Jan. 23, 1968 J. R. WIEGAND 3,364,974

AUTOMATIC OVERHEAD DOOR OPENER

Filed Jan. 18, 1967 3 Sheets-Sheet 1

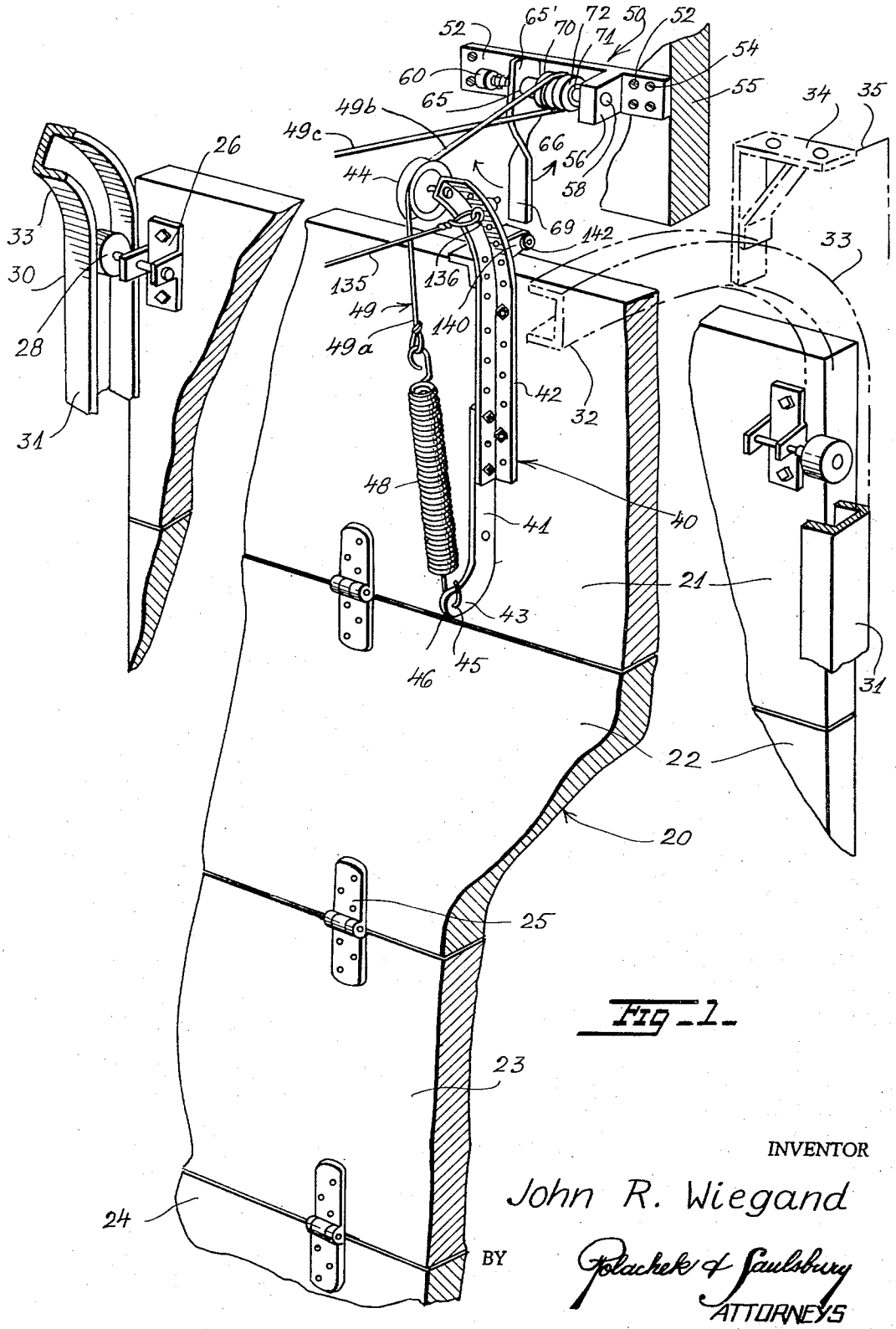


FIG. 1.

