March 28, 1967 R. F. STANSBERRY 3,311,159

GARAGE DOOR HARDWARE

Filed Dec. 7, 1964 3 Sheets-Sheet 1

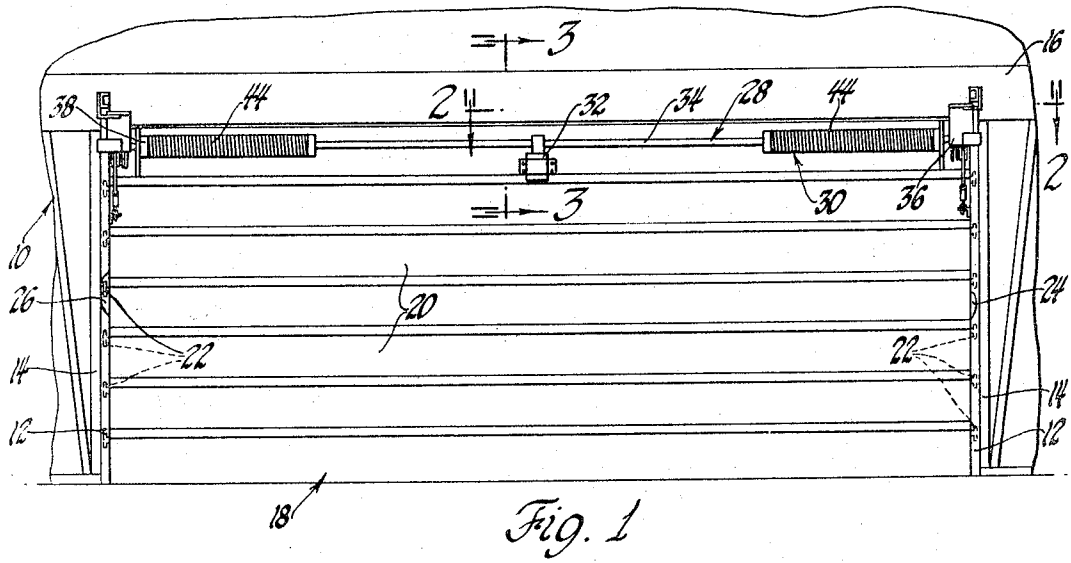

Fig. 1

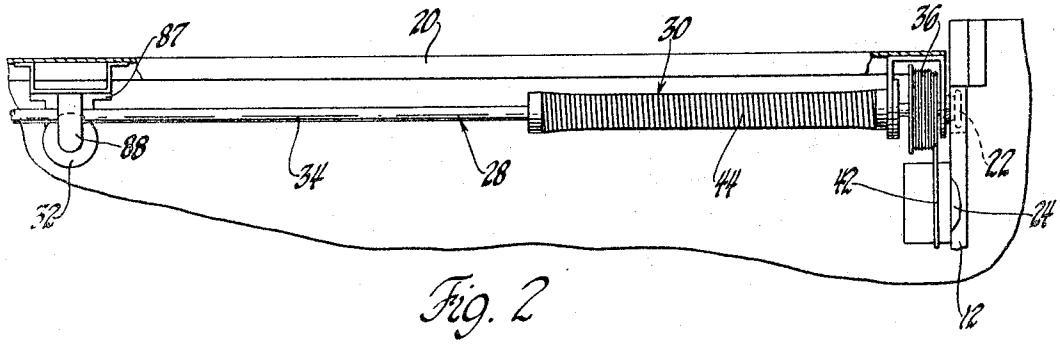

Fig. 2

