A. E. NORRIS.

APPARATUS FOR DELIVERING MATERIALS.

APPLICATION FILED AUG. 1, 1908.

961,732. Patented June 14, 1910.

8 SHEETS—SHEET 1.

Fig. 1.

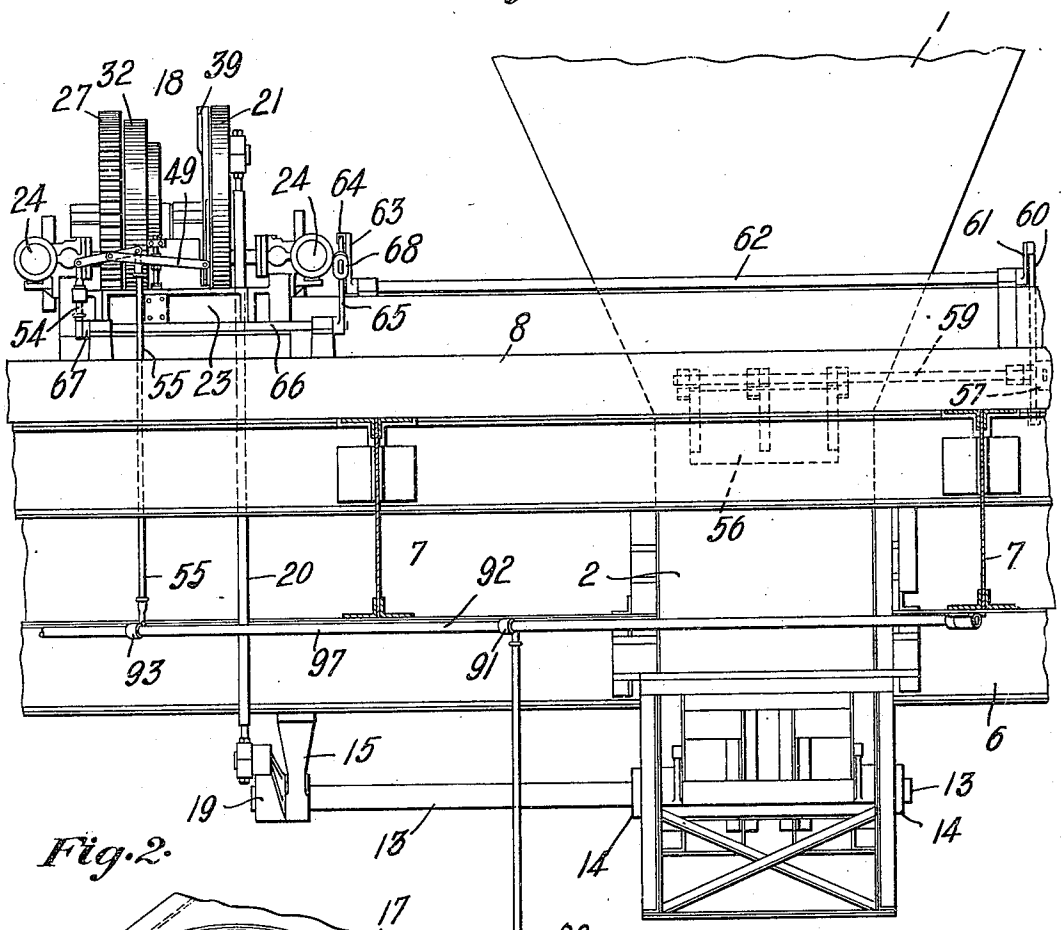
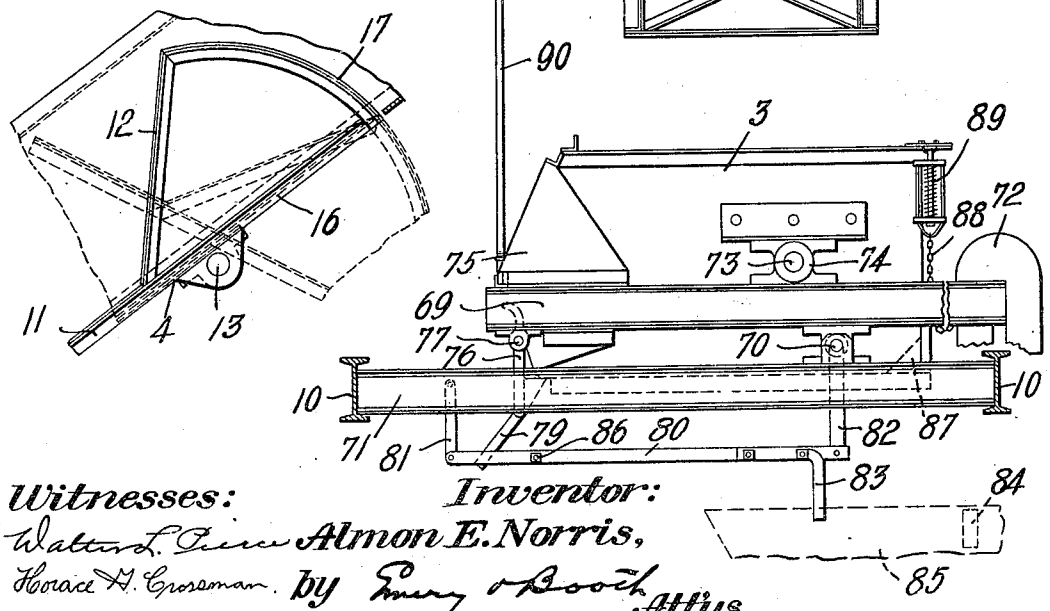


Fig. 2.



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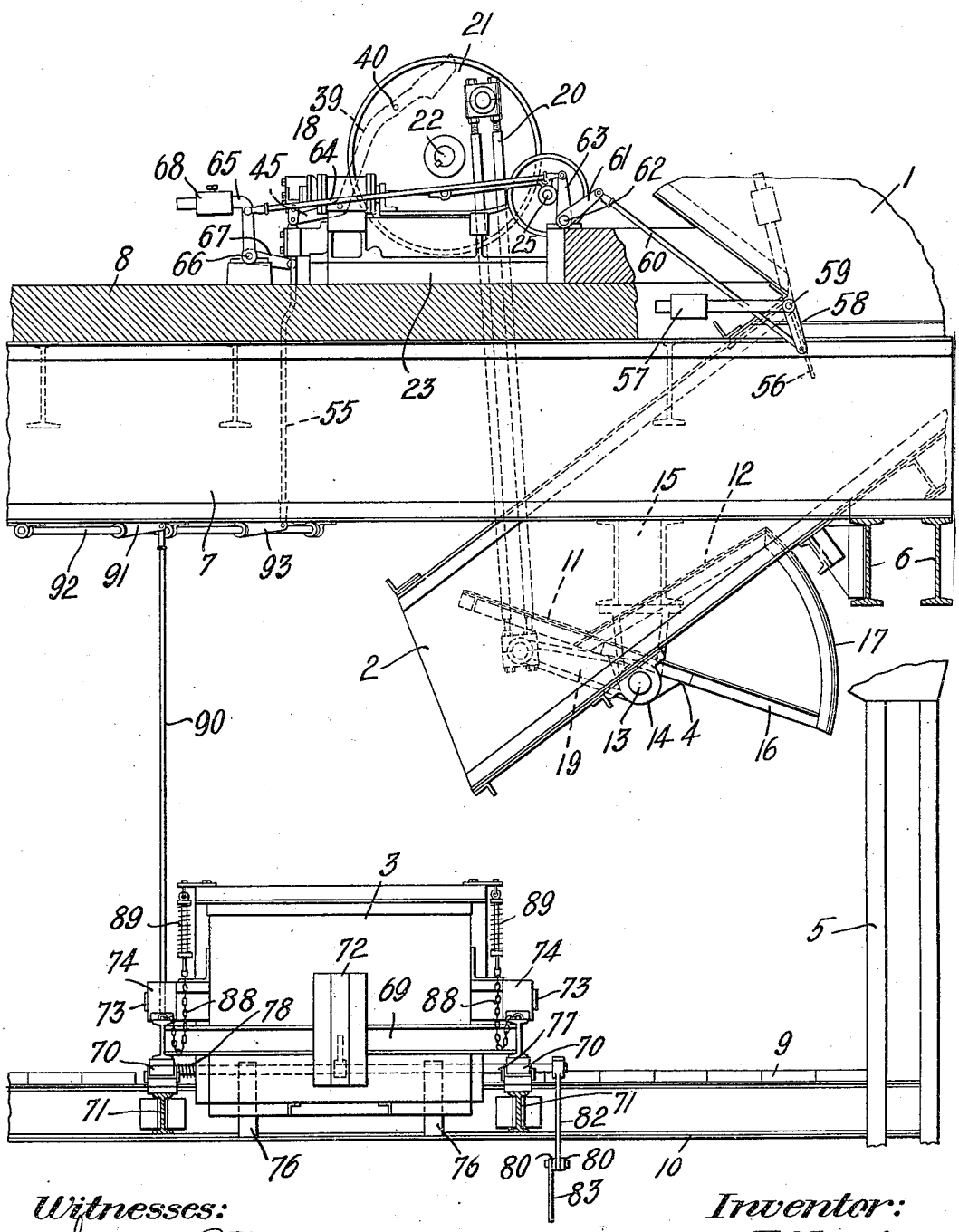
8 SHEETS—SHEET 2.

Fig. 3.



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8 SHEETS—SHEET 3.

Fig. 4.

