May 4, 1943. H. V. McCORMICK 2,318,090

ELEVATOR DOOR OPERATING MECHANISM

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Fig. 1.

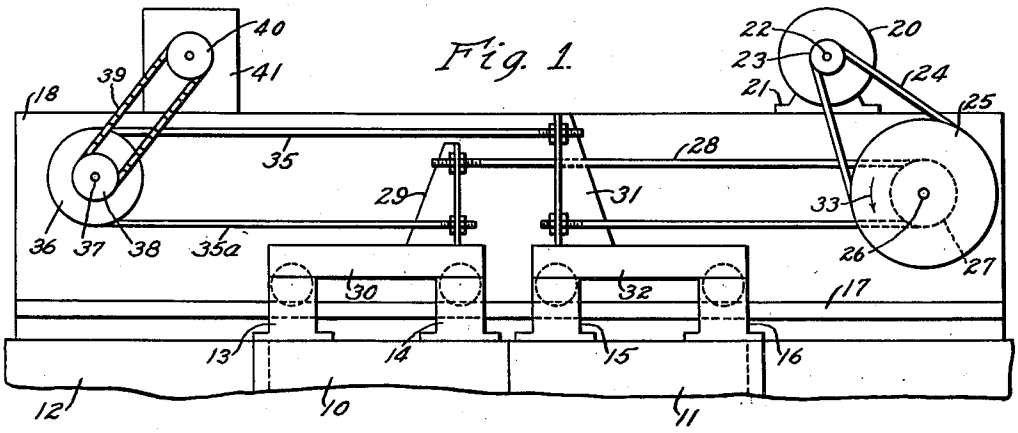


Fig. 4.

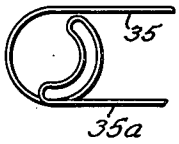
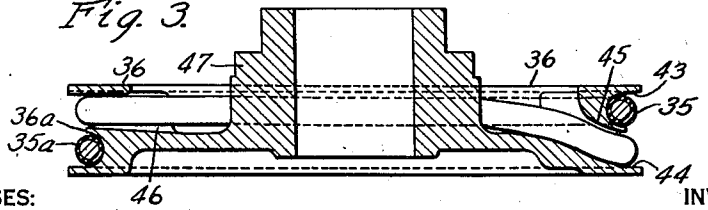


Fig. 5.



Fig. 2.

Fig. 3.



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Fig. 6.

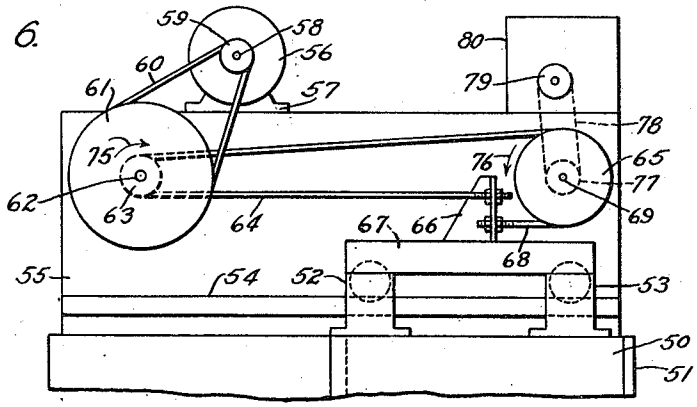
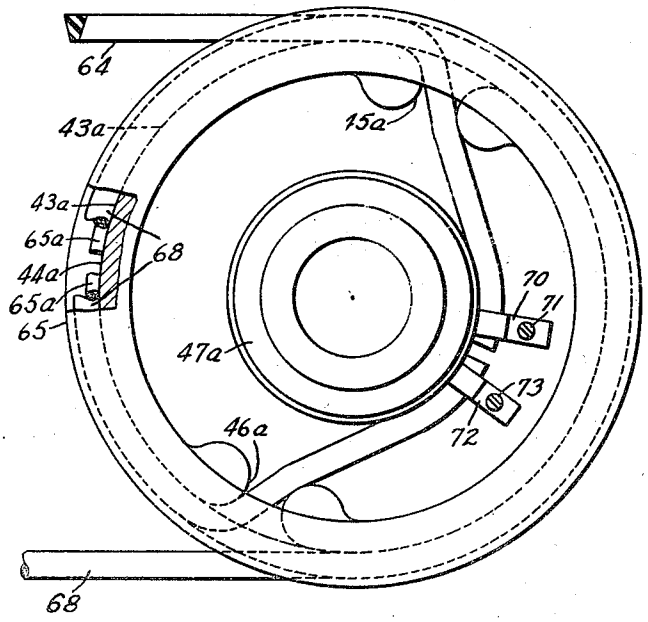


Fig. 7.



