

March 31, 1959

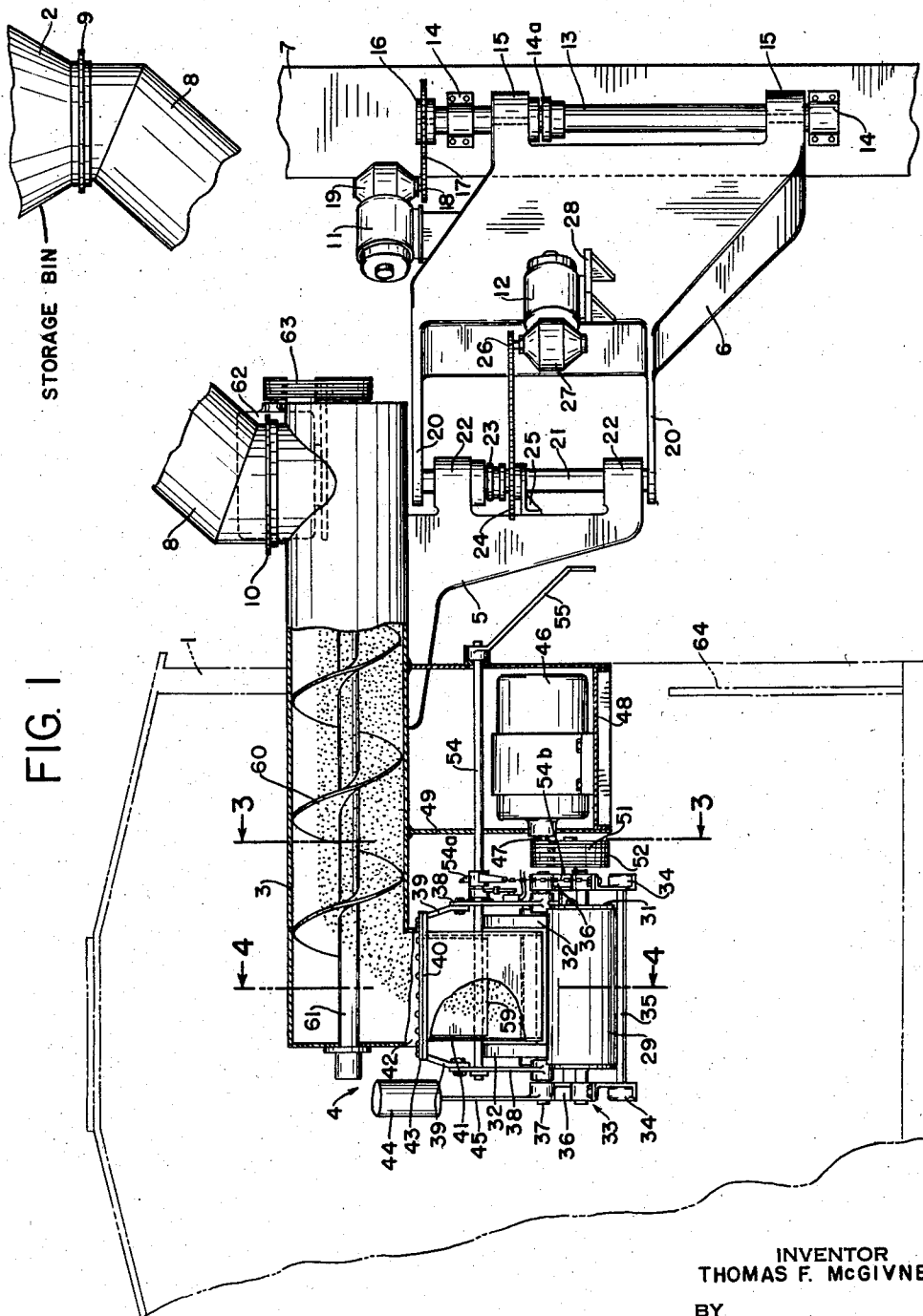
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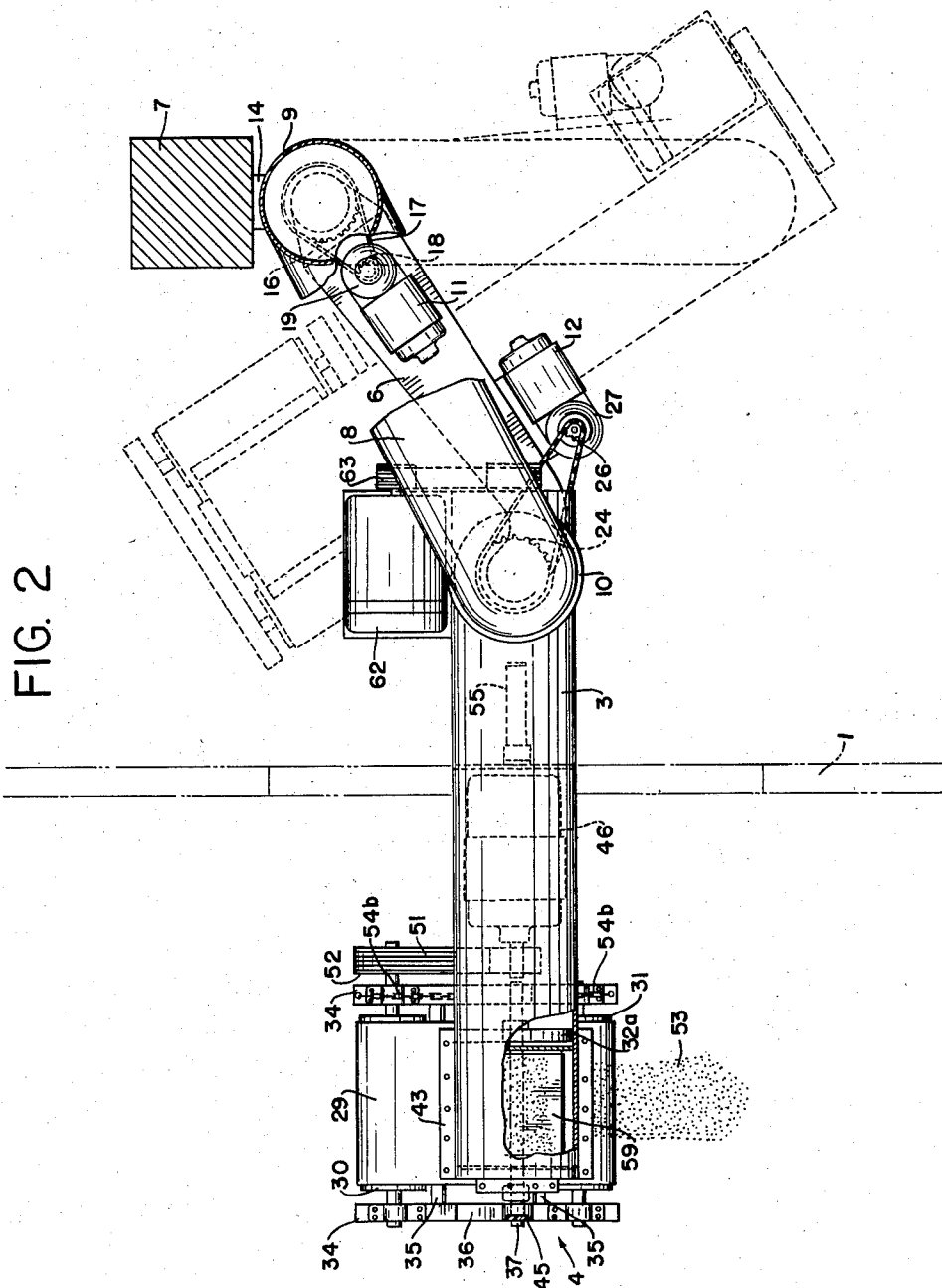
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FIG. 4