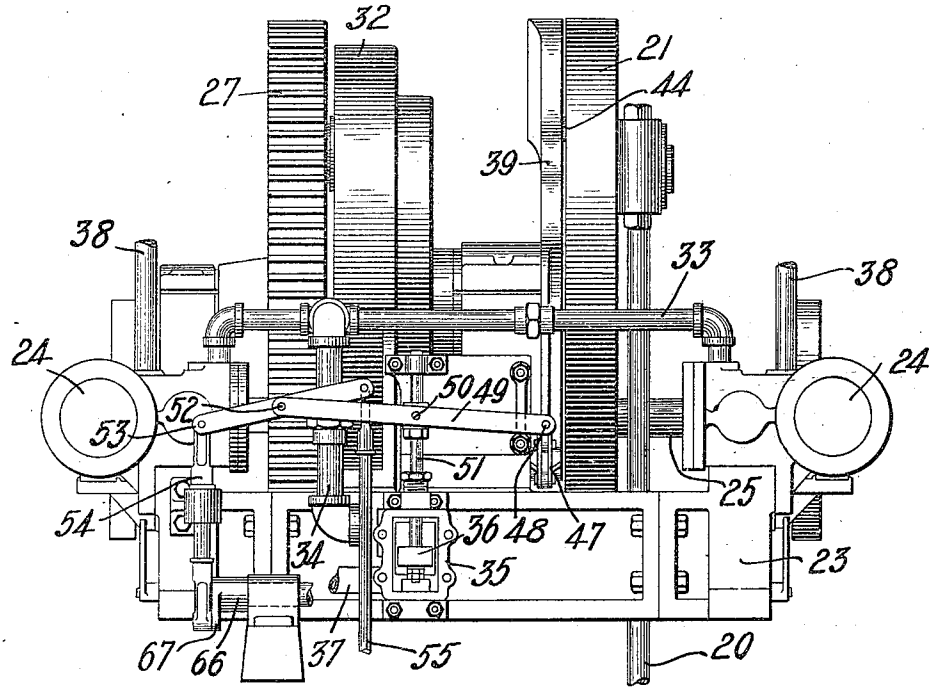
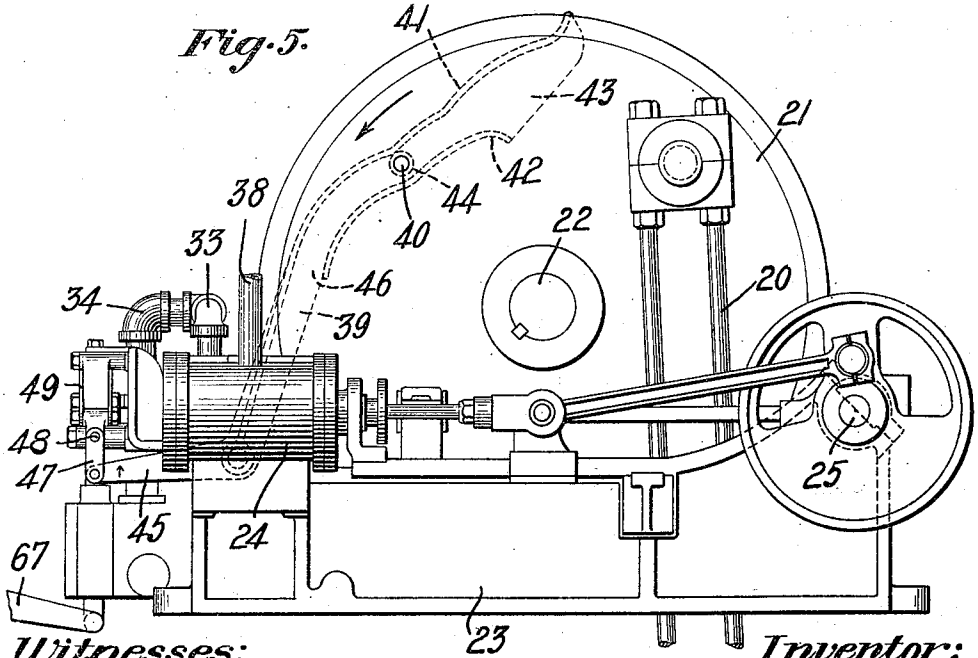


Fig. 5.



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8 SHEETS—SHEET 4.

Fig. 6.

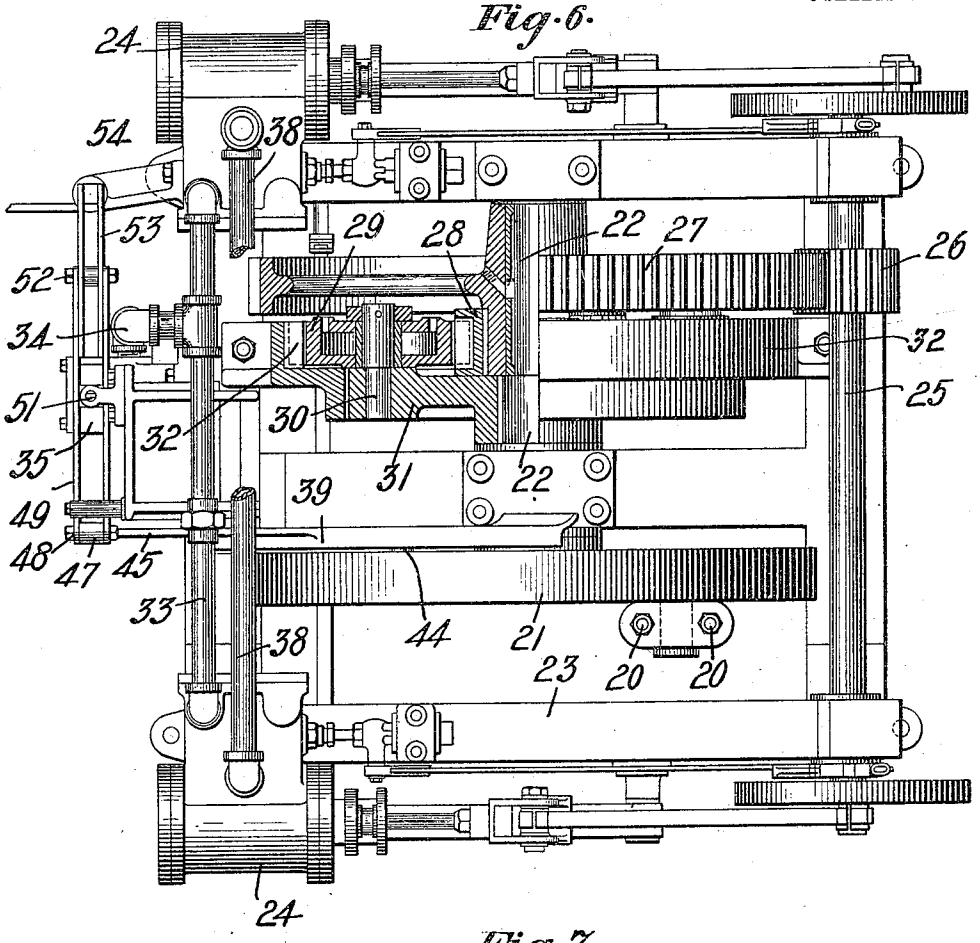

Fig. 7.