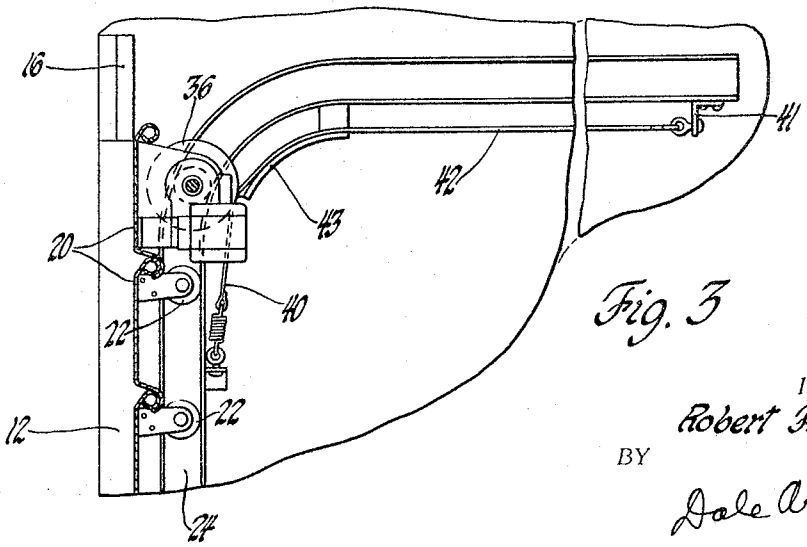

Fig. 3

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GARAGE DOOR HARDWARE

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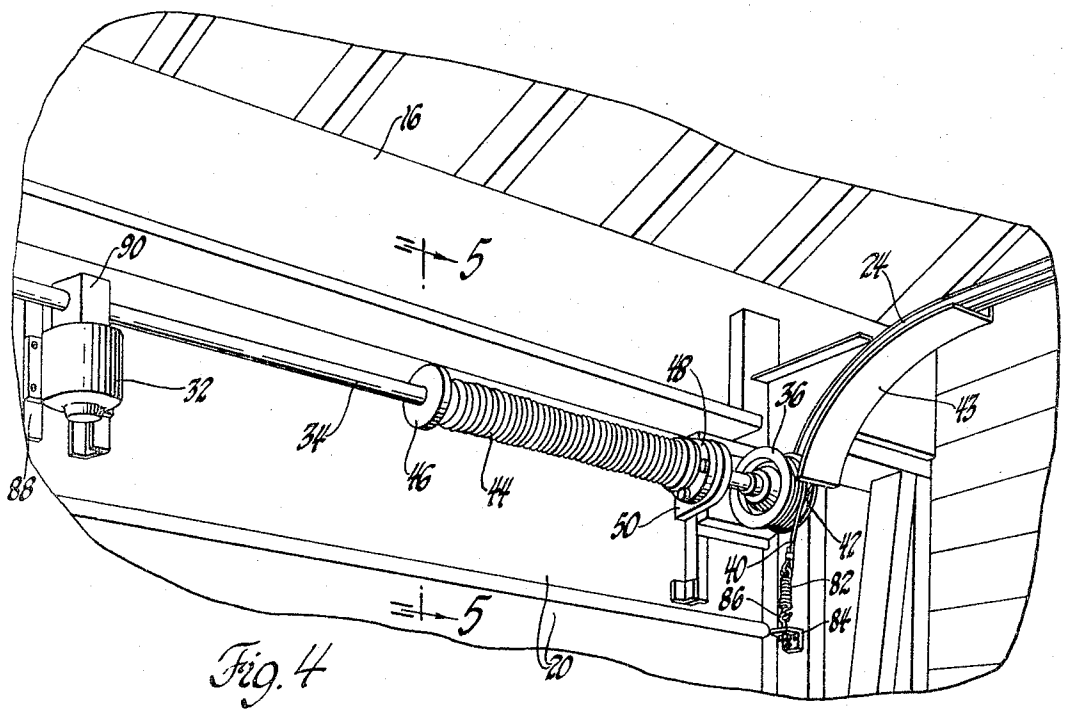

