Nov. 21, 1967 R. CASTONGUAY 3,353,299

OVERHEAD DOOR AND OPERATING MEANS THEREFOR

Filed Aug. 11, 1965 3 Sheets-Sheet 1

FIG. 1

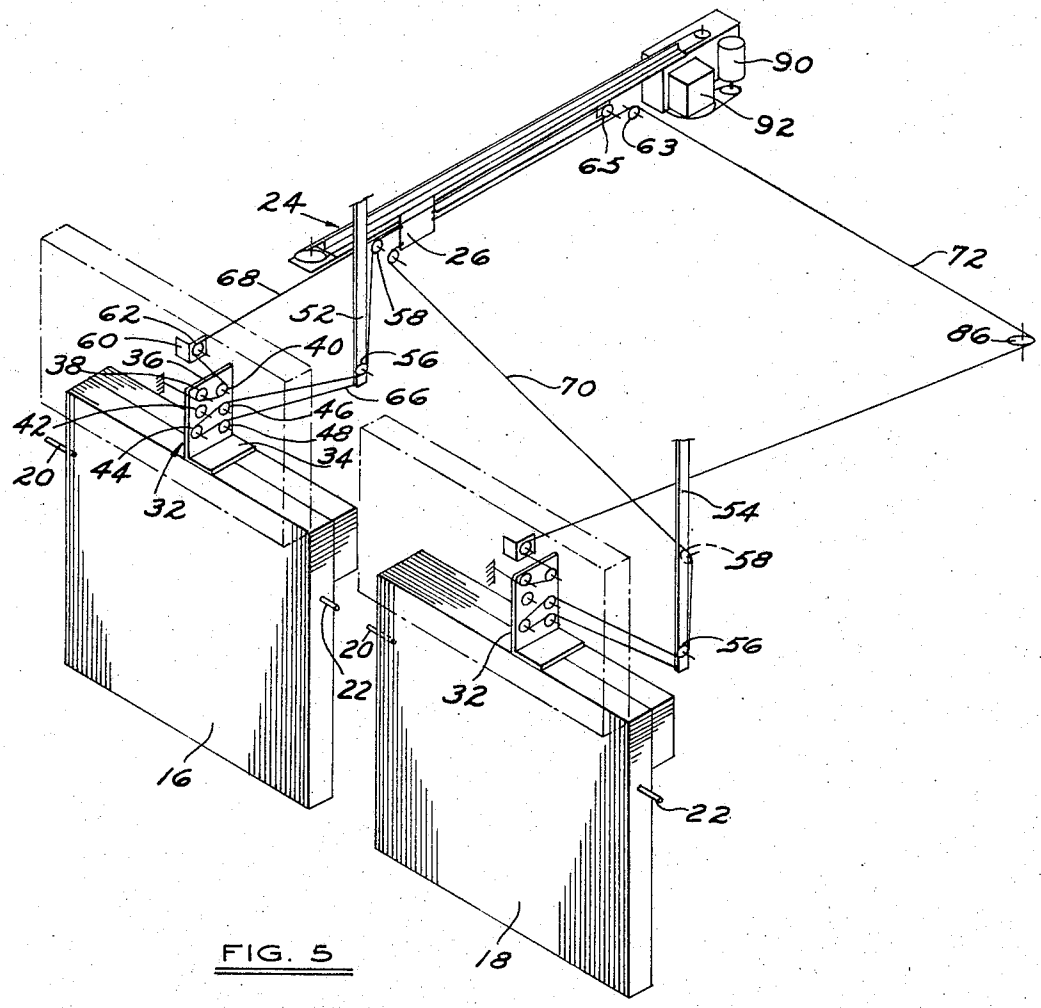
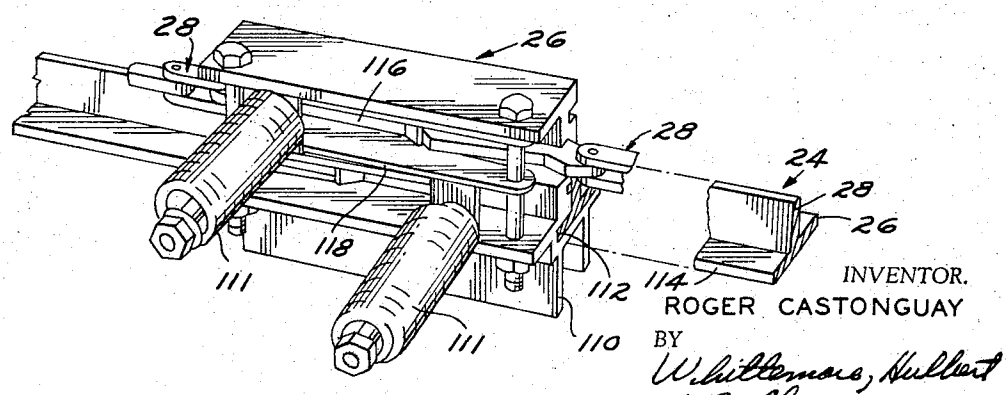