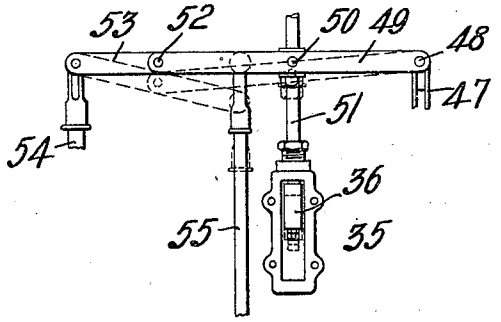

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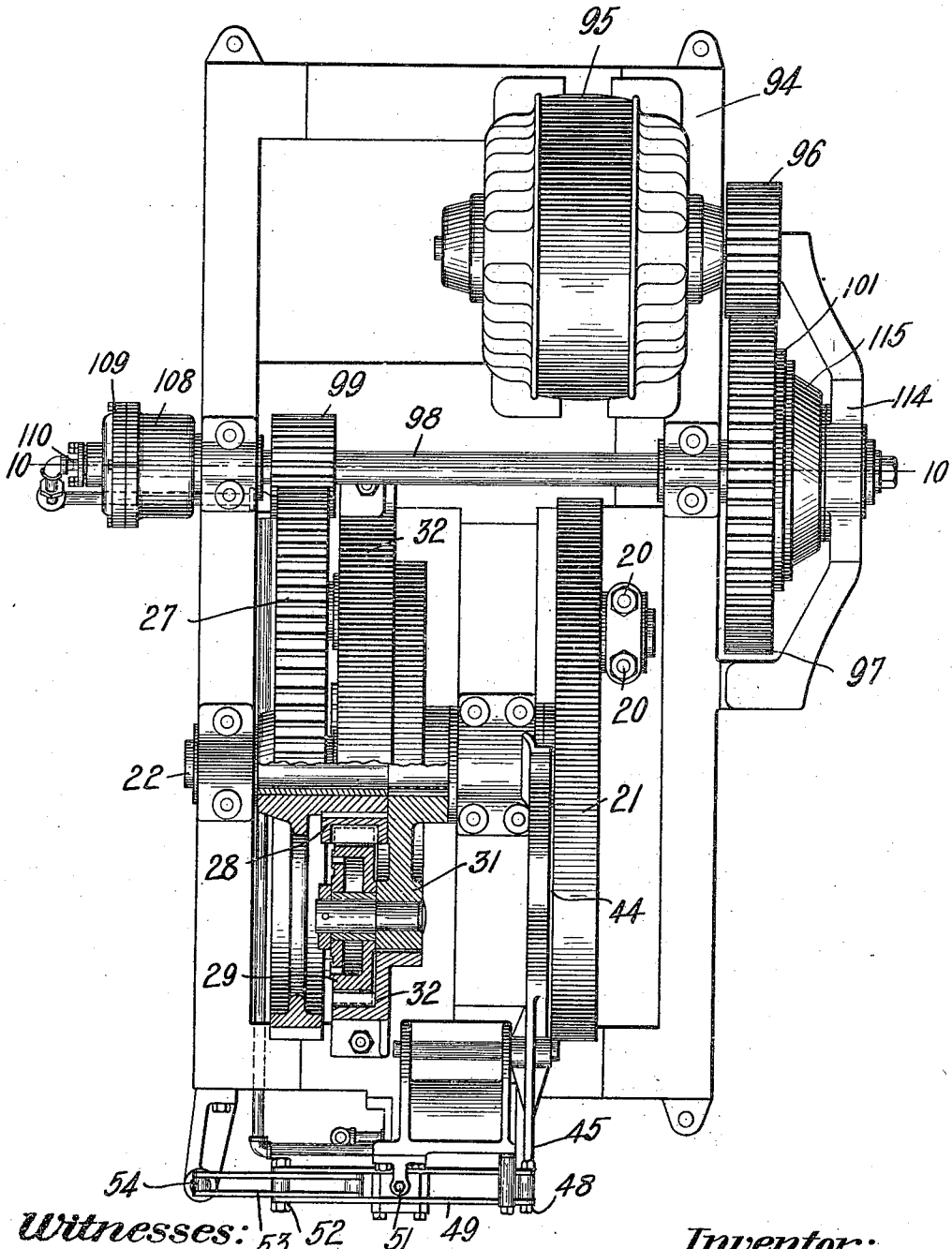
Fig. 8.



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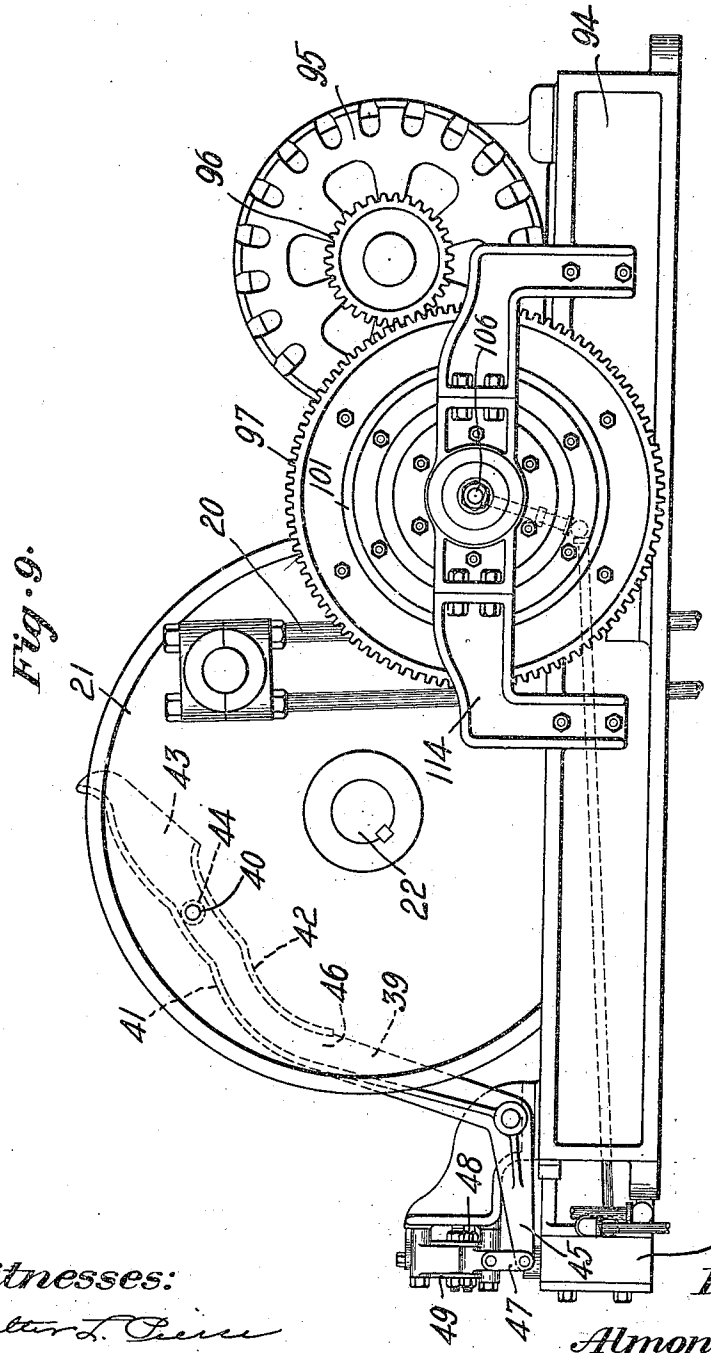
APPARATUS FOR DELIVERING MATERIALS.

APPLICATION FILED AUG. 1, 1908.

961,732. Patented June 14, 1910.

8 SHEETS—SHEET 6.

Fig. 9.



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APPARATUS FOR DELIVERING MATERIALS.

APPLICATION FILED AUG. 1, 1908.

961,732. Patented June 14, 1910.

8 SHEETS—SHEET 7.

Fig. 10.

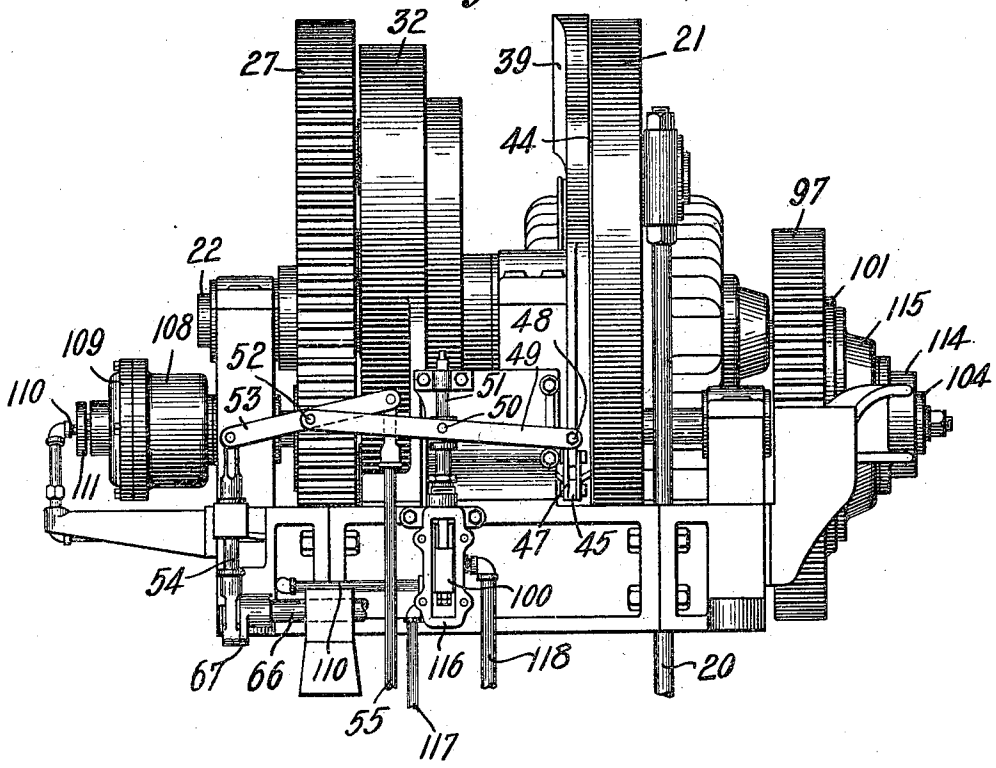


Fig. 11.

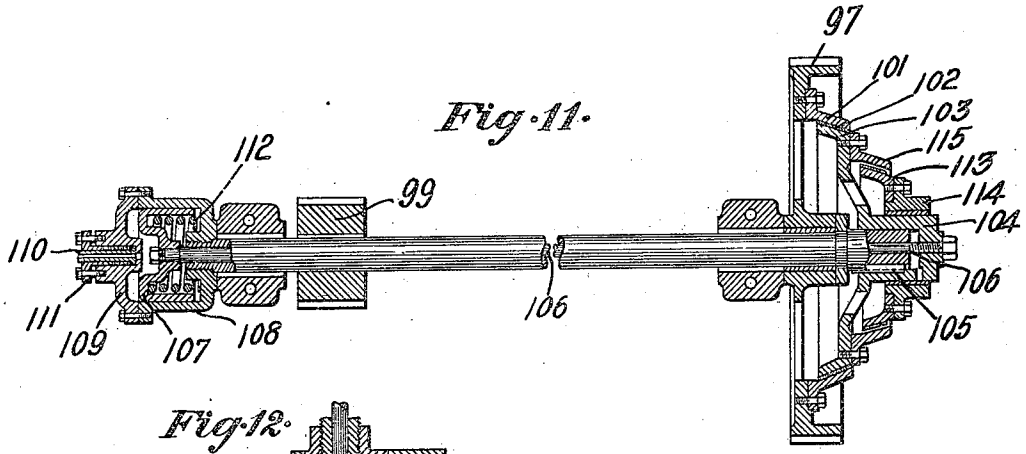
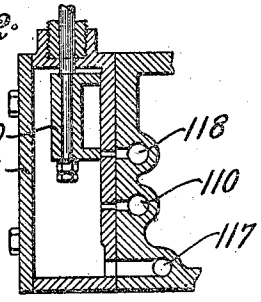


Fig. 12.



