

Nov. 24, 1953

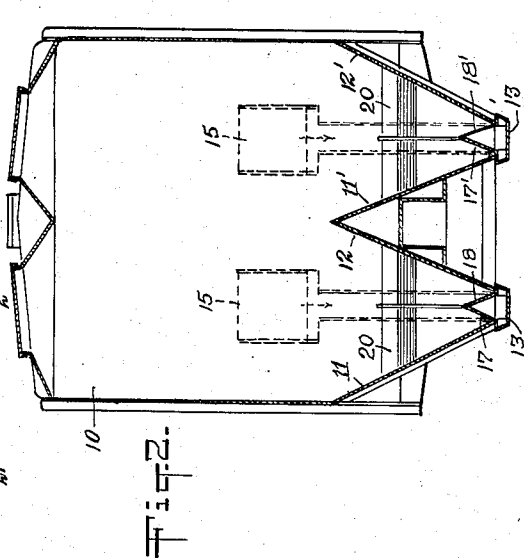
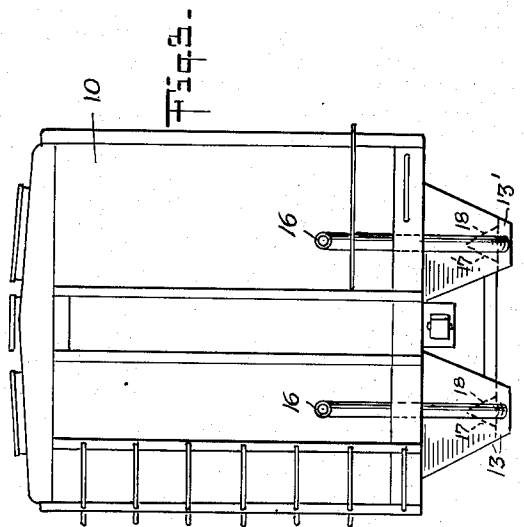
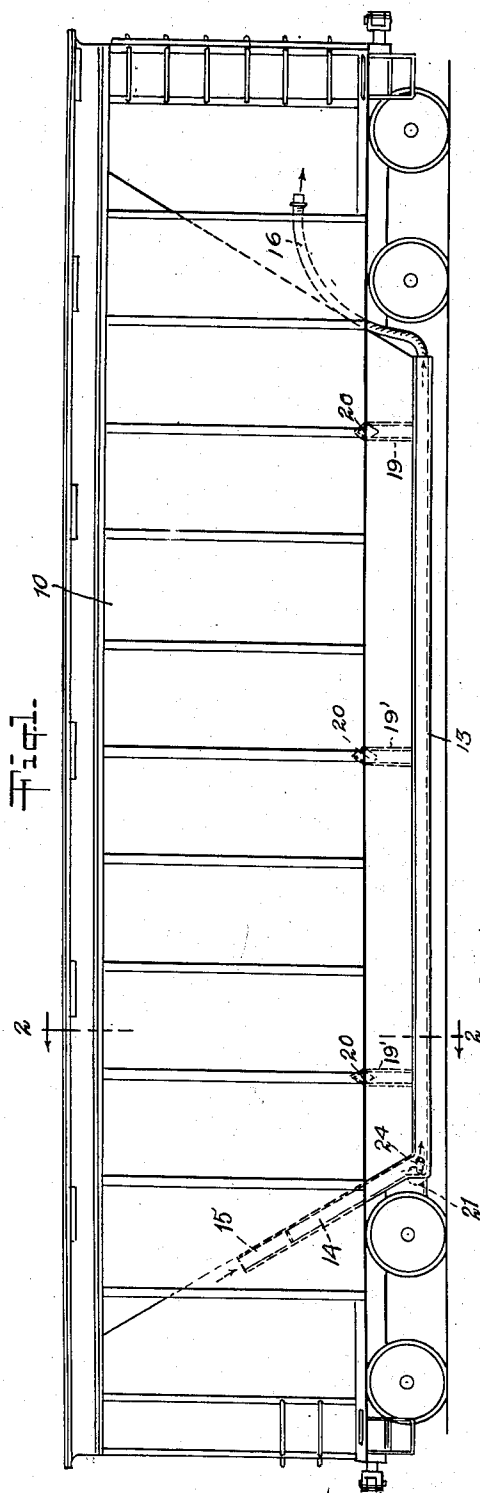
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2,560,341