FIG. 5



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OVERHEAD DOOR AND OPERATING MEANS THEREFOR

Filed Aug. 11, 1965 3 Sheets-Sheet 2

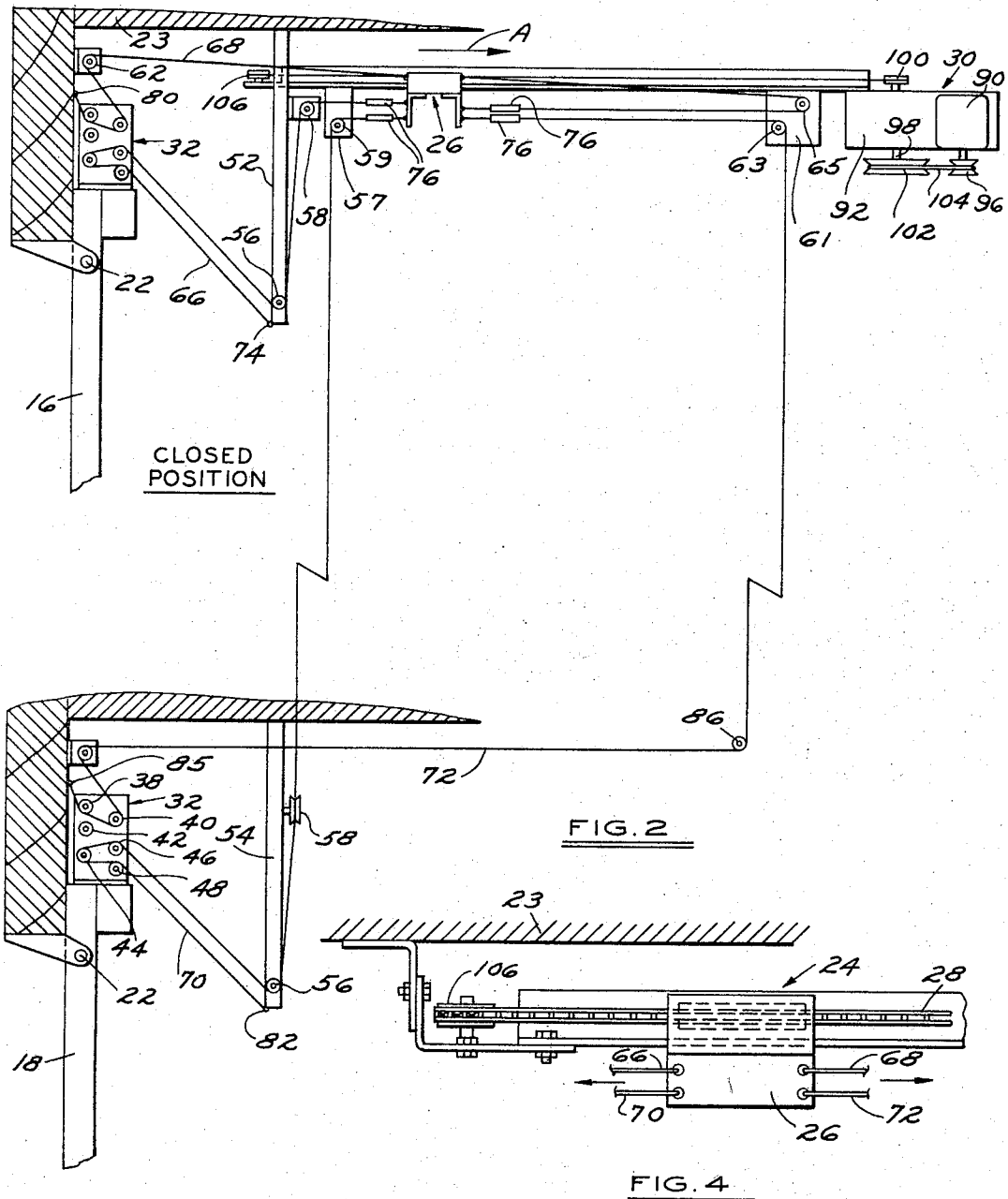

FIG. 2

FIG. 4

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Nov. 21, 1967 R. CASTONGUAY 3,353,299

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Filed Aug. 11, 1965 3 Sheets-Sheet 3

