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BALANCED DOOR ROLLER LIFT MECHANISM

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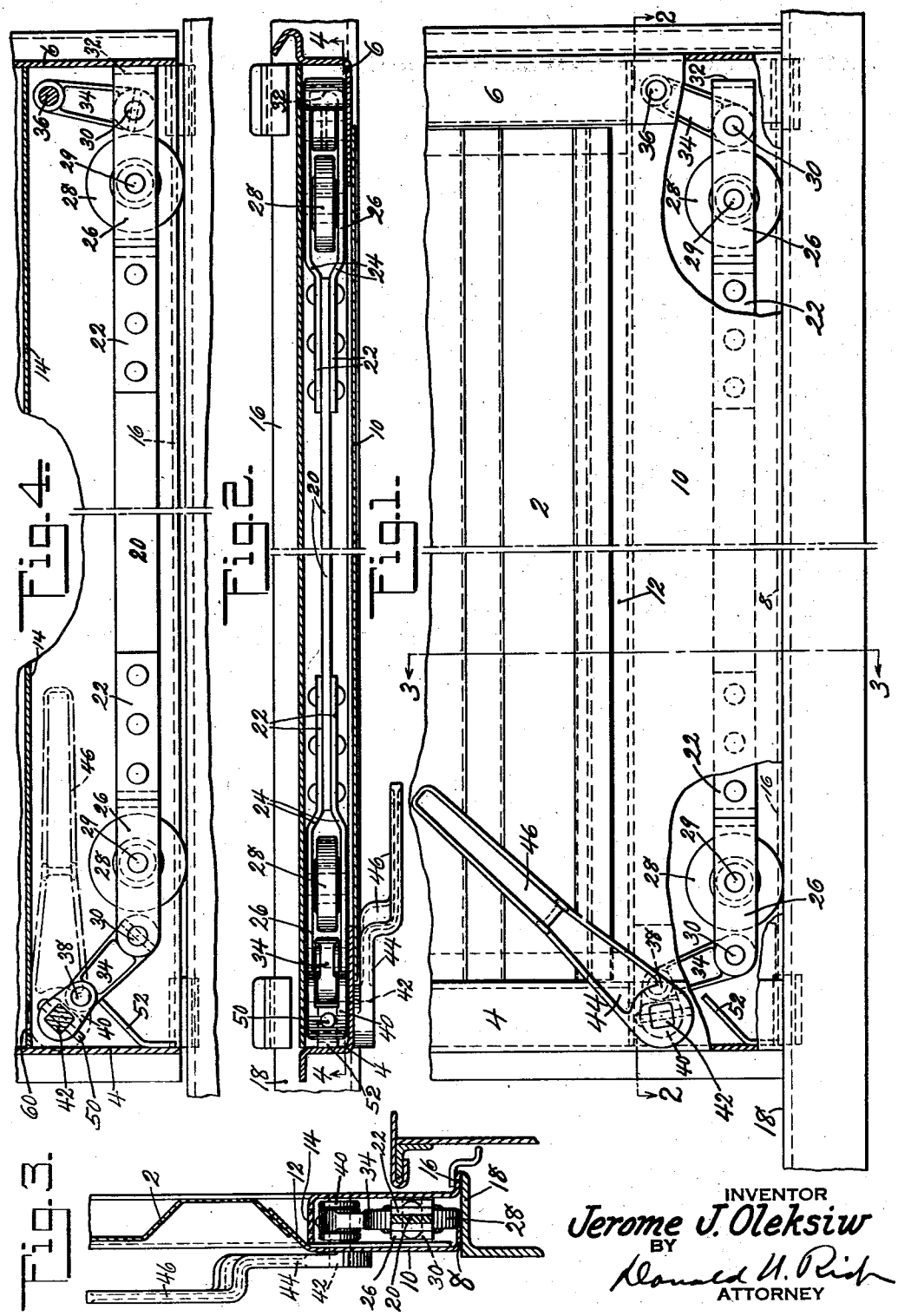


INVENTOR
Jerome J. Oleksiw
BY
Donald H. Rich
ATTORNEY

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## BALANCED DOOR ROLLER LIFT MECHANISM

Jerome J. Oleksiw, Shamokin, Pa., assignor to American Car and Foundry Company, New York, N. Y., a corporation of New Jersey

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9 Claims. (Cl. 16—99)

This invention relates to sliding doors in general and in particular to such doors for use on railway freight cars wherein it is desirable to lift the sliding door to reduce friction.

