Sept. 6, 1966 W. J. ZIMMERLE ETAL 3,270,572

DOOR OPERATING MECHANISM

Filed Oct. 1, 1964 2 Sheets-Sheet 1

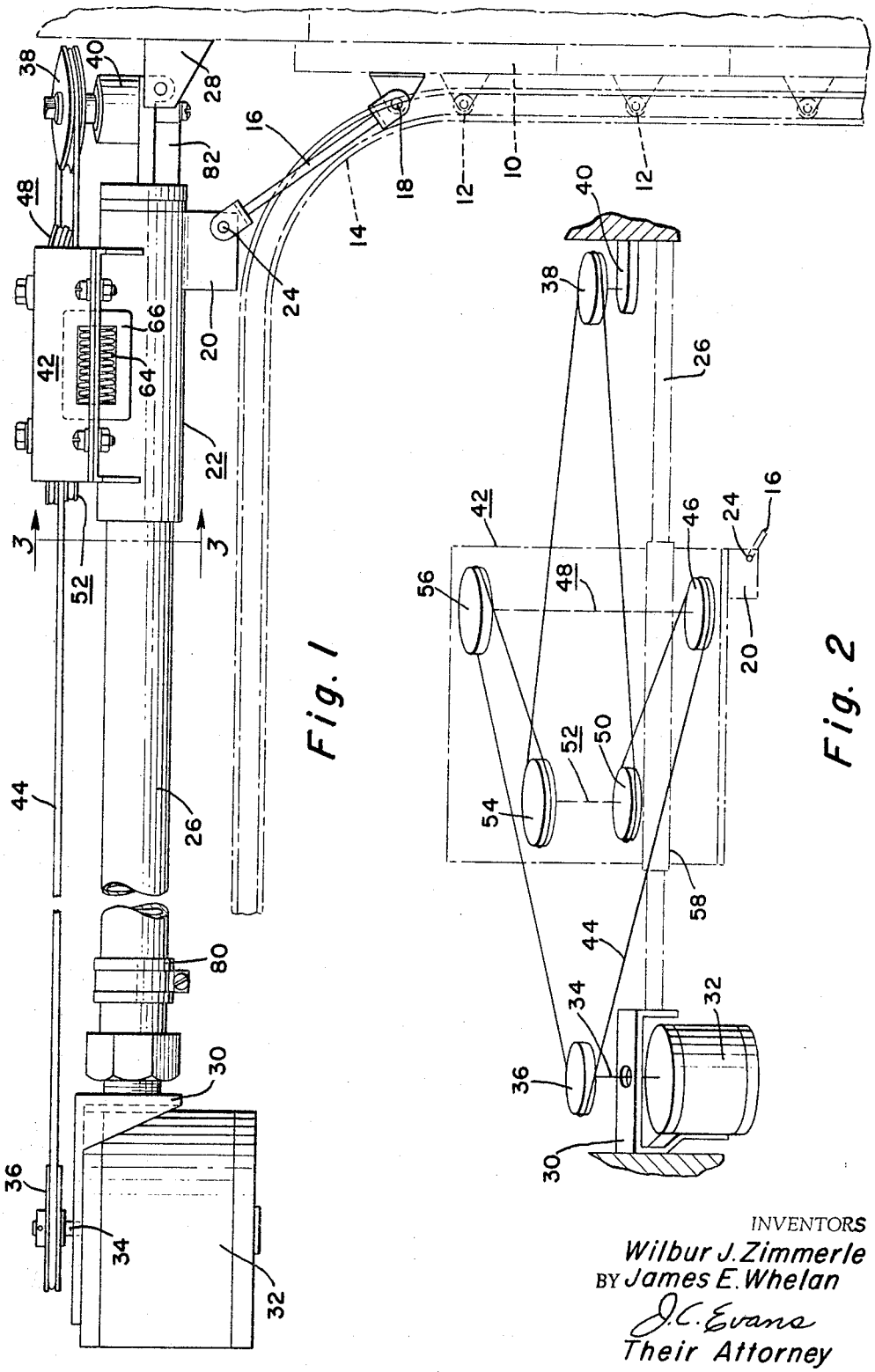


Fig. 1

Fig. 2

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DOOR OPERATING MECHANISM

Filed Oct. 1, 1964 2 Sheets-Sheet 2

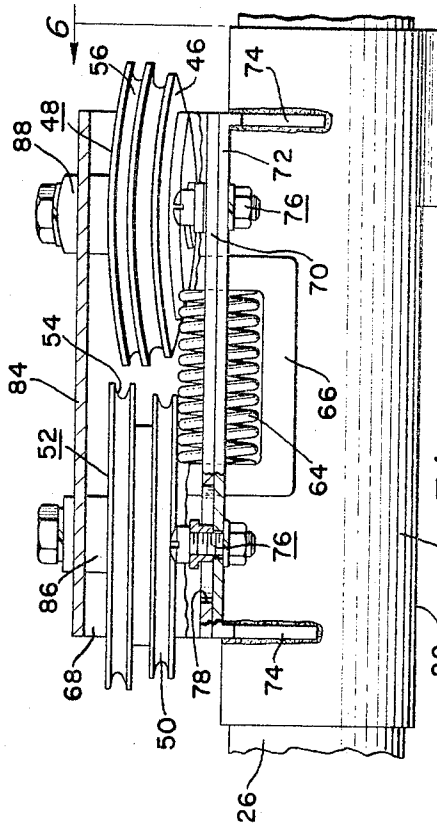


Fig. 5

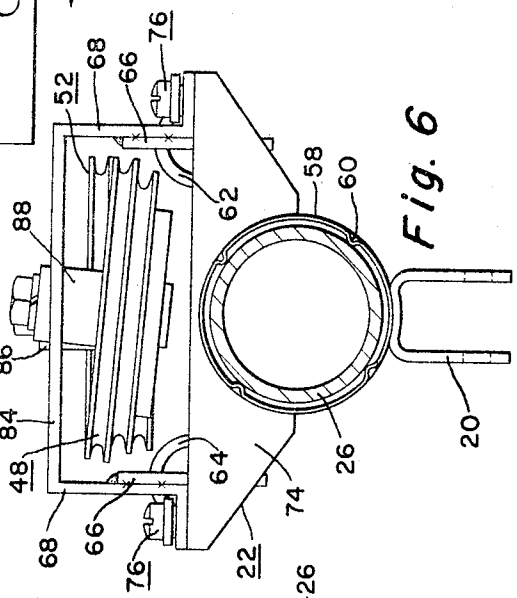


