

May 2, 1933.

H. C. WALDMAN
DOOR ACTUATING MEANS

1,906,677

Filed June 4, 1931

2 Sheets-Sheet 1

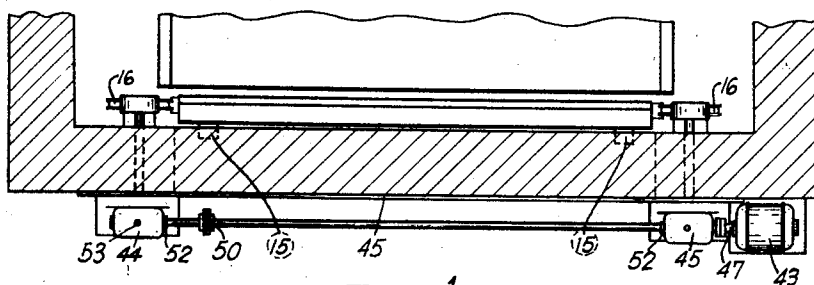


FIG. 1

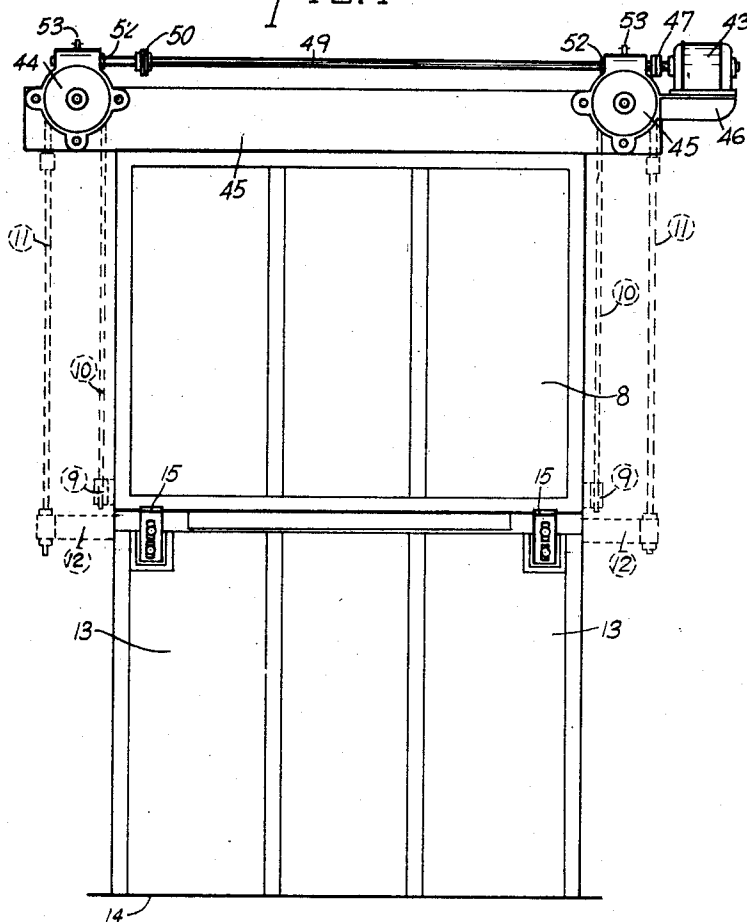


FIG. 2

INVENTOR.
HERMAN C. WALDMAN
BY
Eilw. Schaumburg
ATTORNEYS.

May 2, 1933.

