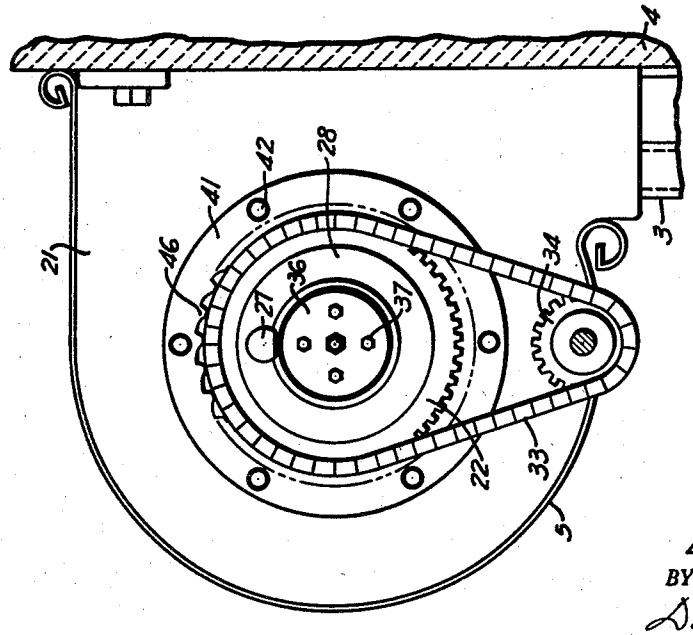

Fig. 5

INVENTOR.
EDWARD J. MANLEY
BY
Donald G. Dalton
HIS ATTORNEY

March 24, 1959 E. J. MANLEY 2,878,865

SAFETY STOP FOR ROLL-UP DOOR

Filed Feb. 9, 1956 3 Sheets-Sheet 3

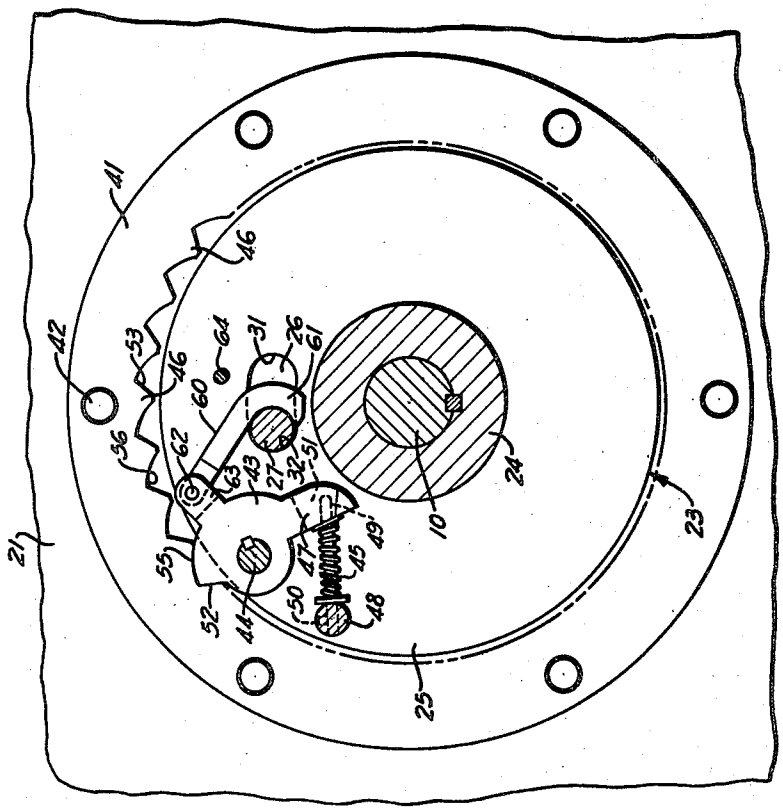

Fig. 4

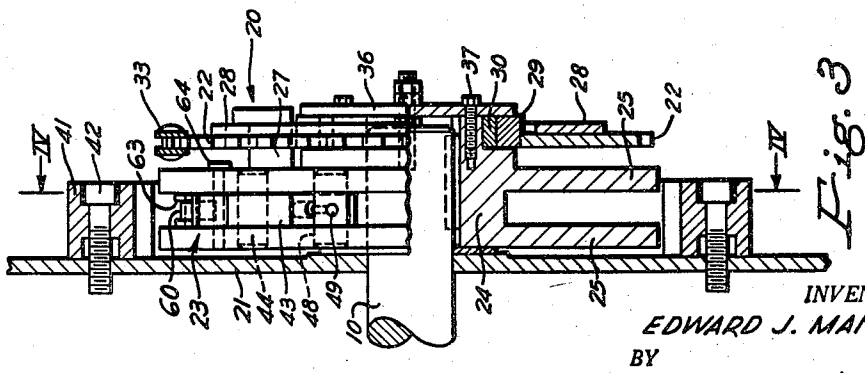

Fig. 3

INVENTOR.
EDWARD J. MANLEY
BY
Donald G. Dalton
HIS ATTORNEY

United States Patent Office 2,878,865
Patented Mar. 24, 1959

2,878,865

SAFETY STOP FOR ROLL-UP DOOR

Edward J. Manley, Yardley, Pa., assignor to United States Steel Corporation, a corporation of New Jersey

Application February 9, 1956, Serial No. 564,540

6 Claims. (Cl. 160—189)

This invention relates to overhead rolling steel doors and, more particularly, is directed to an improved door raising and lowering drive which provides a safety stop for preventing uncontrolled gravitational movement of a door to its lowered position.

Overhead or roll-up doors of the large sizes used in industrial establishments are generally provided with a motor operated drive for effecting their movement between raised and lowered positions. To facilitate opening and closing movements and to reduce power requirements of the drive, the doors are counterbalanced by springs which are wound during lowering movement to closed position and which unwind to assist raising the door to open position. The counterbalance springs, due to repeated winding and unwinding, frequently fail during raising and lowering movements of the door and this causes sudden excessive loading of the door drive mechanism. When a door drive mechanism fails under a load of this character, the door operated thereby is released for gravitational movement to closed position. Since industrial doors may have a weight in excess of ½ ton, such uncontrolled gravitational door movement is hazardous to personnel or equipment under the door.

