

Aug. 28, 1962

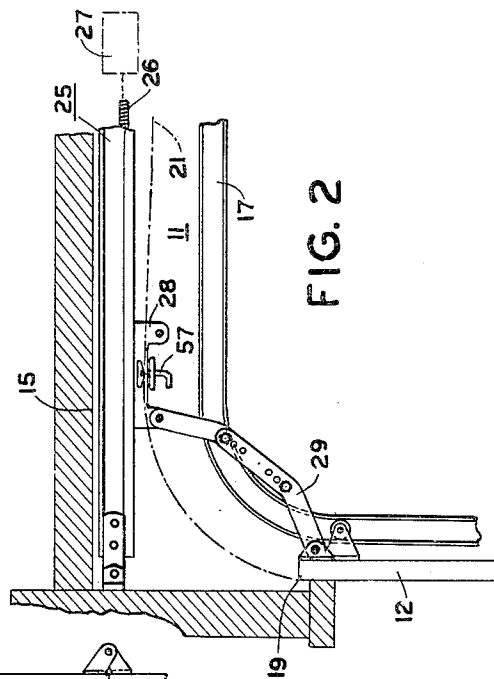
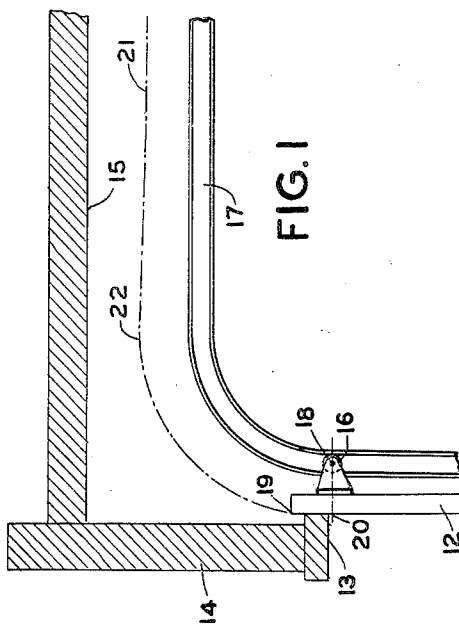
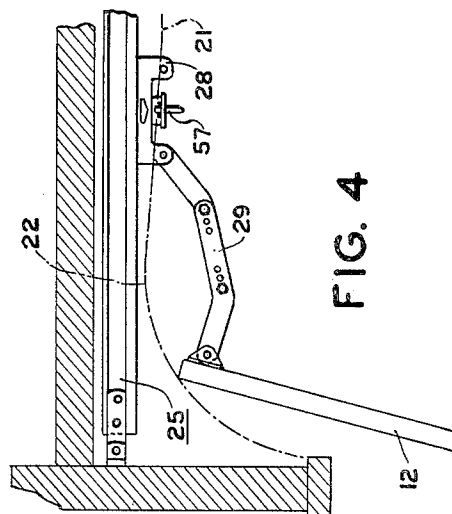
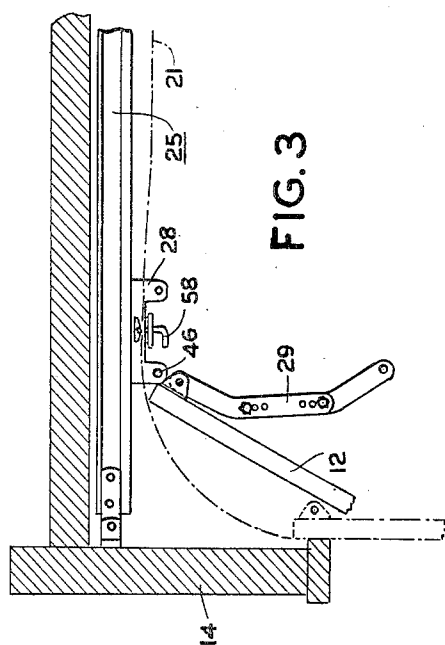
R. D. HOUK

3,051,014

SCREW AND NUT MECHANISM

Filed July 30, 1959

2 Sheets-Sheet 1



INVENTOR.