In the past the majority of sliding lift doors have utilized either a simple linkage or a bell crank, or have utilized inclined cam surfaces, but with these constructions it has been impossible in the limited space to obtain a powerful leverage to lift the door. As a result it has been extremely hard for an operator to lift the car door, particularly after the car has been in use and the joints have become rusted. Also with the majority of these prior constructions the operator had to exert a conscious effort to retain the door in raised position while sliding, since the effort necessary to retain the door in raised position was substantially equivalent to that necessary to initiate lifting movement. It is an object, therefore, of the present invention to provide a door lift mechanism so arranged that the door may be retained in a raised position with a minimum of manual effort.

A further object of the invention is to provide a door lift mechanism so arranged as to positively free the door and rollers during raising of the door thereby breaking any ice that may have formed on the door sealing joints or upon the track.

A still further object of the invention is the provision of a powerful leverage so arranged as to permit an operator to lift substantially the equivalent of one-half the weight of the door, that is, with substantially one-half the manual effort now required by the conventional door lift.

A yet further object of the invention is the mounting of a door in a substantially balanced condition upon a shifting carriage by means of upwardly and outwardly inclined links.

These and other objects of the invention will be apparent to persons skilled in the art from a study of the following description and accompanying drawing, in which:

Figure 1 is an elevational view of the lower portion of a door and with parts broken away to better disclose the roller lift mechanism;

Fig. 2 is a sectional view taken substantially on line 2—2 of Figure 1;

Fig. 3 is a sectional view taken substantially on line 3—3 of Figure 1, and

Fig. 4 is a sectional view taken substantially on line 4—4 of Fig. 2 but showing the mechanism in a door lifting position.

Referring now to the drawing in detail, it will be seen that the mechanism has been applied to a door having a corrugated panel 2 secured at its edges to front and rear stiles 4 and 6 and to a bottom rail of deformed channel section. This bottom rail, as clearly shown in Fig. 3, has a substantially horizontal lower flange 8 connected by web 10 to an inclined upper flange 12 which is directly attached to the lower edge of the corrugated door panel. The bottom rail is also formed in part by a Z-form stiffening member welded or otherwise secured to the stiles and to the channel form rail member just described. This Z-form member has its upper flange 14 directed toward the channel member, while its lower flange 16 is directed outwardly away from the door and is adapted to rest upon the upper surface of track angle 18 as is also the flange 8 of the channel door rail. As is clearly shown in Fig. 3, the arrangement of the channel and Z bottom rail forms a substantially closed downwardly opening housing within which the door mechanism may be mounted.

The door mechanism in the present instance consists of a roller carriage formed by roller carrying members joined together by means of a connecting bar 20. The roller carrying members are formed by straps, having one portion 22 adapted to be attached to the connecting bar 20 and each of these straps is offset as at 24 in order to provide more widely spaced portions 26 in which may be received rollers 28. These rollers are amounted upon pins 29 and preferably rotate upon the pins, rather than have the pins rotate in the straps. As clearly shown the straps are extended beyond the roller pins and pierced to take transverse pins 30. One pair of the straps are extended beyond the pin 30 and are joined together to provide a back wall 32 which may abut against the rear stile of the door, as clearly shown in the right hand portion of Figs. 1, 2 and 4. It is, of course, obvious that if desired the roller carrying straps and connecting bar may be formed in one piece or the roller carrying straps may be made identical, in which case a stop could be attached to the rear stile of the door to limit motion of the carriage relative to the door. The transverse pins 30 have mounted thereon thrust links 34 which may rotate on the pin 30 or may be fixed to the pin causing the pin to rotate in the strap extensions. The thrust link adjacent the trailing edge of the door is directly connected to the door by means of a pin 36 journaled at its ends in the members forming the bottom rail of the door, as clearly shown in the right hand portion of Figs. 1, 2 and 4. The thrust link adjacent the leading edge of the door is connected by