One of the principal objects of this invention is to provide a safety stop for preventing an uncontrolled gravitational closing movement of an overhead rolling steel door in response to failure of its counterbalancing spring and operating drive.

A further object is to provide a drive for raising and lowering a counterbalanced load with a safety stop for stopping lowering movement of the load under conditions rendering the downwardly moving load effective to impart motion to the drive.

A still further object is to provide a drive of the character referred to with a stop in the form of a ratchet mechanism which is normally inoperative to interfere with load raising or lowering operations of the drive but which is rendered operative to stop the drive and thereby lowering movement of the load in response to load conditions tending to impart motion to the drive.

Another object of the invention is to provide a ratchet mechanism for controlling the operation of a drive for overhead roll-up doors with a means for rendering it inoperative to stop a door lowering movement by the drive and for rendering it operative to stop door closing movement both when such closing movement takes place independently of its drive and upon failure of its drive.

Other objects and advantages of the invention will be apparent from the following description.

In the drawings, there is shown a preferred embodiment of the invention. In this showing:

Figure 1 is a partial front elevational view of an overhead steel roll-up door and in which parts are broken away and shown in section to illustrate the construction of the door reeling mechanism;

Figure 2 is a sectional view taken along the line II—II of Figure 1 and in which the roll-up door is shown diagrammatically by broken lines;

Figure 3 is a sectional view of a portion of the drive shown in Figure 1, parts of the drive being shown in side elevation;

Figure 4 is a sectional view taken substantially along the line IV—IV of Figure 3; and

Figure 5 is a sectional and elevational view taken substantially along the line V—V of Figure 1.

