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**2,690,137**

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OPERATING MECHANISM FOR CLOSURE MEMBERS OF DISCHARGE  
OUTLET ASSEMBLIES AND METHODS OF ASSEMBLING THE SAME  
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4 Sheets-Sheet 1

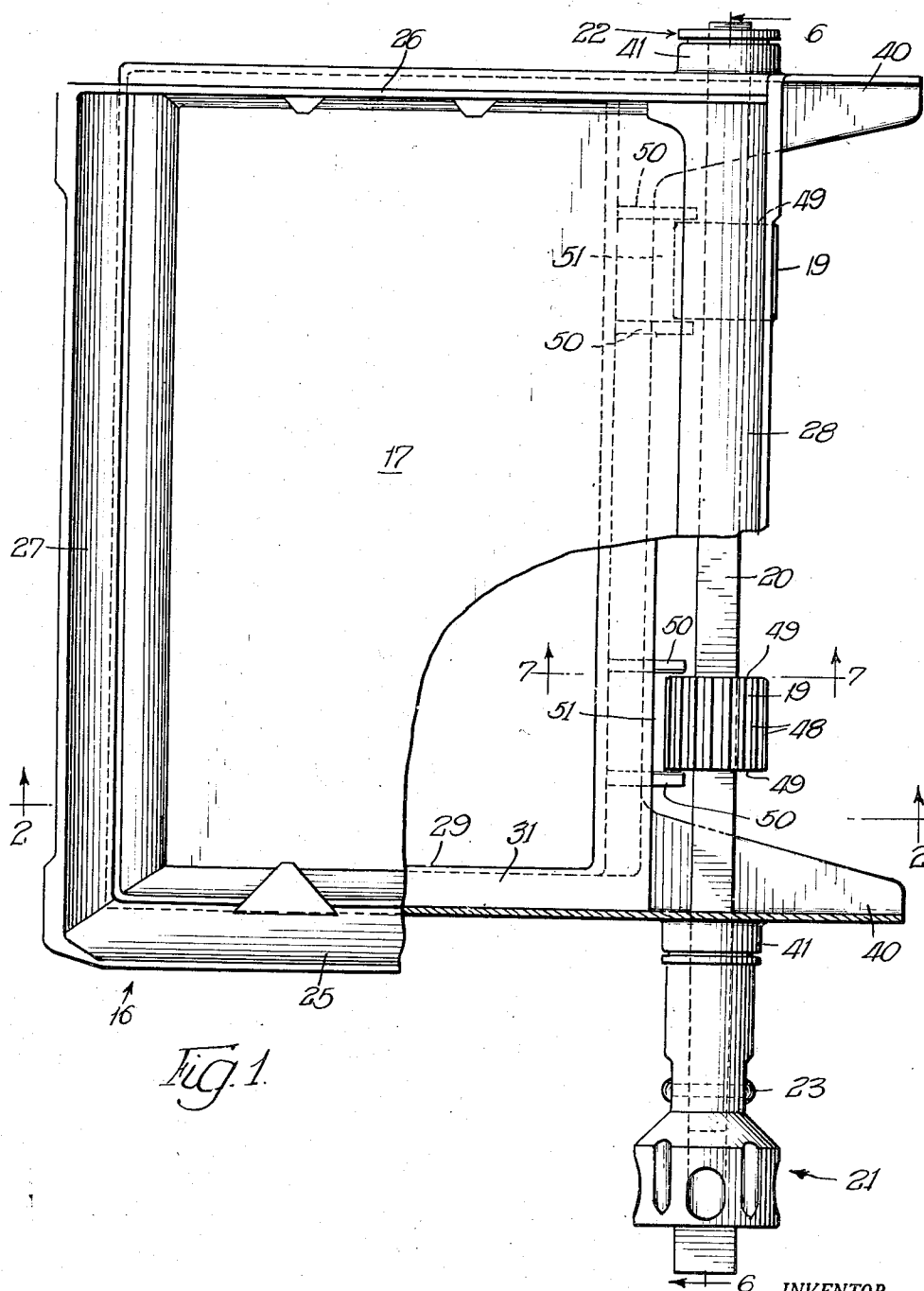


Fig. 1.