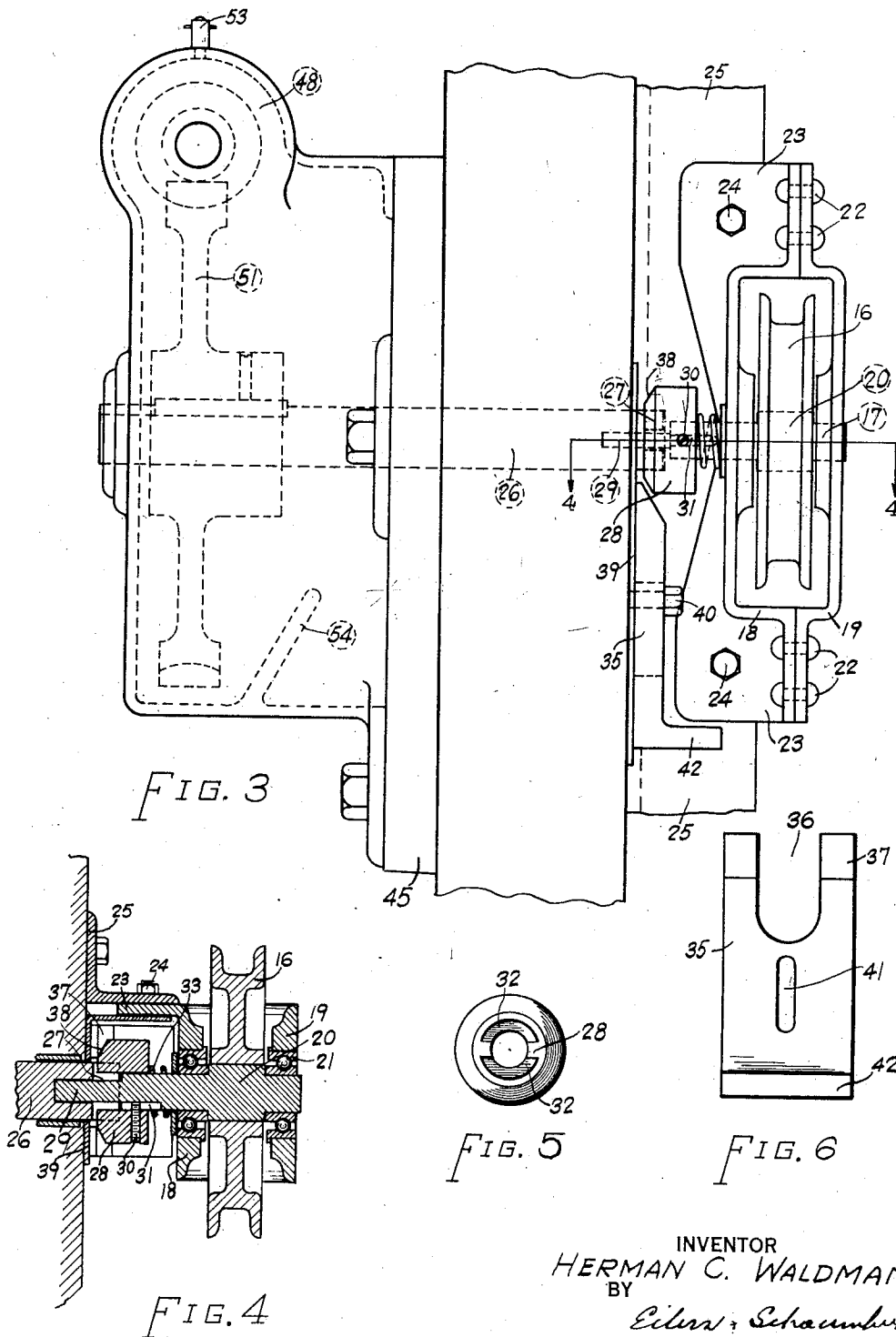
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

HERMAN C. WALDMAN, OF ST. LOUIS, MISSOURI

DOOR ACTUATING MEANS

Application filed June 4, 1931. Serial No. 542,085.

My invention relates to improvements in door actuating means, and more particularly to an electrical device especially adapted for the operation of elevator doors.

5 An object of my invention is to provide an improved electrical door operator.

Another object of my invention lies in the provision of improved power operated mechanism adapted for the actuation of elevator doors, embodying an emergency releasing device, which enables a door so equipped, to be manipulated by hand, should the source of power be interrupted.