Figures 1 and 2 show a conventional type of roll-up door which is formed of steel slats 1 pivotally connected together along adjacent edges so that the door may be raised and lowered by winding and unwinding on a reel 2. The ends of the slats 1 are arranged in guides 3 which are secured to the door jambs 4 and guide the vertical movement of the door as it is wound and unwound on the reel 2, the path of reeling movement of the door slats 1 being indicated by the broken line also designated by the numeral 1 in Figure 2. The reel 2 is mounted in an enclosure or housing 5 and comprises a pipe 6 on which rings 7 are secured. The end slat 1 of the door is secured to the rings 7 as at 8 in such manner that each ring 7 forms a drum on which the door is reeled. Operation of the reel 2 is effected by a drive shaft 10 which has a keyed connection with a plug 11 in one end of the pipe 6 and a bearing support at 12 in one end of the housing 5. The other end of the pipe 6 is rotatably supported by a plug 13 on a shaft 14 which is provided with a bearing support 15 in the other end of the housing 5. The outer end of the shaft 14 is locked against rotation by a wheel 16 and locking detent 17. The inner end of the shaft 14 is connected to one end of a counterbalancing spring 18 which has its other end connected to a pin 19 secured in the pipe 6.

Rotation of the pipe 6 in a counter-clockwise direction as viewed in Figure 2 is effective to wind the door slats 1 on the reel drums 7 and to move the door to its raised or open position. Rotation of the pipe 6 in a clockwise direction effects unreeling of the slats 1 and moves the door to its lower or closed position. Movement of the door to and from its open and closed positions is counterbalanced by the spring 18 which is wound during lowering movement and which unwinds during raising movement of the door. In conventional arrangements of this type of door, the shaft 10 is driven by a chain and sprocket drive which is subjected to sudden and excessive loading upon breakage of the counterbalancing spring 18. Failures of the counterbalancing springs 18 are frequent and generally cause failure of the chain and sprocket drives. This in turn releases the door for free and unrestrained gravitational movement to its lowered position.

The drive of this invention is designated as a whole by the numeral 20 and, as best shown in Figure 3, is applied to the outer end portion of the shaft 10 which projects through an opening in the end plate 21 of the housing 5. It comprises a sprocket wheel 22 which transmits motion to a driven member 23 in a manner to be described. The driven member 23 comprises a hub 24 which is keyed on the shaft 10 and has a pair of axially spaced flanges 25 secured thereto and projecting radially outwardly therefrom. Each of the flanges 25 has a slot 26 of arcuate shape through which a drive pin 27 projects. The drive pin 27 is secured to an assembly comprised of the sprocket wheel 22 and a reinforcing ring 28 which is mounted on a hub 29. The hub 29 is rotatably supported by a bushing 30 on the hub 24 so that the sprocket assembly 22 may rotate relatively with respect to the driven member 23. This relative rotational movement is limited to a movement between two angular positions in which the drive pin 27 has driving engagement with the ends 31 and 32 of the slot 26. Movement of the drive pin 27 into engagement with the ends 31 and 32 of the slot 26 render the sprocket wheel 22

effective as a drive or driving member to impart motion in opposite directions to the driven member **23** and the shaft **10** for effecting raising and lowering movements of the door. As best shown in Figures 1 and 5, the sprocket **22** is operated by a sprocket chain **33** which in turn is operated by a sprocket **34** having a motor **35** for operating it in reverse directions. The assembly of the sprocket wheel **22** and its hub **29** is secured against axial movement on the hub **24** by an end plate **36** which is secured to the hub **24** by bolts **37**.

A ratchet mechanism is provided for controlling rotation of the driven member **23**. It comprises a stationary internal ratchet wheel **41** which is secured by bolts **42** to the housing end plate **21** and a ratchet pawl **43**. The pawl **43** is pivotally supported in the space between the flanges **25** by a pin **44** which has its ends rotatably supported in the flanges **25**. A spring **45** provides a bias for pivotally moving the pawl **43** in a counter-clockwise direction to the position shown in Figure 4 in which it has ratcheting engagement with the ratchet teeth **46** on the ratchet wheel **41**. The spring **45** has one end bearing against an operating arm **47** extending outwardly from the body of the pawl **43** and its other end bearing against a pin **48** extending transversely of the space between the flanges **25**. It is mounted on a guide pin **49** which has one end secured by a set screw **50** in the pin **48** and its other end projecting into an opening **51** in the pawl arm **47**. The spring **45** biases the pawl **43** to a position with its cam surface **52** engaged with a stationary cam surface **53** on a stationary ratchet tooth **46**. Upon rotation of the driving member in a counter-clockwise direction as viewed in Figure 4, the pawl **43** has a ratcheting movement over the ratchet teeth **46**, engagement of the cam surfaces **52** and **53** being effective to pivot the pawl **43** against the action of its biasing spring **45**. In the position shown in Figure 4, the pawl **43** is effective to prevent rotational movement of the driven member **23** and shaft **10** in a clockwise direction, such movement being prevented by engagement of a curved stop surface **55** on the pawl **43** with a stop surface **56** on one of the ratchet teeth **46**. The surfaces **55** and **56** have a similar radius of curvature about the axis of the pin **44** when in locking engagement so that the pawl **43** may be rotated to and from an operative locking position.