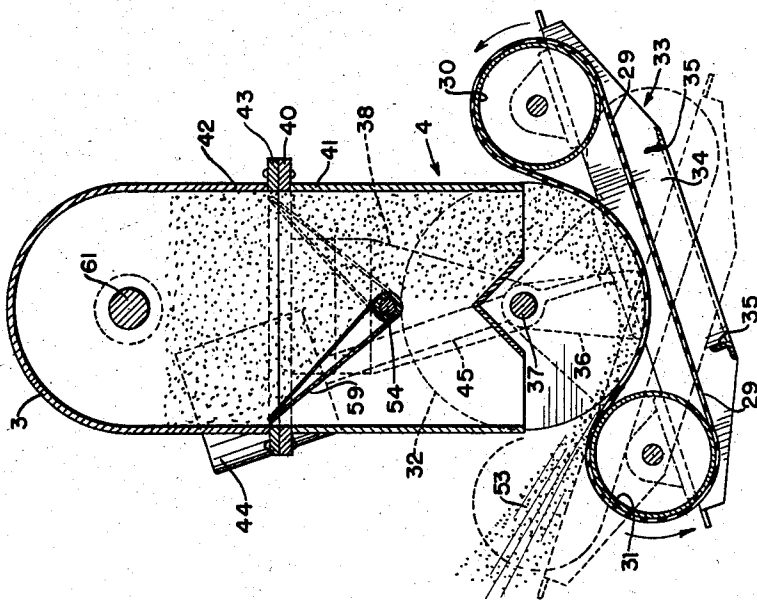
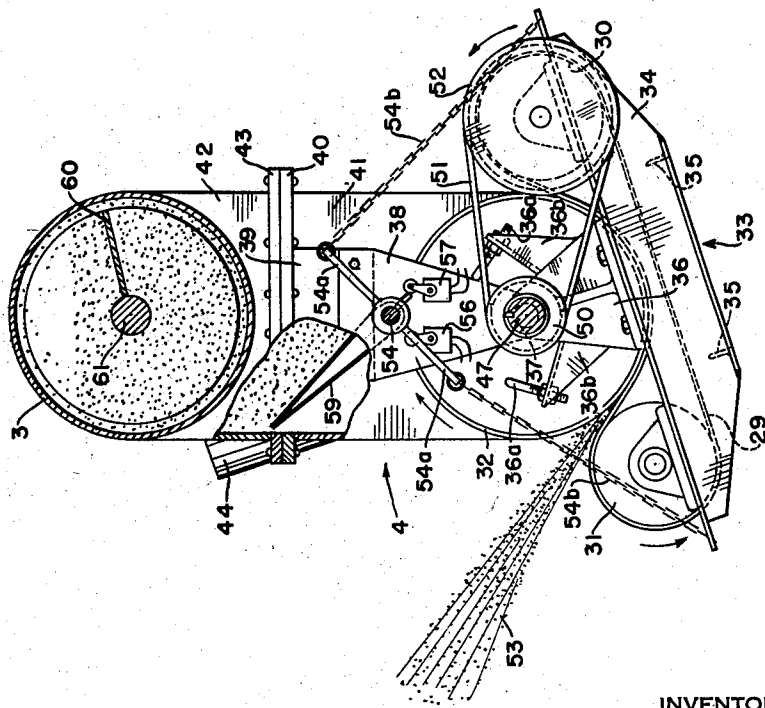


