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2,441,092

DOOR OPERATING MECHANISM

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2 Sheets-Sheet 1

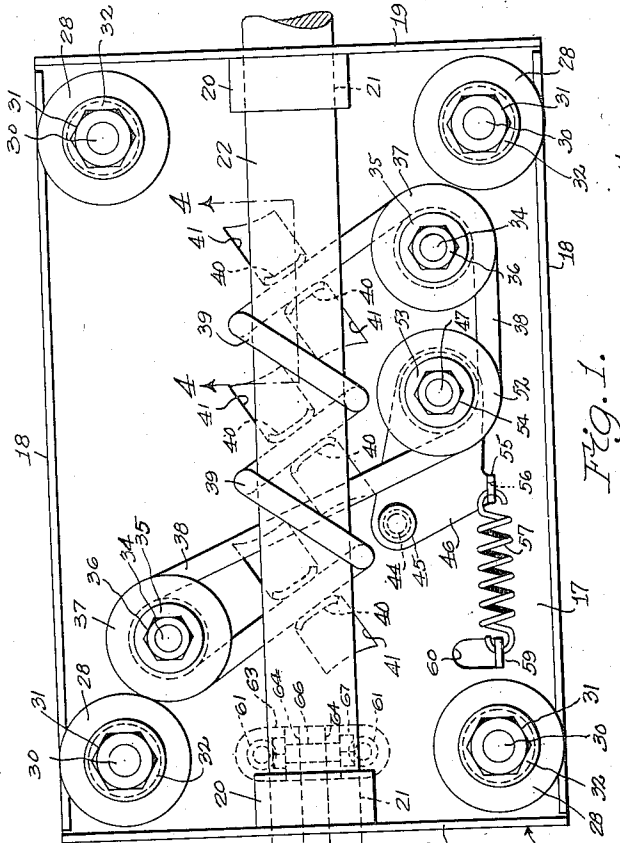


Fig. 1.

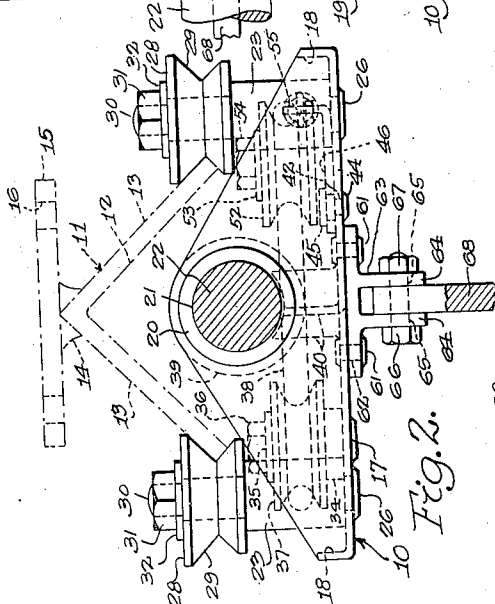


Fig. 2.

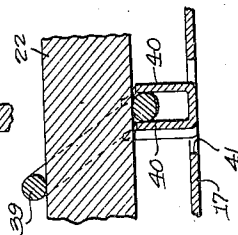


Fig. 4.

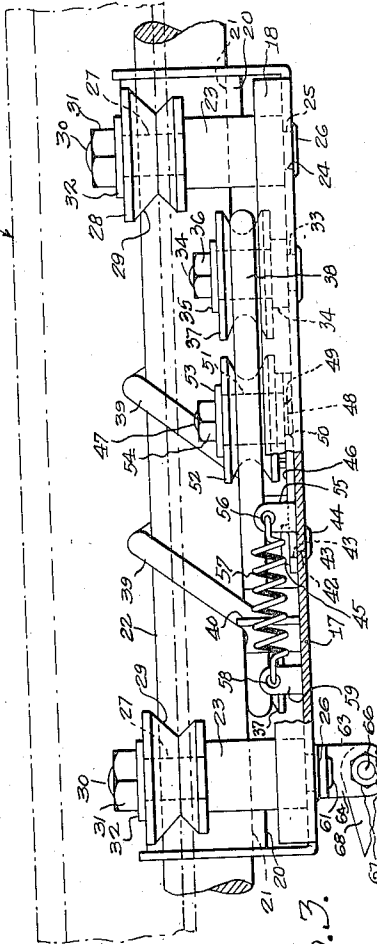


Fig. 3.