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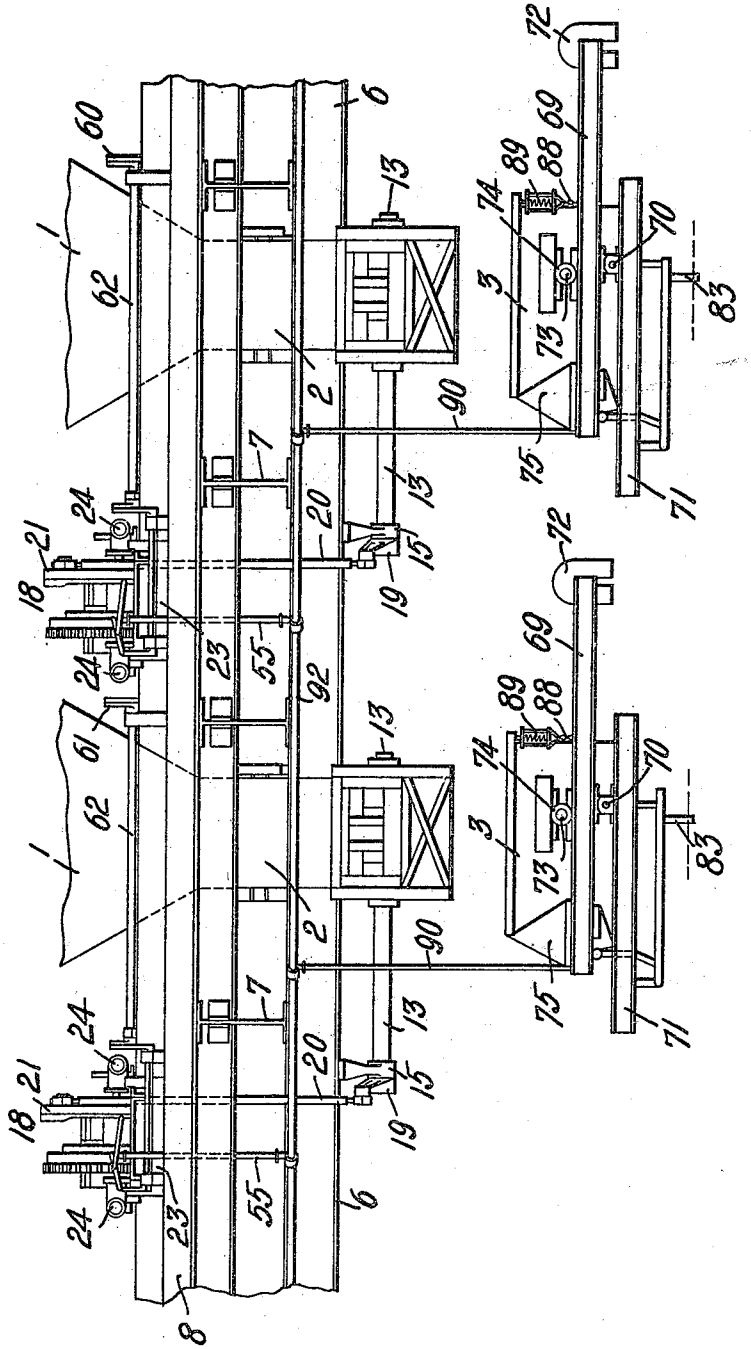
APPLICATION FILED AUG. 1, 1908.

961,732. Patented June 14, 1910.

8 SHEETS—SHEET 8.

Fig. 13.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR DELIVERING MATERIALS.

961,732. Specification of Letters Patent. Patented June 14, 1910.

Application filed August 1, 1908. Serial No. 446,427.

To all whom it may concern:

Be it known that I, ALMON E. NORRIS, a citizen of the United States, residing at Cambridge, in the county of Middlesex and State of Massachusetts, have invented an Improvement in Apparatus for Delivering Materials, of which the following description, in connection with the accompanying drawings, is a specification, like numerals on the drawings representing like parts.

My invention relates in general to loading apparatus and more particularly, though not exclusively, to apparatus for automatically loading material on moving cars or other conveyances.

My invention will be best understood by reference to the following description when taken in connection with the accompanying drawings, which for purposes of illustration, show specific embodiments thereof, while its scope will be more particularly pointed out in the appended claims.

In the drawings: Figure 1 is a front elevation partly in section showing a feed controlling mechanism embodying one form of my invention; Fig. 2 is a detail showing the feeding gate in a position of discharge; Fig. 3 is a transverse vertical view of Fig. 1, partly in section and partly in elevation; Fig. 4 is a front elevation on an enlarged scale of the engine for the feeding gate shown in Figs. 1 and 2; Fig. 5 is a side elevation of the same; Fig. 6 is a plan view of the same partly in section; Fig. 7 is a diagram showing the position of the valve controlling links in a different position from that shown in Fig. 3; Fig. 8 is a plan view, partly in section, showing a modified form of gate controlling motor in which electricity is employed as a motive power; Fig. 9 is a side elevation of the same; Fig. 10 is a front elevation; Fig. 11 is a section taken through the countershaft of the gate motor shown in Figs. 7 to 9 inclusive; Fig. 12 is a detail of the controlling valve employed in connection with the electric gate motor; and Fig. 13 is a front elevation showing the arrangement of a plurality of loading installations of the character described.

Referring to the drawings and to the particular embodiment of my invention there shown, there is disclosed a loading apparatus which herein is specifically intended for automatically loading measured quantities of material, such as coal or the like, into cars or other moving conveyances, which are caused to move past one or more loading installations. For this purpose there may be employed a single loading installation only, or a plurality of such installations. In Fig. 13 I have shown for illustrative purposes two such installations, each comprising primarily a hopper 1 having a chute 2 leading therefrom, and a properly located dumping receptacle 3 adapted to receive measured quantities of material from the chute under the control of a moving feeding device 4 (Fig. 3), which latter controls the delivery of material from the chute to the dumper. The successive dumping devices are so arranged that the movement of a car, or like conveyance, to a materials-receiving position beneath each one, acts automatically to discharge the material therein into the car. The purpose in the particular installation described is to cause the discharge of a load from each dumper into each car as the latter passes along, each dumper, in turn, receiving one or more and, usually two or three, discharges from the moving feeding device in the chute to complete its load between the passage of successive cars.

While the various features of my invention are more particularly designed to increase the efficiency and render the operation of such a system more automatic in its nature, broadly considered they are not limited to this particular system of loading or to the constructional or other details described, or to relative arrangement of parts.

Referring more particularly to the constructional details of the described system, the loading apparatus hereinafter described is supported upon any suitable framework, herein shown as comprising suitable columns, such as 5 (Fig. 3), the latter bearing girders 6 and beams 7 supporting the upper platform 8 on which is supported the hopper 1. A lower platform 9 is also sustained by suitable girders 10 secured to the columns 5.

In the embodiment of my invention shown in Figs. 1 to 6 inclusive, the hopper 1 is mounted on the platform 8 and has the chute 2 for delivering material to the dumping receptacle 3, the latter supported on the platform 9. The delivery of material from the chute to the dumper is controlled by a moving feeding device which is caused to deliver intermittent quantities of material to the dumper and preferably in predetermined measured amounts. While such feeding device may be otherwise constructed and lo-

cated, in the present instance it is arranged near the bottom of the chute and consists of an oscillating measuring gate or feeder, comprising transverse walls 11 and 12 extending completely across the chute, but arranged as shown in Figs. 2 and 3, at an obtuse angle to each other. These are carried by a framework secured to the gate shaft 13, the latter adapted to oscillate in bearings 14 depending from the under side of the chute, and, also (Fig. 1) in a bracket 15 depending from the framework. The feeding gate 4 has also the rearwardly extending frame members 16 (Figs. 2 and 3) to which is secured at one end the curved wall 17 also extending completely across the chute, the opposite end of said wall being joined to the end of the gate measuring wall 12. The gate 4 in its feeding movement is caused to oscillate from a materials-receiving position, in which all delivery from the chute is cut off, to a discharging position (represented in full line in Fig. 2) wherein the measured discharge of the gate is delivered into the dumper.

In Fig. 3 the gate is represented as having reached a position just short of its full receiving position, the measuring wall 11, however, shutting off all delivery from the chute. In the subsequently attained full receiving position (which is represented by dotted lines in Fig. 2) the pocket formed between the measuring walls 11 and 12 is completely filled with material gravitating from the hopper. The gate being then moved to the other extreme shown in full lines in Fig. 2, the material contained in the pocket between the walls 11 and 12 is completely discharged, the curved wall 17 during discharge cutting off further movement of material in the chute as the gate moves toward its discharging position. As the gate oscillates back and forth in the chute, therefore, it receives successive measured charges of material and delivers them to the underlying dumper.