FIG. 3



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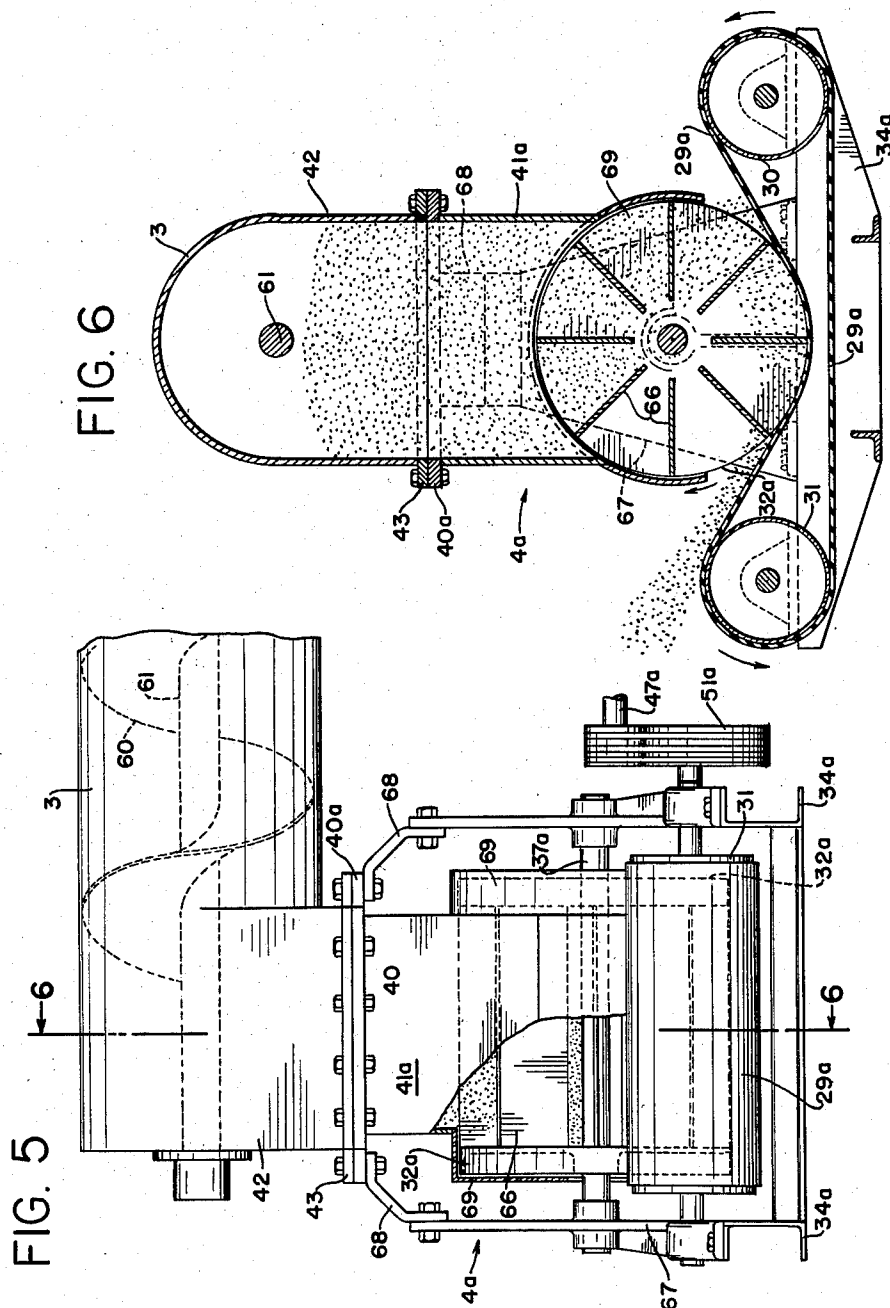
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Application August 14, 1956, Serial No. 604,009