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Fig. 2

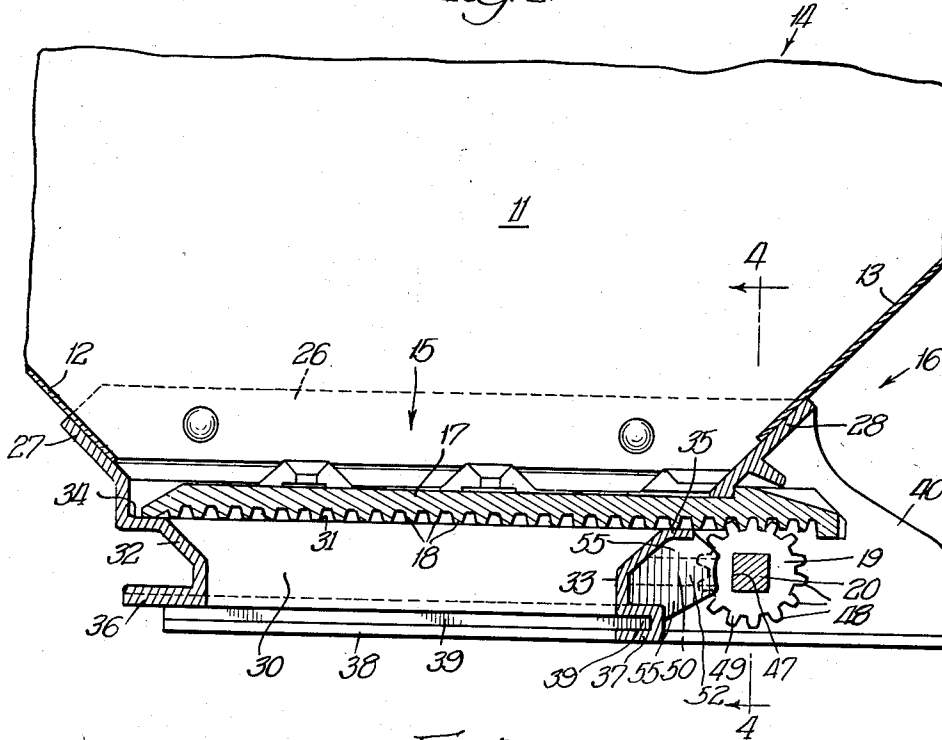
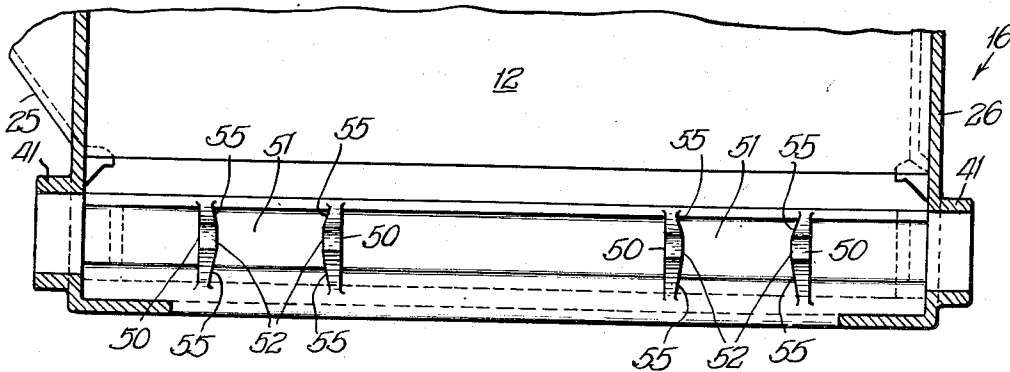