15 A further object of my invention is to provide a door-operating mechanism embodying certain improved features of construction which render the device simple and economical of manufacture, and which enable the installation and removal of the driving portions of the mechanism as an assembled unit, and so reduces materially the cost of installation.

Yet another object of my invention is the provision of a mechanical door-operator, especially adapted for elevator doors of the vertical sliding type, the device being so constructed that personal injury and danger to a user are effectually eliminated.

25 The objects enumerated above, as well as additional objects and advantages, will appear as the description proceeds and will also be suggested by reference to the accompanying drawings, forming a part of my specification, and in which:

35 Fig. 1 is a sectional view taken horizontally through a portion of an elevator hatchway and showing an elevator door in plan, equipped for operation by the device of my invention; Fig. 2 is an elevational view of my device as applied to an elevator door of vertical sliding, self counterbalanced or compound type; Fig. 3 is a side elevation of the operator illustrated in Figs. 1 and 2; Fig. 4 is a section taken along the line 4-4 of Fig. 3; Fig. 5 is a plan view of a collar,

forming part of the clutch or emergency release mechanism; and Fig. 6 is a front view of a preferred form of actuating member for the emergency releasing device.

The device of my invention is shown as applied to an elevator door of the vertical sliding type. This type of door may consist of a single panel, arranged usually on the hatchway side of the enclosure wall for movement in suitable guideways, and supported by means of a pair of cables or chains which pass over sheaves, the free ends of the cables or chains being secured to suitable weights for counterbalancing the panel. Or the door may be of the compound type, sectioned horizontally, as herein shown and described, the panels so formed being removable in mutually opposite directions, one serving to counterbalance the other. Thus the upper panel, designated by reference numeral 8, is provided with arms 9 which extend laterally from opposite lower edges of the panel. To each of the arms 9 is secured a cable, or chain 10, which extends upwardly from one of the recited arms and passes over a sheave, to be hereinafter designated and described in detail, thence downwardly to engage the upper end of a vertical rod 11. The lower end of each rod engages an arm 12 which projects laterally from the lower panel 13. To maintain the proper tension in the cables or chains 10, suitable adjusting means are provided, which may consist, as in the present example, of an adjustable connection (not shown in detail) between the rods 11 and arms 12.

When the door is open to its fullest extent, the upper edge of the panel 13 lies substantially flush with the door level, indicated at 14. The downward movement of this panel is limited by means of angulate members, or stops 15, which are secured, preferably in adjustable relation, to the panel 13, and abut the floor when the limit of door-travel is reached.

Proceeding now with the description of the door actuating means, or operator forming the subject matter of the present invention, each of the sheaves 16, previously mentioned, is mounted for rotation with a shaft 17 (hereinafter designated a sheave-shaft) between mated bearing arms 18 and 19, which together comprise a split housing for the sheave. Although the sheave may be mounted for rotation with the shaft in various other ways, I prefer to provide the sheave with an axial bore of polygonal cross-section, and the portion 20 of the shaft, upon which portion the sheave is disposed, of similar cross-section, sized snugly to fit the sheave. The shaft 17 is journaled in bearings 21, (Fig. 4) preferably of radial, ball type, which are disposed in suitable recesses in the arms 18 and 19, the recesses being accessible from the inner surfaces of the housing members. In assembly, the bearings 21 are placed within the recesses, from the inner sides of the bearing arms, and the journaled portion of the shaft, which has the sheave mounted thereon, is then inserted into the bearings. The bearing arms are fastened together by means of bolts, or rivets 22. Since the longitudinal distance between opposite bearings approximates the length of the enlarged, polygonal portion of the shaft, endwise movement of the shaft, and hence the sheave, is substantially prevented. For mounting the sheave assembly, the arm 18 is provided with an extension, or bracket portion 23, which is adapted to be secured, as by bolts 24, to a door-guide 25, shown as a vertical member of angle section.