APPARATUS FOR THE PNEUMATIC EVACUATION OF MATERIALS

Filed May 3, 1950

2 Sheets-Sheet 1



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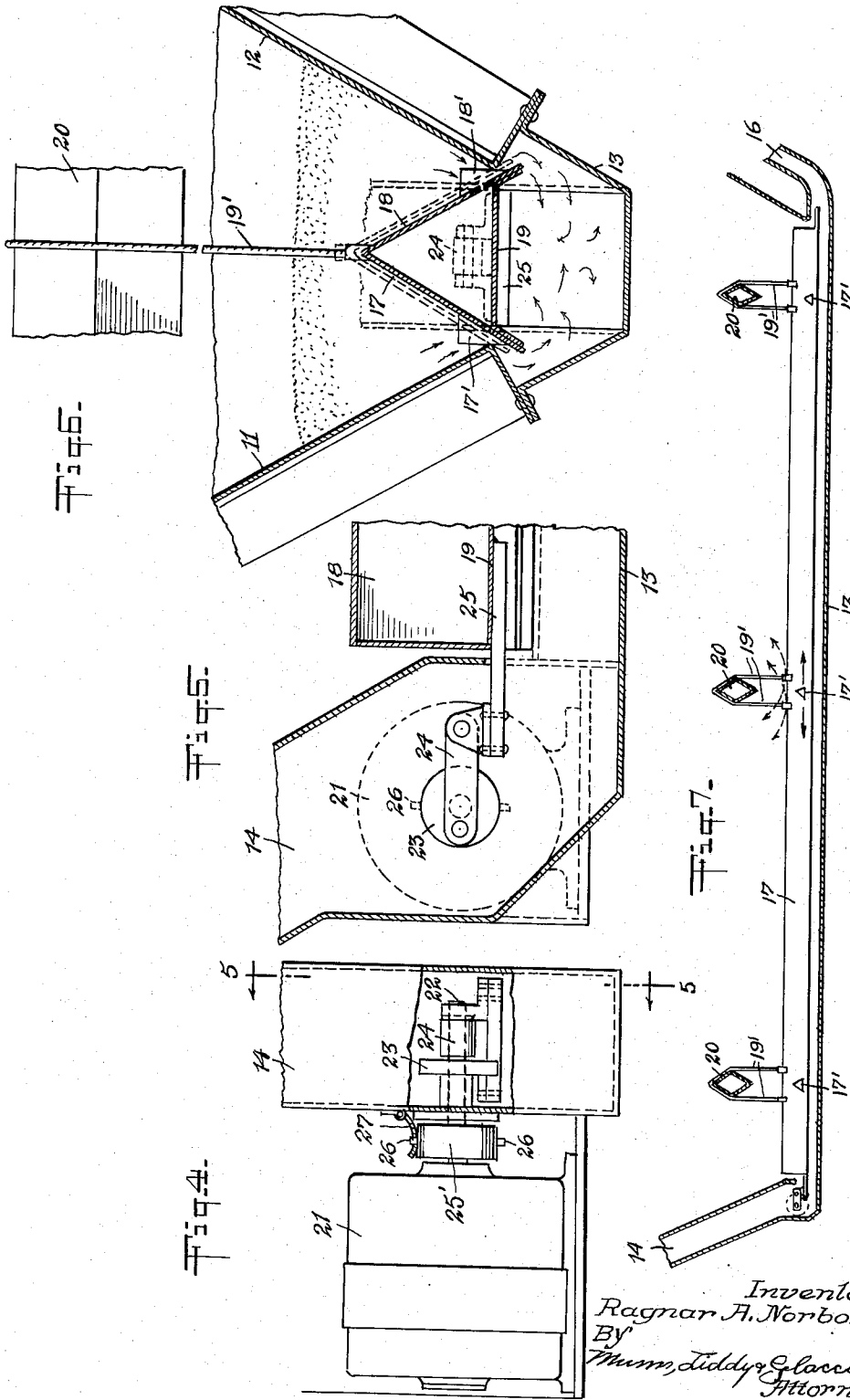
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APPARATUS FOR THE PNEUMATIC EVACUATION OF MATERIALS