Fig. 6

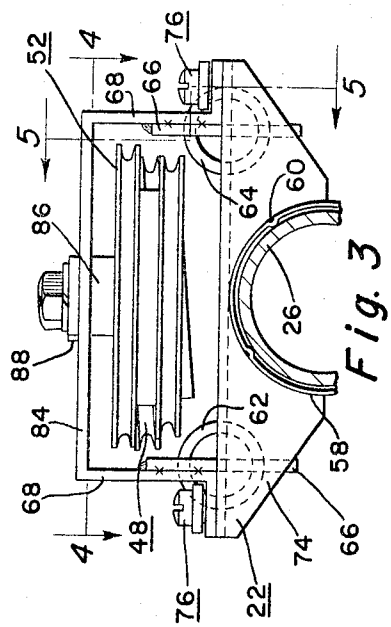


Fig. 3

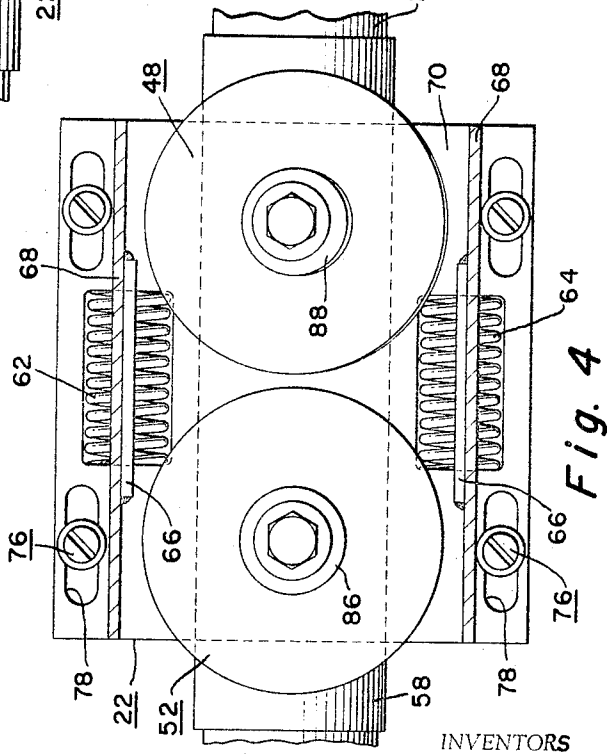


Fig. 4

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DOOR OPERATING MECHANISM

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4 Claims. (Cl. 74—89.22)

This invention relates to garage door operators and more particularly an improved drive system therein.