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Jan. 23, 1968 J. R. WIEGAND 3,364,974

AUTOMATIC OVERHEAD DOOR OPENER

Filed Jan. 18, 1967 3 Sheets-Sheet 2

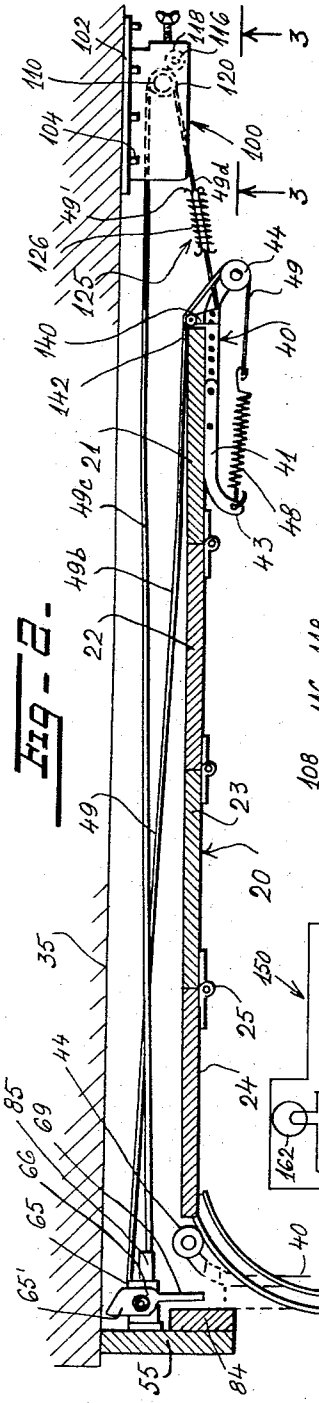


Fig - 2.

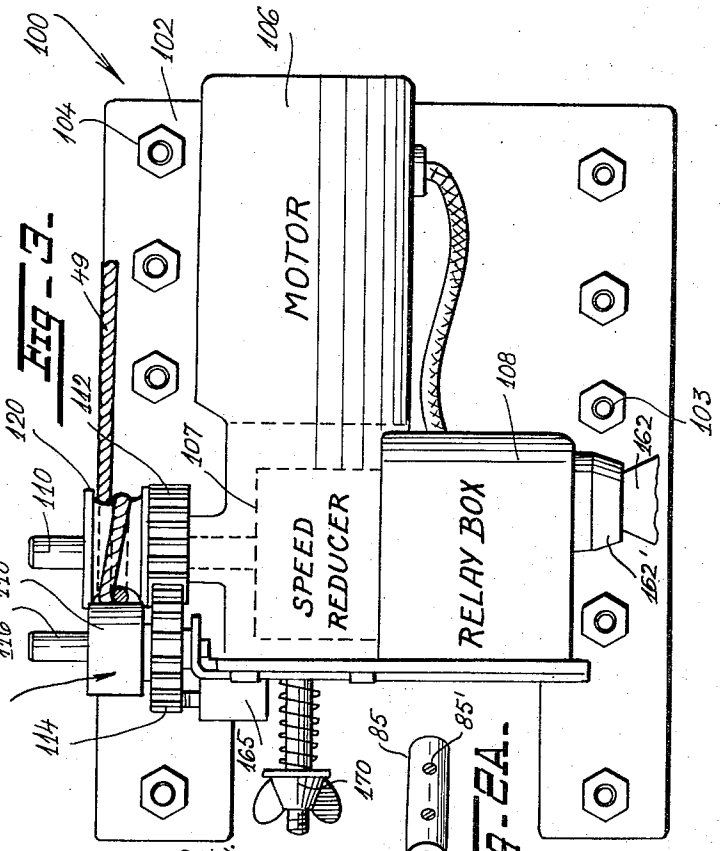


Fig - 3.

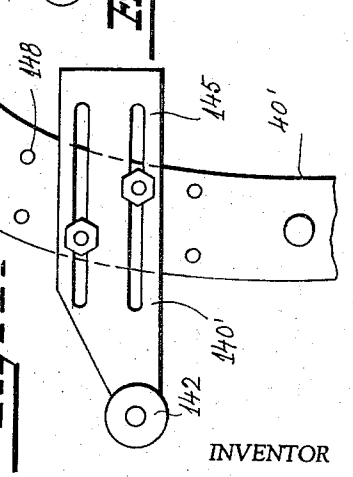


Fig - 4.