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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

2,660,341

APPARATUS FOR THE PNEUMATIC
EVACUATION OF MATERIALSRagnar A. Norbom, New York, N. Y., assignor to
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6 Claims. (Cl. 222-199)

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The main object of the invention is to provide a simple and efficient apparatus for evacuating the material quickly and economically.

A further object is to remove material by means of an apparatus which is simple and formed of a few simple parts easily operated with a minimum of power requirements. Yet another object is to provide a simple and efficient apparatus which will permit the material to be held securely within the receptacle while in transit, and yet which will permit the material to be quickly and easily evacuated therefrom under proper regulation as to the flow of the material to avoid any tendency of the material to clog up and obstruct the system.

Further and more specific objects, features and advantages will more clearly appear from a consideration of the detailed specification hereinafter set forth, especially when taken in connection with the accompanying drawings which illustrate a present preferred form which the invention may assume and which form part of the specification.

In brief and general terms, the invention includes a tank, bin, or other receptacle which has downwardly sloping converging side walls, the lower edges of which are spaced a predetermined distance apart along the length of the receptacle. An air conduit is formed and disposed below these lower edges and is securely associated therewith and provided with suitable air inlets at one end and connections at the other end which may be connected to suitable pumps or other means to create a strong suction along the length of the conduit whereby material therein may be sucked out.

A bottom wall or plate is disposed longitudinally along the lower edges of the side walls of the receptacle and is suitably and flexibly supported, and means are provided and connected with this bottom wall to reciprocate it or vibrate it back and forth along a predetermined arcuate path so that during its vibration the space between it and the lower edges of the side walls will vary to permit small and regulated amounts of material to be agitated at this point and flow through these small gaps into the air conduit beneath and be sucked out into suitable reservoirs. The arcuate path of vibratory movement of the bottom wall is so predetermined that at either end of its swing, the space between the bottom wall and the lower edges of the side walls is closed. Means are provided so that the means for actuating the vibratory bottom wall may be stopped in predetermined position with the above

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mentioned gap closed so that the receptacle may be transported from one point to another, such as in a tank car, without allowing any leakage of the material from the main receptacle into the air conduit below until the means for vibrating the bottom wall is energized.

In the preferred form of invention, the bottom wall which extends longitudinally of the receptacle is in the form of an oscillating frame of triangular cross section with its apex extended upwardly into the receptacle and its sloping side walls disposed closely adjacent the lower edges of the side walls of the receptacle. This bottom plate, or member, is suitably hung flexibly from supports within the receptacle and at a plurality of points along its length so that as it is moved back and forth, it will swing in a slight arc to vary the distance between its side walls and the lower edges of the side walls of the receptacle. This movement will thereby effect the agitation of the powdered material in the receptacle to permit it to flow in regulated quantities through the gap thus formed into the air conduit therebeneath to be sucked out of the system. Preferably, an eccentric connection is established between one end of this vibratory bottom wall and a drive motor to cause its motion. It is within the purview of the invention to have the bottom of the tank car or similar receptacle formed with more than one longitudinal section with downwardly converging side walls with each section provided with a vibratory bottom plate whereby the weight and load of the material in the receptacle may be distributed between more than one vibratory bottom plate. A further feature relates to the provision of simple means to enable the drive motor to be stopped at either end of the swing of the vibratory plate so that in this position it can be insured that the gap between the bottom plate and the receptacle is closed.