One problem in typical automatic garage door operating systems is that of how to inexpensively reduce the driven speed of a carriage member off a relatively high speed electric drive motor or the like so as to effect a desirable rate of closing and opening movement of a door operatively connected to the carriage member.

An object of the present invention, therefore, is to improve garage door operating systems by the provision of a low-cost speed reduction pulley system for driving a door connected carriage element into opened and closed positions.

A further object of the present invention is to improve garage door operating systems by the provision therein of a belt-pulley system including movable differential pulley means for reducing the driven speed of a carriage member with respect to the speed of rotation of a drive motor in the system.

Yet another object of the present invention is to improve garage door operating systems by the provision therein of a continuous belt-pulley arrangement including a movable differential pulley operative to reduce the driven speed of a door connected carriage member off a relatively high speed electric motor or the like and wherein the differential pulley includes canted pulley components for locating the continuous belt out of frictional engagement with itself during its travel about the pulley system.

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 embodiment of the present invention is clearly shown.

In the drawings:

FIGURE 1 is a view in side elevation of the garage door operator of the present invention;

FIGURE 2 is a schematic view of the pulley system of the present invention;

FIGURE 3 is an enlarged view in vertical section taken along the line 3—3 of FIGURE 1;

FIGURE 4 is a view in horizontal section taken along the line 4—4 of FIGURE 3;

FIGURE 5 is a view in vertical section taken along the line 5—5 of FIGURE 3; and

FIGURE 6 is a view in vertical section taken along the line 6—6 of FIGURE 5.

Referring now to the drawings, in FIGURE 1, the garage door operator of the present invention is illustrated as being associated with a garage door **10** supported by rollers **12** on a track **14** for movement into opened and closed positions therealong. In the illustrated embodiment of the invention the door **10** is connected to a link **16** having one end thereof pivotally connected at **18** to the door and the opposite end thereof pivotally connected to a depending bracket **20** on a carriage assembly **22** at **24**.

The carriage assembly **22** of the improved operator is slidably supported for reciprocal movement on an elongated tubular track member **26** having one end thereof secured by a bracket **28** to a suitable support such as a front wall of a garage and the opposite end thereof secured to a bracket **30** adapted to be secured from a suitable support such as the ceiling of the garage. Adjacent the bracket **30** is supportingly located a reversible electric drive motor **32** having its drive shaft **34** fixedly secured to a drive pulley **36**. At the opposite end of the tubular track **26** is supported an idler pulley **38** rotatably mounted in a bearing block **40**.

The drive pulley **36** and idler pulley **38** are part of an improved belt-pulley system **42**, best illustrated in FIGURE 2, that is operative to drive the carriage assembly **22** to and fro on the tubular track **26** for raising and lowering the door **10** connected thereto through the link **16**. More specifically, the improved belt-pulley system **42** includes a continuous belt member **44** that runs from the drive pulley **36** under a predetermined desired tension across a small diameter pulley **46** of a first pair of differential diameter pulleys **48** and thence across a small diameter pulley **50** of a second pair of differential diameter pulleys **52**. From pulley **50** the belt **44** passes around the idler pulley **38** and thence to a large diameter pulley **54** of the pulley pair **52** and thence to a large diameter pulley **56** of the pulley pair **48** to return around the drive pulley **36**. By virtue of the illustrated arrangement, the drive motor **32** operating at a substantial r.p.m. will act to move the carriage assembly **22** to and fro on the track **26** at a reduced speed dependent upon the relative diameters of the pulley components of the pulley pairs **48, 52**. Accordingly, a relatively economical speed reduction off the motor **32** is obtained by means of a direct-acting drive arrangement for moving the carriage assembly along the path of the track **26**.

One feature of the present invention is the support of the carriage assembly **22** on the track **26** and the manner in which the carriage **22** is stopped at each end of its travel along the track **26**. More particularly, with reference to FIGURE 6, the assembly **22** is seen to have a tubular base **58** having radially inwardly directed indentations **60** formed at circumferentially arranged points therealong to effect a plural point supported relationship between the track **26** and the carriage **22** for reducing frictional forces therebetween so as to improve the sliding movement of the carriage assembly **22** along the track **26**. Furthermore, the assembly **22** is illustrated as including a pair of bumper springs **62, 64** located, respectively, on either side of the base **58**. Each of the springs **62, 64** is located within a spring retainer member **66** supported on either side of the base **58** by a vertically arranged side plate member **68** on either side of the base **58**. The carriage assembly **22** includes a movable base plate **70** and a base plate member **72** fixedly secured to the tubular base **58** by gusset plates **74** at either end thereof. The plate **72** slidingly, supportingly receives the movable plate **70**. The relatively sliding plates **70, 72** are held in guided relationship by a plurality of screw assemblies **76** secured to the fixed plate **72** and having one end thereof directed through enlarged openings **78** in the movable plate **70**. Upon relative sliding movement between the movable plate **70** and the fixed plate **72**, the bumper springs **62, 64** are compressed therebetween so as to dampen movement of the carriage assembly **22** at either end of the track **26** to thereby prevent undesirable impacting thereof against stops **80, 82** at opposite ends of the track.