RICHARD D. HOUK

BY Woodling and Kroat,
Attys.

Aug. 28, 1962

R. D. HOUK

3,051,014

SCREW AND NUT MECHANISM

Filed July 30, 1959

2 Sheets-Sheet 2

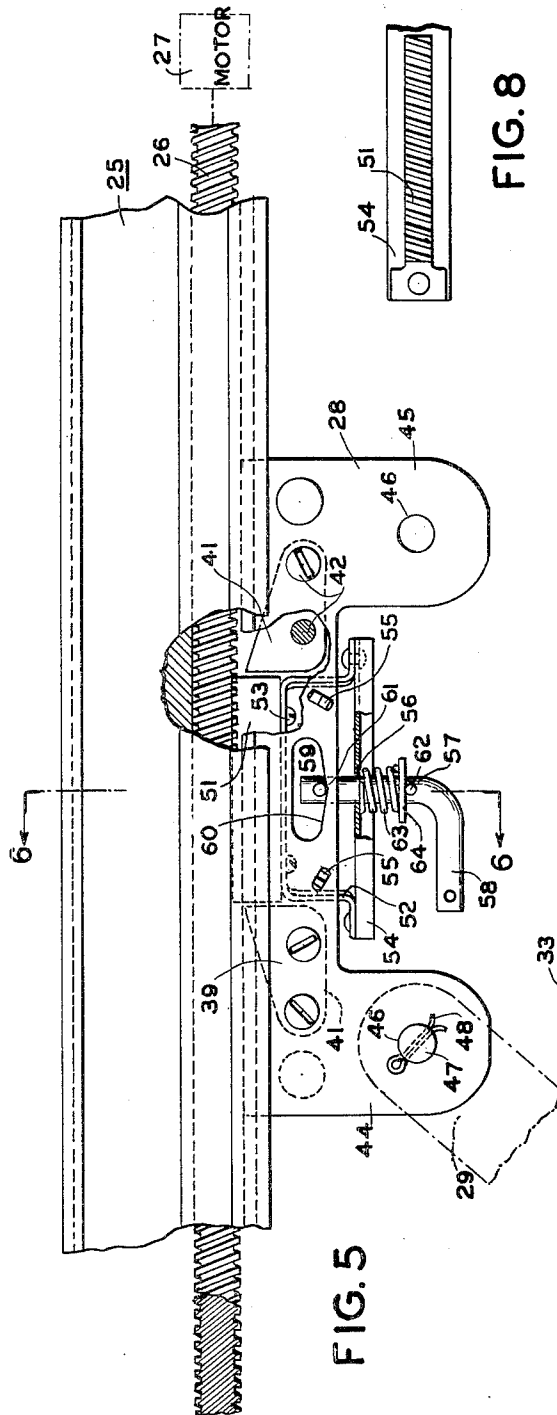


FIG. 5

FIG. 8

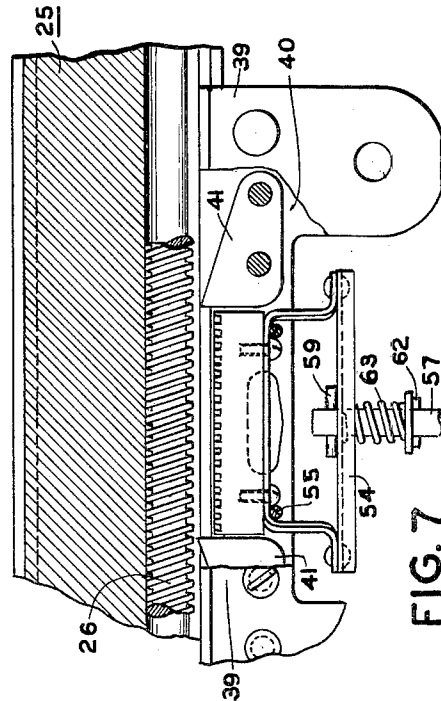
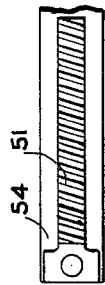


FIG. 7

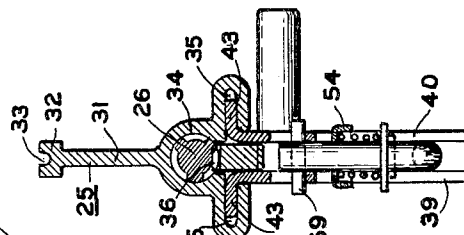


FIG. 6

INVENTOR.

