Jan. 10, 1928. 1,655,478

M. G. ROCKEFELLER

DOOR MECHANISM

Filed Jan. 26. 1924 2 Sheets-Sheet 1

Fig. 1.

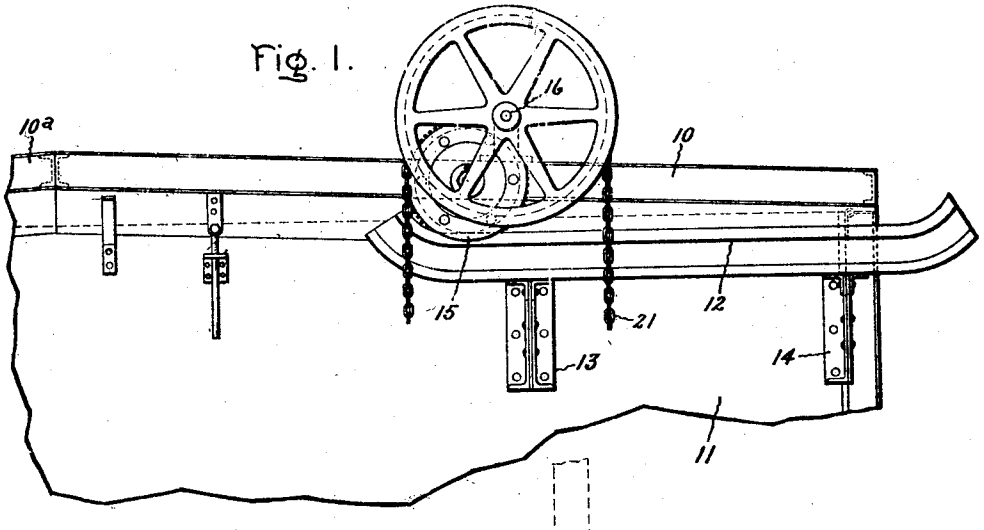

Fig. 2.

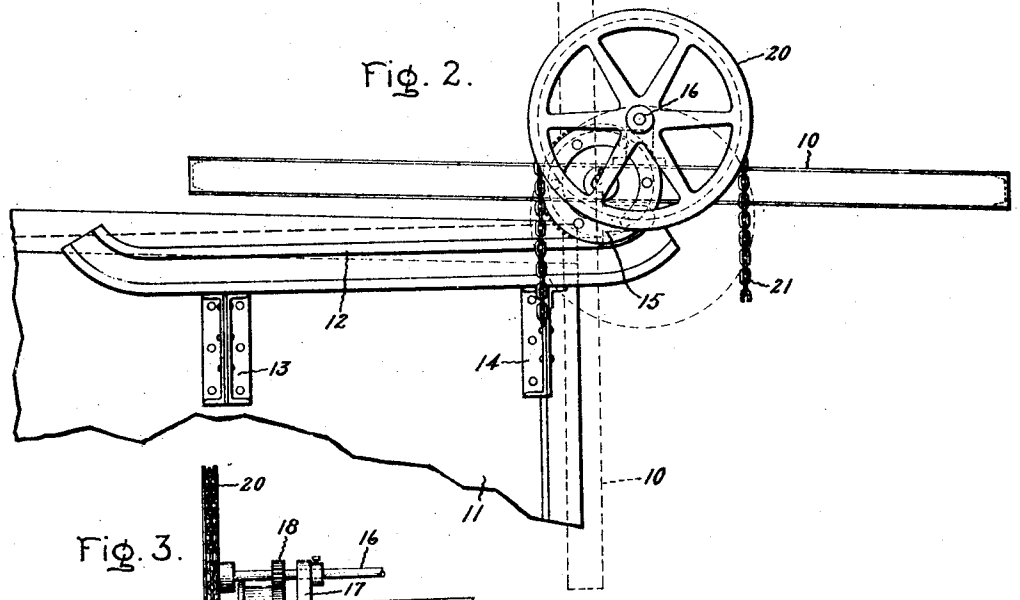

Fig. 3.

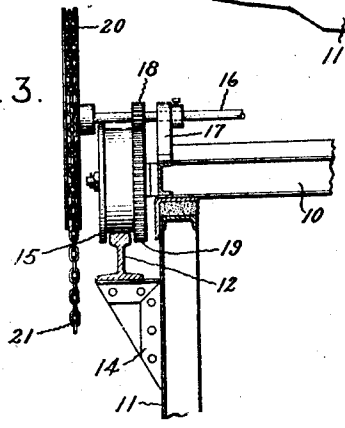

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Fig. 4.