Fig. 4

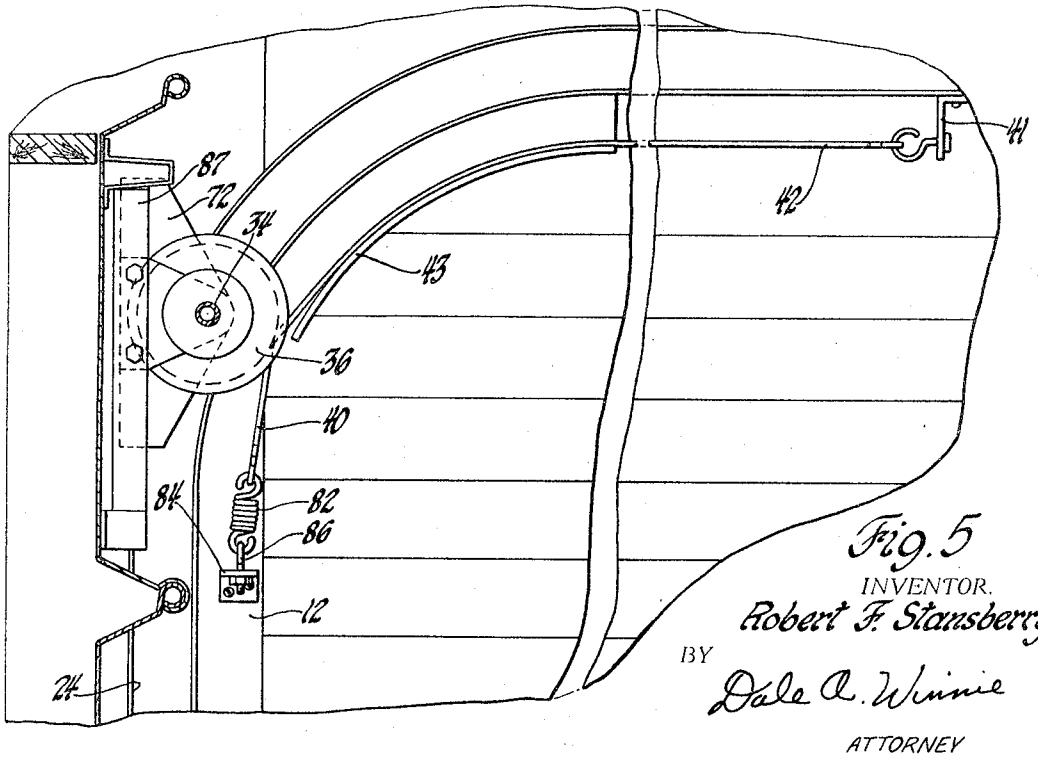

Fig. 5

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GARAGE DOOR HARDWARE

Filed Dec. 7, 1964 3 Sheets-Sheet 3

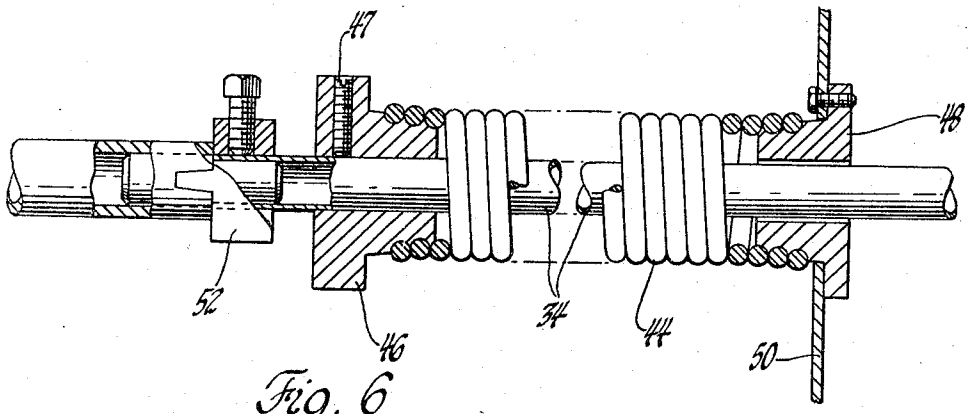

Fig. 6

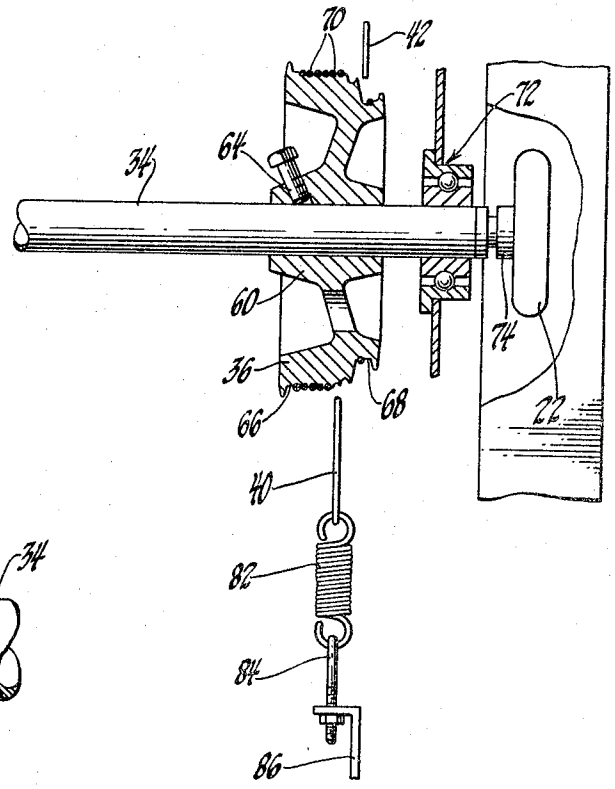

Fig. 7

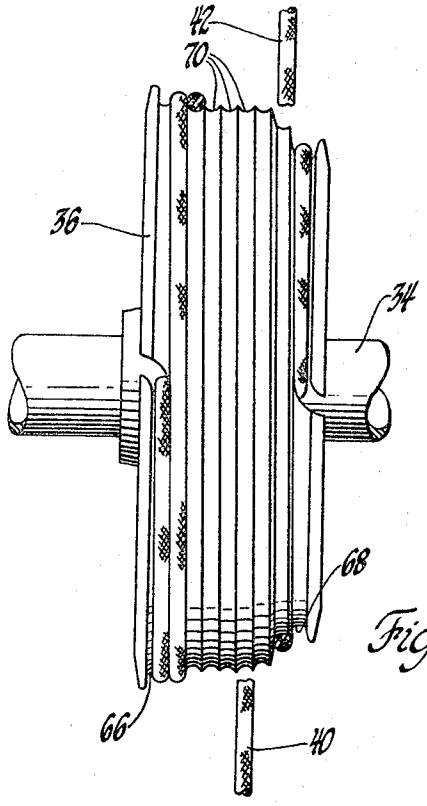

Fig. 8

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United States Patent Office 3,311,159 Patented Mar. 28, 1967

3,311,159

GARAGE DOOR HARDWARE

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Filed Dec. 7, 1964, Ser. No. 416,579
6 Claims. (Cl. 160—189)

This invention relates to garage door hardware, in general, and more particularly to door hardware which may be provided directly on a door and is useful in counterbalancing the weight of the door so that it is easier to operate, either manually or under power.

Overhead opening garage doors are heavy and their excessive weight has to be counterbalanced before they can be manually or otherwise operated with any ease or safety. Usually, this requires door hardware which is securely anchored and is disposed apart from the door itself but which is engaged to the door to serve its intended purpose. For example, overhead sectional garage doors frequently use an overhead mounted extension spring which is engaged to the door so that it is stretched and tensioned as the door is closed to counterbalance the weight of the door in closing. This type of arrangement also provides a source of stored energy, in the extended spring, to help lift the door later on.

One problem with this kind of door hardware is that it takes care and time to install. Almost everything has to be assembled and adjusted at the same time that the door is being installed. It would be most advantageous and would make for a much easier and simpler installation if the means of counterbalancing the weight of the door could be preassembled and provided directly on the door itself.

The same thing applies as far as power operated garage doors are concerned. They also need means to counterbalance the weight of the door and, in fact, the more of the weight of the door that is counterbalanced the less will be the strain and effort on the power driven mechanism itself. If the counterbalancing means can be provided on the door and be preassembled and adjusted, it will make the installation of power operated doors easier and also somewhat less expensive.