Fig. 4



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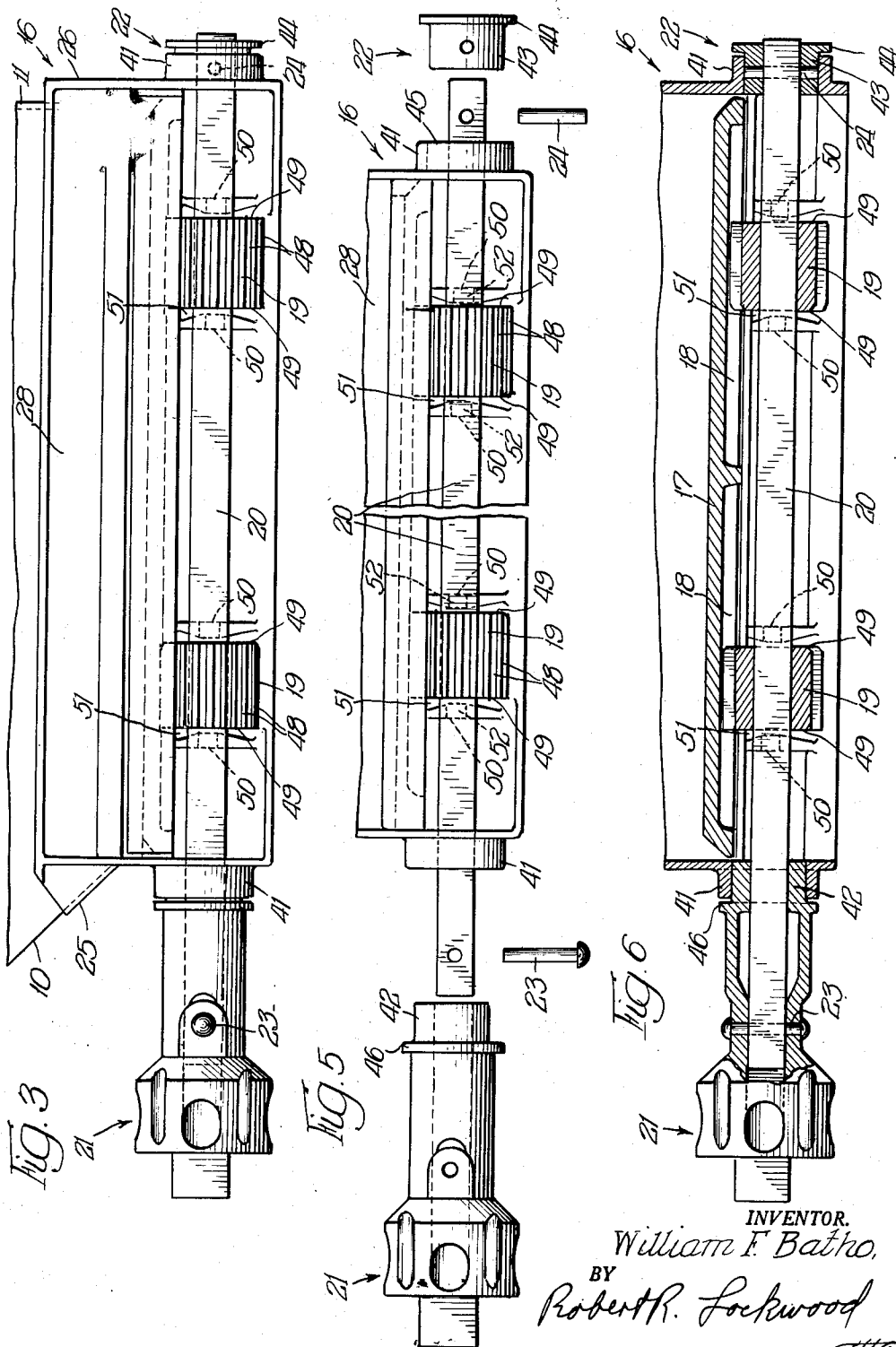
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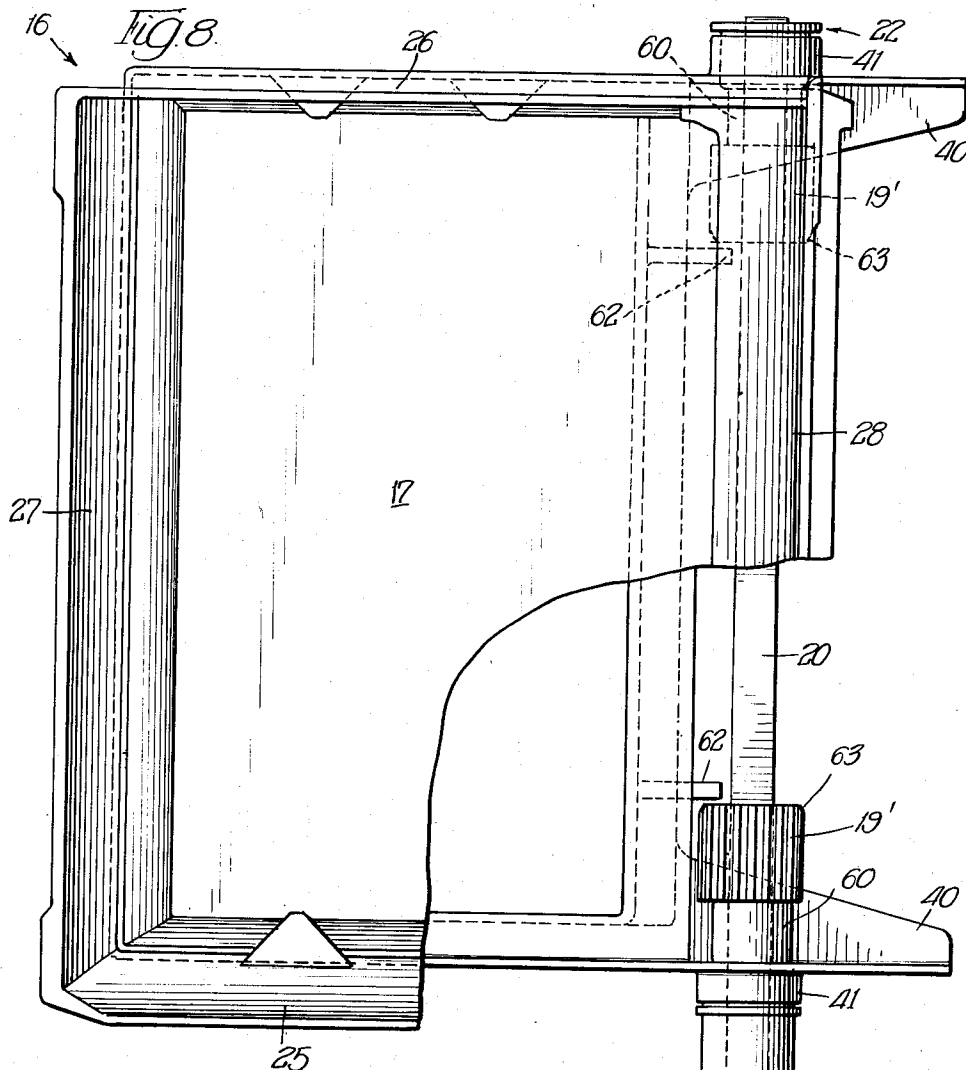