Extending preferably through suitable conduits in the hatchway partition wall, and coaxial with the sheave-shafts 17, are the shafts 26, by means of which the sheave-shafts are adapted to be driven. Each of the shafts 26 projects a distance beyond the inner, or hatch-side of the wall, and terminates in a toothed projection 27, (Fig. 4) adapted for engagement with a collar 28, (Fig. 5) which is disposed for rotation with sheave-shaft 17. For purposes of maintaining the shafts 17 and 27 in accurate alignment, and thereby insure smooth operation of the device, the sheave-shaft 17 is provided with an axial extension 29 of reduced diameter, which is adapted to fit into a bore, drilled axially in the end of shaft 26. Under normal operating conditions, the shafts 17 and 26 revolve as a unit, being operatively connected by means of the collar 28 which forms an element of a clutch mechanism, to be hereinafter described. However, under other circumstances to be subsequently mentioned, the sheave-shaft 17 will rotate free of the shaft 26 and the portion 29 will revolve in bearing engagement with the shaft 26.

The clutch-collar 28 is disposed for movement along the sheave-shaft, for selective, operative engagement with the shaft 26. Rotation of the collar relative to the sheave-shaft, however, is prevented by means of a radially disposed threaded element, or set-screw 30, the inner end of which is adapted to project into a longitudinal slot, or key-way 31, in the shaft 17. Suitable recesses 32, (Fig. 5) in one end of collar 28, are provided for the accommodation of the toothed projections 27, on shaft 26. Carried by the shaft 17, and disposed between the collar 28 and the bearing arm 18, is a coil spring 33, the function of which is to bias the collar toward engaging position with shaft 26. A washer 34 is preferably provided on the sheave-shaft, between the spring 32 and the sheave housing.

For shifting the collar 28, to non-clutching position, a throw-out member 35 (Fig. 6) is provided, and is mounted for endwise movement in a direction radially of the shafts 17 and 26, and one end of the member 35 is bifurcated to provide a recess 36, and thus permits the collar to be engaged, without interference by the shaft 26. The furcations or legs of the throw-out member are provided with beveled surfaces 37, companion beveled surfaces 38 being formed on the collar 28, so that a predetermined movement of the member 35 toward the shafts, will effect a disengagement of the clutch. When the member 35 is in the inoperative position shown in Fig. 3, the collar 28, free of the member 35, and under the action of spring 33, will be urged into driven engagement with the shaft 26. The member 35 is mounted on a wall plate 39, a bolt 40 extending through a longitudinal slot 41 in the member 35, threadedly engaging the plate 39, provides adjustable positioning means for this member. For purposes of facilitating its actuation, the member 34 is provided with an angular projection 42 which may readily be grasped by the hand, or any suitable tool.

Proceeding now to a description of the driving elements, a motor 43, or other suitable power device, is located by preference on the floor-side of the partition wall. Power is transmitted to the shafts 26 through suitable gearing encased in housings 44 and 45, each of which is associated with one of the shafts 26. The gears may be any of various types, but the worm gear type, herein shown and described, is my preference, since speed reduction may be readily accomplished in small space, by such means.

Formed preferably integrally with a gear housing 45 is a projecting arm 46, (Fig. 2) which serves as a base for the motor 43. The motor shaft 47 is arranged axially of, and in driving relation with worms 48 (Fig. 3)

3) which are interconnected by means of a horizontal shaft 49, and a flexible coupling device 50. The worms are provided with oppositely pitched threads, each worm engaging the teeth of a worm gear 51, suitably keyed to a shaft 26. Thus, when the motor is energized, the worm gears will be actuated in relatively reverse directions to effect and thus adapted to cause the sheaves 16 to rotate in opposite directions. This expedient is rendered necessary by reason of the preferred arrangement of door chains 10, but otherwise is advantageous since end thrust in the worms 48 is substantially eliminated. For this reason bearings 52 associated therewith may be of the usual, radial-ball type. For lubricating the gear mechanism, oil may be introduced into the gear housings through self-closing oil ports 53, one associated with each housing and located preferably directly above the worms. A web member 54, disposed inside and at the bottom of each housing, serves to retain the lubricant to provide a bath for the gear 51.