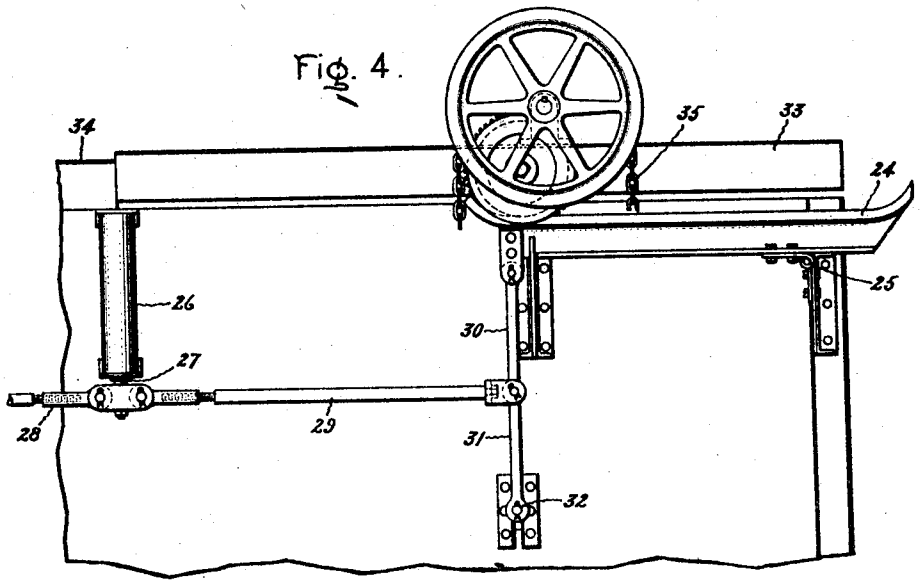
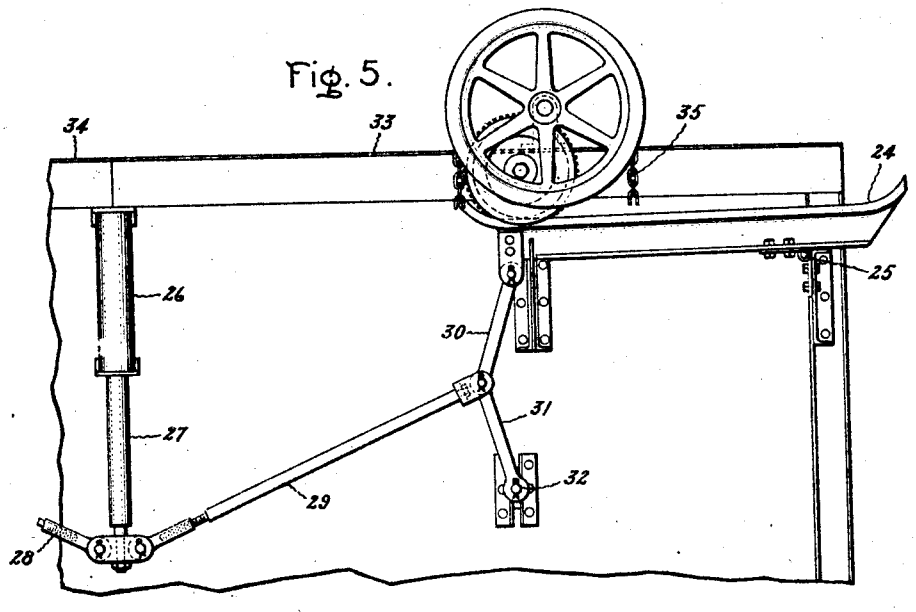


Fig. 5.



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Patented Jan. 10, 1928. 1,655,478

UNITED STATES PATENT OFFICE.

MATTHEW G. ROCKEFELLER, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

DOOR MECHANISM.

Application filed January 26, 1924. Serial No. 688,898.

My invention relates to door mechanisms, with reference more particularly to doors which are in a substantially horizontal position when closed, and has for its object the provision of simple, reliable and efficient means for opening and closing doors.

My invention has particular application to horizontal doors or covers for closing open top chambers, such for example as open top furnace chambers. The opening and closing of heavy horizontal doors presents serious difficulties since it is impracticable to mount such a door on hinges so that its weight is carried by the hinges. It is usually necessary to lift the weight of the door in whole or in part in order to open or close it. These doors have sometimes been provided with counter-weights to facilitate their being opened. In carrying out my invention I mount the door on a pair of wheels which move on tracks whereby the door may be rolled to one side and then tilted about its axis of support to a substantially vertical position which is the full open position.

For more complete understanding of my invention, reference should be had to the accompanying drawing in which Fig. 1 is a fragmentary side elevation view of a furnace door provided with mechanism embodying my invention; Fig. 2 is a fragmentary view similar to Fig. 1 illustrating various steps in the opening of the door; Fig. 3 is a fragmentary end elevation view showing various details of construction, while Figs. 4 and 5 are fragmentary elevation views showing a modified form of my invention.