4 Claims. (Cl. 198—6)

This invention relates to car loading apparatus, and more particularly to apparatus for loading granular or powdered materials of a dust producing nature into freight cars.

Fertilizer ingredients such as muriate of potash are produced throughout the year but, due to seasonal demand, are stored in large piles during most of the year. The demand is so seasonal that failure to ship on a specified date will cause cancellation of the orders. Consequently, it is imperative to be able to load large quantities of the material quickly.

After the material from the storage pile has been properly processed for handling, it is delivered into bins built over or close to the railroad scales. Empty box cars are spotted on the scales and the loading apparatus is used for transferring the material from the bins into the box cars.

The apparatus heretofore proposed for this purpose comprised a throwing or slinging mechanism mounted by means of a swivel joint on the end of a conveyor duct and introduced through the car door into the car. The throwing mechanism was operated to throw the material a distance of about twenty feet to load one end of the car. Then, in order to load the opposite end, it was necessary to swing or turn the throwing mechanism approximately 180°.

When loading muriate of potash and other dusty and highly saline materials, dust and moisture combine to produce, in the dusty atmosphere within the car, a corrosive condition that will "freeze" the bearings of the swivel joint. Because of this, much difficulty was experienced in turning the throwing mechanism around on the swivel joint, so that as much as ten minutes was required for this operation. Unless the operation of the throwing mechanism were stopped during this turn-around, a considerable amount of the granular material would be thrown out of the car door on the opposite side of the car.

A shut-down of as much as ten minutes duration is serious because it not only increases the car loading time, but also interferes with the smooth operation of the material handling system as a whole and would necessitate the installation of larger storage bins than would otherwise be required, inasmuch as the intention is to deliver the material from the storage piles into the bins at about the same rate as it is removed and loaded into the car.

In handling granular or powdered material, the flow of the material by gravity down the conveyor duct system tends to produce an air current through the duct which picks up particles of the material and produces an extreme dust condition. The same volume of air that flows into the car also flows out of the car carrying away valuable products in the form of air-borne dust.

Accordingly, the primary object of the present invention is to provide a loading apparatus which overcomes such difficulties and by means of which a box car can be loaded in the shortest possible time.

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Another object of the invention is to provide a car loading apparatus which will operate without wastage of the material either as dust or otherwise.

Another object of the invention is to provide a car loading apparatus by means of which the car can be completely loaded without requiring the operator to enter the car.

Still another object of the invention is to provide a car loading apparatus wherein the necessity of swinging the throwing mechanism in order to load both ends of the car is eliminated.