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UNITED STATES PATENT OFFICE

2,318,090

ELEVATOR DOOR OPERATING MECHANISM

Harold V. McCormick, Westfield, N. J., assignor to Westinghouse Electric Elevator Company, Jersey City, N. J., a corporation of Illinois

Application January 26, 1940, Serial No. 315,695

1 Claim. (Cl. 268—49)

My invention relates to elevator door apparatus and more particularly to door operators in which the doors are driven by flexible connectors or by worm gear wheel drives.

Heretofore, in the construction and operation of door operators, it has been customary to utilize driving chains or worm gear drives in order to obtain a sufficiently positive operation of the apparatus to secure accurate operation of the doors and the controllers associated therewith. When sprocket chains are used, the noise of operation increases so much with any increase of speed that they become very objectionable. Therefore, where quiet operation at intermediate or high speed has been required, it has been the usual practice to use worm gearing drives instead of chain drives, but worm gear drives increase the cost of the apparatus considerably. Furthermore, there is usually some objectionable noise even with a worm gear drive, and there is also the problem of preventing oil leakage. Although the oil leakage may be reduced to a very small amount, it is still objectionable where the door operating mechanism is mounted immediately above the door entrance because of oil dropping on the passengers as they enter or leave the car.

Therefore, one object of my invention is to provide an elevator door operator mechanism which shall be practically noiseless regardless of the speed at which it is operated.

Another object is to provide an elevator door drive which may utilize low-cost flexible connectors and belts, such as rubber-covered steel cables and ordinary driving V-belts, and yet have an accurate and positive drive of the doors and the controllers for controlling the acceleration, deceleration and stopping of the doors.

Another object is to provide an elevator door operator which shall be inexpensive to construct, operate and maintain in operation.

Another object is to provide an elevator door operator which shall require very little lubrication and which may be operated at high speed without danger of causing oil or other lubricant to drop upon the passengers as they enter or leave the car.

A still further object is to provide a door operator in which the sheaves, pulleys and idler wheels required may have a much smaller diameter than those heretofore used.

For a better understanding of my invention, reference may be had to the accompanying drawings, in which:

Figure 1 is a representation of a door operating mechanism for a pair of center opening horizontally slidable elevator doors embodying my invention;

Fig. 2 is an enlarged view of one of the secondary sheaves embodied in the apparatus illustrated in Fig. 1;

Fig. 3 is a sectional view taken along the line III—III of Fig. 2;

Fig. 4 is a diagrammatic representation of the position assumed by one of the driving cables when mounted on one of the sheaves in Fig. 1;

Fig. 5 is a view in cross-section of one of the driving V-belts shown in Fig. 1;

Fig. 6 is a view in front elevation of a door operator embodying my invention, as applied to a single door disposed on an elevator car; and

Fig. 7 is an enlarged view of one of the secondary sheaves embodied in the operator illustrated in Fig. 6 with a V-belt and an operating cable attached thereto.

Referring more particularly to Figs. 1 to 5 of the drawings, I have illustrated a pair of center opening horizontally slidable doors 10 and 11 for an elevator car 12. The doors are provided with suitable hangers 13, 14, 15 and 16 by means of which they may be suspended from an overhead track rail 17 in the usual manner, so that the doors may slide toward or away from the center in closing or in opening. The track rail 17 may be secured in any suitable manner to a frame 18 mounted upon the top of the car.