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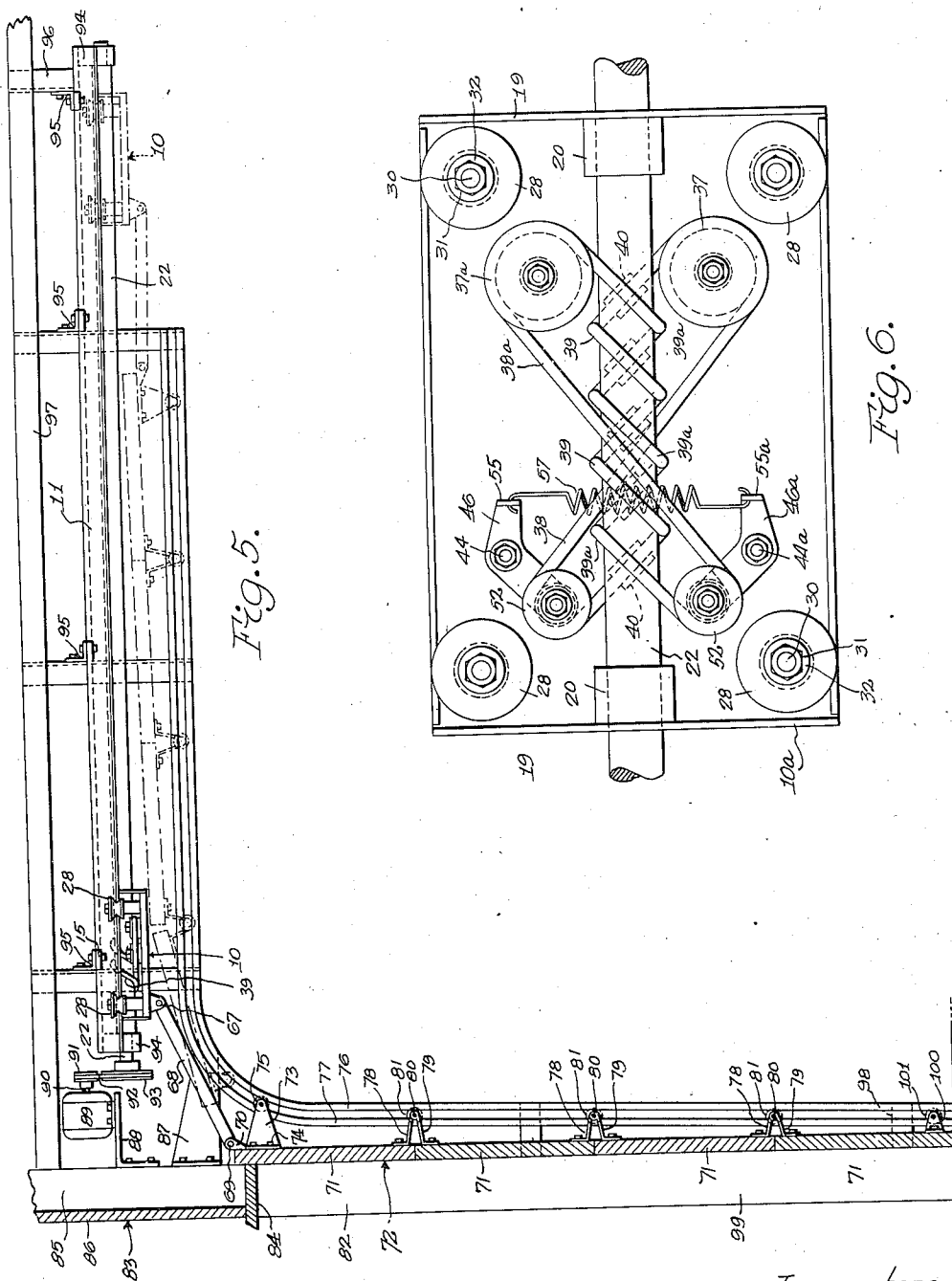
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2 Sheets-Sheet 2



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DOOR OPERATING MECHANISM

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16 Claims. (Cl. 74-25)

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This invention relates to door operating mechanisms, and in particular, to overhead door operating mechanism.

One object of this invention is to provide an overhead door operating mechanism which occupies an unusually small overhead height, thereby making it especially well-adapted for installation in buildings with low ceilings, such as garages.

Another object is to provide an overhead door operating mechanism which is relatively free from wearing parts and wherein the parts, even if worn, will continue to function without seriously impairing the efficiency of the mechanism.