For the complete automatic control of the apparatus it is desirable to control the oscillating movement of the gate so that, while continuing so long as the normal operation of the apparatus continues, such movement can be automatically interrupted when the normal operation of the apparatus is interrupted, as by the exhaustion of the supply in the hopper, or the failure of the dumping receptacle to discharge its material for any reason, such as the absence of a suitable receiving car or conveyance beneath the same. While such control may be effected by unclutching the gate from its driving motor or other source of driving power, in the embodiment shown in Figs. 1 to 6 inclusive I have provided a driving motor, herein a steam engine for oscillating the gate and controlling means for stopping not only the gate but also the engine itself under certain predetermined conditions.

Referring more particularly to Figs. 1 to 3 the gate engine, designated at 18, is shown as mounted upon the platform 8 and connected to oscillate the gate by means of the crank 19 attached to the gate shaft 13 and the connecting rod 20, the latter eccentrically connected to the crank disk 21 on the main driving shaft 22. The engine may be of any suitable type of construction and employing any desired form of motive power, but herein I have shown a steam engine mounted (Figs. 4 and 5) upon a suitable framework 23 having twin cylinders 24, both acting to turn the engine crank shaft 25. In order to reduce the speed and impart a relatively slow oscillating movement to the gate, speed reduction gearing is provided between the crank shaft 25 and the main drive shaft 22. This may be of any suitable construction, but herein there is provided upon the crank shaft a spur gear 26 meshing with the large spur gear 27, the latter mounted to turn loosely upon the drive shaft 22. Further speed reduction is obtained by means of planetary gearing between the large gear 27 and the drive shaft 22. This comprises a driving pinion 28 keyed or otherwise fixedly secured to the hub of the gear 27 and meshing with the teeth of one or more pinions 29 journaled upon studs 30, the latter fixedly secured to a spider 31 keyed to the drive shaft 22. The pinions 29 also engage with the internal teeth of a fixed gear member 32 which is bolted to the frame, so that as the gear 27 and its attached pinion 28 are turned in one direction the pinions 29 are turned thereby and caused to carry the spider 31 about in the same direction of rotation, thereby turning at a relatively low rate of speed the drive shaft 22 and the crank disk 21.

The cylinders and their steam chests are connected (Figs. 4, 5 and 6) by a steam pipe 33, which has a depending supply branch 34 leading to the chamber 35 of a throttle valve 36, of any usual or suitable construction, the latter, when elevated, acting to connect said supply pipe 34 with the steam pipe 37 (Fig. 4), and starting or continuing the operation of the engine. When the valve is depressed (as shown in Fig. 4) it acts to shut off the supply of steam to the supply pipe 34 and stop the operation of the engine. Pipes 38 are employed to carry off the exhaust from the engine.

Having described the mechanism for driving or rotating the crank disk 21 and the feeding gate 4, the mechanism for automatically starting and stopping the gate will now be described. In stopping the gate it is desirable to stop it at some predetermined position and this usually is some position approximating the full receiving position of the gate so that, when subsequently started, it will be in a position suitable for immediately commencing the deliv-

ery of material without the loss of time. In order that the engine may be stopped at such a predetermined position, I have provided a device insuring the movement of the gate to such a position and its stoppage thereat under certain conditions, which will be more fully referred to. For this purpose there is pivoted to a bracket on the engine frame 23 a bell-crank cam lever 39 weighted at its outer or upper end and oscillating in a plane adjacent and parallel to the face of the crank disk 21 so as to co-act with a pin 40 fixed at a definite position thereon.

Referring more in detail to the present embodiment, the longer arm of the lever (Figs. 4 and 5) is shown more or less undulating in shape and is provided (Fig. 5) with a back flange 41 extending its entire length, and with a shorter front flange 42 extending a portion only of its length. This arm of the lever widens at its outer end and the flanges follow the contour of the widened portion, so that a mouth 43 is presented to receive the pin 40 in the face of the crank disk. The pin is provided with a roll 44 which, after entering the mouth 43, bears on the inner side of the flange 41, moving the long arm of the lever upward and rocking the shorter arm 45 of the bell-crank lever downwardly. In Fig. 5 the pin is shown in a position drawing the longer arm of the lever down to a maximum degree. Continued rotation of the disk from the position shown in Fig. 5 and in the direction of the arrow, will cause the pin 40 to leave the path defined by the flange 41 at the exit 46, the lever 39 being allowed thereby to fall back to its normal position, raising the short end of the bell crank 45. Thus the lever 39 will be periodically moved at predetermined intervals by the intermittent engagement of the pin 40 therewith, this acting to move the valve, as hereinafter described.

Connections lead from the short end 45 of the bell-crank lever to the throttle valve 36 as follows: the lever 45 has connected thereto the short link 47, the latter jointed at 48 to the outer end of the main controlling link 49. The link 49 has a jointed connection at 50 to the upright valve stem 51, which latter is connected to the throttle valve 36 and mounted for a limited sliding movement as the link 49 is moved up or down. The opposite end of the link 49 may also be moved up or down, and for this purpose is jointed at 52 to the mid-portion of a second link 53, to which latter at one end is connected the link-actuating rod 54, and at the other end to the link-actuating rod 55.

The described mechanism for controlling the valve constitutes a floating linkage and requires for the closure of the valve and the stoppage of the engine the depression, not only of the end 48 of the link 49, due to the approach of the feeding gate to its initial position, but also the coincident depression of the opposite end 52 of the link, due to the depression either of the actuating rod 54 or the actuating rod 55, or both. In the specific construction illustrated the extent of movement of the end of the bell-crank lever 45 as it rises and falls, due to the successive rotation of the crank disk, is about the same as the extent of movement of the actuating rod 55 or the actuating rod 54. Since the rods 54 and 55, however, act through the link 53, the depression of either one individually produces only half the movement at the valve produced by the bell-crank lever 45.

Starting with both actuating rods 54 and 55 elevated and the lever 45 also elevated, the links lie as represented in full line in Fig. 7, and the construction of the valve is such that movement of the link 49, due to the depression of either or both the rods 54 and 55, is insufficient to close the valve, but with the depression of either or both the rods 54 and 55, coincident with the depression of the link at the end 48, due to the movement of the bell-crank lever 45—39, the valve will move to a closed position and stop the engine. There is, therefore, provided a conjoint control over the gate and the gate engine responsive, not only to the position of the gate, but to other conditions, which herein represent some departure from the normal and continuous operation of the apparatus.

Various conditions may be selected to exercise control over the gate engine. Herein I have provided detector means in the hopper responsive to the presence or absence of material to be fed such that, when the hopper supply falls below the amount necessary again to refill the dumper, one of the link-actuating rods 54 or 55 is automatically depressed so that, when the gate again approaches its initial position, the engine will be stopped unless, meanwhile, the hopper has again been refilled. This may be constructed in various ways, but herein I have provided approximately at the juncture of the hopper and the chute, or wherever else convenient, a detector plate 56, which tends to move toward the interior of the chute by means of a weight 57 and a movable bell-crank lever 58, the latter secured to the plate shaft 59. When the material fills the chute it presses the plate against the top wall thereof (as represented by dotted lines in Fig. 3), but when the material becomes exhausted from the hopper or the upper part of the chute the plate, being no longer pressed up by the material, allows the weight to drop down (see full lines, Fig. 3), and, acting through suitable connections, depresses the actuating rod 54. To cause this actuation the weighted bell-crank lever

58 is connected, through the rod 60, with the lever 61 on the rock shaft 62, the latter extending (Fig. 1) beyond the hopper where it is connected to a lever 63. The latter, in turn, is connected to a link 64 jointed to the weighted lever 65, the latter secured to the rock shaft 66 mounted at the rear of the engine frame. The rock shaft 66 in turn is secured to a lever arm 67, the latter jointed to the lower end of the link-actuating rod 54. Through these connections the position of the detecting plate 56, *i. e.*, whether depending or pressed against the upper wall of the chute, determines the position of the actuating rod 54. So long as the plate is pressed against the top of the chute, indicating an ample supply of material, the actuating rod remains elevated. When, as represented in the drawings, the plate drops down, due to the exhaustion of material, the actuating rod is dropped down and the valve stem 51 is depressed so that, when the pin 40 on the crank disk next engages the cam lever, the closure of the valve will be effected. Means for varying the sensitiveness of the plate may be employed, such, for example, as the adjustable weight 68 adjustably supported on the lever 65.

During the operation of the apparatus the underlying dumping receptacle, when filled with a predetermined quantity of material, is allowed to tip, and, when subsequently actuated by the approach of a car beneath the same to a receiving position, is caused to discharge its material thereinto and immediately restore itself to its initial position. In the preferred operation of the apparatus the movements are preferably so timed that the cars move continuously along beneath the receptacles, each car taking a portion of its load from each dumping receptacle, and sufficient time elapsing between the advent of successive cars to permit the dumping receptacle to be filled by one or more oscillations of the feeding gate, as may be required to discharge thereinto the predetermined quantity. If, however, the discharge of the dumping receptacle is delayed for any reason, as, for example, by delay in bringing up the next car, or if its restoration to its initial position is retarded, it becomes desirable meanwhile to stop the feeding action of the feeding gate. In the present instance, therefore, I have so constructed the dumping receptacle that, by connection therefrom to the link-actuating rod 55 at the engine, until the filled dumping receptacle is discharged and restored to its receiving position, no more material can be fed through the feeding gate, although the latter before stoppage will continue its movement approximately to its full receiving position ready to renew the feed as soon as the dumper has been discharged and restored to its initial position. With this end in view the dumping receptacle (Figs. 1 and 3) comprehends an oscillating dumper-supporting frame 69 which is centrally trunnioned at 70 to the frame members 71, the latter sustained by the lower platform 9. One end of the oscillating frame supports the dumper 3, while the opposite end is counterbalanced by one or more weights 72 adjustably arranged upon the frame so as to permit the tipping movement thereof under a predetermined load on the dumper. The dumper 3 is also itself mounted for tipping or discharging movement on the frame 69, being provided for that purpose at each side thereof and appropriately positioned with reference to its center of gravity, with trunnions 73 supported in bearings 74 located on the upper side of said oscillating frame 69. The dumper may be of any suitable shape or size, consisting of a bin-like inclosure having imperforate sides, back and bottom, but an open top to receive the material from the chute. The front or mouth of the dumper is closed by a hood 75 separate from the dumper and fixedly secured to the frame 69. This hood incloses the mouth of the dumper and retains the loading material therein when the dumper is in its normal position. When the dumper receives a predeterminate quantity of material from the chute through one or more discharges of the feeding gate, the oscillating frame 69, together with the dumper 3 and the hood 75, together tip downward about the trunnions 70, lifting the counterweight without change of position relatively to each other.