A still further object of the invention is to provide a car loading apparatus which will handle dust producing materials with a minimum of dust production.

The invention will be understood from a consideration of the accompanying drawings and the following description.

In these drawings:

Fig. 1 is a view in side elevation showing the loading apparatus in operating position within a car;

Fig. 2 is a plan view of the apparatus as shown in Fig. 1 and also showing the apparatus in retracted position in dotted outline;

Fig. 3 is a view in vertical section taken on line 3—3 of Fig. 1;

Fig. 4 is a similar view taken on line 4—4 of Fig. 1;

Figs. 5 and 6 illustrate a modified form of the apparatus; Fig. 5 being a side elevation of a part of the apparatus shown in Fig. 1 and drawn to a larger scale, whereas Fig. 6 is a view in vertical section taken on line 6—6 of Fig. 5.

Referring to the drawings, it will be understood that the car 1, indicated in diagrammatic outline, has been spotted on the railroad scales (not shown) which are located adjacent a storage bin 2 containing the granular or powdered material, such as muriate of potash. The loading apparatus which comprises a conveyor duct 3 and a throwing mechanism, indicated generally by reference numeral 4, fixed at the outer end thereof, is supported by means of a heavy bracket 5 on a swinging forked structure 6. This structure is mounted on a heavy column 7 adjacent the outlet of storage bin 2 and which may form a part of the supporting structure for the bin. The material is delivered from bin 2, the bottom of which has steeply inclined converging walls, by means of a steeply inclined conveyor duct 8 which is connected by means of a swivel joint 9 to the discharge opening of the bin and by a second swivel joint 10 to the inner end of conveyor duct 3.

In order to move the throwing mechanism 4 and the outer end of conveyor duct 3 into and out of car 1 through one of the doors thereof, the forked member 6 is mounted for swinging movement on a heavy hinge structure secured to the side of column 7, and bracket 5 is somewhat similarly hinged to the outer forked end of member 6. The swinging of member 6 about its supporting hinge is by power through an electric motor 11, and that of bracket 5 by a second electric motor 12 through push button controls (not shown) for these two motors. The loading mechanism may be swung from the retracted position shown in dotted lines in Fig. 2 to the extended position, shown in full lines in this figure and in Fig. 1.

The hinge mounting for forked member 6 comprises a heavy vertical shaft which is supported for rotation, that is, oscillating movement, in upper and lower bearings 14 which are secured in any suitable manner to the column 7. Shaft 13 passes through apertures in two large lugs formed on the rear edge of forked member 6. These two lugs, as well as the bearings 14 are spaced a considerable distance apart vertically and a ball thrust bearing 14a supports the weight.

Shaft 13 is keyed, as shown by the dotted lines, to the lugs 15 and at its upper end has a large sprocket 16 fixed thereto by means of a key or otherwise. This sprocket is connected by a chain 17 to a similar sprocket 18 on the output shaft of a gear box 19. The input shaft of this speed reducer is the driving shaft of motor 11.

Member 6 is provided at its forward end with upper and lower fork arms 29 and between these arms there is mounted another vertical shaft 21. This shaft is stationary and passes through bearings in upper and lower lugs 22, the weight being carried on a ball thrust bearing 23.

In order to swing bracket 5 and conveyor duct 3 about pivot shaft 21, a sprocket 24 is fixed to a bracket 25 which is mounted on member 5, and this sprocket is chain-connected to a smaller sprocket 26 on the slow speed shaft of another speed reducer 27 which is driven by motor 12. Motor 12 is mounted on a bracket structure 28 which is fixed to the side of forked member 6. It will be understood that the pivot shaft of forked member 6 is in vertical alignment with the swivel bearing 9 at the lower end of bin 2, and that the axis of pivot shaft 21 is also in vertical alignment with the swivel bearing 10.

The throwing mechanism 4 comprises an endless belt 29 which is trained around a driving pulley 30 and an idler pulley 31, the upper reach of this belt passing beneath a pair of guide discs 32 to be referred to later. Belt 29 is somewhat wider than the diameter of conveyor duct 3. Pulleys 30 and 31 are mounted near the opposite ends of a pivotally suspended frame structure indicated generally by numeral 33, and comprising two spaced side channel members 34 which are secured together by cross-bars 35.