Another object is to provide an overhead door operating mechanism which is free from gearing and which operates silently and smoothly.

Another object is to provide an overhead door operating mechanism wherein the principal operating parts consist of an endless belt or cable wound in a spiral path around and frictionally engaging a drum or shaft, the resulting mechanism being cheap and simple to manufacture and therefore inexpensive to sell.

Another object is to provide an overhead operating mechanism as set forth in the preceding object wherein the spirally wound belt is supported by pulleys mounted on a carriage connected to the door and traveling on a track, for example an elongated member of angle cross-section, this track providing both a support and a protecting canopy for the shaft and its associated mechanism against dust or the weather.

Another object is to provide a modified door operating mechanism wherein the principal operating elements consist of a pair of endless belts or cables wound spirally around the shaft or drum in mutually perpendicular directions.

Another object is to provide a mechanical motion operable horizontally or vertically and comprising a guiding support engaged by a carriage having pulleys carrying an endless belt or cable, a portion of which is wound spirally around an elongated drum or shaft whereby when the shaft is rotated, the carriage travels along it or when the carriage is driven lengthwise of the shaft, the latter is rotated, the guiding support meanwhile preventing the carriage from rotating with the shaft as it travels along the shaft or rotates the shaft.

Other objects and advantages of the invention will become apparent during the course of the following description of the accompanying drawings, wherein:

Figure 1 is a top plan view of an overhead door

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operating mechanism according to a preferred embodiment of the invention, with the overhead support or rail removed to disclose the parts more clearly;

5 Figure 2 is a left-hand end elevation of the overhead door operating mechanism shown in Figure 1;

Figure 3 is a side elevation of the overhead door operating mechanism shown in Figure 1, with a portion thereof broken away to disclose the construction more clearly;

10 Figure 4 is a longitudinal detailed section along the line 4-4 of Figure 1;

Figure 5 is a side elevation, partly in section, of a complete overhead door unit actuated by the overhead door operator of the present invention; and

Figure 6 is a top plan view similar to Figure 1, but showing a modification thereof having double spirally wound belts.

Referring to the drawings in detail, Figures 1 to 5 inclusive show a preferred embodiment of the overhead door operating mechanism of this invention as consisting of an operating carriage generally designated 10, traveling upon a horizontal guideway structure generally designated 11 (Figures 2 and 3), and consisting of an elongated member 12 of L-shaped or angle cross-section having sides 13 inclined equally to the vertical. These are secured as by welding at 14 to plates 15 having holes 16 whereby the guideway structure 11 may be secured to an overhead building structure or to brackets secured to such a structure. By reason of its roof-like shape, the guideway structure 11 additionally serves to cover and protect the mechanism beneath it from dust or the weather.

The operating carriage 10 has a base plate 17 with upturned sides and ends 18 and 19 respectively. The ends 19 are roughly triangular in shape (Figure 2) and carry journal bearings 20 secured thereto and having bores 21 rotationally supporting a shaft 22. Rising from the corners of the base plate 17 are uprights 23 (Figures 2 and 3) having reduced diameter portions 24 passing through bores 25 in the base plate 17 and upset or enlarged as at 26 to rigidly secure the uprights 23 to the base plate 17. The upper ends of the uprights 23 are provided with reduced diameter portions 27 rotatably supporting pulleys 28 with V-grooved peripheries 29. The upper ends of the reduced diameter portions 27 are threaded as at 30 to receive retaining nuts 31 and washers 32 for holding the pulleys 28 in position upon the uprights 23. In practice, thrust bearings would

preferably be employed in cooperation with the washer 32 in order to sustain the axial load arising from the weight of the operator 10, but these obvious mechanical details have been omitted for simplicity of showing.

Mounted in apertures 33 at opposite corners of the base plate 17 are two stub shafts 34, the lower ends of which are upset to secure them rigidly to the base plate 17. The stub shafts 34 carry washers 35 and nuts 36 to retain grooved pulleys 37 mounted on the shafts 34 (Figure 3). Carried by the grooved pulleys 37 is an endless belt 38, the coils 39 of which spirally encircle the shaft 22 and are guided therein by parallel guides 40 (Figure 1), struck up from apertures 41 in the base plate 17, between which guides the spiral coils 39, of the endless belt 38 pass.