For the subsequent release of the dumper 3 to discharge its material, there is pivoted (Figs. 1 and 3) on the under side of the oscillating frame 69 a pair of hook-shaped latches 76 engaging the under front edge of the dumper and supporting the same in position with its mouth closed by the hood 75. The latches are secured to a rock shaft 77 which is provided with the spring 78, the latter tending to project the latches under the edge of the dumper. The shaft 77 projects at one end (Fig. 3) beyond the oscillating frame and is provided with a depending arm 79 fixed thereon. The lower end of the arm extends between a pair of parallel strips or bars 80, which latter are swingingly supported at one end to a link 81 and at the opposite end to a link 82. In order to permit the latches 76 to be tripped automatically the strips are provided with a depending bar 83 rigidly attached thereto, which bar is adapted to be engaged by a suitably located lug or obstruction 84 carried by a passing car 85. The movement of the car to a position where it can suitably receive the material from the dumper causes the lug 84 to strike the bar 83, swing the strips 80 forward on their supporting lugs, and cause the latch arm 79 to be struck by a

pin 86 connecting the two strips 80. This permits the dumper to tip and its open mouth being thereby depressed below the closing hood 75 it delivers its contents to the car below. The dumper is counterbalanced (Fig. 1) by a weight 87 which tends to restore it to its normal position as soon as its contents are discharged, and, for limiting the pivotal or discharge movement thereof chains 88 are provided having each a spring 89, for relieving the jerk or strain interposed between it and the point of its attachment to the dumper. Immediately on its restoration the latches 76 snap in under the forward end of the dumper and retain it in its normal position until it is tripped by the next car.

Referring now to the connections for controlling the feeding gate and the gate-operating engine through the condition or movements of the dumper, the frame 69 is connected to the other link actuating rod 55 at the engine by means of the vertical rod 90 pivotally attached at the hood end of the frame 69, and connected at its upper end (Fig. 3) to the lever arm 91, the latter connected, through the rock shaft 92, with a second arm 93, which arm is directly connected to the link-actuating rod 55.

When the oscillating frame 69 is in its normal position represented in Fig. 1 the actuating rod 55 is held elevated, as in the position shown in Fig. 7. When, however, the dumper receives its intended load and the oscillating frame is thereby caused to tilt, the vertical rod 90 is drawn down and this, in turn, through the described connections draws down the link-actuating rod 55 to the position represented in dotted lines in Fig. 7. This has no effect on the operation of the engine until the gate-connecting rod 20 approaches the dead point represented as in Fig. 3, whereupon, if the oscillating frame still remains tilted, the cam lever will be moved to press the valve link 49 still farther and close the throttle valve.

It will be seen that the links 49 and 53, with their attached connections, form a floating linkage mechanism for controlling the engine, through the valve 36, the fulcruming points of both links being movable. This permits the engine to be controlled in response to the interruptions in the normal operation of the loading apparatus, as described, the arrangement herein being such that, if either or both ends of the link 53 are lowered, due to the exhausting of material in the hopper or the failure of the dumper to discharge and return to its initial position, the subsequent depression of the cam lever 39—45 will stop the engine.

While the pin 40 on the crank disk might be located at different angular positions on the disk and thereby stop the gate at any desired predetermined position, preferably it is located as shown and in such a position that it will stop the engine with the connecting rod 20 just short of the dead point, or short of its highest elevation. It, therefore, still leaves, after subsequent starting, a slight movement before the delivery of materials can commence. This avoids the possibility of delivering materials to the dumper before the latter has been restored to its normal position and locked by the latches 76, which restoration may require a slightly longer time interval than the more rapid restoration of the oscillating frame 69, upon which depends the starting of the engine.

Briefly, the operation of the apparatus is as follows: The supply in the hopper 1 is replenished from time to time by any usual or suitable loading apparatus, not shown. Assuming that the engine is started up to turn the gate and deliver coal from the chute into the dumper, the detector plate 56 will then be pressed up against the top wall of the chute, showing the full condition of the hopper, and the left-hand link-actuating rod 54 will be elevated, as represented in Fig. 7. The dumper and oscillating frame being also in the normal position shown in Fig. 1, the right-hand link-actuating rod 55 will also be elevated, as represented in Fig. 7, and, with steam admitted to the supply pipe 37, the engine will start the gate in motion. At the beginning of the oscillation of the gate, the pin 40 on the crank disk soon leaves the exit 46 on the cam lever 39 and the cam lever drops lifting the end 48 of the valve-actuating link 49 and insuring the maintenance of the engine operation until the crank disk has turned again to the position shown in Figs. 3 and 5. Meanwhile, the valve is held open irrespective of the link-actuating rods 55 and 54. The engine having started up, the gate swings down until the connecting rod 20 is beyond the dead point, when it delivers its measured discharge of material to the dumper 3 and then lifts again. While the dumper may act to discharge on a single oscillation of the feeding gate only, normally the dumper is arranged to be filled through two or three oscillations of the gate. When filled, the oscillating dumper frame 69 tilts down and throws down the link-actuating rod 55. The obstruction 84 on the next car 85 then engages the bar 83 and releases the dumper catches 76, tilting the dumper and discharging the contents into the car. With its contents discharged the dumper 3 is restored to its normal position by the tilting frame 69, the latter swinging back to a horizontal position under the influence of the counterweights 72, thus lifting the vertical rod 90 and the link-actuating rod 55. If this happens before the gate finishes its full revolution, as will ordinarily be the case, the gate movement will be continued to deliver a sec-

ond charging to the dumper. If the restoration of the dumper, however, is delayed for any reason, so that, when the gate returns to its stopping position, the dumper is still tipped and, hence, the link-actuating rod 55 still depressed, the movement of the cam lever 39—45 will act to stop the engine. If, at any time the plate 56 in the hopper drops, showing the exhaustion of material, the engine and gate will be stopped at the completion of the next revolution of the crank disk. In order to prevent the tipping of the dumper 3 when empty, the relative positions of the strips 80, the pin 86 and the depending latch arm 79 are preferably such that, while with the oscillating frame tilted down, the movement of the strips when engaged by the obstruction 84 readily trips the latch, such tripping cannot be effected when the frame is in its normal or horizontal position, as represented in Fig. 1.

It will be seen that the normal operation of this apparatus contemplates the restoration of the dumper to a materials-receiving position and also contemplates the maintenance of a supply in the hopper sufficient to fill the gate. During such normal operation the gate continues to be oscillated, delivering successive charges to the dumper which, when filled, immediately discharges the same and is self-restored to its receiving position. Such continuous operation of the gate is interrupted only by an interruption in the normal operation of the apparatus, as for example, by failure of the dumper to return before the return of the gate or exhaustion of the hopper supply sufficient to permit the dropping of the detector plate.

While, for many purposes, I have preferred for the control of the gate to start and stop the gate operating motor in preference to cutting off power from the motor to the gate, since this results in greater economy and efficiency of operation, the latter method may be employed and the control of the gate effected by clutching or unclutching the driving motor from the gate-operating mechanism.

In Figs. 8 to 11 inclusive I have shown a modified form of my invention wherein such control is effected, the conjoint control over the gate, however, being provided by a pressure fluid controlling valve and through a floating linkage mechanism of substantially the same construction as that already described. It will therefore be necessary to describe the motor and the driving mechanism only, it being understood that the construction of this motor and driving mechanism, all as shown in Figs. 9 to 11, is equally applicable with the steam engine to the loading apparatus previously described.

Referring to the drawings and particularly to Figs. 8 to 11, the gate-operating mechanism there described is mounted upon a frame 94 carrying at one end the electric driving motor 95 of any suitable construction or type. The motor shaft is provided with a driving pinion 96 meshing with a large spur gear 97, the latter loosely mounted for rotation upon the clutch shaft 98, but adapted to be clutched to or unclutched from the same by clutch mechanism hereinafter described. Fixedly secured to the clutch shaft 98 is the driving pinion 99, the latter, acting, through the driving gear 27 and connected planetary gearing, to drive the crank disk 21, all of these parts being of substantially the same construction as those previously described in connection with the steam gate engine in Figs. 4 to 6 and being given, therefore, similar and corresponding reference numerals without further description. There is also employed in conjunction with the crank disk 21 and actuating pin 40 (Fig. 9), bell-crank lever 39—45 and linkage connection, a pressure fluid controlling valve 100, the said linkage and other connections to the valve being substantially the same as previously described in connection with the steam gate engine. There is also provided a similar system of controlling links connected to the link-actuating rods 54 and 55, as already described, all combining to effect a conjoint control over the pressure-controlling valve 100 in the same fashion as has been previously described.