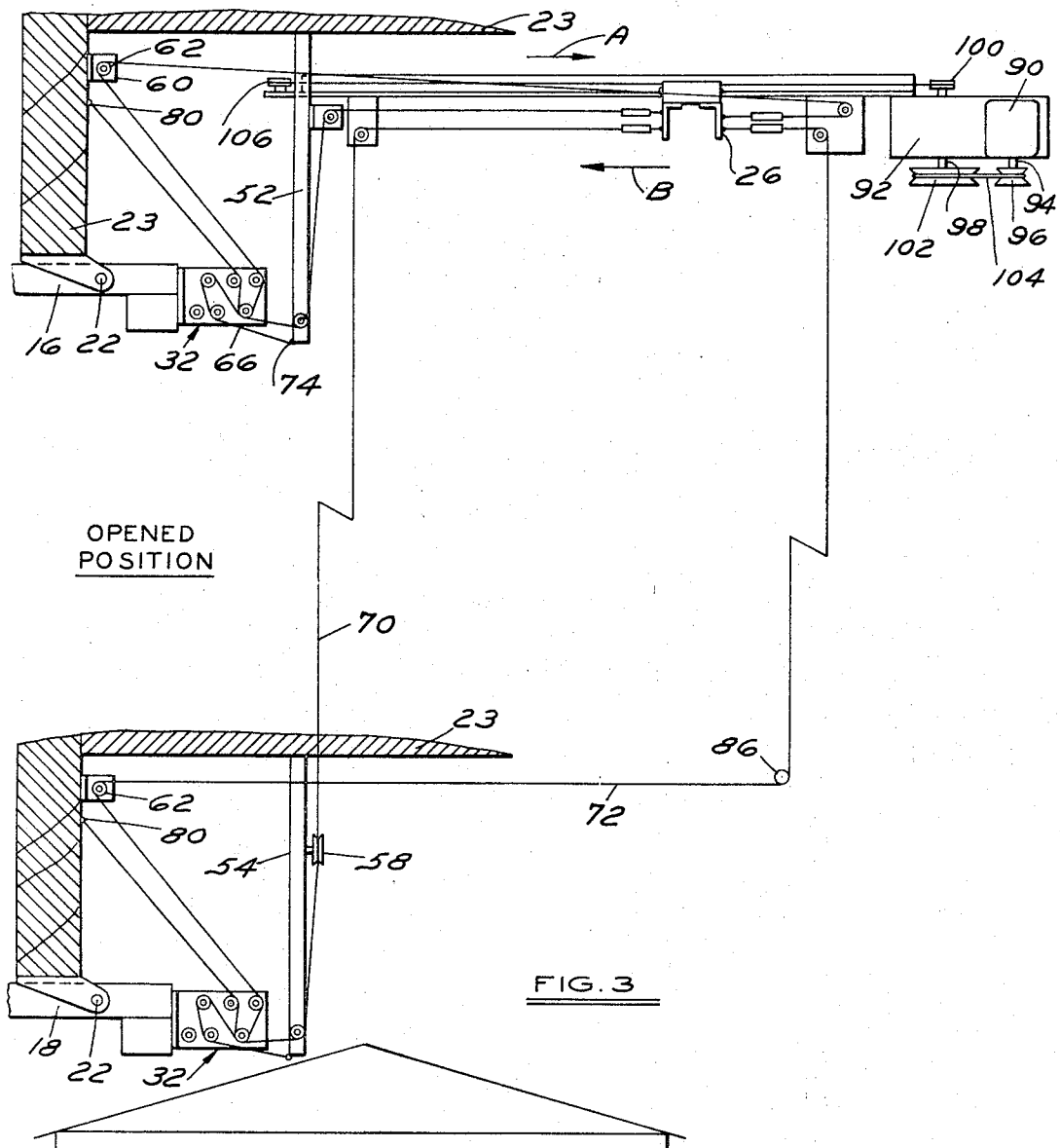

FIG. 3

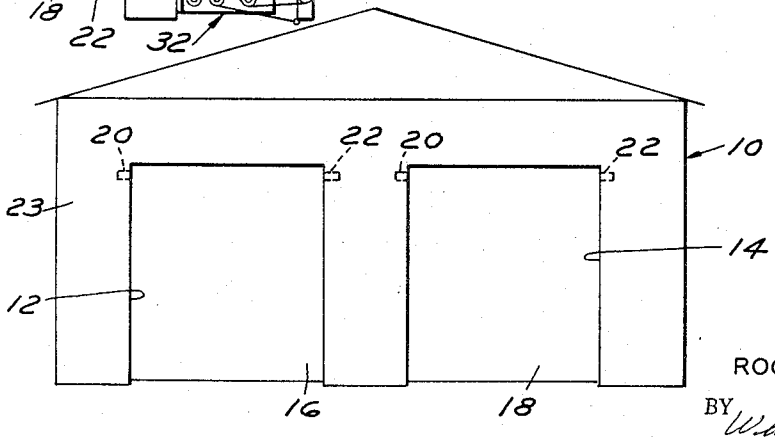

FIG. 6

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United States Patent Office 3,353,299 Patented Nov. 21, 1967

3,353,299

OVERHEAD DOOR AND OPERATING MEANS THEREFOR

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Filed Aug. 11, 1965, Ser. No. 478,812
8 Claims. (Cl. 49—104)

ABSTRACT OF THE DISCLOSURE

A door operating device is disclosed which is adapted to be associated with one or more doors mounted in a fixed support structure such as a garage, with each door mounted for swinging movement from a generally vertical closed position to a generally horizontal open position. The door operating device includes a single power operated trolley movable on a track provided therefor. Each door is provided with pulley means. The door operating device further includes opening and closing cables for each door, with each cable having one end connected to the movable trolley and the other end connected to the fixed support structure, with intermediate portions of each of the cables being engageable with the pulley means provided on the corresponding door.

This invention relates to a door operating system and relates more particularly to a cable-operated system for one or more overhead type doors. The invention is characterized by the manner in which one or more doors are operated by opening and closing cables which are all operatively connected to a single power-operated trolley movable, as an example, on a track provided therefor.