The means for moving the doors to their open or to their closed position comprises an electric motor 20 provided with a foot plate 21, by means of which it is mounted on the upper portion of the operator frame 18 on the car. The motor is provided with a shaft 22, upon the outer end of which is mounted a driving pulley or wheel 23 over which a driving V-belt 24 passes to a driving pulley 25. As indicated in Fig. 5, the V-belt section is lined to show that it is constructed mainly of rubber or a similar resilient material. The driving pulley is mounted upon the outer end of a shaft 26, the inner end of which is secured to the frame 18 in any suitable manner. A primary or driving sheave 27 is mounted upon the shaft 26 and secured to the pulley 25, so that the two will rotate as a unit. A V-belt 28 passes around the sheave 27, and has its upper end secured to an arm 29 mounted on a bar 30 connecting the hangers 13 and 14 on the door 10. The lower end of the V-belt 28 is attached to a vertical arm 31 mounted on a bar 32 attached to the upper ends of the hangers 15 and 16, so that rotation of the sheave 27 in the direction of

the arrow 33 will cause the lower end of the V-belt 28 to pull on the arm 31 in order to move the door 11 to the right toward its open position.

A rubber-covered steel cable 35 is provided for coupling the two doors together so that operation of the door 11 will cause a simultaneous operation of the door 10. One end of the cable is secured to the upright arm 31 on the door 11, and the other end passes to a secondary sheave 36 and thence to the vertical arm 29 on the door 10 to which it is fastened. The sheave 36 is rotatably mounted on a shaft 37, the inner end of which is secured to the frame 18.

A sprocket wheel 38 is mounted on the shaft 37 and secured to the sheave 36 so that rotation of the sheave 36 will also cause the sprocket to rotate. A sprocket chain 39 is mounted on the sprocket wheel 38 in position to extend to and around a sprocket wheel 40 mounted upon a controller 41 to operate the controller 41 in accordance with the position of the doors. The controller 41 may be provided with cams (not shown) for operating switches in a control system (not shown) for the door operating motor 20.

The controller 41 should be operated exactly in accordance with the movement of the doors 10 and 11, so that the motor will be accelerated, decelerated or deenergized at the proper points in the movement of the doors. I provide for the positive operation of the controller in a novel manner by constructing the sheave 36 with two peripheral grooves 43 and 44 to receive and hold the rubber-covered steel cable 35. The grooves are molded in the rim and separated by a web 36a. The bottom of the groove 44 is provided with an aperture or passageway 45 leading to the inner face side of the sheave. A similar aperture or opening 46 is provided in the bottom of the groove 43 leading also to the inner face of the sheave.

The apertures 45 and 46 are disposed at opposite points in the rim of the sheave so that the cable 35 may wrap around the groove 43 to a point where it enters the aperture 45, and thence pass along the inner face of the sheave beside the hub 47 to the point where it enters the groove 44 through the aperture 46, and then passes along the groove 44 until it reaches the point where it extends to its point of attachment to the arm 29.

When the motor rotates the sheave 27 in the direction of the arrow 33, the lower end of the V-belt 28 pulls the arm 31 attached to the door 11, and thereby pulls that door to its open position. The movement of the door 11 toward its open position causes its arm 31 to pull the upper end of the rubber-covered steel cable 35, thereby rotating the sheave 36 and at the same time causing the lower end 35a of the cable 35 to pull the arm 29, thus moving the door 10 to its open position simultaneously with the movement of the door 11 to its open position. The frictional engagement of the cable 35 with the sheave 36 where it passes through the apertures and around the hub is sufficient to prevent any relative movement between the cable and the sheave. Hence the sheave and the sprocket 38 are rotated exactly in accordance with the operation of the doors, thus rotating the sprocket wheel 40 by the sprocket chain 39 and causing a positive operation of the controller 41 in accordance with the movement of the doors.

If desired, a clip 48 may be secured by a machine screw 49 on the inner face of the sheave 36 in position to press against the cable 35 and hold it firmly against longitudinal movement.

In Figs. 6 and 7 of the drawings, I have illustrated my invention as embodied in an operating mechanism for a single horizontally slidable door 50 for closing the entrance to a car 51. The door is provided with suitable hangers 52 and 53 by means of which it is suspended from an overhead track rail 54 mounted on a frame 55 on the top of the car in the usual manner, so that the door may slide toward or away from the doorway in closing or in opening.