Power operated garage doors are normally significantly more expensive than manually operated doors because of the need for separate and distinct drive train hardware. Aside from the electric drive motor and providing a source of power at the door, a whole new and different drive mechanism is usually required to move the door between its open and closed positions. No satisfactory means has been devised to make use of the guide track means or the counterbalancing mechanism for the doors to also accommodate some drive power apparatus. The same hardware is used to guide and counterbalance the door but additional hardware is added when it is desired to operate the door automatically and/or by power.

In passing, it is also worth noting that power operated doors may require considerably more head room over and above that required for manual door operation. Frequently, automatic garage door operators require that the drive motor and its associated drive mechanism be mounted over and above the normal path of the door. Where adequate space is not available considerable expense may be involved before the installation is completed.

The present invention seeks to avoid many of the problems mentioned as regards both manual and power operated overhead opening garage and other door structures.

It is an object of this invention to provide a self-contained overhead opening door with hardware which can be preassembled, adjusted and tested in the course of manufacture, or after, but before actual installation.

It is an object of this invention to provide door operating hardware as a part of the door structure itself.

It is an object of this invention to teach a door operating mechanism which may be manually operated or may be simply and inexpensively converted to a power operated mechanism without undue cost of material or labor.

With respect to having a power operated door mechanism, it is proposed to provide a structure which makes use of the same door hardware as for manual operation and simply adds an electric motor and appropriate control means.

It is an object of this invention to teach mounting the manual and/or power operating mechanism for the garage door on the door itself, for travel with it, and to do so in a manner which requires no additional head room and enables the garage door to be mounted as close to the garage ceiling as is practical.

To be more specific, it is an object of this invention to provide an overhead opening garage door, of the sectioned and articulated type, with hardware which is mounted near the top of the door, and actually right on the door, to move with it. This hardware includes a shaft, which may be power driven or not, and has torsion spring means wound thereon and adapted to bias the shaft for rotation. Cable drums on the ends of the shaft have cable means wound on them and the cables have their terminal ends attached to fixed means at the ends of the door travel.

The torsion spring biases the shaft to turn the cable drums and wind the cables up on the drums and thereby lift the door; or, more properly, to compensate in large part for the massive weight of the door and enable it to be manually operated or power driven much easier than before.

The use of the torsion spring on the cable drum shafts, the mounting of the installation right on a panel of the garage door, certain unique features of the cable drums, means for compensating for changing lengths in the cables operating the door, the drive motor assembly, and several other features contribute to the uniqueness and novelty of the structure proposed and to the advantages gained in the practice of the invention.

Numerous other objects and advantages to be gained in the practice of this invention will be better understood and appreciated upon a reading of the following specification in regard to a preferred embodiment of the invention and having reference to the accompanying drawings wherein:

FIGURE 1 is an elevational view of the inside of a garage door installation incorporating the features of this invention in one suggested combination.

FIGURE 2 is an enlarged and fragmentary view of a part of the garage door installation shown in the first drawing figure with the garage door in an open and overhead stored rather than closed position.

FIGURE 3 is a cross-sectional view of the garage door installation of the first two drawing figures, taken at the left of the drive motor in FIGURE 1, and looking towards it, with the door shown between its fully open and closed positions.

FIGURE 4 is a perspective view of a fragmentary part of the overhead opening garage door installation of this invention and of the garage in which installed.

FIGURE 5 is a cross-sectional view, slightly enlarged, of the installation shown by FIGURE 4, as seen in the plane of line 5—5 therein and looking in the direction of the arrows.

FIGURE 6 is an enlarged and cross-sectioned detail of a part of the assembly of this invention; namely of the torsion spring means.

FIGURE 7 is a cross-sectional view of one of the cable drums of the operating mechanism of this invention substantially in the scale of FIGURE 6.

FIGURE 8 is an enlarged elevational view of the cable drum of the last figure with the cables broken away in part.