To clutch the motor to or unclutch the same from the motor shaft, through the control of the valve 100, the clutch shaft is constructed as follows: For imparting driving movement from the gear 97 to the clutch shaft the gear has bolted thereto an annular member 101 having an interior surface preferably lined with friction material 102 and adapted coöperatively to engage with the sliding friction cone 103. The friction cone has a central hub 104 slidably mounted on the end of the clutch shaft 98 and inclosing the end of the same. The cone hub 104 is splined to the clutch shaft at 105 and to move it longitudinally it is bolted fast to an axial rod 106 passing centrally through the entire length of the hollow interior of the clutch shaft and adapted to be moved longitudinally therein to clutch or unclutch the gear 97 to actuate the clutch shaft. At the opposite end of the clutch shaft the clutch-actuating rod 106 is secured to an appropriate piston 107 slidably mounted within a cylinder 108 carried at the end of the clutch shaft and having a cylinder head 109 bolted thereto, a pressure supply pipe 110 being provided to admit pressure fluid to the cylinder and move the piston therein to apply the clutch. A stuffing box and gland 111 is provided between the cylinder head 109 and the pressure pipe 110 to provide a tight joint and permit the movement of the

cylinder 108 with the shaft relatively to the pipe 110. To release the clutch automatically, when the pressure is exhausted from the clutch cylinder 108, there is provided a heavy coil spring 112 acting against the piston 107 to move the same outwardly in the cylinder and separate the two clutch members.

It is desirable that the movements of the gate should be quickly responsive to the movements of the valve and, when the valve is closed, that the movement of the gate should be promptly stopped. To prevent the momentum of the crank disk and the other connected parts from continuing the movement of the gate for an interval after the clutch members have been released, I preferably provide some automatic positive stoppage device operative when the clutch is released, such, for example, as a friction brake. As one means of effecting this result, in the illustrated embodiment I have shown a brake device which is thrown into engagement as the clutch is released. Such braking device comprises a stationary friction cone 113 bolted or otherwise fixedly secured to a stationary part of the frame, such as the yoke member 114 (Figs. 8 to 11). The stationary friction cone is mounted in operative relation to an annular member 115 bolted to the side of the clutch cone 103 and adapted to engage with the stationary cone when the clutch is released. Accordingly, with the piston forced in one direction and into the position shown in Fig. 11, the brake is released and the clutch engaged, as shown. With the pressure in the cylinder exhausted and the piston forced in the opposite direction, the clutch is released and simultaneously the brake members thrown into engagement.

For the admission of pressure to or exhaust from the clutch cylinder, the clutch cylinder supply pipe 110 leads (Fig. 12) to the interior of the valve chamber 116 and there is also connected to the chamber, the pressure supply pipe 117 and the exhaust pipe 118. The valve 100 (shown in detail in Fig. 12) is connected to the valve stem 51 to be raised or lowered by the linkage, as previously described. In its depressed position, as represented in Fig. 10, pressure is cut off from the clutch cylinder supply pipe and the latter is opened to the exhaust pipe 118. With the valve elevated, however, as represented in Fig. 12, pressure is admitted to the supply pipe and the clutch cylinder with the result of moving the piston therein to the position shown in Fig. 11. Any suitable source of pressure supply may be provided for the clutch cylinder, although preferably in practice compressed air, supplied either from a source of stored pressure or from an auxiliary compressor, is preferably employed.

As represented in Fig. 13, a number of units, similar to those already described, are preferably employed in practice, in order that the car or succession of cars may move continuously and, by the automatic arrangement above described, each receive a predetermined amount from each unit in turn, so that, when the car shall have passed under the entire battery of units, it may be completely filled. It will, therefore, be seen that I have provided a system of units each including a gate or feeder for loading a continuously moving car, the entire operation taking place automatically and each feeder always stopping, if at all, in closed position.

While I have shown the starting and stopping valve for the feeding gate controlled by the conjoint action of the three controlling members described, one responsive to the position of the gate, another to the condition of the dumper, and the other to the absence or presence of supply, the floating linkage mechanism can readily be elaborated, as will be obvious to those skilled in the art, to comprehend the control through other and additional conditions which accompany the interruption of the normal operation of the apparatus. On the other hand, if it is desired to control the valve through two members alone instead of three as, for example, the cam lever 39—45 and either one of the link-actuating rods 54 or 55, the latter could then be directly connected to the end 52 of the valve link 49.

While I have shown and described one embodiment of my invention, it will be understood that the same is not limited to the details of construction or form or relative arrangement of parts, but that extensive modifications may be made without departing from the spirit of the invention.

Having thus described my invention, what I claim is;

1. In an automatic loading apparatus, the combination with a hopper to receive a supply of material, a chute leading therefrom, an oscillating dumping receptacle to receive the material in measured quantities from the chute, an oscillating frame upon which the dumping receptacle is pivotally mounted, said frame being adapted to tip when the dumper receives a predetermined supply of material, means controlled by a conveyance moving relatively to said dumper to cause the discharge of the material into said conveyance, means automatically to return both said frame and said dumper to their initial position on the discharge of the material to the conveyance, materials-detector means for said hopper responsive to the absence or presence of material, a reciprocating measuring gate for causing the delivery of measured quantities of material from the chute to the dumper, an engine for reciprocating said gate having a crank disk and a

connecting rod attachment to said gate, a valve for starting and stopping said engine, a link connected to move said valve, a part connected to one end of said link adapted to be moved by said crank disk in a predetermined position of the gate to move said valve to stop said engine, a second link having its mid-portion connected to the opposite end of said valve-actuating link, a connection between said detector means and one end of said second link and adapted to be actuated by said detector means to move said valve toward a closed position when the supply of materials fails in said hopper, and a connection from the opposite side of said second link to said oscillating frame and adapted to be actuated by the tilting of said frame when said dumper is loaded to move said valve toward a closed position, the said engine being stopped only when the gate arrives at the said predetermined position coincidentally with the tilted condition of the oscillating frame or the absence of material.

2. In an automatic loading apparatus, the combination with a hopper to receive a supply of material, a chute leading therefrom, an oscillating dumping receptacle to receive measured quantities of material from the chute, said receptacle having a tipping movement when a predetermined supply of material is received, means controlled by a conveyance moving toward the receptacle to cause the subsequent discharge of the material into said conveyance, means automatically to restore said receptacle to its initial position on the discharge of material to the conveyance, a movable feeding device for delivering measured quantities of material from the chute to the dumper, a motor for moving said feeding device, and means following the delivery of a predetermined amount of material to the dumping receptacle automatically to stop the motor.

3. In an automatic loading apparatus, the combination with a hopper to receive a supply of material, a chute leading therefrom, an oscillating dumping receptacle to receive measured quantities of material from the chute, said receptacle having a tipping movement when a predetermined supply of material is received, means controlled by a conveyance moving toward the receptacle subsequently to cause the discharge of the material into said conveyance, means automatically to restore said receptacle to its initial position on the discharge of material to the conveyance, a movable feeding device for delivering measured quantities of material from the chute to the dumper, a motor for moving said feeding device, and means following the delivery of a predetermined quantity of material to the dumping receptacle to stop the feeding device always at a predetermined position.

4. In an automatic loading apparatus, the combination with a hopper to receive a supply of material, a chute leading therefrom, an oscillating dumping receptacle to receive measured quantities of material from the chute, said receptacle having a tipping movement when a predetermined supply of material is received, means controlled by a conveyance moving toward the receptacle subsequently to cause the discharge of the material into said conveyance, means automatically to restore said receptacle to its initial position on the discharge of material to the conveyance, a movable feeding device for delivering measured quantities of material from the chute to the dumper, a motor for moving said feeding device, and means for continuing the movement of the feeding device after the dumping receptacle has received a predetermined load, but for stopping it prior to further feeding of material if, meanwhile, the dumping receptacle has not been emptied.

5. In an automatic loading apparatus, the combination with a hopper to receive a supply of material, a chute leading therefrom, an oscillating dumping receptacle to receive measured quantities of material from the chute, said receptacle having a tipping movement when a predetermined supply of material is received, means controlled by a conveyance moving toward the receptacle subsequently to cause the discharge of the material into said conveyance, means automatically to restore said receptacle to its initial position on the discharge of material to the conveyance, a movable feeding device for delivering measured quantities of material from the chute to the dumper, a motor for moving said feeding device, detector means responsive to the absence or presence of material in the hopper, and means for stopping feeding movement of the feeding device after failure of the supply in the hopper.

6. In an automatic loading apparatus, the combination with a hopper to receive a supply of material, a chute leading therefrom, an oscillating dumping receptacle to receive measured quantities of material from the chute, said receptacle having a tipping movement when a predetermined supply of material is received, means controlled by a conveyance moving toward the receptacle subsequently to cause the discharge of the material into said conveyance, means automatically to restore said receptacle to its initial position on the discharge of material to the conveyance, a movable feeding device for delivering measured quantities of material from the chute to the dumper, a motor for moving said feeding device, and means responsive to the tilting movement of the dumping receptacle for stopping the feeding device after it has reached a predetermined position.

7. In an apparatus of the class described, the combination with dumping means adapted automatically to discharge a predetermined load of material, means automatically to restore the dumping means to its initial position, a movable feeding device for delivering charges of material to said dumping means, and means for continuing the movement of said feeding device after dumping movement of the dumping means, but for stopping the same prior to further feeding movement, unless meanwhile the dumping means has been restored to its materials-receiving position.