Referring to the drawing, I have shown my invention as applied to a substantially horizontal door 10 which closes the top of a containing body having walls 11 which may, for example, be an electric furnace. As shown the door 10 closes one half of the furnace top, the other half being closed by an adjoining door 10^a. In accordance with my invention, I provide horizontal tracks 12 on each side of the container, which tracks are secured to the walls 11, for example, by means of suitable brackets 13 and 14. The ends of the tracks are curved upwardly as indicated in the drawing to form limit stops for flanged rollers or wheels 15, one being provided for each track. The wheels 15 form supports for the door 10, and are attached to opposite sides of the door at points substantially midway between its ends. It will be understood that although only one side of the door is shown in the drawing the opposite side of the door is supported on a wheel 15 which is attached thereto in a similar position. The preponderance of the weight of the door is carried on these flanged wheels 15, the door being substantially balanced about its axis of support on the wheels, a very small portion of its weight resting at one end or the other on the top of the walls 11.

To move the door from closed position as shown in Fig. 1 to open position as indicated in dotted lines in Fig. 2, the door is rolled on tracks 12 toward the right for a distance somewhat greater than one-half its length until the flanged wheels 15 are brought to rest against the stops formed by the upturned outer ends of the tracks 12. This position is shown in full lines in Fig. 2. The door is then tilted or rotated about its axis of support on wheels 15 in a clockwise direction until it assumes a vertical position, as indicated in dotted lines, which is the full open position. Since the door is balanced or very nearly so on the wheels 15 but little effort is required to move it. In closing the door, it is first tilted in a counter-clockwise direction to a substantially horizontal position and then rolled on the tracks back over the furnace. Preferably the top of the furnace or other containers slopes downward slightly toward the outer or right hand side as viewed in Figs. 1 and 2 so as to facilitate the horizontal movement of the door.

For simplifying the manipulation of the door, I have provided a shaft 16 which extends across the top of the door and is rotatably mounted thereon, for example, by means of a bracket 17 at each end. On each end of shaft 16 is a small spur gear 18 which meshes with a spur gear 19 rigidly secured to the wheel 15. Secured to one or both extremities of shaft 16 is a chain sprocket wheel 20 which can be turned as desired by means of an endless chain 21. It will be understood that, while supporting and operating mechanism is shown in the drawing for one side of the door only, the other side of the door is provided with duplicate supporting an operating mechanism with the exception that a chain wheel 20 may be provided on one end only of the shaft 16.

As thus constructed, the door may be

moved sideways from the position shown in Fig. 1 to open it by pulling downward on the left-hand side of the chain 21; i. e., by pulling the chain so as to turn the wheel 20 in a counter-clockwise direction. This rotates the shaft 16 and imparts rotation to the wheels 15 by means of the driving connection formed by the gears 18 and 19. The door is thus moved on the wheels 15 to the right-hand extremity of the tracks. It will be observed that by virtue of the driving connection the wheels 15 are turned at the same rate so that the sides of the door are moved evenly along the tracks. At the moment that the wheels engage and are brought to rest by the stops formed by the up-turned outer ends of the tracks, and while the door is held by its own momentum against the stops, the right-hand end of the chain 21 will be pulled downward so as to quickly reverse the rotation of the wheel 20. This clockwise rotation thus applied to wheel 20 causes the spur wheels 18 to travel around the gears 19, which are momentarily fixed, in a clockwise direction whereby the door is tilted in a clockwise direction about its axis or pivot on wheels 15 to the vertical or open position shown in the dotted lines. In closing the door, the wheel 20 is first rotated in a counter-clockwise direction by means of chain 21 whereby spur gears 18 are caused to travel upward around the spur gears 19 until the door assumes the substantially horizontal position shown in full lines. The rotation of wheel 20 is then reversed and motion thus applied to wheels 15 in a counter-clockwise direction whereby the wheels are caused to roll along the tracks toward the left and carry the door to full closed position.

In the modified form of my invention shown in Figures 4 and 5, I provide means for raising the door for a short distance off the furnace wall so that it may be easily opened and closed. In this form of my invention the tracks 24 are mounted on pivots 25 near their outer ends and may be moved on their pivots through a small angle to an inclined position by means of suitable operating means, such as hydraulic motors 26, secured to the sides of the furnace body. A single hydraulic motor on each side of the furnace may be used to raise and lower the inner ends of the two tracks on that side of the furnace. As shown, the plunger 27 of the hydraulic motor is connected through links 28 and 29 to a toggle mechanism cooperating with the ends of the tracks. Each toggle mechanism comprises two links 30 and 31 each of which is pivoted at one end on the link 29. The other end of link 31 has a fixed pivot 32 on the furnace while the other end of link 30 is pivotally connected to the end of the track 12. Although the raising and operating mechanism for one end of the door 33 only is shown, it will be understood that similar mechanism is provided for the adjoining door 34. Also, the opposite side of the furnace will be similarly arranged so as to raise and lower the opposite ends of the doors.