The first drawing figure shows the front of a garage **10**, from the inside, and framing supports **12** and **14** on each side of the door opening with the header or cross beam **16** extending thereover. An overhead opening sectional door **18** closes the garage door opening and includes a plurality of panels **20** which extend the full width of the garage door opening and are hinged together at their upper and lower edges. The garage door **18** is provided with a plurality of rollers **22** along its opposite side edges and the rollers are engaged in guide tracks **24** and **26** which extend up along the side edges of the garage door opening and then back behind the opening at substantially the height thereof, or a little higher.

The guide tracks **24** and **26** are usually supported by hangers from the rafters or ceiling of the garage but the means of support isn't specifically shown in this instance since it forms no part of the present invention.

The device or means which enables operating the garage door **18** with ease, despite its excessive weight, is provided on the top panel **20** of the door and is designated **28**. It includes a mechanism **30** to counterbalance the weight of the door and a gear motor **32** for operating the door by power, if desired.

The counterbalancing mechanism **30** includes a shaft **34** which is mounted on the uppermost door panel **20** and is journaled for axial rotation. A pair of cable drums **36** and **38** are provided on opposite ends of the shaft **34**. Each of the drums include a first cable or cable end **40**, which has one end connected to the door frame and the other end wrapped on the cable drum, and a second cable or cable end **42** which is wrapped on the drums and has the other end connected to suitable bracket means **41** provided near the back of the guidetracks **24** and **26**.

The cables **40** and **42** may be distinct and separate or they may be cable ends of a single cable wrapped on the respective drums. They may be regarded in either respect in the discussion which follows.

When the garage door **18** is closed the cables **40** are wound on the drums **36** and **38** and the cables **42** are laid out over a radiused cable guide **43**, and toward the end of the guide tracks. When the garage door is open, the cables **42** are wound on the cable drums and the cables **40** are unwound and laid out. In other words, as one of the cables is wound up on the cable drum the other is unwound from it. This is accomplished without having the different cable ends overlapping, or wound up on each other, in a manner which will later be described.

A torsion spring **44** is provided on the shaft **34** near each end. Although one spring might be used, two are preferred since they split the reactive force towards each end of the door panel on which the shaft is mounted. Also, otherwise the torque force is concentrated at one point and the spring load has to be transmitted through the gear motor shaft to get to the other side. Another reason for using two springs, one on each side, is that lighter and smaller tubing may be used from the motor out to the springs since the motor torque will be considerably less than the spring torque.

One of the torsion springs **44** is shown by FIGURE 6. It has one end engaged to a winding cone **46** which is fixed to the cable drum shaft **34**, as by set screw means **47**. The other end of the spring is engaged to the door panel **20** by means of a stationary cone **48** which is part of the bracket **50** that is engaged in turn to the panel itself.

The torsion springs **44** are used to counterbalance the weight of the garage door **18** by being preloaded or tensioned by being wound tight on the shaft **34** so that

when the door is closed they exert a biasing or torsional effort through the shaft **34** trying to rotate the cable drums **36** and **38** and to lift the garage door **18** by winding the cable ends **42** up on the cable drums.

When the garage door **18** is fully open the springs are essentially unwound and when the door is being closed the torsion springs **44** are wound up progressively more and more as more and more of the weight of the garage door comes into the vertical plane of the garage door opening. Thus, the springs build up a resistant force to balance the weight of the garage door in direct proportion to the weight to be supported.

The torsion springs **44** on shaft **34** offer a truly proportionate means of counterbalancing the weight of the garage door as well as a simple system for doing so.

FIGURE 6 shows that the shaft **34** extends through the stationary cone **48** and door panel bracket **50** previously mentioned. It also shows a quick disconnect coupling **52** in the shaft line which enables the ends of the shaft to be free so they can turn independently of the rest for easier assembly but which is otherwise fixed for torque transmission therethrough.

FIGURE 7 shows the cable drum **36**, which is identical to the other cable drum **38** except that one is right wound and the other is left wound. Each has a hub **60** which is received on the shaft **34** and has the shaft extended therethrough and held as by set screw means **64**. The cable drum includes a recessed peripheral surface **66** on which the cables **40** and **42** are respectively wound. One end of the cable drum surface is of smaller diameter than the rest, as at **68**, for reasons later described and the drum surface is also formed to include a helix groove **70** so that the different turns of the cables **40** and **42** can be laid out neatly and separately on the drum and they won't overlap each other.