The present invention has certain advantages over prior art door operator mechanisms including the important advantage that each door opens and closes quickly and smoothly under the operation and control of the opening and closing cables. The operating mechanism including the opening and closing cables is compact, easy to install and can be advantageously mounted in any convenient location in a building such as near a ceiling beam or the top edge of the door or even in a place remote from the door. The closing cable is effective when operated by the power operated trolley to forcibly close the door and lock the door in a vertically closed position without the utilization of any counterweights or similar devices which are presently utilized in the art.

It is an object of the present invention to provide a cable operated system for opening and closing one door or a plurality of doors simultaneously.

Another object of the present invention is to provide a cable operated system for an overhead door comprising opening and closing cables which are all operatively connected to a single power-operated trolley which pulls on the cables to open and close the door.

Still another object of the present invention is to provide an overhead door for a building which is properly balanced, easy to open and close and which requires a smaller amount of mechanical energy to operate the door than has been heretofore utilized.

A further object of the present invention is to provide a door structure for a garage or other building having a doorway, a door mounted in the doorway for swinging movement from a generally vertical closed position to a generally horizontal open position, means for opening and closing the door comprising an opening cable and a closing cable, each cable being operatively connected to the door for controlling the swinging movement thereof, and drive means connected to the cables

for operating same to effect swinging movement of the door.