means of a pin 38 to a second link 40 which is non-rotatably mounted on a transverse pin 42. This pin is mounted for rotation in the members forming the bottom rail of the door and extends outwardly beyond the web 10 of the outer rail forming member and has rotatably mounted thereon an operating handle 44. As clearly shown, this handle is provided with an offset portion 46 in order to form a hand grip portion. The pin 42 may, if desired, be welded or otherwise permanently secured to the operating handle, but in any case it is retained in position in the door bottom rail by means of a pin 50 extending through the shaft and through link 40. In order to prevent excessive movement of the thrust link 34 and link 40 which form the powerful toggle joint, it is necessary to provide a stop 52 which, in the present instance, is welded or otherwise secured to the front stile of the door and is of such a length as to prevent the toggle joint from reaching a dead center of position or from passing beyond the dead center position during lifting of the door.

It will be obvious that the door may be assembled complete as a unit and that the roller carriage and thrust links may be also assembled as a unit to be applied to the door by inserting the same into the bottom rail, after which pins 36 and 42 are inserted. The pin 36 may be retained in any manner, such as by direct welding or placing a cap over the pin, while pin 42 is, as was previously explained, held in position by pin 50. This pin 50 may be inserted due to the provision of a small opening 60 formed in the upper flange of the Z-form bottom rail member.

The operation of the mechanism is as follows, assuming the door to be in the lowered position as shown by Figure 1: Application of force in a downward direction to the operating handle will cause the toggle joint formed by links 34 and 40 to assume a substantially in line relation. This movement of the toggle joint will apply a lifting effort through pin 42 at one side of the door and will impart a translatory movement to the roller carriage causing it to shift toward the rear of the door and rearward shifting of the carriage causes the rear thrust link 34 to lift the door through pin 36 due to its change in angular position. Excessive movement of the carriage is prevented by the stop 32 striking the rear stile of the door, while excessive movement of the toggle joint is prevented by stop 52 at the forward edge of the door. The provision of these stops also prevents the door from tilting relative to the carriage when in fully raised position and the stop will also prevent the toggle joint from breaking beyond dead center, which would permit a collapse of the door onto the supporting track. It will thus be seen that whenever a downward motion is applied to the lift handle the carriage must move relative to the door and thus any ice that may be on the track adjacent the rollers will be broken. If, however, the ice or some other obstruction is sufficiently strong as to prevent the carriage from shifting, then the mechanism will still operate causing the front edge of the door to be lifted an amount equal to the total movement of the toggle joint but such movement will cause a tilting of the door, which tilt will bring the lower corner of the door into contact with the front sealing strip (not shown) and will exert a powerful leverage to break any ice preventing shifting of the carriage. As soon as the carriage can shift, then the door will promptly rock to the position shown in Fig. 4 and without any effort on the part of the operator. From this last analysis it will be seen that the operator in effect lifts only half of the door and that the arrangement of the linkage causes this raised half to lower slightly lifting the other half of the door to the final position. During normal operation of the door, however, the straightening of the toggle joint will impart a translatory motion to the roller carriage and a vertical lift to the door by pins 36 and 42. The use of the toggle joint and shifting carriage will, as is obvious, permit the application of an extremely powerful leverage to lift the door.

While the door lift mechanism has been described more or less in detail, it is obvious that various modifications and rearrangements of parts other than those shown and described will suggest themselves to persons skilled in the art and all such modifications and rearrangements of parts are contemplated as will fall within the scope of the appended claims which define my invention.

What is claimed is:

1. The combination with a sliding door and a track adapted to frictionally support said door in its lowered position of means for elevating said door for sliding movement, said means comprising an antifriction carriage shiftable relative to said door, a plurality of non-parallel oscillatory links connecting said carriage and door, certain of said links being connected together and constituting a toggle joint, and operating means connected to said toggle joint to move the same to a substantially locked position and simultaneously shift the carriage and lift the door.