Movement of the pin **27** in the arcuate slots **26** is utilized to move the pawl **43** to an inoperative position and to hold it from movement into ratcheting engagement with the ratchet wheel **41** when the member **23** is actuated in a clockwise direction by the sprocket wheel **22** to impart a lowering movement to the door. This control is effected by a link **60** having a hook **61** at one end which is engaged over the pin **27** and a pivot **62** at its other end connecting it to ears **63** projecting outwardly from the pawl **43**. A pin **64** acts as a stop for maintaining the link **60** in an operative position with respect to the drive pin **27**. When the drive pin **27** is rotated by the sprocket wheel **22** to effect a door lowering movement, the pin **27** moves to the end **31** of the slot **26**, and this movement causes the link **60** to rotate the pawl **43** in a clockwise direction as viewed in Figure 4 to a position out of ratcheting engagement with the ratchet teeth **46**. As long as the pin **27** continues to drive the member **23** in this manner, the pawl **43** will be held out of operative engagement with the ratchet wheel **41**, and the ratcheting mechanism will be ineffective to interfere with a door lowering movement. In the event that the driven member **23** overruns its drive sprocket **22**, as will happen when the sprocket drive fails after failure of the counterbalance spring **18** and lowering movement of the door imparts rotation to the member **23** through the drive shaft **10**, the drive pin **27** will move relatively toward the end **32** of the slot **26** and render the pawl biasing spring **45** effective to move the pawl **43** to a position with its surface **55** engaging a ratchet stop surface **56**. Movement of the surfaces **55** and **56** into engagement with each other in this manner will be effective to stop further rotation of the member **23** and thus discontinue lowering movement of the door.

From the foregoing, it will be apparent that lowering movement of the door cannot be effected unless the drive **20** from the motor **35** is in operation. If the drive **20** is in operation and the door moves downwardly at a faster speed than called for by the motor **35**, the pawl **43** will move into locking engagement with the ratchet teeth **46** and remain there until disengaged by a motor actuated movement of the drive **20**. Attention is particularly directed to the fact that the responsiveness of the pawl **43** to the operating condition of drive **20** is effected in part by providing for relative angular movement of the sprocket **22** and the drive member **23** for the shaft **10**. Upon operation of the drive **20** in reverse directions, the driving member or pin **27** moves to opposite ends **31** and **32** of the slot **26** and this relative movement controls operation of the pawl **43** which, being spring loaded, is forced into locking engagement when the door driving force applied to the pin **27** is interrupted.

While one embodiment of my invention has been shown and described it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

I claim:

1. In a roll-up door assembly including a door mounted for movement between raised and lowered positions and a counterbalancing coil spring providing a resilient bias against movement of said door to its lower position, a safety drive for moving said door to said positions and for preventing its uncontrolled movement by gravity to said lowered position upon failure of said counterbalancing spring comprising a driven member movable in one direction for moving said door toward its raised position and in an opposite direction for moving said door toward its lowered position, a reversible driving member for driving said driven member in both of said directions, means for stoppng the movement of said driven member in said opposite direction to stop the movement of said door toward said lowered position, and means controlling the operation of said stopping means including means for rendering it inoperative in response to movement of said driven member in said opposite direction by said driving member and means for rendering it operative in response to rotation of said driven member in said opposite direction by said door.