When the doors are in closed position, as shown in Fig. 5 the tracks 24 are inclined downward slightly toward the center of the furnace. The doors then rest on the top of the furnace. In this position of the doors, the plunger 27 is expelled whereby the links 30 and 31 of each toggle connection are retracted. In opening the doors the hydraulic motor 26 is first operated to retract its plunger 27 whereby the links 30 and 31 of each toggle connection are brought into alignment and the inner ends of the tracks raised slightly, the tracks moving about their pivots 25. This position is shown in Fig. 4. The tracks are now in substantially horizontal positions and the doors are elevated off the top of the furnace and may be moved to open position by means of the chain 35 as described in connection with Figs. 1 to 3 inclusive. It will be understood that each motor 26 raises the two ends of the doors at that side of the furnace at the same time, and the two motors are operated together.

In closing the door, it is first moved to the position shown in Fig. 4 by means of the operating mechanism as will be understood from the description of Figs. 1 to 3 inclusive, whereupon the hydraulic motors are operated to lower the inner ends of the tracks whereby the doors are lowered on the furnace.

With this form of my invention the top of the furnace may be substantially horizontal since it is not necessary to make it inclined to facilitate movement of the door as in the form shown in Figs. 1 to 3 inclusive. Obviously, a much tighter joint may be obtained between the door and the furnace walls with the form shown in Figs. 4 and 5.

While I have described my invention as embodied in concrete form and as operating in a specific manner in accordance with the provisions of the patent statutes, it should be understood that I do not limit my invention thereto, since various modifications thereof will suggest themselves to those skilled in the art without departing from the spirit of my invention, the scope of which is set forth in the annexed claims.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. Operating mechanism for horizontal doors comprising a pair of oppositely disposed wheels forming supports for the door, and tracks for said wheels on which the door can be moved to one side to substantially half open position and then tilted to a vertical position.

2. Operating mechanism for horizontal doors comprising a pair of oppositely disposed wheels secured to said door, and longitudinally fixed tracks for said wheels, whereby the door can be moved horizontally to substantially half open position and then tilted about its axis of support on said wheels to full open position.

3. Operating mechanism for horizontal doors comprising a pair of wheels secured to opposite sides of the door on which the door is substantially balanced, and tracks for said wheels on which the door may be moved horizontally for a distance slightly greater than one half of its length and tilted about its axis of support on said wheels to a substantially vertical full open position.

4. Operating mechanism for horizontal doors comprising oppositely disposed wheels on which the door is substantially balanced, and means for rotating said wheels to carry the door horizontally and then tilting said door about its axis of support on said wheels to full open position.

5. Operating mechanism for horizontal doors comprising oppositely disposed wheels on which the door is substantially balanced, tracks for said wheels, stops on said tracks, and means for rotating said wheels to carry the door horizontally until said wheels engage said stops and for then tilting said door about its axis of support on said wheels to full open position.

6. Operating mechanism for horizontal doors comprising a pair of oppositely disposed wheels secured to the door, tracks for said wheels, and driving means for said wheels mounted on said door whereby said door can be rolled to one side on said tracks by actuating said driving means in one direction and then tilted to full open position by reversing said driving means.

7. Operating mechanism for horizontal doors comprising oppositely disposed wheels on which the door is substantially balanced, tracks for said wheels, stops on said tracks, a transversely extending shaft mounted on said door, spur gears on said shaft, spur gears on said wheels meshing with the gears on said shaft, and means for turning said shaft in one direction so as to move said wheels on said tracks into engagement with said stops and for turning the shaft in the opposite direction to tilt said door about its axis of support on said wheels to full open position.

8. Operating mechanism for horizontal doors comprising a pair of oppositely disposed wheels secured to the door, pivotally mounted tracks for said wheels, and means for moving the tracks about their pivots so as to raise the door to permit its being rolled to one side and tilted to full open position.

9. Operating mechanism for horizontal doors comprising a pair of oppositely disposed wheels secured to said door, pivotally mounted tracks for said wheels, means for swinging said tracks about their pivots to raise the door, and driving means cooperating with said wheels for rolling said door to one side and then tilting it to full open position.

10. Operating mechanism for a door resting when closed in a horizontal position on the walls of the chamber closed thereby, comprising a pair of oppositely disposed wheels secured to the door, pivotally mounted tracks for said wheels, means for moving said tracks about their pivots to raise the door off the wall of the chamber, a shaft mounted on said door, and a driving connection between said shaft and said wheels whereby the door may be rolled to one side on said tracks by turning said shaft in one direction and then tilted to full open position by reversing the rotation of said shaft.

In witness whereof, I have hereunto set my hand this 25th day of January, 1924.

MATTHEW G. ROCKEFELLER.