A still further object of the present invention is to provide a door structure of the aforementioned type wherein power-operated drive means is provided and effective to pull on the opening cable to open the door and to pull on the closing cable to close the door. With such a construction the opening cable is taut and the closing cable is slack during the opening movement of the door and the closing cable is taut and the opening cable is slack during the closing movement of the door.

Another object of the present invention is to provide a door structure comprising a plurality of doorways and a like plurality of doors mounted in the doorways for swinging movement from a generally vertical closed position to a generally horizontal open position, each door having operatively connected thereto opening and closing cables, and a single power-operated trolley operatively connected to the opening and closing cables, said trolley when driven in one direction being effective to pull on the opening cables to simultaneously open the doors and effective when driven in the opposite direction to pull on the closing cables to simultaneously close the doors.

Still another object of the present invention is to provide a door operating structure of the aforementioned type wherein the closing cables are effective to close the doors and to hold the doors in a locked position until the power-operated trolley is energized.

A further object of the present invention is to provide a cable operated system for an overhead door which does not require any counterweights or similar devices for closing the door.

It is thus another object of this invention to provide a simplified low cost structure of the aforementioned type having certain advantages contributing to efficiency, reliability and long life as well as ease of maintenance.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred form of the present invention is clearly shown.

FIGURE 1 is a perspective view of a plurality of swinging doors and the cable operating system therefor.

FIGURE 2 is a fragmentary elevational view illustrating the doors in a closed position;

FIGURE 3 is a fragmentary elevational view illustrating the doors in an open position;

FIGURE 4 is a plan view of the trolley and track assembly;

FIGURE 5 is a perspective view of the track and trolley; and

FIGURE 6 is a front elevation of a garage having a pair of pivotally mounted doors.

In the present invention the door operating system is designed for one or more doors of a garage although it is to be understood that the door operating system may also be used with doors of other buildings. As illustrated in FIGURE 6, the garage is designated by the numeral **10** and comprises a pair of door openings **12** and **14** in the front wall thereof. Mounted within the door openings **12** and **14** are a plurality of pivotally mounted vertically swinging doors **16** and **18** respectively. The present invention is designed to operate one door or both doors **16** and **18** simultaneously although it should be understood that the cable operating mechanism of the present invention could be provided for each door independently of the other.

Each door **16** and **18** is provided at the top edge thereof with a pair of pivots or pivot arms **20** and **22** which are carried by the frame, wall or support structure **23** of the garage **10**. While pivoted overhead swinging doors are shown it should be understood that the present invention

can be utilized with other types of doors such as overhead doors which utilize tracks, etc.

Mounted within the interior of the garage **10** adjacent the ceiling thereof is an elongated track **24** of T-shaped cross section including a horizontal flange **26** and a vertical flange **28**. The track **24** extends substantially perpendicular to the doors **16** and **18** when closed. Appropriately mounted on the track **24** is a power-driven trolley **26**. Means are provided for moving the trolley **26** along the track **14** in opposite directions toward and away from the doors **16** and **18**, said means including an endless drive chain **28** to which the trolley **26** is connected. The drive chain **28** is driven by the power-operated drive assembly **30** as will be subsequently described.

A bracket **32** is fixedly mounted on the top edge of each door **16** and **18** and includes a horizontal flange **34** attached to the door and a vertical flange **36**. Mounted on the vertical flange **36** of each bracket **32** are six sheaves or pulleys designated by the numerals **38**, **40**, **42**, **44**, **46** and **48**. The sheaves are arranged in a pair of parallel rows, with the first row including sheaves **38**, **42** and **44** and the second row including sheaves **40**, **46** and **48**. Sheave **40** is spaced laterally from and approximately midway between sheaves **38** and **42**. Sheave **44** is spaced laterally from and approximately midway between sheaves **46** and **48**. While all the sheaves are illustrated as being of the same size and diameter it is recommended for successful operation that at least the driving sheaves or pulleys **40** and **44** be of the same size and diameter.

Carried by the frame or support structure **23** of the garage **10** are vertically arranged brackets **52** and **54** each of which is provided on the lower end thereof with a sheave **56**. The upper end of the brackets **52** and **54** are each provided with a sheave **58**. A bracket **60** is mounted above each of the doors **16** and **18** and is connected to the support structure **23** in proximity to the bracket **32**. Each bracket **60** is provided with a sheave **62**. The support structure **23** is further provided with a bracket **57** having a sheave **59** mounted thereon and is also provided with a bracket **61** having sheaves **63** and **65** provided thereon.