Obviously, the gear mechanism must necessarily be positioned and maintained in precise alignment on the partition wall, in order to insure proper operation of the device, hence I prefer to mount the housings 44 and 45 on a plate 55, (Fig. 2) or other suitably rigid member, prior to installation. This provision also tends to conserve much of the time required for installation, since all of the driving elements through the worm gears and shafts 26, may be assembled as a unit at the place of manufacture, and installed in a few minutes time without the usual necessity of fitting, aligning and assembling such parts at the place of installation.

Turning now to a brief recital of the electrical means provided for controlling the operation of the motor 43, which is of reversible type, control switches, arranged in pairs, are located in the elevator car and on the outer surface of the hatch wall for controlling the operation of the door from either of such locations, one switch of each pair serving to complete the circuit for door operation in one direction, and the other for causing rotation of the motor in the opposite direction. A switch located in the hatchway, adapted to be actuated by contact with a cam member on the car, interrupts the circuit and prevents motor energization to open the door except at such times when the elevator car is disposed at the floor landing. Also, suitably arranged in the motor control circuit are limit switches adapted for actuation by the door, to automatically break the circuit when the limit of door travel has been reached. It may at this point be noted that should one of the limit switches accidentally become short-circuited, or fail to

operate, say, for example, when the door obtains its extreme open position, no particular harm would result by reason of the motor continuing in operation, since the supporting chains would be relieved of the weight of the lower panel which would then be carried by the floor structure through the stops 15. The chains, lacking their normal tension, would create but little friction on the sheaves, and the sheaves would rotate relatively freely.

The purpose of the clutching means between shafts 26 and sheave-shafts 27 as an emergency device, should the motor become inoperative, is thought to be apparent. When the collars 28 and shafts 26 are relatively disengaged, the door may be readily operated by hand in the usual manner, unencumbered by the gear mechanism and the driving motor.

Having described my invention with reference to a preferred embodiment thereof, I realize that certain modifications may be made in the structure herein disclosed; that parts may be added or interchanged without departing from the spirit and full intended scope as defined by the appended claims.

I claim as my invention:

1. In an operating device for sliding doors, a door actuating mechanism including in combination, power actuating means, a drive shaft in operative communication therewith and having an axial bore in one end thereof, a driven shaft disposed coaxially with said drive shaft and having an axial projection journaled in the bore of said drive shaft, a sheave mounted on, and fixed for rotation with said driven shaft, flexible means operatively interconnecting said sheave and a sliding door to be moved thereby, a housing for said sheave, a clutch collar splined on the driven shaft and adapted for clutching engagement with said drive shaft, a compression spring on said driven shaft in bearing engagement with said clutch collar and sheave housing, said spring tending to urge said collar into clutching engagement with said drive shaft, and means for moving said clutch collar in opposition to said spring whereby operatively to disconnect said driving and driven shafts to permit of manual actuation of the door, said means including a beveled member disposed for endwise sliding movement in a direction normal to the axis of said shafts.

2. In an operating device for sliding doors, power actuating means, a drive shaft operatively connected with said power actuating means, a driven shaft aligned with said drive shaft having an axially disposed end projection journaled in one end of the drive shaft; clutch means for selectively, operatively connecting said shafts, including

a clutch collar having a beveled end face, carried by one of said shafts, a spring tending to urge said collar in clutching position, and an elongate plate arranged for endwise sliding movement whereby to shift said clutch collar, said plate terminating at one end in an angular projection to permit of ready engagement for manual operation thereof, and terminating at its opposite end in spaced, beveled fingers adapted to engage the beveled end face of said collar; a sheave on said driven shaft, and flexible means operatively interconnecting said sheave and a door to be moved thereby.

HERMAN C. WALDMAN.