A bearing support assembly **72** is provided at the door panel edge and receives the end of shaft **34** therethrough. The stub shaft **74** of one of the standard door rollers **22** is received in turn in the open end thereof.

FIGURES 4, 5, and 7 each show that the end of the cable **40**, which is engaged to the door frame, is actually engaged to a spring **82** and in turn to an eye bolt **84** which is engaged to a bracket **86** and therefore able to be extended in length or contracted for reasons which will be more fully described shortly.

These same figures also show that the cable passes over a simple radiused guide **43** which assures a proper course and guided tension in the control cables.

FIGURE 8 shows the cable drum **36** with the cable **42** wound up on it and the other cable **40** played almost all the way out. It will be noted that as one cable or cable end is unwound from a drum the other cable or cable end is wound up on the drum so that essentially the same number of turns are always on each of the cable drums.

Although the gear motor **32** is not a necessary part of the operating mechanism **30** and is provided only to operate the door **18** under power, the simplicity with which it is incorporated into the structure makes it an important part of the present invention.

FIGURE 4 shows that the gear motor **32** is mounted at the center of the upper door panel **20** on a support **88** and includes a gear box **90** which has the output shaft thereof connected directly to the shaft **34**. As the shaft is driven the cable drums **36** and **38** turn with the shaft, the cables **42** are wound up on the drums and the door **18** is caused to be opened.

The gear motor **32** is preferably a torque responsive reversible motor so that any interference with operation of the door, particularly in closing it, will cause the motor to stop or to reverse and operate the door in the opposite direction.

In both the manual and the power operated door arrangements the full weight of the operating mechanism **28** is carried by the door **18**. As a consequence, the weight which must be lifted with the door initially is pro-

portionately greater than the weight that has to be lifted after the operating mechanism is supported on the overhead tracks and only has to be moved from the front of the garage to near the back of the tracks.

Although a large heavy duty motor might take care of the uneven or irregular load in the power operated installation, this offers no solution for the manual door arrangement.

Another factor is that when the top panel of the door **18** turns the bend, in closing, it has the effect of rotating the stationary spring cones **48** a quarter turn each and an appreciable torque loss results. This load has to be recovered somehow in the system.

The solution offered by the present invention is to use the torque springs **44** to provide a greater turning effort on the cable drums **36** and **38** at the outset so that a greater lift force is transmitted to the cables **42** when the garage door **18** is being first raised up and, similarly, to have it provide a greater resistance just as the door is being closed. To accomplish this, the cable drums **36** and **38** are formed at the ends **68**, previously identified, to have a smaller diameter so that the torque transmitting radius arm is smaller and a greater lift force will be imposed on the door operating cable **42** in its initial effort to raise the door and, likewise, it is able to resist or hold a greater load as the door is being closed.

Simply stated, the torque force transmitted by the springs **44** to the door operating cables wound on the cable drums is made greater by reducing the diameter of the cable drums.

Just as less of cable **42** is required to wrap the smaller diameter **68** of the cable drums, it follows that comparatively more of cable **40** is needed and that some means of extending and contracting the length of the cable are needed. The extension spring **82** serves both this purpose and the notable purpose of assisting the torsion spring torque and supplementing the system with a load comparable to that lost when the stationary spring cones **48** turn the bend as aforementioned.

From the foregoing, it will be appreciated that the garage door **18** can be built with the whole operating mechanism provided on one panel and that the torsion spring might be pre-wound and held with a lock pin. Alternatively, the door can be raised on the tracks and moved to the overhead position from whence, figuratively speaking, the cables **40** and **42** could be attached as required and when the door is closed the spring **44** will be wound-up and effectively placed in service. Perhaps more realistic, but no less advantageous, is the ability to turn-up the spring **44** to any desired torque in the course of installation.