RICHARD D. HOUK

BY *Woodling and Krost,*
attys.

1

3,051,014

SCREW AND NUT MECHANISM

Richard D. Houk, Alliance, Ohio, assignor to Consolidated Electronics Industries Corporation, a corporation of Delaware

Filed July 30, 1959, Ser. No. 830,579

5 Claims. (Cl. 74-424.8)

The invention relates in general to door operators and more particularly to garage door operators such as the overhead type with a powered means to move the garage door between open and closed positions, with a quickly releasable connection in the drive linkage.

Garage door operators have been used in the past which have moved overhead garage doors between open and closed positions but in many cases these have been unsatisfactory for garage doors which have a minimum head room. In such cases there is a problem of the garage doors moving in a path which lies close to the ceiling of the garage and therefore there is insufficient space in which to mount a garage door operator. Many times there is just barely sufficient space to mount the garage door operator out of the path of movement of the door and therefore this makes the door operator capable of being installed, yet should the electric power fail for any reason, then the door operator must be disconnected from the door so that the door may be manually operated. However, in the prior art, this disconnection of the drive linkage has not been at a proper place so that all parts of the drive train which remained stationary were out of the path of movement of the door or movable parts of the drive train connected with the door.

Accordingly, an object of the invention is to provide a door operator wherein the drive train may be readily disconnected for manual operation with stationary parts of the door operator being out of the path of movement of the door.

Another object of the invention is to provide a door operator wherein a releasable cam and cam follower is provided in the drive train to the door so that this cam and follower may be readily released to disconnect the operator from the door.

Still another object of the invention is to provide a garage door operator of the overhead type with a drive train which has a minimum vertical height and which minimum vertical height is maintained whether the drive train is disconnected and the door operated manually or whether the drive train is connected and the door operated by the garage door operator.

Still another object of the invention is to provide a door operator with a longitudinal drive member connected through a carrier and a link to a garage door movable in a path and whereby the carrier may be readily disconnected from the longitudinal drive member so that the door may be manually operated in its said path without obstruction from any part of the drive train.

Other objects and a fuller understanding of this invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a longitudinal elevation of a garage door with which the door operator of the invention may be used;

FIGURE 2 is a longitudinal elevation similar to FIGURE 1 but showing the door operator connected to move the door;

FIGURES 3 and 4 are similar longitudinal elevations showing the door in different positions;

FIGURE 5 is an enlarged partial longitudinal elevation of the door operator in the engaged position;

FIGURE 6 is a sectional view on line 6-6 of FIGURE 5;

2

FIGURE 7 is a longitudinal view partially in section similar to FIGURE 5 but showing the drive train disengaged; and

FIGURE 8 is a top view of the skew rack which engages the drive worm.

The door operator 11 of the invention is generally shown in FIGURE 2 in conjunction with an overhead door 12 in this case shown as a sectional type door although it could be a solid type door. The door 12 is mounted in a door opening 13 of a garage 14 which has a ceiling 15 permitting only a limited head room above the door opening 13. The door 12 moves on rollers 16 in a track 17 and such doors are usually counterbalanced by weights or springs to permit easy overhead opening movements.

Because the pivot 18 of the roller 16 is farther from the outermost upper corner 19 of the door 12 than from a point 20 on a perpendicular from the door surface, the point 19 travels on a path 21 which includes a high point of travel 22. This high point of travel determines the minimum clearance or head room in which the door operator 11 may be placed. Many installations of garage doors in the past have had such a small amount of head room that many types of garage door operators cannot be used.

The present door operator 11 is designed to require minimum head room for installation and also to have the same minimum head room whether or not the door operator is connected to the door 12.