Likewise mounted in an aperture 42 in the base plate 17 (Figure 3) and enlarged as at 43 to secure it thereto is a pivot pin 44 having an enlarged head 45 and carrying a swinging bracket 46 of roughly triangular form. The second corner of the bracket 46 carries a stub shaft 47 having its lower reduced diameter portion 48 passing through an aperture 49 in the bracket 46 and upset at 50 to secure it thereto. The upper end of the stub shaft 47 carries a reduced diameter portion 51 upon which is mounted a grooved take-up pulley 52 similar to the grooved pulleys 37 and similarly held in position by a washer 53 and retaining nut 54 threaded upon the upper end of the stub shaft 47. The third corner of the bracket 46 is provided with an upturned ear 55 having a hole 56 (Figure 3) serving as an anchorage for one end of a coil spring 57, the opposite end of which is anchored in a hole 58 in an ear 59 struck up from the base plate 17 (Figure 1) and leaving an aperture 60, therein.

Secured by the fasteners 61 to apertures 62 in one end of the base plate 17 and depending therefrom (Figure 2) is a bracket 63 having bifurcated arms 64 forming a yoke and having transverse bores 65 for the reception of a pivot bolt 66 held in position by a retaining nut 67. Pivotaly mounted upon the pivot bolt 66 between the arms 64 is an operating link or connecting rod 68. The opposite end of the link 68 is pivotally connected as at 69 (Figure 5) to an ear 70 secured to the upper panel 71 of an overhead door generally designated 72. The upper panel 71 adjacent the ear 70 carries a bracket 73 secured thereto by the fasteners 74 and carrying on its outer end a pulley 75 engaging the tracks 76 and 77. The remaining panels 71 of the door 72 have arms 78 and 79 bolted thereto and pivotally engaging at their outer ends pivot pins 80 forming axles for pulleys 81. The door 72 is arranged in its lower position to close a door opening 82 (Figure 5) in a building, generally designated 83, and having a lintel 84 secured to the upright frame members 85, the latter of which also carries the upper front wall 86 of the building 83.

Bolted to the upright frame members 85 are brackets 87, the outer ends of which support the tracks 77 at the point where their vertical and horizontal portions join. Also bolted to the uprights 83 is an angle bracket 88 to which is bolted a motor 89 having a shaft 90 carrying a drive pulley 91 driving a belt 92 which encircles a pulley 93, the hub of which is drivingly secured to one end of the shaft 22. The shaft 22 is rotatably supported at its opposite ends in bearing brackets or shaft hangers 94 secured to the opposite ends of the rail structure 11. The rail structure 11 is in turn supported by the plates 75

15 which are bolted to angle members 95 (Figure 5), these in turn being bolted to uprights 96 depending from and secured at their upper ends to the stringers 97. The lower ends of the uprights 95 are connected to and support the tracks 76 and 77 in which the pulleys 75 and 81 travel. It will be understood that tracks 76 and 77 are provided at opposite sides of the door opening 82, one side only being shown in Figure 5. The lower ends of the guide tracks 76 and 77 are connected to and supported by a horizontal frame member 98 secured to the upright frame member 99 forming one of the sides of the door opening 82. The lowermost door panel 71 is provided with a bracket 100 bolted thereto in a manner similar to the bracket 73 and similarly carrying a pulley 101 engaging the tracks 76 and 77.

The modification shown in Figure 6 is generally similar to the principal form of the invention shown in Figures 1 to 5 inclusive, and similar parts are similarly designated. The door operator 10a of the modification shown in Figure 6, however, is provided with a second belt and associated mechanism similar to that of the first belt 38, hence is designated similarly to the first belt 38 by numerals to which are appended the suffix *a*. The second belt 38a encircles the shaft 22 in a manner similar to that of the first belt 38, namely, in spiral coils 39a alternating with the spiral coils 39 of the first belt 38. The two belts 38 and 38a are similarly supported at one end by pulleys 37 and 37a. At their opposite ends, however, they are directly supported by the take-up pulleys 52 and 52a similarly mounted upon brackets 46 and 46a on pivot members 44 and 44a and having similar upturned ears 55 and 55a. The latter, however, are interconnected by the opposite ends of a single coil spring 57 although obviously individual coil springs could be employed, as at 57 in Figure 1. The brackets 46 and 46a in Figure 6 are of slightly different outline from the bracket 46 in Figure 1, but operate upon the same principle for the same purpose, namely, taking up the slack in the belts 38 and 38a and tensioning these belts.