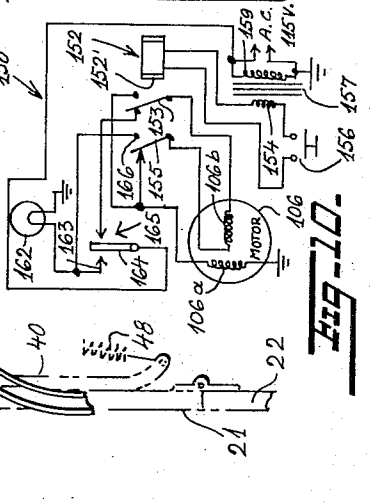


Fig - 10.

Fig - 2A.

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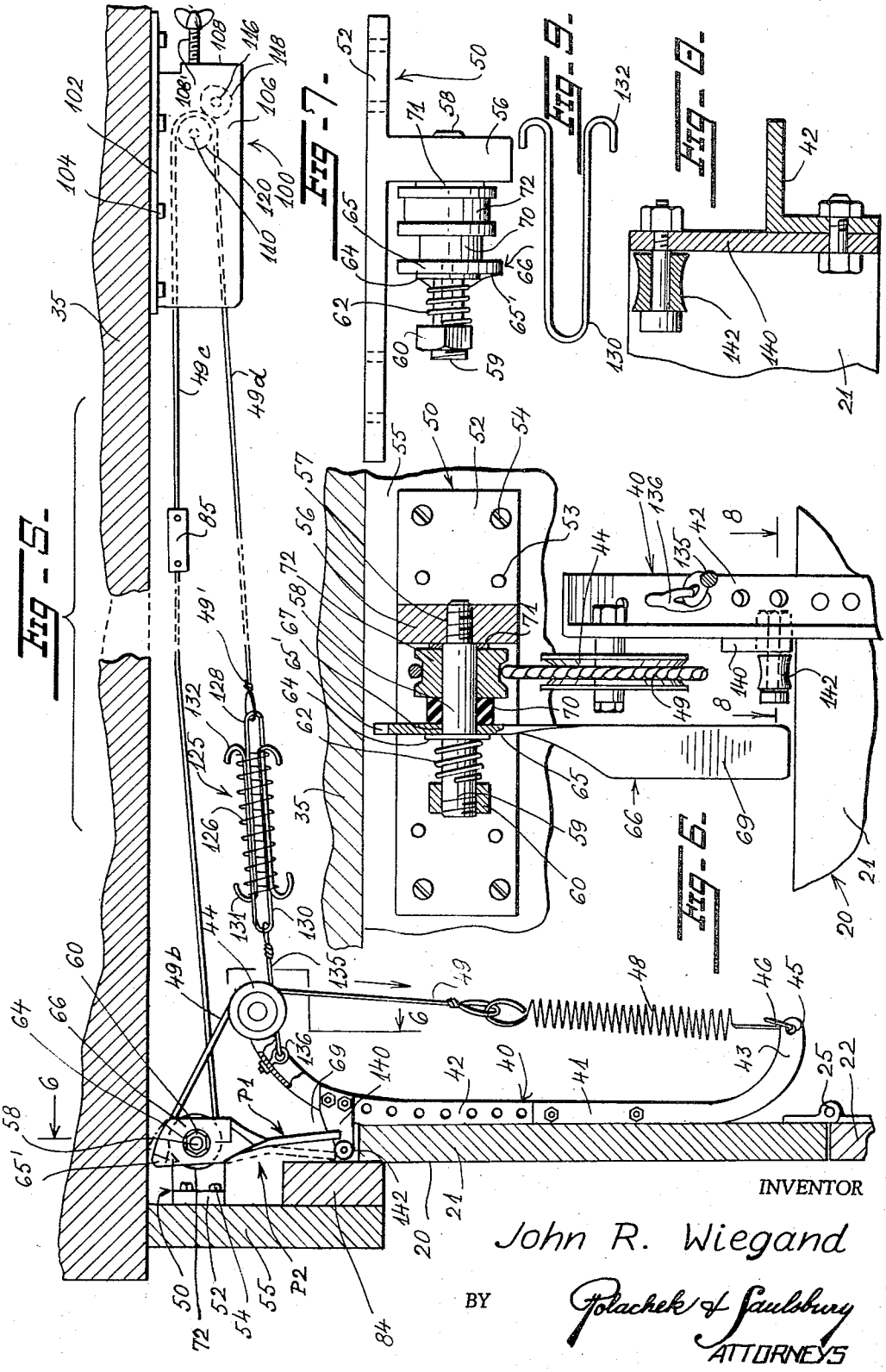
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AUTOMATIC OVERHEAD DOOR OPENER