Extending upwardly from the centers of the side members 34 are two brackets 36 by means of which the frame structure 33 is pivotally suspended from a fixed shaft 37 (Fig. 4). This shaft is fixed to the slinger frame and is in line with the motor shaft 47 shown in section in Fig. 3. The guide discs 32 turn on fixed shaft 37 which is mounted at the lower end of the triangular supporting plates 38, one on each side of the throwing mechanism. These plates are bolted at their upper ends to two rectangular plates 39 which, in turn, are welded to the sides of a flange 40 which is square in shape. Flange 40 forms the upper edge of a square housing or chute 41 which delivers the granular material to the surface of throwing belt 29 between the guide discs 32.

The outer end of conveyor duct 3 has a downwardly directed outlet 42 which is square in shape and provided with a flange 43 at its lower end to which the square flange 40 is bolted. The weight of the pivoted frame structure 33 is partially counter-balanced by means of a counterweight 44 which is mounted at the upper end of an arm 45. Arm 45 extends upwardly from the hub of the outer bracket member 36, as shown in Fig. 1.

From the above it will be understood that the throwing mechanism 4, instead of being connected by means of a swivel joint with the discharge outlet 42 of the conveyor duct, is permanently mounted in fixed relation thereon with the direction of travel of the throwing belt 29 at right angles to the conveyor duct 3. The pivotally suspended frame structure 33 carrying the throwing belt 29, however, being arranged to rotate or rock about the axis of the guiding discs 32, can be tilted to one side or the other of the vertical, depending upon the direction of the throw, that is, depending upon which end of the car is being loaded.

The throwing belt 29 is driven by means of an electric motor 46 having a driving shaft 47 (Figs. 1 and 3) which is arranged in axial alignment with shaft 37 (Fig. 4) on which the guiding discs 32 rotate, and also about which the pivoted frame structure 33 swings. Thus the drive not only does not interfere with the swinging of this structure, but is made to assist in producing the tilting

of the throwing belt, as will be discussed further below. Driving motor 46 is mounted on a shelf 48 supported between two vertical plates 49 which are welded to the lower side of conveyor duct 3. Motor shaft 47 has keyed thereto a pulley 50 carrying a multiple V-belt 51 which drives a pulley 52 keyed to the shaft of driving pulley 30 to drive the throwing belt 29.

When it is desired to cause the throwing mechanism 4 to discharge the granular material in the opposite direction, belt 29 is operated in the reverse direction and the suspended frame structure 33 is oppositely tilted from the position shown in full lines in Figs. 3 and 4 to that shown in dotted lines in Fig. 4. This may be accomplished either manually or automatically or partly by manual and partly by automatic action. Automatic reversal is accomplished by merely reversing the operation of the driving motor 46. Part of the force required to swing frame 33 is supplied by the pull of driving belt 51, and part by the reaction of the stream 53 of the discharged material.

When loading freight cars of standard length the suspended frame structure 33 may be arranged to have a fixed angle of tilt in each direction. However, to load cars that are either longer or shorter than standard length, the loading apparatus may be provided with adjustable stops to control or adjust the angle of tilt in each direction. Thus, in Fig. 3, there are shown two stop screws 36a mounted on extensions 36b projecting from the sides of one of the supporting brackets 36 of frame structure 33. Their upper ends engage the opposite edges of the right-hand supporting plate 38 (Fig. 1). These stop screws are fixed in adjusted position by means of the lock nuts shown.

The angle of tilt may also be adjusted by adjusting counterweight 44 at different positions on its supporting arm 45 by means (not shown), so as to counterbalance the weight of the suspended frame structure 33 to a greater or lesser extent. By either of these methods the trajectory angle of the stream of material 53 may be controlled to produce the required length of throw of the discharge material so as to cause the material to be deposited at the ends of the car, with the belt 29 being operated at a uniform speed of, for example, about 2100 feet per minute.

A control shaft 54 is provided having an operating handle 55 at its outer end on the outside of the freight car. Shaft 54 mounts two oppositely directed arms 54a of equal length and each connected by chains 54b extending from the ends of the arms to the outer extremities of one of the channel members 34 of frame structure 33. Shaft 54 also has a short projecting finger which actuates electrical control switches 56 and 57, one for each direction of rotation of driving motor 46. Consequently, as shown in the drawings, the handle 55 is operated manually to reverse the direction of throw of the loading mechanism, and this reversal is accomplished in part by manual force through the chains 54b, and in part automatically by the pull of belt 51 and the reaction of the stream 53 of the material.