Door **16** is provided with an opening cable **66** and a closing cable **68**. Door **18** is provided with an opening cable **70** and a closing cable **72**. Opening cable **66** for door **16** is fixedly connected and anchored to the vertcial bracket **52** as indicated by the numeral **74**. Cable **66** extends from the fixed point or anchor **74** around sheaves **48**, **44**, **46**, **56** and **58** in the order mentioned and has the leading end thereof connected to the power driven trolley **26**. The leading end of the cable **66** is provided with a turnbuckle **76** for adjusting the cable tension.

The closing cable **68** for door **16** is anchored at **80** to the support structure **23** and extends therefrom between sheaves **38** and **42** and then around sheaves **40**, **62** and **65** in the order mentioned from where the leading end of the cable is attached to the power driven trolley **26**. A turnbuckle **76** is provided near the leading end of the cable **68** for adjusting the cable tension.

The opening cable **70** for door **18** is secured and anchored to the lower end of the bracket **54** as indicated by the numeral **82**. The cable **70** then extends around pulleys or sheaves **48**, **44**, **46**, **56** and **58** in the order mentioned and then transversely across the interior of the garage **10** where the leading end of cable **70** extends around pulley or sheave **59** and then through a turnbuckle **76** and fiinally is connected to the power driven trolley **26**. The closing cable **72** for the door **18** is secured to the support structure as indicated by the numeral **85** and extends therefrom between pulleys **38** and **42** and then around pulleys **40**, **62**, and **86** and then transversely across the interior of the garage where the leading end of the closing cable **72** extends around the pulley **63** from where it is fixedly connected to the power driven trolley **26**. A turnbuckle **76** is also provided on the leading end of the closing cable **72** so as to permit the tension of the cable to be adjusted as is conventional in the art. The pulley or sheave **86** is appropriately connected to the support structure by means not shown.

The track **24**, trolley **26** and the power-operated drive assembly **30** are manufactured and sold by the Heath Company, of Benton Harbor, Mich., a subsidiary of Daystrom Incorporated as part of its garage door operator mechanism Model GDA–20–3. The specific details of the track **24**, drive chain **28**, trolley **26** and the power-operated drive assembly **30** are illustrated and described in the catalog entitled "Heathkit Assembly Manual" copyrighted 1962 by the Heath Company.

More specifically, the power-operated drive assembly **30** includes a motor **90** and a receiver **92** (Heath Company Model GDA–20–2) useable in conjunction with a Heath Company transmitter (Model GDA–20–1) not shown. The transmitter and receiver per se form no part of the present invention and provide a convenient means of quickly opening and closing the garage doors **16** and **18** from the driveway without requiring a person to leave the automobile.

The motor **90** includes a shaft **94** provided on the outer end thereof with a pulley **96**. The receiver **92** is provided with a rotatably mounted threaded element **98** which extends through the housing of the receiver **92**. The upper end of the element **98** is provided with a sprocket **100** while the lower end is provided with a relatively large pulley **102** which is connected to the motor driven pulley **96** by means of a drive belt **104**. The receiver **92** further includes various transformers, relays, switches and limit switches not illustrated and which are more adequately shown and described in the aforementioned catalog.

The sprocket **100** is located at the far end of the track **24**. Mounted at the near end of the track **24** is a sprocket **106**. The link chain **28** extends around sprockets **100** and **106** with the opposing ends operatively connected to the trolley **26** as best illustrated in FIGURE 5. The transmitter, not shown, is designed to provide a signal for the receiver **92** which is effective to energize the motor **90** which in turn drives the member **98** through means of the sprocket **96**, drive belt **104** and sprocket **102**. Thereafter the drive sprocket **100** is rotated which is effective to move the chain **28** and also move the trolley **26** in one direction as will subsequently be described.