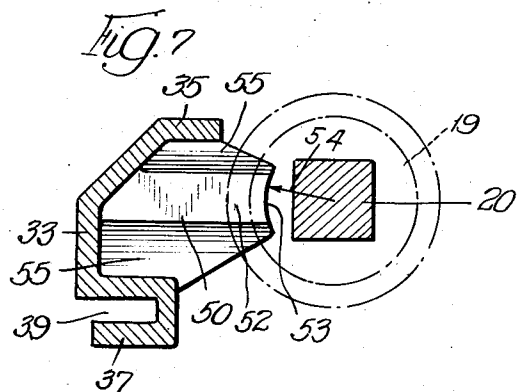
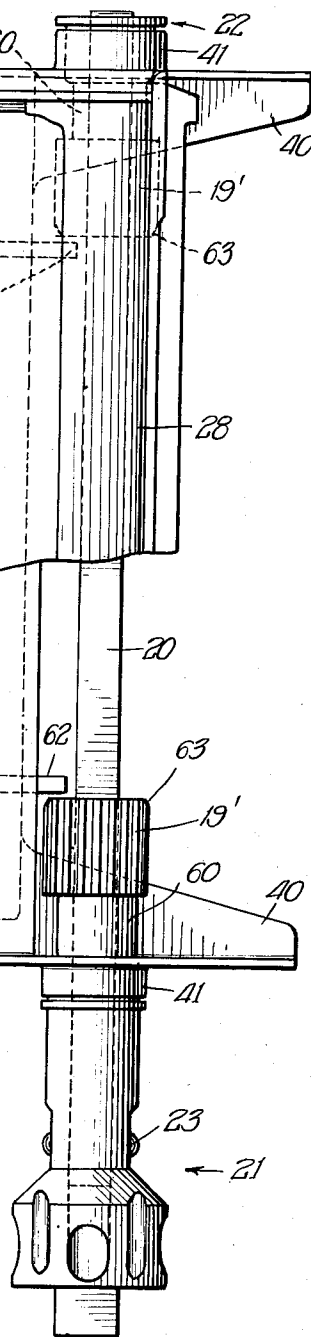
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4 Sheets-Sheet 4