On the same control shaft 54, there is arranged a deflector plate 59, which, in one angular position, for example as shown in Fig. 3, directs the stream of granular material onto the throwing belt 29 between the guiding discs 32 on one side of the chute 41. But upon turning shaft 54 to reverse the direction of operation of motor 46 and throwing belt 29, the deflector plate 59 is swung to the opposite side, as shown in the dotted lines in Fig. 4 so as to direct the granular material to the opposite side of the chute.

The granular material after being received in the conveyor duct 3 from the duct 8 is propelled along duct 3 by means of a conveyor screw 60 which extends substantially throughout the length of duct 3. This is a continuous helical screw fitting the internal diameter of duct 3 and mounted upon a supporting shaft 61 which extends

lengthwise of the duct. This shaft is supported in appropriate bearings at the opposite ends of duct 3 and is continuously rotated by means of an electric motor 62. This motor is connected to drive the shaft 61 by a multiple V-belt 63 which is trained around appropriate pulleys mounted respectively on the shaft of motor 62 and on the right end of shaft 61.

In the operation of the apparatus to load a box car, the electric motors 11 and 12 are first operated to shift the duct system from the dotted position of Fig. 2 to full line position where the throwing mechanism 4 is not far from the center of the car. Grain doors 64, one of which is shown in Fig. 1, have previously been placed in both of the car door openings. Lever-operating handle 55 is now moved in one direction or the other to cause the operation of motor 46, and the driving of throwing belt 29. The driving motor 62 for the conveyor screw 60 is also started in operation.

The granular material feeding by gravity down the conveyor duct 8 into the horizontal conveyor duct 3 is fed forward through this duct by the conveyor screw 60 and discharged at its left-hand end into the throwing mechanism 4, and belt 29 continuously throws a stream 53 of the granular material towards one end of the car. The direction of the stream material can be shifted sideways sufficiently to fill the corners of the car by swinging the conveyor duct 3 under the control of motor 12. The throwing mechanism 4 being mounted in fixed position on the end of conveyor duct 3, the duct need be shifted only a slight amount to one side or the other.

As soon as the loading of one end of the car has been completed, the operator, from outside of the car where he is not subjected to a severe dust condition, moves control handle 55 to its opposite position. This reverses driving motor 46 and throwing belt 29 and causes the tilting of the suspended frame structure 33 to the dotted position of Fig. 4. The stream of granular material thrown by the belt now issues from the opposite side of the throwing mechanism and at the same trajectory angle as before. The motor 12 is operated to swing conveyor duct 3 so as to direct the stream of discharged material appropriately to load the opposite end of the car.

It will be understood that the trajectory angle of the mechanism may be adjusted to cause the granular material to be deposited at the proper position with respect to the end of the car by adjusting the angle of tilt of the throwing belt 29 and that this may be done in any of the ways previously mentioned. The pull of the driving belt 51 and the reaction of the stream 53 of material not only cause the reverse tilting of member 33, when the direction of operation of the throwing belt is reversed, but also hold the frame structure 33 and belt 29 at the adjusted angle of tilt.

Although a certain amount of dust is necessarily created by the stream 53 as it builds a pile within the car, such dust is not forced out of the car inasmuch as there is no current of air flowing into the car. The presence of the conveyor screw 60 with its plurality of flights or turns within the duct 3, effectively prevents any flow of air into the car by the injector action of the flowing stream of granular material, which would take place if it were not for the presence of the several turns of the conveyor screw 60 which serve as baffles to prevent such flow.

Referring now to the modified form of the throwing mechanism shown in Figs. 5 and 6, the throwing mechanism 4a is similar to that previously described except that the frame structure which supports the throwing belt 29a does not tilt from one side to the other, but is fixed in horizontal position, and the shiftable deflector plate 59 is eliminated. In place of this deflector a series of vanes 66 are mounted between the guide discs 32a. These vanes carry the granular material to one side or the other of the chute 41a, depending upon the direction of rotation

of discs 32a. Consequently, the granular material is deposited on the surface of belt 29a at the correct location regardless of the direction of operation of the throwing belt 29a.

The driving pulley 30 and idler pulley 31 are mounted on shafts which are supported in bearings carried by a pair of horizontal channel members 34a, and these members are bolted to the bottoms of two rigid bracket castings 67, one on each side of the mechanism, as shown in Fig. 5. The upper ends of bracket 67 are bolted to hangers 68 which are, in turn, bolted beneath the lower flange 40a which is like the flange 40 of the mechanism of Figs. 1-4. Also the left end of conveyor duct 3 is provided with a downwardly directed discharge outlet 42 which is square in cross-section and has the same square supporting flange 43 to which flange 40 is secured.