A preferred form of the invention is shown in the drawings of which,

Fig. 1 is a side elevation of a railroad tank car equipped with my invention;

Fig. 2 is a vertical cross section taken on the line 2-2 of Fig. 1;

Fig. 3 is an elevation of the right hand end of the car shown in Fig. 1;

Fig. 4 is a detail of the motor and connections for vibrating the bottom wall;

Fig. 5 is a vertical section taken on the line 5-5 of Fig. 4;

Fig. 6 is an enlarged sectional detail of the

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bottom of one of the hoppers of the tank car shown in Fig. 1; and,

Fig. 7 is a general schematic representation shown in side elevation of the air conduit and the vibratory bottom wall of the hopper.

Referring now merely to the specific form of the invention shown in the drawing, it is to be noted that the form used for illustration is a tank car 10 of any conventional type, and in the form shown the bottom, longitudinally thereof, is divided into two sections having downwardly convergent side walls 11, 12 and 11' and 12'. The reason for dividing the bottom into two sloping hopper sections is to distribute the weight or load of the material between two discharge or exhaust systems as will be subsequently explained in order to reduce the weight or load of any one system. Referring now to Figs. 6 and 7, which show more clearly the details of the construction of this part of the apparatus, it will be noted that the side walls 11 and 12 at their bottom edges are spaced apart. To the bottom edges of the side walls is connected a metal channel member 13 to form a longitudinally extending air conduit disposed below the bottom edges and securely fastened and sealed to the side walls to form a longitudinal passage through which air may be drawn to exhaust the material therethrough. As shown in Fig. 7, one end of this passage is connected to an air inlet pipe 14 to the upper end of which may be connected any suitable air filters 15, and to the other end of the conduit is connected a pipe 16 which is adapted to be connected in any suitable manner (not shown) to a source of suction such as a pump so that when the pump is connected to this air conduit a strong current of air is pulled through this conduit along the bottom of each hopper below the bottom edges of the side walls thereof.

It is understood, of course, that Figs. 6 and 7 illustrate the construction with respect to the bottom of each hopper, and that some tanks or receptacles may have only one such hopper and others may have more, dependent upon the size of the receptacle and the amount of load of material contained therein. One of the main features of the invention is to provide a longitudinally extending bottom wall or plate extending longitudinally along the bottom of the hopper and lying closely adjacent the bottom edges of the side wall thereof, and provided with mechanical or other means to oscillate or vibrate it in a generally longitudinal manner so as to agitate the material resting upon it. In the normal reciprocation or vibratory movement of this bottom plate, its motion causes it to be separated in varying amounts from the bottom edges whereby small regulated amounts of the material in the receptacle may flow by gravity from the receptacle past the bottom wall into the air conduit and be passed out of said conduit by air suction into any suitable reservoir. Preferably, the plate is supported along its length to swing in a slight arcuate path so that at a low point of the swing it will be spaced a maximum distance from the lower edges of the hopper side walls, and at each end of its arcuate swing it will lie closely in contact with the bottom edges of said side walls whereby, when stopped at either end of its swing, the bottom wall is closed against the bottom edges of the side wall and no material passes through. This particular arrangement permits the car tank or receptacle to be moved in transit with the parts mentioned in closed position so that no material can leak

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down in the air conduit and cause any clogging of material therein.

In the preferred form of this construction above mentioned, a bottom plate is in the form of a longitudinal frame or structure of triangular cross section with the apex of the triangle extending upwardly into the bottom of the particular upper section. This triangular bottom frame or plate is composed of suitable metal plates welded or riveted together and has upwardly sloping side walls 17 and 18 joined at the bottom by the horizontal plate 19. This bottom plate is suspended in position by means of cables 19' which are suitably connected at each end to the apex of this triangular frame at spaced points therealong, and at their intermediate portions pass over and around cross struts or members 20 which are disposed along the length of the receptacle and are connected at opposite ends of the side walls of said receptacle thereby acting also as stiffening members for the receptacle.