2. The combination with a sliding door and a track adapted to frictionally support said door in it lowered position of means for elevating said door for sliding movement, said means comprising a plurality of rollers connected together to form a carriage, an oscillatory link connecting one end of said carriage to the door, a toggle joint connecting the other end of said carriage to the door, said link and toggle joint being so constituted and arranged as to permit longitudinal and vertical shifting of the carriage relative to the door, and operating means connected to said toggle joint to move the same and simultaneously shift the carriage longitudinally and lift the door.

3. The combination with a sliding door and a track adapted to frictionally support said door in its lowered position of means for elevating said door for sliding movement, said means comprising a plurality of rollers connected together to form a carriage, an upwardly and outwardly inclined oscillatory link connecting one end portion of said carriage to the door, an upwardly and outwardly inclined toggle joint connecting the other end portion of said carriage to the door, and operating means connected to said toggle joint to straighten the same and simultaneously shift the carriage longitudinally and lift the door.

4. The combination with a sliding door and a track adapted to frictionally support said door in its lowered position of means for elevating said door for sliding movement, said means comprising an antifriction carriage located adjacent the lower edge of said door, an oscillatory link connecting one end portion of said carriage to the door, a toggle joint connecting the other end portion of said carriage to the door, and operating means connected to said toggle joint to

straighten the same and lift at least the adjacent side of the door.

5. The combination with a sliding door and a track adapted to frictionally support said door in its lowered position of means for elevating said door for sliding movement, said means comprising an antifriction carriage located adjacent the lower edge of said door, an oscillatory link connecting one end portion of said carriage to the door, a toggle joint connecting the other end portion of said carriage to the door, and operating means connected to said toggle joint to straighten the same and lift at least the adjacent side of the door, said toggle joint being so constructed and arranged as to utilize the weight of the adjacent side of the door to shift the carriage longitudinally and vertically relative to the door and lift the far side of said door.

6. The combination with a sliding door and a track adapted to frictionally support said door in its lowered position of means for elevating said door for sliding movement, said means comprising a plurality of rollers connected together to form a carriage, an oscillatory link connecting one end of said carriage to the door, a toggle joint connecting the other end of said carriage to the door, said link and toggle joint being so constituted and arranged as to permit longitudinal shifting of the carriage relative to the door, and operating means connected to said toggle joint to move the same and simultaneously shift the carriage longitudinally and lift the door, and means on said door to limit the movement of said toggle joint and of said carriage.

7. The combination with a sliding door and a track adapted to frictionally support said door in its lowered position of means for elevating said door for sliding movement, said means comprising an antifriction carriage shiftable longitudinally and vertically relative to the door, a plurality of oscillatory links connected to said carriage and to said door, certain of said links being connected together and constituting a toggle joint, and operating means connected to said toggle joint to straighten the same and lift the adjacent side of the door.

8. The combination with a sliding door and a track adapted to frictionally support said door in its lowered position of means for elevating said door for sliding movement, said means comprising an antifriction carriage shiftable longitudinally and vertically relative to the door, a plurality of oscillatory links connected to said carriage and to said door, certain of said links being pivotally connected together and constituting a toggle joint, and operating means connected to said toggle joint to straighten the same and lift the adjacent side of the door, said toggle joint when straightened inclining upwardly and outwardly from its connection with the carriage to its connection with the door thereby utilizing the weight of the adjacent side of the door to shift the carriage longitudinally and lift the far side of the door.

9. The combination with a sliding door and a track adapted to frictionally support said door in its lowered position of means for elevating said door for sliding movement, said means comprising an antifriction carriage located adjacent the lower edge of said door, an oscillatory link pivotally connected to one end portion of said carriage and inclining upwardly and outwardly therefrom to a pivotal connection with said door, a toggle joint connecting the other end portion of said carriage to the door, and operating means connected to said toggle joint to straighten the same and lift at least the adjacent side of the door, said toggle joint when straightened inclining upwardly and outwardly from its connection with the carriage to its connection with the door thereby utilizing the weight of the adjacent side of the door to shift the carriage longitudinally of the door and lift the far side of the door by decreasing the inclination of said oscillatory link.

JEROME J. OLEKSIW.