A garage door installation which includes the operating mechanism of this invention may be provided without any appreciable overhead space or head room for the counterbalancing mechanism since it travels with the door.

No separate or complicated drive system is necessary to motorize a garage door including the basic counterbalancing means by this invention. About all that is required is a source of power, an electric motor and a speed reducer, or a gear motor, and suitable control circuitry of power. There is no installation cost to mention and no extensive revision of the system required.

Both the counterbalanced garage door operating mechanism of this invention and the power operated and counterbalanced door operating mechanism may be provided on almost any overhead type garage door, and be all assembled, tested, and ready for use practically as soon as the door is hung. All that is required of the builder in choosing the power operated system over the manual is providing for electrical power. The installation for one or the other is in all other respects essentially the same. This makes it possible to provide a motorized garage door much more economically than has heretofore been possible.

Although a preferred form and embodiment of this invention has been specifically shown and described in detail, it will be appreciated that this has been done to illustrate the scope of the present invention and without intent to unnecessarily limit the invention in any regard. Such improvements, modifications and alterations as come to mind and are within the spirit of this invention, and are not specifically excluded by the language of the hereinafter appended claim, are to be considered as inclusive herewithin.

1 claim:

1. An overhead opening garage door, comprising sectional garage door forming panels hinged together and having roller means providing at opposite side edges thereof,

guide tracks for receiving the door panel roller means in guided engagement therewith and the door panels therebetween,

said tracks disposed vertically beside and horizontally over and rearwardly of a garage door opening,

shaft means rotatably mounted on the uppermost of the garage door forming panels, on the inside thereof, and extending between the side edges of the panel,

a cable drum provided on one end of the shaft means and having cable means wound thereon,

said cable means having the opposite ends thereof extended in close following relation and secured at fixed locations relative to the guide tracks and the extremes of travel of the panel for the winding and unwinding thereof alternately on said drum in the opening and closing of the garage door,

torsion spring means provided concentrically on the cable drum supporting shaft means and having one end engaged to the shaft supporting door panel and the other end engaged to the shaft, said torsion spring means being operative for biasing said cable drum to wind said cable means thereon in the opening of the garage door and to resist the unwinding thereof in the closing of the door for counterbalancing the weight of the garage door at least in part,

said cable drum having a cable receptive helix groove provided therearound for receiving and spacing the turns of the cable means wound thereon,

and having a smaller cable receptive circumference at the ends thereof wound first in the opening of the garage door and last in its closing for imposing greater torsional biasing via the torsion spring to compensate for the unbalanced weight of the uppermost end of the door.

2. The overhead garage door of claim **1**, including: cable tensioning means operatively connected to said cable means for compensating for the cable length difference occassioned by the smaller circumference at one end of said cable drum when wound and supplementing said torsion spring biasing force.

3. The overhead garage door of claim **2**, including; an overload responsive reversible motor operatively connected to the shaft means for driving the cable drums and provided on the uppermost garage door forming panel for travel therewith.

4. An overhead opening garage door, comprising:

sectional panels hinged together along top and bottom edges and including guide track means receptive of the ends thereof and extending vertically beside and rearwardly over the opening to be closed thereby,

cable drum means provided on one of said panels and cable means provided along the rearwardly extending section of said guide track means and having turns wound on said cable drum means,

torsion spring means provided on one of said panels and engaged to said cable drum means for counterbalancing the weight of said sectional panels at least in part,

and means operatively engaged with said torsion spring means for winding said spring proportionally tighter

as the weight carrying panels are vertically disposed and relieving the added tension imposed thereon as the panels are horizontally disposed and carried on said guide tracks.

5. The overhead opening garage door of claim 4, said last mentioned means including a smaller cable receptive circumference on said cable drum at the end thereof receptive of said cable means when the panels including said drum and spring means are vertically disposed for tighter winding of the torsion spring means engaging said drum.

6. The overhead opening garage door of claim 5, and tensioned means provided in said cable means and acting on said cable drum means through the turns wound on the smaller circumference thereof for added torsional resistance in the panel closing movement thereof and assistance in the opening movement thereof.

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