As shown in Figs. 4 and 5 particularly, there is provided a motor 21, the shaft 22 of which extends into the air duct 14 and carries a disc 23 to which a link 24 is eccentrically connected. This link at its other end is connected by a bar 25 to one end of the vibratable bottom frame, preferably by being welded thereto so that as the motor is energized the bottom wall or plate will be moved back and forth and cause the swing in a predetermined arcuate path as it is held in suspension on the cables 19'. In Fig. 6 this bottom plate or frame is shown in full lines at the lowest point in its path wherein there is provided a small space between it and the bottom edges of the side walls of the hopper section. This plate is shown in dotted lines in the same figure in the position it occupies at either end of its swing, in which position it is at its highest point in the swing and the sloping walls 17 and 18 thereof are in close contact with the bottom edges of the receptacle so that no material, in this position of the parts, can pass down into the air conduit 13. There is a coupling member 25' disposed between the motor and the shaft 22, and this coupling member lies outside of the air admission passage or duct 14. This coupling has oppositely disposed pins 26 thereon, and these pins are so disposed with respect to the action and position of the vibratable bottom wall or plate, that when either pin is at its high point position, the bottom wall will be closed as shown in dotted lines in Fig. 6. To enable the motor to be stopped in this particular position and held therein, an apertured plate 27 is pivoted to the side of the air duct 14 so that it can be swung down to permit one of the pins 26 to lie in its aperture and thereby permit the coupling to be held in this position. It is obvious that this simple arrangement will permit the operator to be sure that when the tank car or receptacle, filled with material, is to be put into transit, there will be no substantial leakage of material down into the air conduit to clog up the same.

When the receptacle reaches its destination, and its contents are to be evacuated, it is merely necessary for the workmen to release the latch plate 27, connect the pipes 16 to suitable pumps or sources of suction and start the motor 21. When these arrangements are effected, it will be clear that the vibration of the bottom plate in a slightly arcuate path will create cyclical variations in the space along this bottom plate between it and the bottom edges of the side wall of

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the hopper to agitate the material in the bottom of the hopper section and to permit more quantities of such material to fall by gravity into the air conduit whereupon they are immediately transported by the strong flow of air being sucked through this conduit, along the same, and may be passed to any suitable storage reservoir (not shown) by means of this simple apparatus which is composed of a relatively few rugged parts and it is perfectly clear that the material in a large receptacle can be evacuated in regulated amounts rapidly along the entire length of the bottom of the one or more hopper sections with which it may be provided. The control of the discharge of the material from the hopper sections into the air conduit is such that these amounts are efficiently handled by the air stream of predetermined strength so that any liability to clog up the air conduit is entirely eliminated. In order to permit longitudinal oscillation of the bottom plate, but to prevent lateral movement, it will be noted that the side walls 17 and 18 of said member are provided along their length with spaced laterally extending guide ears respectively numbered 17' and 18', which when the plate swings down in its arcuate movement, will prevent side-swing.

While the invention has been described in detail and shown with respect to the accompanying drawing, it is not to be limited to such details, since many changes and modifications may be made in the invention without departing from the spirit and scope thereof. Hence, it is desired to cover any and all forms and modifications of the invention which may come within the language and scope of any one or more of the appended claims.

I claim:

1. In a device of the class described, a receptacle adapted for the reception of a material to be evacuated therefrom and having downwardly converging walls spaced apart at their lower edges and there forming a discharge opening, an oscillatory element including a pair of upwardly and inwardly inclined plates connected together at their upper edges and normally closing the space between the lower edges of said walls, means for mounting said oscillatory element for oscillatory movement within said opening, whereby said plates are alternately moved out of and into closed relation to the lower edges of said walls so that said material may be evacuated from said receptacle by way of said opening, guide ears arranged in spaced relation to each other on said plates and presenting vertically disposed guide surfaces cooperating with the lower edges of said walls to retain said oscillatory element against lateral displacement while such element is undergoing oscillatory movement.