The trolley **26** as best illustrated in FIGURE 5 is disclosed and described in the aforementioned catalog and includes a body which is spring loaded by means of a pair of springs **111**. The body **110** is provided with ways **112** which receive the longitudinal edges **114** of the track **24**. The trolley **26** further includes a chain safety release **116** which is received in a groove of the body **110**. The ends of the link chain are connected to the safety release **166**. The trolley **26** further includes a safety release **118**. The link chain **28** includes a turnbuckle not illustrated which permits the tension of the chain to be adjusted with respect to the drive sprocket **100** and the idler sprocket **106**.

FIGURES 1 and 2 illustrate the doors **16** and **18** in a closed position with the trolley **26** located near the forward end of the track **24**. When it is required to open the doors **16** and **18**, the operator sends a signal by means of a transmitter not illustrated which is picked up by the receiver **92** and is effective to energize the power-operated drive means **30**. As a result thereof the threaded shaft **98** is rotated so as to rotate the sprocket **100** and thereby drive the chain **28**. As a result thereof the trolley **26** is moved to the right as viewed in FIGURES 2 and 3 as illustrated by arrow A. The trolley **26** as it moves to the right as viewed in FIGURES 2 and 3 pulls on the opening cables **66** and **70** and holds such cables taut. At the same time the closing cables **68** and **72** become slack due to the fact that the trolley in effect is moving closer to the anchor ends **80** and **85** of cables **68** and **72** respectively. Thus, in order to open the doors **16** and **18**

the trolley **26** pulls on cables **66** and **70** so as to swing doors **16** and **18** about the pivots **20** and **22**.

When it is required to close the doors from the open position illustrated in FIGURE 3 to the closed position illustrated in FIGURES 1 and 2 the operator sends a signal from the transmitter which is received by the power-operated assembly **30** effective to rotate the drive sprocket **100** and link chain **28** in the opposite direction. Thereafter the trolley **26** is moved to the left as viewed in FIGURE 3. At such time the trolley **26** is effective to pull on the closing cables **68** and **72** and to hold such cables taut during the closing movement of the doors. As the trolley moves to the left the opening cables **66** and **70** are slack. As the trolley **26** approaches the forward limiting position illustrated in FIGURE 2 the closing cables **68** and **72** pull on the doors **16** and **18** respectively so as to positively and forcibly close the door. The closing cables **68** and **72** tensioned by the trolley **26** are effective to not only close the doors but also to hold and lock the doors.

With the present invention no gear boxes, tracks, counterweights or counterbalances are required. The opening and closing cables control the speed at which the doors open and close. While the present invention is primarily designed for overhead doors it should be understood that the teachings of this invention can be applied to other types of doors. Only one motor and one receiver are required to operate one or more doors. Each closing cable not only closes the corresponding door but also locks the door. The speed at which each door opens and closes is dependent upon the number of pulleys or sheaves utilized.

Additional features of the present invention are that the doors will open slowly and safely under the control of the pulley and cable system; each door has approximately twenty pounds pressure against the cables whether the door is open or closed; said pressure results in less wear and strain on the receiver and other component parts of the system and the pressure permits the motor to be started easier than heretofore.

The drawings and the foregoing specification constitute a description of the improved overhead door and operating means therefor in such full, clear, concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What I claim as my invention is:

1. The combination with a fixed support structure having a doorway: a door mounted in said doorway for swinging movement from a generally vertical closed position to a generally horizontal open position; pulley means carried by said door; a track; a trolley movably supported by said track; cable operating means connected between said fixed support structure and said trolley and including intermediate portions engageable with said pulley means; and means for moving said trolley in opposite directions to pull on said cable operating means and thereby move said door.

2. A structure comprising a fixed support structure having a doorway, a door mounted in said doorway for swinging movement from a generally vertical closed position to a generally horizontal open position, a track, a trolley movably supported by said track for movement in opposite directions, pulley means carried by said door, cable operating means including an opening cable and a closing cable interposed between said fixed support structure and said trolley for respectively opening and closing said door, said opening and closing cables each having one end connected to said movable trolley and the other end connected to said fixed support structure, with intermediate portions of each of said cables engageable with said pulley means, and power-operated means for moving said trolley in one direction to pull on said opening cable to open said door and in the opposite direction to pull on said closing cable to close said door.