The chute 41a is provided with a hood 69 at its lower portion to partially enclose the guide vanes and discs 32a (Fig. 6) and aid in directing the flow of the granular material onto the surface of belt 29a.

Inasmuch as the pulleys for the throwing belt 29a are carried by a fixed instead of a pivoted frame structure, it is not necessary that the axis of the driving motor shaft 47a be in alignment with the axis of the shaft 37a which supports the guide discs 32a, and greater freedom is, therefore, possible in the mounting of the driving motor. Otherwise, the drive through multiple V-belt 51 is similar to the drive of the mechanism described in Figs. 1 to 4.

In the operation of this modified mechanism, the granular material is carried down by the vanes 66 and discharged onto the surface of the belt 29a below the edge of the hood 69. The length of travel of the material in contact with the belt before it is discharged at the left, as viewed in Fig. 6, is greater than in the apparatus of Figs. 1-4. Also the material is accelerated by vanes 66 until it receives substantially the same velocity as belt 29a before being deposited thereon. Consequently, the throwing capacity of this modified form is, at least, as good as that of the mechanism of Figs. 1-4. Moreover, it has the advantages of eliminating the deflector plate and also the necessity that the operator make sure that the suspended frame structure 33 is properly tilted each time the mechanism is reversed.

The trajectory angle of this mechanism can be raised or lowered by increasing or decreasing the size of the pulleys 30 and 31 which drive the slinger belt 29a. Thus, for example, by increasing the size of these pulleys belt 29a is caused to leave the surface of guide discs 32a at a smaller angle, thereby raising the angle of throw, that is, the trajectory angle. Conversely, employment of smaller pulleys 30 and 31 will have the opposite effect. The same result may be obtained by mounting shafts for pulleys 30 and 31 so that they may be adjustably raised or lowered with respect to the channel members 34a.

It will be understood that the invention can be embodied in still other forms of apparatus and its scope is, therefore, intended to be set forth in the appended claims.

I claim:

1. In a car loading apparatus for handling dust-producing granular or powdered material, a source of supply of such material, a horizontal conveyor duct, said duct having mounted at right angles to said duct at its outer end a loading mechanism of the reversible thrower belt type, a mounting for said conveyor duct permitting movement thereof to position said loading mechanism within the car to be loaded and with the belt of said loading mechanism directed lengthwise of the car, means for connecting the receiving end of said conveyor duct with said source of supply, said loading mechanism comprising a fixed frame structure, an endless thrower belt, supporting pulleys for the opposite ends of said belt mounted respectively near the ends of said frame structure, a pair of guiding discs mounted in spaced relation

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midway between said pulleys, said discs cooperating with the opposite margins of said belt on its upper load-carrying side and being substantially larger in diameter than said pulleys and positioned to cause the surface of said belt on each side of said discs to be directed upwardly at a predetermined trajectory angle, a motor operatively connected to drive the said belt, a plurality of vanes mounted between said discs and rotating therewith to convey material from the outer end of said duct to the surface of said belt, said duct being arranged to deliver the material between the radially outward edges of said vanes, and means for reversing said motor so as to permit the material to be discharged from either end of said thrower belt.

2. A car loading apparatus as claimed in claim 1 wherein a closed chute receives the material from the outer end of the conveyor duct and delivers it to said vanes, the walls of said chute extending into cooperative relation with the radially outward edges of said vanes.

3. In a carloading apparatus for handling dust-producing granular or powdered material, an elevated source of supply of such material, a rigid screw-conveyor duct having a conveyor screw therein, a bracket mechanism for supporting said duct in substantially horizontal position, a gravity operated duct for connecting the receiving end of said screw-conveyor duct with said source of supply of the dust-producing material, a loading mechanism

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of the reversible thrower belt type supported by said conveyor duct and mounted in fixed position at the outer end of said rigid conveyor duct and at right angles thereto, an electric driving motor for said throwing mechanism mounted on said rigid duct adjacent said throwing mechanism, control means for reversing the operation of said loading mechanism, and mechanically operated means for operating said bracket mechanism to swing said duct horizontally and move the outer end thereof and said loading mechanism and driving motor carried thereon through the upper portion of the door of the car to be loaded and into or out of the car.

4. A carloading apparatus as set forth in claim 3 wherein the conveyor screw has a driving motor which is supported on the rigid screw-conveyor duct.

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