Filed Jan. 18, 1967 3 Sheets-Sheet 3



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3,364,974

AUTOMATIC OVERHEAD DOOR OPENER

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Continuation-in-part of application Ser. No. 524,401, Feb. 2, 1966. This application Jan. 18, 1967, Ser. No. 610,116

10 Claims. (Cl. 160—188)

ABSTRACT OF THE DISCLOSURE

The disclosure describes an automatic overhead door opening assembly including three units. One unit has a pivotable safety locking arm mounted on a lintel, header beam or ceiling over the door. A second unit is a drawbar assembly mounted on the door, and a third unit includes a remotely mounted drive motor, with a flexible cable driven by the motor to open and close the door and to turn the safety locking arm out of the way of the door.

This application is a continuation-in-part of my copending application Ser. No. 524,401, filed on Feb. 2, 1966, now Patent No. 3,332,472.

This invention concerns an automatic overhead door opener of improved simplified construction and installation. In my prior patent application I have described an automatic overhead door opener which is mounted on a header or lintel above a doorway. This has proven very successful in practice. However, there are some building structures in which the space above the doorway is too limited to install the unit including motor, lock arrangement, winch and clutch mechanism. The present invention is directed at overcoming this difficulty by an arrangement in which the unit including motor, winch and clutch is mounted remotely from the doorway and is operatively connected to the door solely by a flexible cable. A pivotable safety locking arm which prevents accidental or unauthorized opening of the door, is mounted on the header beam lintel or ceiling just above the door. This locking arm is operated by the flexible cable which lifts the door. By this arrangement, an automatic overhead door opener assembly can be installed above any overhead opening door regardless of the limited space available thereat. The invention is adaptable to sectional type or one-piece swing-out doors made of wood, metal, polyester reinforced with fiberglass or other materials. The invention is adaptable to doors of any practical height.

It is therefore a principal object of the invention to provide an overhead door opening assembly having three separate units, one unit including a motor, clutch and winch; a second unit including a drawbar assembly; and the third unit including a pivotable safety locking arm for the door, with a flexible cable driven by the motor to operate the locking arm and lift the door.

A further object is to provide an assembly as described, with a draw bar on the door to which the cable is connected, and an idler wheel or roller on the draw bar to keep the cable clear of the door when the door is being opened and closed.

Another object is to provide an improved automatic overhead door opening assembly which is light in weight, simple to install, compact in construction, reliable in operation, and adaptable to a great variety of sizes and arrangements of garage doors.

A further object is to provide an automatic overhead door opening assembly as described, wherein a single flexible cable is the sole connecting means between the door and the remotely located drive motor.

For further comprehension of the invention, and of the objects and advantages thereof, reference will be had to the following description and accompanying drawings and to the appended claims in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings forming a material part of this disclosure:

FIGURE 1 is a perspective rear and top view with parts broken away of a sectional door shown provided with a safety locking arm, flexible lifting cable and associated components of a door opening assembly according to the invention, the door being shown in a lowered closed position.

FIG. 2 is a reduced sectional view of the sectional door with associated components of the door opening assembly, the door being shown in an elevated open position.

FIG. 2A is a perspective view of a cable stop member.

FIG. 3 is an enlarged bottom plan view taken on line 3—3 of FIG. 2, of a unit including drive motor, speed reducer, clutch and winch, and relay box.