2. In a device of the class described, a receptacle adapted for the reception of material to be evacuated therefrom and having downwardly converging walls spaced apart at their lower edges and there forming a discharge opening, an oscillatory element including a pair of upwardly and inwardly inclined plates connected together at their upper edges and normally closing the space between the lower edges of said walls, flexible suspension means having its upper end anchored at a fixed point above said opening, an oscillatory element connected to the lower end of said suspension means for oscillatory movement within said opening, whereby said plates are alternately moved out of and into closed relation to the lower edges of said walls so that said material

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may be evacuated from said receptacle by way of said opening.

3. In a device of the class described, a receptacle adapted for the reception of material to be evacuated therefrom and having downwardly converging walls spaced apart at their lower edges and there forming a discharge opening extending lengthwise of said receptacle substantially throughout the longitudinal extent of the lower edges of said walls, an oscillatory element extending substantially throughout the extent of said opening and including a pair of upwardly and inwardly inclined plates connected together at their upper edges and normally closing the space between the lower edges of said walls, a plurality of flexible cables suspended from fixed points above said opening and spaced from each other longitudinally of said receptacle, an oscillatory element connected at various points along its length to the lower ends of said cables for oscillatory movement within said opening whereby said plates are alternately moved out of and into closed relation to the lower edges of said walls so that said material may be evacuated from said receptacle by way of said opening.

4. In a device of the class described, a receptacle adapted for the reception of material to be evacuated therefrom and having downwardly converging walls spaced apart at their lower edges and there forming a discharge opening extending lengthwise of said receptacle substantially throughout the longitudinal extent of the lower edges of said walls, an oscillatory element extending substantially throughout the extent of said opening and including a pair of upwardly and inwardly inclined plates connected together at their upper edges and normally closing the space between the lower edges of said walls, a plurality of flexible cables suspended from fixed points above said opening and spaced from each other longitudinally of said receptacle, an oscillatory element connected at various points along its length to the lower ends of said cables for oscillatory movement within said opening whereby said plates are alternately moved out of and into closed relation to the lower edges of said walls so that said material may be evacuated from said receptacle by way of said opening, guide ears arranged in spaced relation to each other on said plates and presenting vertically disposed guide surfaces cooperating with the lower edges of said walls to retain said oscillatory element against lateral displacement while such element is undergoing oscillatory movement.

5. In a device of the class described, a receptacle adapted for the reception of a material to be evacuated therefrom and having downwardly converging walls spaced apart at their lower edges and there forming a discharge opening, an oscillatory element including a pair of upwardly and inwardly inclined plates connected together at their upper edges and normally closing the space between the lower edges of said walls, means for mounting said oscillatory element for oscillatory movement within said opening, whereby said plates are alternately moved out of and into closed relation to the lower edges of said walls so that said material may be evacuated from said receptacle by way of said opening, guide ears arranged in spaced relation to each other on said plates and presenting vertically disposed guide surfaces cooperating with the lower edges of said walls to retain said oscillatory element against lateral displacement while such element is undergoing oscillatory movement,

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power driven reciprocatory means located wholly without said receptacle and there connected to said oscillatory element for moving that element in an arcuate path out of and into closed position with relation to said opening.

6. In a device of the class described, a receptacle adapted for the reception of a material to be evacuated therefrom and having downwardly converging walls spaced apart at their lower edges and there forming a discharge opening, an oscillatory element including a pair of upwardly and inwardly inclined plates connected together at their upper edges and normally closing the space between the lower edges of said walls, means for mounting said oscillatory element for oscillatory movement within said opening, whereby said plates are alternately moved out of and into closed relation to the lower edges of said walls so that said material may be evacuated from said receptacle by way of said opening, guide ears arranged in spaced relation to each other on said plates and presenting vertically disposed guide surfaces cooperating with the lower edges of said walls to retain said oscillatory element against lateral displacement while such element is undergoing oscillatory movement, power driven reciprocatory means located wholly without said receptacle and there connected to

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said oscillatory element for moving that element in an arcuate path out of and into closed position with relation to said opening, manually operated latching means associated with said power driven reciprocatory means and cooperating therewith to retain said oscillatory element in closed position as that element reaches the full extent of its oscillatory movement in either direction.

RAGNAR A. NORBOM.

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