Operation of the invention

In the operation of the invention, it will be assumed that the overhead door 72 is in its vertical position shown in Figure 5, closing the door opening 82. The motor 89 is energized from a suitable source of electric current (not shown) rotating the pulleys 91 and 93 and causing the shaft 22 to rotate. The frictional engagement of the spiral coils 39 of the belt 38 around the shaft 22 causes the rotation of the shaft 22 to be translated into an endless travel of the belt 38 around its pulleys 37 and 52, guided by the parallel guides 40 on the base plate 17.

As the shaft 22 rotates, the spiral coils 39 advance longitudinally in a spiral path along the shaft 22, effecting a linear motion of the door operator 10 which thereby serves as a carriage traveling upon and suspended from the guide rail structure 11. As the door operator 10 travels rearwardly along the guide rail structure 11 (Figure 5), its linear motion is transmitted to the upper panel 71 of the door 72 through the connecting rod 68. This action raises the door 72 and causes the pulleys 75, 81 and 101 to roll along and between the tracks 76 and 77, the arms 78 and 79 pivoting away from each other slightly as the bends in the tracks 76 and 77 are traversed. When all panels 71 of the door 72 have passed

over the path from the vertical portions of the tracks 76 and 77 to the overhead horizontal portions thereof, the door operator 10 encounters a limit switch (not shown) or other conventional means of halting the drive to the shaft 22, such as de-energizing the motor 81 and terminating the travel of the overhead door 72 in its raised position shown by the chain lines in Figure 5.

To lower the door 72, a conventional reversing switch (not shown) is employed to reverse the direction of rotation of the motor 89, thereby reversing the direction of rotation of the shaft 22 and causing the door operator 10 to move along the guide rail structure 11 from the chain line position (Figure 5) to the solid line position thereof. This motion is transmitted to the door 72 through the connecting rod 68, lowering the door 72 into a vertical position where it closes the door opening 82. When the door reaches this position, either the door or the door operator 10 or mechanism connected thereto operates a second limit switch in a conventional manner (not shown) to halt the rotation of the motor 89 and shaft 22. The electrical circuit and limit switches for energizing and controlling the motor 89 are conventional and well-known to those skilled in the art and their details form no part of the present invention.

The operation of the modified form shown in Figure 6 is similar to that just described in connection with the form of the invention shown in Figures 1 to 5 inclusive and accomplishes a similar result. Due to the fact that two belts 38 and 38a spirally encircle the shaft 22, approximately twice the gripping effect is created and hence the door operator 10a of Figure 6 is much more powerful than the single belt door operator 10 of Figures 1 to 5 inclusive. Consequently, the double belt door operator 10a may be used to raise heavier doors 72 or may be employed in climates where extremes of cold and dust or sand form ice or dirt which increase the load upon the mechanism. The more powerful door operator 10a of Figure 6, however, occupies almost the same space as the single belt door operator 10 of Figures 1 to 5 inclusive, hence may be mounted in buildings having similar restricted space overhead. In either of the door operating mechanisms of this invention, it will be seen that so little space is required for mounting the door operators 10 or 10a that the height of the building may be reduced below that normally required, thereby resulting in economy of construction of the building 83 as well as in the economy of manufacture of the door operators themselves, due to their simplicity of construction.

While I have shown and described my invention in detail, it is to be understood that the same is to be limited only by the appended claims, for many changes may be made without departing from the spirit and scope of my invention.

What I claim is:

1. A door operating device for buildings comprising an elongated guideway structure attachable to the building, a carriage movable along said guideway structure, a shaft mounted co-directionally with said guideway structure, means for rotating said shaft, an endless belt having portions thereof spirally encircling said shaft, and means on said carriage for supporting said belt.

2. A door operating device for buildings comprising an elongated guideway structure attachable to the building, a carriage movable along said guideway structure, a shaft mounted co-directionally with said guideway structure, means for rotating said shaft, an endless belt having

portions thereof spirally encircling said shaft, and a plurality of pulleys mounted on said carriage on opposite sides of said shaft for supporting said belt.

3. A door operating device for buildings comprising an elongated guideway structure attachable to the building, a carriage movable along said guideway structure, a shaft mounted co-directionally with said guideway structure, means for rotating said shaft, an endless belt having portions thereof spirally encircling said shaft, means on said carriage for supporting said belt, and means on said carriage for guiding said belt into spiral engagement with said shaft.