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## UNITED STATES PATENT OFFICE

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OPERATING MECHANISM FOR CLOSURE  
MEMBERS OF DISCHARGE OUTLET AS-  
SEMBLIES AND METHOD OF ASSEM-  
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5 Claims. (Cl. 105-282)

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This invention relates to an improved operating means for a closure member, such as employed for varying the size of a discharge outlet for the discharge opening of a load containing hopper and methods for assembling the same.

The objects of the invention among others are: To provide an improved means for retaining a geared pinion in a definite position in relation to an operating shaft without the necessity of forming apertures in the shaft; to facilitate the assembly of geared pinions with an operating shaft; to improve the method of mounting the same on an outlet frame; and to provide pockets on an outlet frame for maintaining geared pinions in definite spaced relation independently of the operating shaft carrying them.

This improved construction is especially desirable for use in connection with outlets of railway hopper cars such as are employed in handling cement, lime and similar compacted materials where great force and multiplied leverage are usually necessary for moving the closure member under the weight of the lading. In such service it is customary to provide pinions of comparatively small diameter in order to obtain the necessary leverage. The use of small diameter pinions in turn necessitates the employment of a comparatively small shaft which, by reason of its limited size, requires heat treatment and special alloys to obtain the required strength. In view of the small size of the shaft and the hardness of the material associated with special steel and hardening, the provision of apertures in the shaft for receiving pins to hold the pinions is not desirable. Furthermore the presence of holes to receive rivets or pins materially weakens the shaft.

It is therefore another object of this invention to eliminate rivets or similar holding means for the pinions which require perforation or weakening of the shaft and to substitute therefor stop means on the frame or hopper structure which will retain the pinions against axial movement independently of any connection with the shaft.

For a more complete comprehension of this invention reference may be had to the accompanying drawings wherein:

Figure 1 is a plan view of a frame and gate assembly, with the pinion gears and associated shaft indicated thereon, a portion of the gate being broken away to show more clearly the parts identified with this improvement;

Figure 2 is a vertical sectional elevational view of the structure shown in Figure 1 and taken on line 2-2 thereof;

Figure 3 is a vertical end elevational view of

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the assembly shown in Figure 1 as viewed from right to left;

Figure 4 is a vertical sectional view taken through the outlet frame on line 4-4 of Figure 2 showing the frame construction with the shaft, pinion gears and associated parts omitted;

Figure 5 is a vertical end view, similar to Figure 3, showing the shaft and pinions in position with the end bearing members and retaining pins in disassembled relation;

Figure 6 is a vertical sectional view on an enlarged scale taken through the assembly on a line 6-6 of Figure 1;

Figure 7 is a sectional view, on an enlarged scale, taken through the transverse end wall of the frame adjacent one of the abutment wall members as viewed on a line 7-7 of Figure 1; and

Figure 8 is a plan view of an assembly similar to that shown in Figure 1, showing a modified form of the invention.

In the drawings, the invention is illustrated as embodied in an outlet assembly of a load containing hopper such as employed for the discharge opening of a railway car hopper. A load containing hopper is indicated in Figures 2 and 3, generally, by side walls 10 and 11 which meet with end sloping walls 12 and 13 to form a four-sided hopper 14 having a rectangularly shaped discharge opening 15.