2. In a roll-up door assembly including a door mounted for movement between raised and lowered positions and a counterbalancing coil spring providing a resilient bias against movement of said door to its lower position, a safety drive for moving said door to said positions and for preventing its uncontrolled movement by gravity to said lowered position upon failure of said counterbalancing spring comprising a rotatable member having a mechanical connection with said door for rotation in opposite directions respectively in response to movement of said door toward different ones of said positions, a stationary ratchet wheel arranged concentrically of said rotatable member, a ratchet pawl mounted on said member for movement into and out of ratcheting engagement with said ratchet wheel, said ratchet pawl and wheel when in ratcheting engagement being effective to provent rotation of said member in the one of said opposite directions corresponding to lowering movement of said door but permitting its rotation in the other of said directions corresponding to raising movement of said door, a driving member for rotating said rotatable member, and means responsive to rotation of said rotatable member in said one direction by said driving member for holding said pawl against movement into ratcheting engagement with said ratchet wheel and to its rotation by said load through said mechanical connection for releasing said pawl for movement into ratcheting engagement with said wheel.

3. In a roll-up door assembly including a door mounted

for movement between raised and lowered positions and a counterbalancing coil spring providing a resilient bias against movement of said door to its lower position, a safety drive for actuating said door to said positions and for preventing its uncontrolled falling movement to said lowered position upon failure of said counterbalancing spring comprising a drive shaft rotatable in one direction to raise said door and in an opposite direction to lower said door, a drive member mounted on said shaft for rotation therewith, a stationary ratchet wheel mounted concentrically of said drive member, a ratchet pawl mounted on said drive member for movement into and out of ratcheting engagement with said ratchet wheel, said ratchet wheel and pawl being effective when in ratcheting engagement to hold said drive member and shaft against rotation in said opposite direction but permitting their rotation in said one direction, a driving member mounted for angular movement between two operating positions relative to said drive member, means interconnecting said driving and drive members and rendering said driving member operative to rotate said drive member in opposite rotational directions respectively upon movement to its said operating positions, and means for holding said pawl out of ratcheting engagement with said ratchet wheel in response to relative angular movement of said driving member into the one of its said two operating positions in which it is operative to rotate said drive member and shaft in said opposite direction to lower said door, said holding means including means rendering it inoperative upon relative angular movement of said driving and drive members out of said one operating position.

4. The invention defined in claim 3 characterized by said interconnecting means comprising a crank pin secured to said driving member, and said drive member having an arcuate slot in which said crank pin is received.

5. The invention defined in claim 4 characterized by said pawl holding means comprising a link having a pivotal connection with said pawl and a part lying in the path of movement of said crank pin through said slot so that it is operated by movement of said pin in said slot.

6. In a roll-up door assembly including a door mounted for movement between raised and lowered positions, a shaft rotatable in one direction for operating said door to its raised position and in an opposite direction for operating said door to its lowered position, and a door counterbalancing coil spring providing a resilient bias against rotation of said shaft in said opposite direction, the combination therewith of a safety drive for operating said shaft comprising a drive member keyed on said shaft and having an arcuate slot therein, a drive sprocket wheel supported for rotation relative to said shaft and having a crank pin projecting into said slot for movement to positions at opposite ends thereof in which it provides driving connections between said sprocket wheel and drive member, and means for preventing rotation of said shaft in said opposite direction by the weight of said door upon failure of said counterbalancing spring comprising a stationary ratchet wheel mounted concentrically of said drive member, a ratchet pawl mounted on said drive member for movement into and out of ratcheting engagement with said ratchet wheel, said ratchet wheel and pawl being effective when in ratcheting engagement to hold said drive member and shaft against rotation in said opposite direction but permitting their rotation in said one direction, and means responsive to movement of said crank pin to the end of said slot in which it provides a driving connection for rotating said driving member and shaft in said opposite directon for moving said pawl out of ratcheting engagement with said ratchet wheel.

References Cited in the file of this patent

UNITED STATES PATENTS

1,700,864	Tredway	Feb. 5, 1929
2,020,831	Greegor	Nov. 12, 1935
2,097,242	Robinson	Oct. 26, 1937
2,099,191	Blodgett	Nov. 16, 1937