An electric motor 56 is mounted on the top of the frame 55 by means of a footplate 57 for operating the door. The motor is provided with a shaft 58, upon the outer end of which is mounted a driving pulley or wheel 59 over which a V-belt 60 passes to a driving pulley 61 which is rotatably supported upon a shaft 62, the inner end of which is affixed to the frame 55. A primary or driving sheave 63 is also seated on the shaft 62. This sheave may be molded integral with the driving pulley 61, or be constructed as a separate part and affixed to the driving pulley 61 so that it rotates therewith. An open end V-belt 64 passes around the driving sheave 63 and has its one end attached to a secondary sheave 65, and its other end attached to the door 50 by means of a vertical arm 66 mounted on top of a bar 67 attached to the upper ends of the hangers 52 and 53. The secondary sheave 65 is rotatably mounted upon a shaft 69, the inner end of which is secured to the frame 55.

The secondary sheave 65 is similar to the secondary sheave illustrated in Figs. 2 and 3, in that it is provided with parallel grooves 43a and 44a in its rim separated by a web 65a and a pair of oppositely disposed apertures 45a and 46a (Fig. 7) which provide a passageway from the bottom of one of the grooves to the bottom of the other groove along the outer face of the sheave. The upper end of the V-belt 64 is secured to the sheave 65 by threading it along the inner groove 44a and through the aperture 45a to the outer face of the hub 47a, where it is firmly secured in position by a clip 70 mounted on the side of the sheave by a machine screw 71.

An open end rubber-covered steel cable 68 (which may be called a secondary belt) is secured to the sheave 65 by extending one end along the outer groove 43a and through the passageway 46a to the outer face of the hub 47a, where it may be firmly secured by a clip 72 maintained in place by a machine screw 73. The other end of the cable 68 is fastened to the vertical arm 66 on the door 50. When the motor rotates the sheave 63 in the direction of the arrow 75, the lower part of the belt 64 pulls the door 50 to its open position. At the same time, the movement of the door to its open position pulls the cable 68, thereby rotating the sheave 65 and causing the upper end of the belt 64 to be wrapped around the sheave in its groove 44a. When the motor is reversed, the sheave 63 is operated in a direction reverse to the arrow 75, thereby rotating the sheave 65 in the direction of the arrow 76 and causing the sheave to wrap the cable 68 around its groove 44, thus pulling the door to its closed position.

A sprocket wheel 77 is disposed on the shaft 69 and attached to the sheave 65 to rotate therewith. A sprocket chain 78 passes over the sprocket wheel 77 and around a sprocket wheel 79 on a controller 80 mounted on top of the frame 55. From this it will be obvious that the rotation of the

sheave causes the controller 80 to be operated in accordance with the movement of the door, and, inasmuch as one end of the cable 68 is fastened to the sheave and the other end is fastened to the door, the sheave will be rotated exactly in accordance with the movement of the door and thus cause the controller to be operated exactly in accordance with the movement of the door.

From this construction, it will be observed that the provision of the sheave with the double groove construction permits the use of a smaller diameter sheave than would otherwise be necessary.

It will also be observed that my improved construction permits the use of a rubber-covered steel cable on the secondary sheave in either a single door operator or in an operator for opening and closing a pair of center opening doors. It will also be obvious that the construction permits the use of a V-belt on the driving sheave, as well as on the driving pulley, and that the cable and belts used in such operators will not require lubrication. In fact, they will work better without being lubricated. It will also be obvious that the cable and belt construction will permit the door operator to be operated at intermediate speed or at high speed with practically no noise, and that the positive connection of the cable to the secondary sheave will cause the controller operated thereby to be operated exactly in accordance with the position and movement of the doors, so that the control system (not shown) operated by the controller will accurately control the motor for operating the door or the doors in accordance with their position.

Although I have illustrated and described only two embodiments of my invention, it will be readily understood that changes therein and modifications thereof may be made without departing from the spirit and scope of the invention.

I claim as my invention:

An operating mechanism for a doorway comprising a pair of center opening horizontally slidable doors, a driving sheave, power means for operating the driving sheave, a primary open end friction belt disposed on said sheave to be driven through friction therewith, said belt having its one end attached to one of the doors and its other end attached to the other door, a secondary sheave having a pair of parallel grooves in its rim and a passageway connecting the bottom portion of one groove with the bottom portion of the other groove, and a secondary soft faced belt threaded through said passageway with one end attached to one of said doors for operation in one of said grooves and the other end attached to the other door for operation in the other of said grooves for coupling the doors and causing operation of the secondary sheave in accordance with the operation of the doors.

HAROLD V. McCORMICK.