FIG. 4 is an enlarged view of part of a draw bar with an adjustable roller mounting bracket thereon.

FIG. 5 is an enlarged fragmentary sectional view of the door in lowered closed position with parts of the door opening assembly shown in side elevation.

FIG. 6 is a fragmentary sectional view taken on line 6—6 of FIG. 5.

FIG. 7 is a top plan view of a unit including roller and safety locking arm.

FIG. 8 is an enlarged sectional view taken on line 8—8 of FIG. 6.

FIG. 9 is a side view of a spring compression unit employed in the assembly of FIG. 5, and

FIG. 10 is a diagram of an electric circuit employed in association with the door opening assembly.

Referring first to FIGS. 1 and 2, there is shown a door 20 having a multiplicity of rectangular sections 22, 23 and 24 connected by strap hinges 25 so that the sections pivot with respect to each other on horizontal axes. At the back of the door near the upper corners of section 22 are brackets 26 carrying rollers 28 which are engaged rotatably and slidably in channeled rails 30. The rails have lower forwardly located straight sections 31 and upper rearwardly located horizontal sections 32 connected by integral curved corner sections 33. Brackets 34 secured to the ceiling 35 of a garage, warehouse or other building, support the rails 30 in vertical planes at opposite lateral ends of a doorway. To the extent described, the construction described is conventional.

At the back of section 21 is mounted a drawbar assembly 40. This drawbar includes an angle bar 42 secured by nuts and bolts to section 21 of the door. The bar has an upper rearwardly curved end on which is mounted an idler roller 44. A flat link bar 41 is joined by other nuts and bolts to bar 42. This bar extends downwardly and has a forwardly extending foot 42 provided with a hole 45 in which engages end hook 46 of a strong coil spring 48. To the upper end hook of the spring is secured one end of a flexible steel cable 49. This cable is entrained over roller 44 and then forwardly to unit 50. Spring 48 can be adjusted so that if an obstruction is encountered as the door goes down, the cable will slip on a winch to shut off a motor at unit 50.

Unit 50 shown to best advantage in FIGS. 1, 2, 5, 6 and 7, includes a flat base bar or plate 52 which has holes 53 receiving mounting screws or bolts 54. The plate 52 is shown mounted to the rear side of a short vertical header beam or lintel 55 at the top of the doorway closed by door 20. Plate 52 has an integral flange 56 which extends in a vertical plane rearwardly of the vertically mounted plate. In flange 56 is a threaded hole 57. A stationary headless stud or bolt 58 is securely seated at one

end in hole **57**. The bolt **58** is extended horizontally and has a free threaded end **59** on which is an adjustable nut **60**. Adjacent the nut is a coil spring **62** which bears on a washer **64**. The washer abuts the upper straight end **65** of an arm **66**. The arm has a hole **67** through which the bolt **58** extends. Arm **66** has a lower free section **69** twisted 90° to the plane of arm end **65**. The arm **66** can turn on the stationary bolt **58** but is normally restrained frictionally by pressure of a resilient ring **70**. Ring **70** is juxtaposed to an idler roller **72** rotatably mounted on the smooth portion of bolt **58** between its threaded ends. Between roller **72** and flange **56** is a washer **71**. The nut **60** can be adjusted to tension the spring for limiting excessively the free swinging movement of the arm **66** and rotation of roller **72**. At its upper end the arm **66** has a rather pointed part **65'** which will contact the plate **52** when the arm **66** rotates upwardly or counterclockwise from the solid line position of P1 of FIG. 5. The pointed part **65'** limits forward or clockwise movement of arm **66** by abutting ceiling **35**, so that arm **66** is always in a position to prevent opening door **20** once the door is down. The bottom free end **69** of arm **66** will extend close to the header as shown by dotted line position P2 in FIG. 5, when the arm is pivoted in a clockwise direction or the door is started upwardly. When arm **66** is in the substantially vertical solid line position of P1 of FIG. 5, it is in line with door **20** and will prevent accidental or unauthorized raising of the door. When the arm is drawn against the header **84** in position P2, the door is sufficiently cleared by the arm so that the door can be raised. When the door is started down from the fully open position of FIG. 2, arm **66** is turned forwardly to position P1 away from the header. The door in any case can always still descend freely. It is its upward movement from a fully closed position which is prevented when an attempt is made to raise the door in an unauthorized manner.