Enclosing the lower portion of the four sides of the hopper 14 is a unitary frame 16 having a sliding gate 17 carried thereby which is provided on its under side with rack teeth 18. Cooperating with the rack teeth 18 of the gate 17 are pinions 19 which are non-rotatably mounted on an operating shaft 20. The shaft 20 is journaled in the frame 16 and is provided at one end with an operating head 21. At the opposite end the shaft 20 is fitted with a combined bearing and stop member 22. The head 21 is maintained against lengthwise movement by a rivet 23 and the bearing and stop member 22 is likewise maintained against lengthwise movement relative to the shaft 20 by a headless pin 24. The manner in which these parts are assembled will be set forth presently.

The frame 16 in its preferred form includes an upper wall portion lying above the gate 17 and formed with walls 25, 26, 27 and 28 which overlie the respective walls 10, 11, 12, and 13 of the hopper 14. The frame 16, below the gate 17, is formed with a four-sided chute-like portion having walls of appreciable depth including side walls 29 and 30 which are spaced inwardly from the adjacent

upper walls 25 and 26 a sufficient distance to provide flat runway surfaces 31 at each side of the frame 16 on which the gate 17 is adapted to have lengthwise sliding movement.

The four walls of the chute are completed by transverse walls 32 and 33 which extend between the respective side walls 29 and 30. The end wall 32 is spaced from the upper wall 27 to provide an end ledge 34 disposed on a level corresponding to the level of the side runway surfaces 31—31 and forms therewith a three-sided supporting surface for the gate 17.

The end wall 33 extends transversely below the gate 17 and is provided at its upper margin with a flat horizontal wall 35. At the lower portion of the frame 16 there is a laterally outwardly extending structure which projects from the lower margin of the chute walls 29, 30, 32 and 33. This structure on two adjacent sides is in the form of a flange indicated at 36 and on the other two adjacent sides, as indicated at 37 and 38 in Figure 2, is in the form of channel section presenting an inwardly facing groove 39. The flange 36 and the groove 39 are for the purpose of accommodating a removable extension chute (not shown). The flange 36 and channel sections 37 and 38 operate to strengthen the four sides of the frame 16.

As shown in Figure 7, the outstanding grooved section 37 extends in parallelism with the upper transversely disposed wall 35 and in combination with this wall and the wall 33 forms a substantially channel shaped beam member. Projecting forwardly beyond the beam member as formed by walls 33, 35 and 38 and disposed at each side of the frame are vertical side wall extensions 40 which are each provided with a bearing portion 41 presenting an annular bearing for rotatably supporting the operating shaft 20.

The operating shaft 20 is preferably of rectangular cross section throughout and circular hub bearing end portions to form journals are provided on members 21 and 22 at each end of the shaft 20 to seat in the annular portion of bearings 41 carried by the side wall extension 40. The circular bearing portion at the outer end of shaft 20 is preferably formed integrally with the head 21 as indicated at 42 in Figure 5 and at the opposite end of the shaft 20 in the circular bearing portion is incorporated with the bearing and stop member 22 as indicated at 43. The bearing member 22 is maintained in position on the shaft 20 by the headless pin 24 which is just long enough to extend through the bearing portion 43. It is held in place on assembly by the inner surface of the bearing portion 41. The member 22 is provided with a stop collar 44 which cooperates with the outer face 45 of the bearing portion 41 formed integrally with the frame 16 to limit outward movement of the shaft 20. Similarly at the opposite end of the shaft 20 there is provided a stop collar 46 on the head 21 which, in cooperation with the adjacent bearing portion 41, limits inward movement of the shaft 20. The shaft 20 is, therefore, maintained in position and restrained against axial movement in either direction and the entire structure is locked in place in operative position by the rivet 23.