Another feature of the present invention is the arrangement of the pairs of differential diameter pulleys **48, 52** which are each illustrated in detail in FIGURES 3 through 6 as including the pulleys **46, 56** and **50, 54** being arranged in a colinear manner and as having somewhat helical grooves for receiving the continuous belt **44** in tension therearound. More specifically, with reference to the pulley pair **52**, the pulley portions **54, 50** are shown as being arranged colinearly on a substantially vertical axis and secured to a plate **84** between

side members **68** by a pulley mounting stud assembly **86**. The pulley pair **48** is arranged colinearly on a pulley mounting stud assembly **88** on plate **84** that has its axis canted from the vertical to the right of the axis of pair **52** as illustrated in FIGURE 6 whereby the continuous belt **44** as it passes from the pulley pair **48** to the pulley pair **52** and thence to the idler pulley **38** and back to the pulley pair **52** and thence to pulley pair **48** will be continuously located out of interference engagement with itself throughout its path of movement to thereby minimize the frictional losses in the system that would otherwise occur.

In view of the above description, it will be appreciated by those skilled in the art that the present invention constitutes a new concept in garage door operators utilizing a movable differential pulley in a horizontal plane for effecting a necessary speed reduction between drive speed and driven speed of a garage door connected carriage assembly. The improved system includes in one aspect two differential pulleys that are arranged so that a continuous belt or cable will clear itself at all times to improve the operation of the device and, moreover, a further clearance provision effected by canting of one of the two differential pulleys to prevent any interference of the continuous cable as it progresses through its driven path. Furthermore, the carriage assembly is characterized by the manner in which it is slidingly, supportingly received on an elongated tubular track to reduce friction and by an improved spring dampening system therein that reduces the impacting of the carriage assembly against stops on either end of the track.

While the embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. An operator assembly for opening and closing a garage door or the like comprising, an elongated track, drive means supported adjacent one end of said track, a driven pulley operatively associated with said drive means, garage door connectible carriage means slidably supported on said track for movement longitudinally thereof in opposite directions therealong, differential pulley means on said carriage means, a continuous belt passing over said drive pulley and said differential pulley means to be driven thereabout by said drive means, said differential pulley means rotatable upon passage of said belt therearound to effect a resultant reaction on said carriage means operative to cause relative movement of said carriage means to and fro on said track member at a reduced speed with respect to that of said drive pulley, said carriage means including a fixed base portion slidably supported on said track member, a movable base portion slidably supported on said fixed base portion, and spring members on either side of said base portions compressible upon relative movement between said base portions for damping impact between said carriage means and said track at the limits of the travel of said carriage means.

2. In the combination of claim **1**, said differential pulley means including a pair of spaced pulley members each having first and second grooves formed therein of varying diameters for effecting the resultant reaction for producing relative movement of said carriage means along said track member, and wherein one of said pulley pairs is canted for guidingly directing said continuous belt through paths wherein no portion of the continuous belt is in frictional engagement with another portion of the continuous belt during the operation of the device.

3. In the combination of claim **1**, said movable base portion having a support member thereon at each side thereof, and support means on said support member for carrying said differential pulley means, said differential pulley means being located by said support means in spaced relationship to said movable base portion whereby said continuous belt is located out of frictional engagement with said movable base portion.

4. In the combination of claim **3**, said differential pulley means including a pair of spaced pulley members each having first and second grooves formed therein of varying diameters for effecting the resultant reaction for producing relative movement of said carriage means along said track member, and wherein one of said pulley pairs is canted for guidingly directing said continuous belt through paths wherein no portion of the continuous belt is in frictional engagement with another portion of the continuous belt during the operation of the device.

References Cited by the Examiner

UNITED STATES PATENTS

396,430	1/1889	Reichel.	
2,861,800	11/1958	McKee et al.	268—59
2,884,788	5/1959	Clark	74—95 X
3,231,260	1/1966	Shirley	268—59

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