3. The combination with a fixed support structure having a doorway, a door mounted in said doorway for swinging movement from a generally vertical closed position to a generally horizontal open position: a track; a trolley movably supported by said track for movement in opposite directions; pulley means carried by said door; cable operating means interposed between said support structure and said trolley for opening and closing said door, said cable operating means comprising an opening cable and a closing cable; said opening and closing cables each having one end connected to said movable trolley and the other end connected to said fixed support structure, with intermediate portions of each of said cables engageable with said pulley means; and means for moving said trolley in one direction to pull on said opening cable to open said door and in the opposite direction to pull on said closing cable to close said door, said opening cable being taut and said closing cable being slack during the opening movement of said door and said closing cable being taut and said opening cable being slack during closing movement of said door.

4. A structure comprising a fixed support structure having a doorway, a door mounted in said doorway for swinging movement from a generally vertical closed position to a generally horizontal open position, a track, a trolley movably supported by said track for movement in opposite directions, pulley means carried by said door, cable operating means interposed between said fixed support structure and said trolley for opening and closing said door, said opening and closing cables each having one end connected to said movable trolley and the other end connected to said fixed support structure, with intermediate portions of each of said cables engageable with said pulley means, said cable operating means comprising an opening cable and a closing cable, and power operated means for moving said trolley in one direction to pull on said opening cable to open said door and in the opposite direction to pull on said closing cable to close said door, said opening cable being taut and said closing cable being slack during the opening movement of said door and said closing cable being taut and said opening cable being slack during closing movement of said door.

5. The combination with a fixed support structure having a plurality of doorways: a plurality of doors in said doorways for simultaneous swinging movement from a generally vertical closed position to a generally horizontal open position; pulley means on each of said doors; a track; a trolley movably supported by said track; means for opening and closing said doors comprising opening and closing cables for each door which are connected between the fixed support structure and said trolley and including intermediate portions engageable with the pulley means on the corresponding door; and means for moving said trolley in one direction to pull on said opening cables to simultaneously open said doors and in the opposite direction to pull on said closing cables to simultaneously close said doors.

6. A structure comprising a fixed support structure having a plurality of doorways, a plurality of doors in said doorways for simultaneous swinging movement from a generally vertical closed position to a generally horizontal open position, a track, a trolley movably supported by said track, pulley means carried by each of the doors, means for opening and closing said doors comprising opening and closing cables for each door which are connected between the fixed support structure and said trolley and including intermediate portions engageable with the pulley means on the corresponding door, and power operated means for moving said trolley in one direction to pull on said opening cables to simultaneously open said doors and in the opposite direction to pull on said closing cables to simultaneously close said doors.

7. The combination with a fixed support structure having a plurality of doorways, a plurality of doors mounted in said doorways for swinging movement from a generally vertical closed position to a generally horizontal open

position: a track; a trolley movably supported by said track for movement in opposite directions; pulley means carried by each of the doors; cable operated means interposed between said support structure and said trolley for opening and closing said doors; said cable operating means comprising an opening cable and a closing cable for each of said doors; the opening and closing cables for each door each having one end connected to said movable trolley and the other end connected to said fixed support structure, with intermediate portions of each of the cables engageable with the pulley means on the corresponding door; and means for moving said trolley in one direction to pull on said opening cables to simultaneously open said doors and in the opposite direction to pull on said closing cables to simultaneously close said doors, said opening cables being taut and said closing cables being slack during the opening movement of said doors and said closing cable being taut and said opening cable being slack during closing movement of said doors.

8. A structure comprising a fixed support structure having a plurality of doorways, a plurality of doors mounted in said doorways for swinging movement from a generally vertical closed position to a generally horizontal open position, a track, a trolley movably supported by said track for movement in opposite directions, pulley means carried by each of the doors, cable operated means interposed between said fixed support structure and said trolley for opening and closing said doors, said cable operating means comprising an opening cable and a closing cable for each of said doors, the opening and closing cables for each door each having one end connected to said movable trolley and the other end connected to said fixed support structure, with intermediate portions of each of the cables engageable with the pulley means on the corresponding door, and power operated means for moving said trolley in one direction to pull on said opening cables to simultaneously open said doors and in the opposite direction to pull on said closing cables to simultaneously close said doors, said opening cables being taut and said closing cables being slack during the opening movement of said doors and said closing cable being taut and said opening cable being slack during closing movement of said doors.

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