The pinion gears 19, which are preferably two in number, are slidably mounted on the shaft 20 and non-rotatably related thereto since each is formed with a central rectangularly shaped opening 47, as shown in Figure 2, corresponding substantially in shape and size to the shaft 20. The pinions 19 are formed with gear teeth 48

which mesh with the rack teeth 18 of the gate 17 and adjacent each side wall 49, Figure 3, of the pinions 19 there is disposed a segmental shaped guiding wall 50, Figure 7, which extends forwardly from the frame 16 and is preferably formed integrally with the end wall structure thereof as provided by walls 33, 35 and 37. Each pair of walls 50—50 thus combines to form a pocket 51 within the confines of which each pinion gear 19 is held against axial movement relative to the shaft 20 and independently of any connection therewith. The walls 50 are each formed with a comparatively heavy pad portion 52, Figure 4, lying in the plane of the shaft 20 and extending substantially normal thereto to embrace as much of the side walls 49 of the pinions 19 as to straddle two teeth of each. The outer edge of segmental shaped wall 53 is of arcuate shape as at 53, Figure 7, and is formed on a radius centering from the axis of rotation of the shaft 20 to clear it in its rotating movement. The inner face of each wall 50 on each side of the pad portion 52 flares outwardly as indicated at 55 to present an outwardly flaring pocket structure for guiding the pinions 19 in their rotary movement in either direction. They prevent the pinions 19 from impinging on the side walls 50.

It will be observed that the pinions 19 are held in operative position on the shaft 20 relative to the rack teeth 18 by the pockets 51 formed by the segmental guiding walls 50. They cannot shift axially along the shaft 20. No openings need be provided in the shaft 20 to receive rivets to hold the pinions 19 in place. Thus the shaft 20 is not weakened by the provision of such openings.

The advantages of the invention may be best realized by following the sequence of assembly operations in the mounting of the shaft 20 and pinions 19. Assuming the pinions 19 centralized in the pockets 51, the shaft 20 with the end bearing and stop member 22 held in position by means of the headless pin 24 is threaded from right to left, as viewed in Figure 5, through the bearing portion 41 and through the openings 47 of the pinions 19. It is moved axially until the stop collar 44 contacts the face 45 of the adjacent bearing portion 41, the headless pin 24 being then held in place by the inner surface of the annular bearing 41, as shown in Figure 6. The operating head 21 is then telescoped over the left hand end of the shaft 20 and secured thereon by the rivet 23. It will thus be appreciated that the rivet 23 is the key member holding the entire assembly in place and consequently the assembly or dismantling of the shaft 20 and pinions 19 may be conveniently and quickly effected from an accessible location.

If desired, the shaft 20 may be threaded through the pinions 19 from either direction through one or the other of the bearing portions 41. Then the combined bearing and stop member 22 can be applied and the headless pin 24 inserted. The shaft 20 is shifted to the left as viewed in Figure 5 to place the bearing 43 in the bearing portion 41. Finally, the operating head 21 is assembled on the left hand end of the shaft 20 and the rivet 23 is inserted and headed over.

In the alternate construction shown in Figure 8, each pinion 19' is formed with an extended hub portion 60 which operates as a stop member to limit axial movement in one direction by contact with the adjacent side wall extension 40 of the frame 16 and an abutting wall 62, extending from the transverse wall 33, operates to limit axial

movement of the pinions 19' in the opposite direction. In this embodiment of the invention the outer corner edge 63 of each pinion 19' adjacent the abutting wall 62 is rounded or beveled as indicated to prevent interference therebetween.

What is claimed as new is:

1. For combination with a load containing hopper having a discharge opening, a generally horizontally slidable gate for closing said opening and adapted to have the load in the hopper bear against its upper surface thereby requiring the application of substantial force to move the same to the open position; means for moving said gate including interengaging rack and pinion means carried by the underside of said gate and said hopper respectively, said pinion means having a non-circular uniform aperture there-through, a shaft having a non-circular solid cross-section substantially from one end to the other rotatably mounted on said hopper and extending through and unattached to said pinion means whereby the same is rotatable with and axially slidable on said shaft and torque applied to said shaft for rotating said pinion means and moving said gate loaded as aforesaid is transmitted thereto through said shaft where the same is of solid cross-section and unlikely to be broken by the application of such torque, and means for applying operating torque to said shaft at a location where the same is of solid cross-section between said location and said pinion means; and means limiting relative axial movement between said shaft and pinion means including fixed abutment means carried by said hopper and cooperating with said pinion means.