FIGURE 2 shows the door operator 11 installed and includes generally a rigid channel 25, a drive worm 26 in the channel, a motor 27 to rotate the drive worm or drive screw 26, a carrier 28 longitudinally movable by the drive worm 26, and a link 29 connecting the carrier 28 to the door 12.

FIGURES 5-8 better show the construction of the door operator 11, and the channel 25 is designed to have stiffness both longitudinally and laterally and is of a minimum vertical height so as to require a minimum of clearance between the path 21 and the ceiling 15. This channel 25 may be made of any material and fabricated in any desired manner; however, one satisfactory method has been to extrude this channel of aluminum. This makes a lightweight yet rigid channel with the rigidity aided by the one-piece construction. The channel 25 has a web 31 with a stiffening flange 32 in which a groove 33 may be located to accommodate an electrical wire or cable for electrical control purposes. The lower part of the channel 25 is expanded and includes a partially cylindrical inner surface 34 which defines a groove for the drive worm 26. The lowermost part of the channel 25 is curved upon itself to form two longitudinal slots 35. The lowermost arcuate segment 36 of the drive worm 26 is left exposed.

The carrier 28 includes first and second plate members 39 and 40 which are spaced apart by spacers 41 and fastened together in vertical spaced relationship by bolts 42. The plate members 39 and 40 may conveniently be made identical for ease of manufacture and assembly. Ears 43 are formed on the upper edge of the plate members 39 and 40 and ride in the slots 35 to permit the entire carrier 28 to move longitudinally relative to the channel 25. The carrier 28 has depending legs 44 and 45 each bearing a cross hole 46 and a cotter pin 48. The carrier 28 is purposely made symmetrical end to end to permit assembly in either of two positions without necessity for observing the proper position of assembly.

A skew rack or partial nut 51 is loosely and slidably carried between the two plate members 39 and 40. It is disposed for selective meshing engagement with the drive worm 26. A U-shaped bracket 52 is fastened to the lower surface of the skew rack 51 by any means, for example,

3

by the screws 53, and a bar 54 is attached to the lower legs of the U-shaped bracket 52. Cotter pins 55 passing through the plate members 39 and 40 retain the skew rack 51 within the confines of the plate members 39 and 40 as best shown in FIGURE 7. A central vertical aperture 56 is provided in the bar 54 and a vertical operating rod 57 is disposed in this aperture 56. The lower end 58 of the operating rod 57 is bent in an L-shape to provide a handle for the rod 57. The upper end of the operating rod 57 is of sufficiently small dimension so that it may pass upwardly between the plate members 39 and 40 as best seen in FIGURE 6 and a cam pin 59 extends transversely through the upper end of the operating rod 57. A cam aperture 60 is formed in the plate members 39 and 40 and has a longitudinal length, as seen in FIGURE 5, sufficient to accept the length of the cam pin 59 and has a low central point 61 to receive the cam pin when this pin is turned perpendicular to the carrier 28. The lower end of the operating rod 57 carries a cross pin 62 and a coil compression spring 63 surrounds the operating rod 57 and acts between the bar 54 and a washer 64 which rests on the cross pin 62.

The spacers 41 not only transversely space apart the plate members 39 and 40, but also form a longitudinal spacing for the skew rack 51 to form a guide so that this skew rack may move only generally vertically between engaged and disengaged positions with the drive worm 26.