4. A door operating device for buildings comprising an elongated guideway structure attachable to the building, a carriage movable along said guideway structure, a shaft mounted co-directionally with said guideway structure, means for rotating said shaft, an endless belt having portions thereof spirally encircling said shaft, means on said carriage for supporting said belt, and means on said carriage adjacent said spiral belt portions for guiding said belt into spiral engagement with said shaft.

5. A door operating device for buildings comprising an elongated guideway structure attachable to the building, a carriage movable along said guideway structure, a shaft mounted co-directionally with said guideway structure, means for rotating said shaft, an endless belt having portions thereof spirally encircling said shaft, a plurality of pulleys mounted on said carriage on opposite sides of said shaft for supporting said belt, and means on said carriage for guiding said belt into spiral engagement with said shaft.

6. A door operating device for buildings comprising an elongated guideway structure attachable to the building, a carriage movable along said guideway structure, a shaft mounted co-directionally with said guideway structure, means for rotating said shaft, an endless belt having portions thereof spirally encircling said shaft, a plurality of pulleys mounted on said carriage on opposite sides of said shaft for supporting said belt, and means on said carriage adjacent said spiral belt portions for guiding said belt into spiral engagement with said shaft.

7. A door operating device for buildings comprising an elongated guideway structure attachable to the building, a carriage movable along said guideway structure, a shaft mounted co-directionally with said guideway structure, means for rotating said shaft, an endless belt having portions thereof spirally encircling said shaft, a plurality of pulleys mounted on said carriage on opposite sides of said shaft for supporting said belt, and guides on said carriage engaging the opposite sides of said belt adjacent said spiral belt portions on said shaft.

8. A door operating device for buildings comprising an elongated guideway structure attachable to the building, a carriage movable along said guideway structure, a shaft mounted co-directionally with said guideway structure, means for rotating said shaft, an endless belt having portions thereof spirally encircling said shaft, means on said carriage for supporting said belt, and yieldingly urged means on said carriage for tightening said belt.

9. A door operating device for buildings comprising an elongated guideway structure attachable to the building, a carriage movable along said guideway structure, a shaft mounted co-directionally with said guideway structure, means

for rotating said shaft, an endless belt having portions thereof spirally encircling said shaft; a plurality of pulleys mounted on said carriage on opposite sides of said shaft for supporting said belt, and means for yieldingly urging one of said pulleys into tightening engagement with said belt.

10. A door operating device for buildings comprising an elongated guideway structure attachable to the building, a carriage movable along said guideway structure, a shaft mounted co-directionally with said guideway structure, means for rotating said shaft, a pair of endless belts having portions thereof spirally encircling said shaft, and means on said carriage for supporting said belts.

11. A door operating device for buildings comprising an elongated guideway structure attachable to the building, a carriage movable along said guideway structure, a shaft mounted co-directionally with said guideway structure, means for rotating said shaft, a pair of endless belts having portions thereof spirally encircling said shaft in alternate convolutions respectively, and means on said carriage for supporting said belts.

12. A door operating device for buildings comprising an elongated guideway structure attachable to the building, a carriage movable along said guideway structure, a shaft mounted co-directionally with said guideway structure, means for rotating said shaft, a pair of endless belts having portions thereof spirally encircling said shaft in alternate convolutions respectively directed toward said shaft from opposite sides thereof, and means on said carriage for supporting said belts.

13. A door operating device for buildings comprising an elongated guideway structure attachable to the building, a carriage movable along said guideway structure, a shaft mounted co-directionally with said guideway structure, means for rotating said shaft, a pair of endless belts

having portions thereof spirally encircling said shaft in alternate convolutions respectively, means on said carriage for supporting said belts, and yieldingly urged means on said carriage for tightening said belts.

14. A mechanical motion comprising a shaft, a carriage adjacent said shaft, an endless belt mounted on said carriage and having a portion thereof spirally encircling said shaft, means on said carriage for supporting said belt, and means for preventing rotation of said carriage with said shaft while traveling therealong.

15. A mechanical motion comprising a shaft, a carriage adjacent said shaft, an endless belt mounted on said carriage and having a portion thereof spirally encircling said shaft, pulleys on said carriage for supporting said belt, and means for preventing rotation of said carriage with said shaft while traveling therealong.

16. A mechanical motion comprising a shaft, a carriage adjacent said shaft, pulleys mounted on said carriage, a pair of endless belts mounted on said pulleys having portions spirally encircling said shaft in alternate convolutions respectively directed toward said shaft from opposite sides thereof, and means for preventing rotation of said carriage with said shaft while traveling therealong.

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