Cable **49** has one end **49*a*** attached to the upper end of spring **48**. This cable end extends up over roller **44** then cable section **49*b*** extends upwardly and forwardly over roller **72**. Then the cable goes down and around roller **72**. From roller **72** section **49*c*** of the cable goes rearwardly to remotely mounted drive unit **100**. On cable section **49*c*** is a cylindrical stop tube or collar **85** shown in FIGS. 2, 2A and 5 and secured in position by set screws **85'**. This stop collar keeps the door from going too far rearwardly as the collar is stopped at the unit **50** as shown in FIG. 2. This in turn stops the cable from moving, and causes the cable to slip on the winch which is necessary to stop the motor.

Unit **100** shown in FIGS. 2, 3, 5 has an apertured base plate **102** with holes **103**, receiving bolts **104** secured to the ceiling **35**, the unit includes an electric motor **106** with associated speed reducer **107** and clutch **108** driving a shaft **110**. Shaft **110** carries a drive gear **112** meshed with a gear **114** on stub shaft **116**. On shaft **116** is a capstan roller **118** aligned with a winch **120**. The winch is mounted on drive shaft **112**. Cable section **49*a*** passes around winch **120**. The winch is mounted on drive shaft **112**. Cable **49** passes around winch **120** and is engaged between the winch and capstan roller. The lower course or section **49*d*** of the cable is connected to a shock absorbing spring assembly **125** which protects the door and motor from shock when the door is stopped after being raised or lowered.

The spring assembly **125** includes a coil spring **126** through which extend axially two doubled loops **128**, **130** terminating in hooks **131**, **132**, see FIGS. 5 and 9. The cable end **49'** is connected to the bight of loop **128** at the forward rearward end of spring **126**. The hooks **131** of the loop **128** are located at and bear on the forward end of spring **126**. Connected to the bight of loop **130** at the forward end of spring **126** is one end of short flexible line **135**. The other end of the line is connected to an eye **136** secured on the upper part of the drawbar **40**. Hooks **132** at the rear end of loop **130** bear on the rear end of spring **126**. The spring **126** is compressed since the cable end **49'** exerts a rearwardly directed tension at all times.

Mounted on the drawbar **40** by nuts and bolts is a short arm **140** which extends forwardly just above the door. It carries an axially horizontal idler roller **142** and provides a platform for the lock. Roller **142** is centered in the vertical plane of cable **49**. Thus when the door is being raised and lowered or the portion **49*b*** of the cable between roller **44** and roller **72** will rest at one point on roller **142**. This protects the cable from being scraped and frayed by the sharp edges or corners of the door.

If desired, as shown in FIG. 4, the arm **140** can be replaced by a longer arm **140'** provided with a plurality of longitudinally spaced holes **145** so that the roller **142** can be adjustably positioned forwardly of the drawbar **40'** with respect to the upper curved part of the draw bar. If desired a plurality of holes **148** can be provided in the curved part of drawbar **40'** as shown in FIG. 4 for adjustably positioning the arm **140'** any desired distance above the door.

Relay box **109** contains parts of circuit **150** described below in connection with FIG. 10. On the relay box is a lamp **162** mounted in socket **162'**. A microswitch **165** is located at clutch **108** and operates to shut off the motor **106** when the door is fully open and closed. A wing nut **170** is provided on bolt **171** and bearing on spring **172**. This wing nut provides a fine adjustment to control friction between cable **49** and the winch **120** by reducing the space and increasing the pressure between the clutch roller **118** and the winch. The greater the pressure, the more friction will be exerted on the cable so that a stronger pull will be applied thereto.