2. For combination with a load containing hopper having a discharge opening, a generally horizontally slidable gate for closing said opening and adapted to have the load in the hopper bear against its upper surface thereby requiring the application of substantial force to move the same to the open position; means for moving said gate including interengaging rack and pinion means carried by the underside of said gate and said hopper respectively, said pinion means having a substantially square aperture there-through, a shaft having a substantially square solid cross-section substantially from one end to the other rotatably mounted on said hopper and extending through and unattached to said pinion means whereby the same is rotatable with and axially slidable on said shaft and torque applied to said shaft for rotating said pinion means and moving said gate loaded as aforesaid is transmitted thereto through said shaft where the same is of solid cross-section and unlikely to be broken by the application of such torque, and means for applying operating torque to said shaft at a location where the same is of solid cross-section between said location and said pinion means; and means limiting relative axial movement between said shaft and pinion means including fixed abutment means carried by said hopper and cooperating with said pinion means.

3. For combination with a load containing hopper having a discharge opening, a generally horizontally slidable gate for closing said opening and adapted to have the load in the hopper bear against its upper surface thereby requiring the application of substantial force to move the same to the open position; means for moving said gate including interengaging rack and pinion means carried by the underside of said gate and said hopper respectively, said pinion means having a non-circular uniform aperture there-through, a shaft

having a non-circular solid cross-section substantially from one end to the other rotatably mounted on said hopper and extending through and unattached to said pinion means whereby the same is rotatable with and axially slidable on said shaft and torque applied to said shaft for rotating said pinion means and moving said gate loaded as aforesaid is transmitted thereto through said shaft where the same is of solid cross-section and unlikely to be broken by the application of such torque, and means for applying operating torque to said shaft at a location where the same is of solid cross-section between said location and said pinion means; and means limiting relative axial movement between said shaft and pinion means including a pair of fixed walls extending from said hopper and straddling said pinion means.

4. In combination, a frame and a generally horizontally sliding gate assembly for the discharge opening of a load containing hopper where the load therein bears against the upper surface of said gate thereby requiring the application of substantial force to move the same to open position, said frame being foursided for bordering the discharge opening and one side thereof being slotted for the passage of said gate therethrough and presenting an end wall extending transversely of and below the path of movement of said gate; means for moving said gate including interengaging rack and pinion means carried by the underside of said gate and said frame respectively, said pinion means having a substantially square aperture there-through, a shaft having a substantially square solid cross-section substantially from one end to the other rotatably mounted on opposite sides of said frame and extending through and unattached to said pinion means whereby the same is rotatable with and axially slidable on said shaft and torque applied to said shaft for rotating said pinion means and moving said gate loaded as aforesaid is transmitted thereto through said shaft where the same is of solid cross-section and unlikely to be broken by the application of such torque, and means for applying operating torque to said shaft at a location where the same is of solid cross-section between said location and said pinion means; and means limiting relative axial movement between said shaft and pinion means including fixed abutment means extending laterally from said end wall and cooperating with said pinion means.

5. In combination, a frame and a generally horizontally sliding gate assembly for the discharge opening of a load containing hopper where the load therein bears against the upper surface of said gate thereby requiring the application of substantial force to move the same to open position, said frame being foursided for bordering the discharge opening and one side thereof being slotted for the passage of said gate therethrough and presenting an end wall extending transversely of and below the path of movement of said gate, the sides of said frame adjacent the ends of said slot extending therebeyond; means for moving said gate including interengaging rack and pinion means carried by the underside of said gate and said frame respectively, said pinion means having a substantially square aperture there-through, a shaft having a substantially square solid cross-section substantially from one end to the other rotatably mounted on opposite sides of said frame and extending through and unattached to said pinion means whereby the same is rotatable with and axially slidable on said

shaft and torque applied to said shaft for rotating said pinion means and moving said gate loaded as aforesaid is transmitted thereto through said shaft where the same is of solid cross-section and unlikely to be broken by the application of such torque, and means for applying operating torque to said shaft at a location where the same is of solid cross-section between said location and said pinion means; and means limiting relative axial movement between said shaft and pinion means including said extended sides of said frame to limit outward axial movement of said pinion means along said shaft, and wall means extending laterally from said end wall and cooperating with said pinion means to limit inward axial movement thereof.

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