8. In an apparatus of the class described, the combination with dumping means adapted automatically to discharge a predetermined load, means automatically to restore said dumping means, a movable feeding device for delivering charges of material to said dumping means, and means automatically to stop said feeding device in a given predetermined position.

9. The combination with an automatic dumping device, of self-restoring means for said dumping device, a feeding device for feeding charges of material to said dumping device, a motor for operating said feeding device, and means for automatically starting and stopping said motor.

10. In an automatic loading apparatus, the combination with a receptacle for receiving material from a supply thereof, of delivery means for delivering material to said receptacle, a motor for actuating said delivery means, and means automatically to start and stop said motor.

11. In an automatic loading apparatus, the combination with a receptacle for receiving material from a supply thereof, of delivery means for delivering material to said receptacle, means for actuating said delivery means, means for discharging the contents of said receptacle into a suitable conveyance, and means automatically to stop said delivery means at a given predetermined position.

12. In an automatic loading apparatus, the combination with a receptacle for receiving material from a supply thereof, of delivery means for delivering material to said receptacle, and fluid pressure means for automatically controlling the operation of said delivery means.

13. In an automatic loading apparatus, the combination with a receptacle for receiving material from a supply thereof, of delivery means for delivering material to said receptacle, means automatically to cause the discharge of material from said receptacle to a suitable conveyance, and fluid pressure means responsive to the condition of said receptacle for controlling the operation of said delivery means.

14. In an automatic loading apparatus, the combination with a receptacle for receiving material from a supply thereof, of delivery means for delivering material to said receptacle, means automatically to cause the discharge of material from said receptacle to a suitable conveyance and fluid pressure means responsive to the exhaustion of said supply for stopping the operation of said delivery means.

15. In an automatic loading apparatus, the combination with a receptacle for receiving material from a supply thereof, of a movable feeding device for delivering measured quantities of material to said receptacle, starting and stopping means for said feeding device, a controlling member for said starting and stopping means governed by the position of said feeding device, and a second controlling member for said starting and stopping means governed by the condition of said receptacle, the stoppage of said feeding device requiring the conjoint action of said two controlling members.

16. In an automatic loading apparatus, the combination with a receptacle for receiving material from a supply thereof, of a movable feeding device for delivering measured quantities of material to said receptacle, starting and stopping means for said feeding device, a controlling member for said starting and stopping means governed by the position of said feeding device, and a second controlling member responsive to the presence or absence of supply, the stoppage of said feeding device requiring the conjoint action of said two controlling members.

17. In an automatic loading apparatus, the combination with a receptacle for receiving material from a supply thereof, of a movable feeding device for delivering measured quantities of material to said receptacle, starting and stopping means for said feeding device, a controlling member for said starting and stopping means governed by the position of said feeding device, a second controlling member responsive to the absence or presence of supply, and a third controlling member responsive to the condition of said receptacle, the stoppage of said feeding device requiring the conjoint action of said first controlling member and one of the remaining controlling members.

18. In an automatic loading apparatus, the combination with a receptacle for receiving material from a supply thereof, of feeding means for delivering material to said receptacle, starting and stopping means for said feeding means, and a link for controlling said starting and stopping means, said link having movable fulcra, one of which is controlled by the position of the feeding means and the other by the condition of said receptacle.

19. In an automatic loading apparatus,

the combination with a receptacle for receiving material from a supply thereof, of feeding means for delivering material to said receptacle, starting and stopping means for said feeding means, and a link for controlling said starting and stopping means, said link having movable fulcra, one of which is controlled by the position of the feeding means and the other by the absence or presence of material.

20. In an automatic loading apparatus, the combination with a receptacle for receiving material from a supply thereof, of feeding means for delivering material to said receptacle, a valve for controlling the operation of said feeding means, a valve-controlling member connected to said feeding means, and a second valve-controlling member connected to said receptacle to feed the controlling movement of said valve requiring the conjoint action of said two valve-controlling members.

21. In an automatic loading apparatus, the combination with a receptacle for receiving material from a supply thereof, of feeding means for delivering material to said receptacle, a motor for actuating said feeding means, means for stopping the operation of said feeding means by said motor, and braking means adapted to be applied simultaneously with said stopping means to prevent further movement of said feeding means.

22. In an automatic loading apparatus, the combination with a receptacle for receiving material from a supply thereof, of feeding means for delivering material to said receptacle, means for automatically starting and stopping the operation of said feeding means, and braking means acting automatically and coöperatively on the actuation of said starting and stopping means to prevent further movement of said feeding means.

23. In a loading apparatus, the combination with a receptacle for receiving material from a supply thereof, of feeding means for delivering material to said receptacle, a crank disk and connecting rod for moving said feeding means, means automatically to stop the movement of said crank disk, and braking means adapted to be automatically applied to prevent further movement of said crank disk.

24. In an automatic loading system, a plurality of loading units past which a moving car or other conveyance is adapted to pass and receive from each a measured quantity of material, each unit comprising a hopper, a tilting dumping receptacle adapted to receive material from the hopper, a feeding device for delivering material from the hopper to the dumping receptacle, means automatically to discharge said receptacle and restore it to its receiving position, and means for permitting movement of the feeding device after dumping movement of said receptacle, but for stopping the same prior to further delivery, unless meanwhile the dumping receptacle has been restored to its receiving position.

25. An automatic loading apparatus comprising a hopper, an oscillating dumper to receive the material from the hopper, movable feeding means to deliver successive charges of material from the hopper to the dumper, and means automatically to stop the movement of the feeding means, the movement thereof being interrupted only by the interruption in the normal operation of the apparatus.

26. An automatic loading apparatus comprising a hopper, an oscillating dumper to receive material from the hopper, and movable feeding means to deliver successive charges of material from the hopper to the dumper, the movement of said means continuing during the normal operation of the apparatus.

27. An automatic loading apparatus comprising, in combination, a hopper, a dumper, and a fluid-pressure-controlled means for automatically governing the delivery of material from said hopper to the dumper.

28. In an apparatus of the class described, a dumper having a dumping movement, means for feeding material thereto, and fluid-pressure-controlling means for stopping said feeding means when the restoration of the dumper is delayed.

29. An apparatus of the class described comprising, in combination, a hopper, power driven feeding means, and automatic means for stopping said feeding means on the exhaustion of material from said hopper.

30. An apparatus of the class described comprising a hopper, movable feed delivery means, and means for automatically stopping said feeding means in a predetermined position on the exhaustion of material from said hopper.

31. An apparatus of the class described comprising, in combination, a hopper, a dumper, feeding means, a cam lever, a floating linkage mechanism connected to said dumper and said cam lever, and means for operating said feeding means and said lever.

32. An automatic loading apparatus comprising, in combination, a hopper, a dumper adapted to receive material therefrom, means for feeding measured quantities of material from said hopper, detector means for said hopper, and means responsive to the said detector means and the condition of said dumper, for controlling the said feeding means.

33. An automatic loading apparatus comprising a dumping receptacle, feeding means for feeding material thereto from a suitable source of supply, starting and stopping means for said feeding means, a crank disk

and connecting rod adapted to drive said driving means, a lever connected to said starting and stopping means, and means carried by said crank disk to move said lever.

34. An automatic loading apparatus comprising, in combination, a dumper, an oscillating measuring gate adapted to deliver material to said dumper from a suitable source of supply, driving mechanism for said gate, a valve for controlling the operation thereof, a floating linkage mechanism connected to said valve and composed of two pivotally connected members, one of said members being connected to the dumper and the other to an actuating lever, and means carried by said driving mechanism for moving said actuating lever at a predetermined position of the gate.

35. An automatic loading apparatus comprising, in combination, a hopper, feeding means for delivering material from the hopper, means for oscillating said feeding means to effect the feed, and means for automatically stopping said feeding means in a materials-receiving position.

36. An automatic loading apparatus comprising, in combination, a hopper, feeding means, a dumper, a weighted lever for controlling the operation of said feeding means, a crank disk connected with said feeding means and a member on said disk for operating said lever at a predetermined time.

37. An automatic loading apparatus comprising, in combination, a motor, feeding means driven by said motor, a hopper, a dumper to which material is supplied by said feeding means to said hopper, and speed reduction gearing interposed between said feeding means and said motor.

38. In an automatic loading apparatus, the combination with a hopper, a dumper, a measuring gate for feeding material from the hopper to the dumper, a motor for moving said gate, a clutch between the motor and the gate, and means for automatically disengaging said clutch when said gate is at a predetermined position.

39. An automatic loading apparatus comprising a hopper, a feeding gate, a driving motor, a clutch shaft interposed between said motor and said gate, a fluid-pressure-actuated clutch mounted on said shaft and consisting of an external and internal and an intermediate friction member, the latter in one position acting as a driving member and in another as a brake member for stopping the movement of said gate.

40. An automatic loading apparatus comprising, in combination, receiving means, oscillating delivery means for delivering material to said receiving means, detector means responsive to the presence or absence of a suitable supply, and means governed by said delivery means and said detector means for arresting movement of said oscillating means.

41. In an automatic loading apparatus the combination with the delivery device 11, of the dumper 3, the controlling connection 90 and the prime mover 18.

42. In an automatic loading apparatus the combination with the dumper 3 and the prime mover 18.

43. In an automatic loading apparatus the combination with the delivery device 11, the prime mover 18, the connection 20, the valve 36, and the connections 47, 54, and 55.

44. In an automatic loading apparatus the combination with the feeder 11, prime mover 18, and valve 36.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

ALMON E. NORRIS.

Witnesses:
THOMAS B. BOOTH,
EVERETT S. EMERY.