FIG. 10 shows an electrical circuit **150** which may be used in association with the door opening assembly. The circuit includes a motor **106** having a field **106*a*** and armature **106*b***. The motor is automatically reversed when latching relay **152** in circuit with the motor is reversed. The relay **152** has reversing contacts **153**, **155** which are reversed each time power is applied thereto from low voltage secondary winding **154** of stepdown transformer **157**. A normally open starting switch **156** is connected in series with winding **154** which is connected to coil **152'** of relay **152**. Primary winding **159** of the transformer is connected to ground and to contact **164** of microswitch **165**. This microswitch which is located at the clutch assembly of unit **100** serves to turn the motor off when the door is fully open and fully closed. Lamp **162** is connected to contact **163** of the microswitch and to relay contact **166**. The lamp goes on when the door is up.

Circuit **150** is basically the same as that described in my copending patent applications S.N. 461,366 filed June 4, 1965 and 524,401 filed Feb. 2, 1966, now Patent Nos. 3,319,696 and 3,332,472, respectively, so that no further explanation is required here. It is sufficient to note that closing of switch **156** momentarily triggers the relay to reverse and apply power to motor **106** to drive it in one direction if the door **20** is fully open and to drive it in the other direction if the door is fully closed. As soon as the door moves the lamp lights. The relay locks in reversed position. The motor drives the cable **49** in one direction or another via the winch **120** and capstan **118**.

In operation of the assembly, if the door is initially closed as shown in FIGS. 1 and 5, the cable **49** will turn roller **72** and with it the ring **70** and arm **66** so that the arm end **69** turns to position P2 close to header **84**. This permits the door to rise on rails **30** since the arm **66** is clear of the top of the door. The door moves up to the horizontal fully open position shown in FIG. 2. The stop collar **85** on cable **49** is stopped at unit **100** which in turn stops the cable. When the cable stops, the clutch roller **118** stops since it rolls on the cable. The cluch gear **114** is still driving and screws itself on double thread bearing **114'** against clutch roller **118** on the bearing. The arm

165' of the microswitch 165 rides the clutch gear 114 and is moved to shut off current to the motor 106 and light the lamp 162. The door remains open unit until switch 156 is momentarily closed. Then the motor is started but turns the winch and capstan in reverse direction so that the door is pulled forwardly until its lower end passes beyond the curved parts 33 of the rails when the door descends to the fully closed position. When the motor reverses the direction of drive of cable 49, arm 66 is turned forwardly to about one inch from header 84. This does not interfere with downward movement of the door. After the door is fully closed the cable stops, which again stops the clutch roller. Since the rotational direction is now reversed, the clutch gear 114 screws itself away from the clutch roller and turns the switch arm 165' the other way to shut off the motor. With the motor stopped, end 69 of arm 66 remains in position about one inch from header 84. If the uppermost part of the door touches arm 66 as it passes downwardly, the turning of idler roller 72 brings arm 66 back into position about one inch away from the header which then keeps the door locked.

It will be noted that the motor unit 100 is mounted remotely from the door which can be any desired length. For longer or shorter doors, longer or shorter cables 49 respectively will be provided. In the present arrangement steel bars extending the length of the ceiling between the motor and door as used in prior door openers, are avoided. Also chains and screw drives extending the full length of the door or along the ceiling are avoided. The operation is automatic, quick, safe and foolproof. Installation is quickly effected and no particular mechanical skill is required to install the assembly. A homeowner can perform the installation himself with simple tools in a relatively short time. The units can be packaged in a small compact package for convenient storage and shipment. The assembly described is simpler in construction than prior automatic door openers and it can be manufactured at lower cost.

While I have illustrated and described the preferred embodiments of my invention, it is to be understood that I do not limit myself to the precise constructions herein disclosed and that various changes and modifications may be made within the scope of the invention as defined in the appended claims.

What is claimed is:

1. A door opener for a door mounted between guide rails at a doorway and movable between a lowered vertical closed position and an overhead horizontal open position, comprising a first unit including a reversible drive motor mountable to a ceiling at a position rearwardly of, remote from and above said door, a winch driven by said motor, and a flexible cable entrained intermediate its ends on said winch for driving the cable in either of two directions for raising and lowering the door depending on the direction of drive of said cable; a second unit mountable in a closely confined space above said door, said second unit comprising an idler roller with said cable entrained thereon and supported thereby, a support for said roller, a pivotably mounted safety locking arm carried by said support and normally disposed in a vertical position above said door to prevent raising of the door, friction means engaging the arm and roller so that the arm turns forwardly out of the way of the door when the door is raised by the cable while the cable is driven in one of said two directions, so that the arm remains out of the way of the door when the door is lowered by the cable while the cable is driven in the other of said two directions and a third unit comprising a drawbar assembly mountable on the door, and spring tensioning means connecting opposite sides of the cable to the drawbar assembly.