The door operator 11 may be easily installed in a garage with minimum head room because the channel 25 takes a minimum of head room and because it is light and easily fastened longitudinally of the garage at or near the ceiling 15. The motor 27 may be fixedly mounted relative to the ceiling 15 and connected to rotate the drive worm 26. The handle 58 may be grasped and the operating rod 57 moved upwardly from the position shown in FIGURE 7 so that this operating rod 57 passes between the plate members 39 and 40. This action moves the skew rack 51 upwardly into meshing engagement with the drive worm 26 and then the spring 63 must be compressed to move the cam pin 59 high enough above the bottom of the cam aperture 60 so that the operating rod 57 may be rotated approximately ninety degrees for engagement of the cam pin 59 and cam aperture 60. This is as shown in FIGURE 5 and it will be noted that the compression spring 63 is compressed relative to its position in FIGURE 7. This compression spring 63 acts to urge the skew rack 51 against the drive worm 26 through the agency of the cam 59 and follower 60, and also urges the drive worm 26 against the upper surface of the cylindrical groove 34 in the channel 25. This means that the class of fit between the drive worm 26 and the groove 34 may be less exacting than was the former practice because this resilient urging prevents any appreciable whipping of the drive worm 26 within the groove 34. This worm 26 in practice is usually quite long in the order of ten feet and since it is rotating at relatively high speeds, e.g. 1150 or 1725 r.p.m., it could easily whip as it rotates except for this resilient urging by the skew rack 51. It will be understood that rotation of the motor and drive worm 26 causes longitudinal movement of the skew rack 51 and hence longitudinal movement of the carrier 28 relative to the channel 25. This, through the agency of the link 29, causes opening or closing movement of the door 12, all in accordance with the selected direction of rotation of the drive worm 26.

The closed position of the door 12 will be approximately that shown in FIGURE 2 at which position the carrier 28 is near the door opening 13. The open position of the door 12 is not shown but it will be understood that the carrier 28 has moved to the right as viewed in FIGURE 2 a distance sufficient that the door 12 moves on the track 17 to a generally horizontal overhead position. It is not unknown today that there may be a failure of electrical power in any of several ways between

4

the central power station and the point of utilization, in this case the motor 27. For this reason or for many other reasons, it may be desirable to disconnect the door operator 11 from the door 12 so that the door may be manually operated on the tracks 17. The prior art door operators in many cases required a considerable head room above the path of door movement 22 and even after this requirement of head room was met, there still could be a very undesirable condition occurring in the event of power failure.

FIGURE 3 illustrates what could happen if the only place of disconnection of the power train between the motor 27 and door 12 was at the pivot pin 47. The track 17 has been omitted from FIGURES 3 and 4 for clarity. If the cotter pin 48 were removed and pivot pin 47 removed, the link 29 could be separated from the carrier 28 as shown in FIGURE 3. However, with the carrier 28 still connected to the drive worm 26, then the carrier 28 would be an obstruction in the path of movement 21 which would not permit the door 12 to be opened. This is especially true in event of power failure with the door 12 in the closed position, but is also true in the event the carrier should be in practically any other position along the channel 25. The present invention precludes the occurrence of any such obstruction because the handle 58 may readily be grasped and rotated ninety degrees to release the meshing engagement between the skew rack 51 and the drive worm 26. The skew rack 51 falls down by gravity away from the drive worm 26 which completely frees the carrier 28 from connection with the drive worm 26. The carrier 28 is therefore free to slide longitudinally in the channel 25 and to move with the door 12 as shown in FIGURE 4 when the door 12 is manually moved. It will thus be seen that the door operator 11 has a minimum head room requirement and that this minimum head room requirement is not increased at any time even including power failure which requires disconnection of the power train between the motor 27 and the door 12.

The drive worm 26 may be considered a longitudinal drive member which is longitudinally disposed relative to the path of movement 21 of the door 12. The cam 59 and follower 60 provide a releasable cam means or releasable latch means for quickly connecting and disconnecting the drive train between the door 12 and motor 27.

In the FIGURES 2-4, the channel 25 has been shown as mounted slightly spaced from the ceiling 15, and slightly spaced from the high point of door travel 22. This makes for clarity in the drawings, but it will be understood that the channel 25 may be mounted directly against the ceiling, and with the door just brushing the bottom of the channel at the high point of travel, and that this would be an installation with a minimum of head room.

Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. In an overhead garage door operator, the provision of drive mechanism including, a drive screw, means to rotate said screw, longitudinal guide means substantially parallel to said screw, a carrier, means on said carrier cooperating with said guide means to permit longitudinal movement of said carrier relative to said screw, a link connected to said carrier and adapted for connection to a door, a partial nut movably carried in said carrier and adapted to mesh with said drive screw, an operating rod loosely carried in said carrier, a cam pin connected to said operating rod, a cam follower aperture in said carrier, and a compression spring surrounding said operating rod

5

and acting between said operating rod and said partial nut, whereby said operating rod may be moved against the urging of said spring and rotated into a first position to have said cam pin engage said cam follower aperture to resiliently urge said partial nut into mesh with said drive screw, and whereby when said operating rod is rotated into a second position said spring is released to permit said partial nut to move away from said screw whereby said entire carrier may longitudinally move without connection to said drive screw.