2. A door opener as recited in claim 1, wherein the second unit further comprises a plate mountable in a fixed position over the doorway, and a flange extending outwardly of said plate, said support comprising a bolt secured in said flange and rotatably carrying said roller, friction means and locking arm.

3. A door opener as recited in claim 2, wherein said bolt has a threaded free end, a nut on said free end of the bolt, and a coil spring on said bolt between said nut and said arm, whereby adjustment of said nut adjusts spring pressure on said arm and roller to prevent excessively free rotation of the locking arm and roller.

4. A door opener as recited in claim 1, wherein the drawbar assembly comprises a drawbar secured to the door and having a portion extending above the door rearwardly of said idler roller, a second idler roller carried by said drawbar, said cable being entrained over said second idler roller; said spring tensioning means comprising a coil spring interconnecting said one end of the cable to a point on said drawbar, a short arm secured to the drawbar just above the door, and a third idler roller carried by said short arm for contacting the cable at a point between the first named and second idler rollers to protect the cable from being scraped and frayed by the upper end of the door.

5. A door opener as recited in claim 4, wherein the spring tensioning means further comprises a second coil spring, a pair of loop members extending axially through the second spring with bights exposed beyond opposite ends of the other spring, each loop member having hooked end portions engaged on a different end of the second spring, the other end of said cable being attached the bight of one loop member and a flexible line connected between the bight of the other loop member and the door, so that tension exerted on the loop members by said cable and said line in opposite directions compresses said second spring between the hooked end portions of the loop members whereby the door and motor are protected from shock when movement of the door is stopped, and whereby sections of the cable between the door and said first unit are held in tension to slip on the winch when the door encounters an obstruction.

6. A door opener as recited in claim 5, wherein said second unit further comprises a support for the first named idler roller, a pivotally mounted safety locking arm carried by said support and normally disposed in a vertical position above the door to prevent raising of the door, and friction means engaging the arm and first named idler roller, so that the arm turns backward out of the way of the door when the door is raised by the cable while the cable is driven in one of said two directions, and so that the arm turns 1" forward when the door is lowered by the cable while the cable is driven in the other of said two directions.

7. A door opener as recited in claim 6, wherein the second unit comprises a plate attachable to a header beam over the door, and a flange extending outwardly of said plate, said support comprising a bolt secured in said flange and rotatably carrying the first idler roller, friction means and safety locking arm.

8. A door opener as recited in claim 7, wherein said bolt has a threaded free end, a nut on said free end of the bolt, and another coil spring on said bolt between said nut and said safety locking arm, whereby adjustment of said nut adjusts spring pressure on the locking arm and the first idler roller to prevent excessively free rotation of the locking arm and first idler roller.

9. A door opener as recited in claim 8, wherein the means connecting the other end of the cable to the door, comprises a further coil spring, a pair of loop members extending axially through said further spring and arranged to compress said further spring when tension is applied to the loop members in opposite directions, said other end of the cable being connected to one loop member, and a flexible line connected between the other loop member and the door, so that tension exerted on the loop members by the cable and the line in opposite directions compresses said further spring to prevent shock to the door and motor when the door is raised and lowered.

10. A door opener as recited in claim 9, wherein said first unit further comprises a fixed bearing, a clutch roller rotatable on said bearing and cooperating with the winch to keep the cable adjustably tight around the winch and to control slipping of the cable on the winch, said bearing having a threaded portion, a clutch gear turnable on the threaded portion of said bearing, and a switch mounted in a fixed position near the clutch gear, whereby the switch is operated each time the clutch gear advances axially on said portion of the bearing both toward and away from said switch, said switch being connected in circuit with said motor, whereby current passing to the motor is turned on and off as the clutch gear moves axially on said portion of the bearing.

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