2. In a door operator, the provision of drive mechanism including a support channel, a drive screw in said channel having an exposed arcuate segment, means to rotate said screw, longitudinal guide means in said channel, a carrier, means on said carrier riding in said guide means to permit longitudinal movement of said carrier relative to said channel, a link connected to said carrier and adapted for connection to a door, a partial nut movably carried in said carrier and adapted to mesh with said drive screw, an operating rod connected to said partial nut, a cam pin connected to said operating rod, a cam follower aperture in said carrier, and spring means acting between said operating rod and said partial nut, whereby said operating rod may be moved against the urging of said spring and rotated into a first position to have said cam pin engage the cam follower aperture to resiliently urge said partial nut against said drive screw, and whereby when said operating rod is rotated into a second position said spring is released to permit said partial nut to move away from said screw whereby said entire carrier may longitudinally move without connection to said drive screw.

3. In an overhead garage door operator, the provision of drive mechanism including a support channel, a drive screw in said channel having an exposed arcuate segment, means to rotate said screw, longitudinal guide means in said channel, a carrier, means on said carrier riding in said guide means to permit longitudinal movement of said carrier relative to said channel, a link connected to said carrier and adapted for connection to a door, a partial nut movably carried in said carrier and adapted to mesh with said drive screw, an operating rod loosely carried in said carrier, a cam pin connected to said operating rod, an abutment on said operating rod, a cam follower aperture in said carrier, and a compression spring surrounding said operating rod and acting between said abutment and said partial nut, whereby said operating rod may be moved against the urging of said spring and rotated into a first position to have said cam pin engage said cam follower aperture to resiliently urge said partial nut against

6

said drive screw, and whereby when said operating rod is rotated into a second position said spring is released to permit said partial nut to move away from said screw whereby said entire carrier may longitudinally move without connection to said drive screw.

4. In a garage door operator mechanism for a door linked to a carrier cooperating with longitudinal guide means, said door operator mechanism including, a screw disposed generally parallel to said guide means, a partial nut movably carried in said carrier and adapted to mesh with said screw, an operating rod carried in said carrier, a cam connected to said operating rod, a cam follower aperture in said carrier, and a compression spring carried by said operating rod and acting between said operating rod and said partial nut, said operating rod having first and second positions, said first position of said operating rod establishing said cam engaged in said cam follower aperture and compressing said spring a first amount to resiliently urge said partial nut into mesh with said screw, and said second position of said operating rod establishing said cam out of said cam follower aperture and with said spring compressed less than said first amount to permit disengagement between said screw and partial nut.

5. In a door operator mechanism for a door linked to a carrier cooperating with longitudinal guide means, said door operator mechanism including, a screw generally parallel to said guide means, a partial nut movably carried in said carrier and adapted to mesh with said screw, drive means to rotate one of said screw and nut, an operating rod loosely carried in said carrier, a cam pin connected to said operating rod, a cam follower aperture in said carrier, and a compression spring surrounding said operating rod and acting between said operating rod and said partial nut, said operating rod having first and second rotational positions, said first position of said operating rod establishing said cam pin engaged in said cam follower aperture and compressing said spring to resiliently urge said partial nut into mesh with said screw, and said second position of said operating rod establishing said cam pin out of said cam follower aperture and release of said spring to permit said partial nut to move away from said screw for disengagement therebetween.

References Cited in the file of this patent

UNITED STATES PATENTS

825,151	McLean	July 3, 1906
934,451	MacDonald	Sept. 21, 1909
1,024,582	Jones	Apr. 30, 1912
2,533,116	Jenkins	Dec. 5, 1950
2,883,182	Bornemann	Apr. 21, 1959