Aug. 14, 1923. 1,464,742

F. BILLINGS ET AL

LOADING MACHINE

Filed March 18, 1918 4 Sheets-Sheet 1

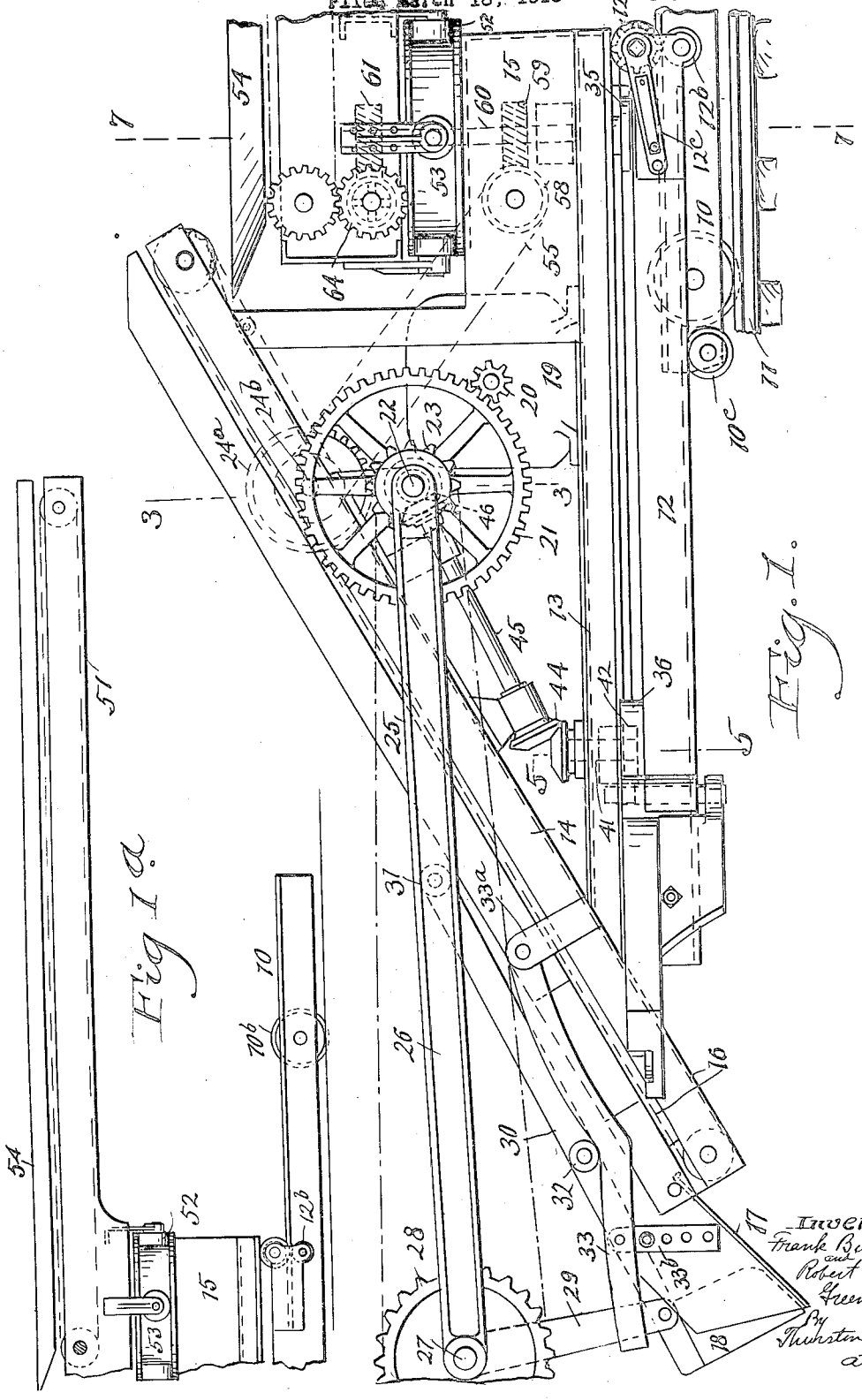


Fig. 1.

Fig. 1a.

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4 Sheets-Sheet 2

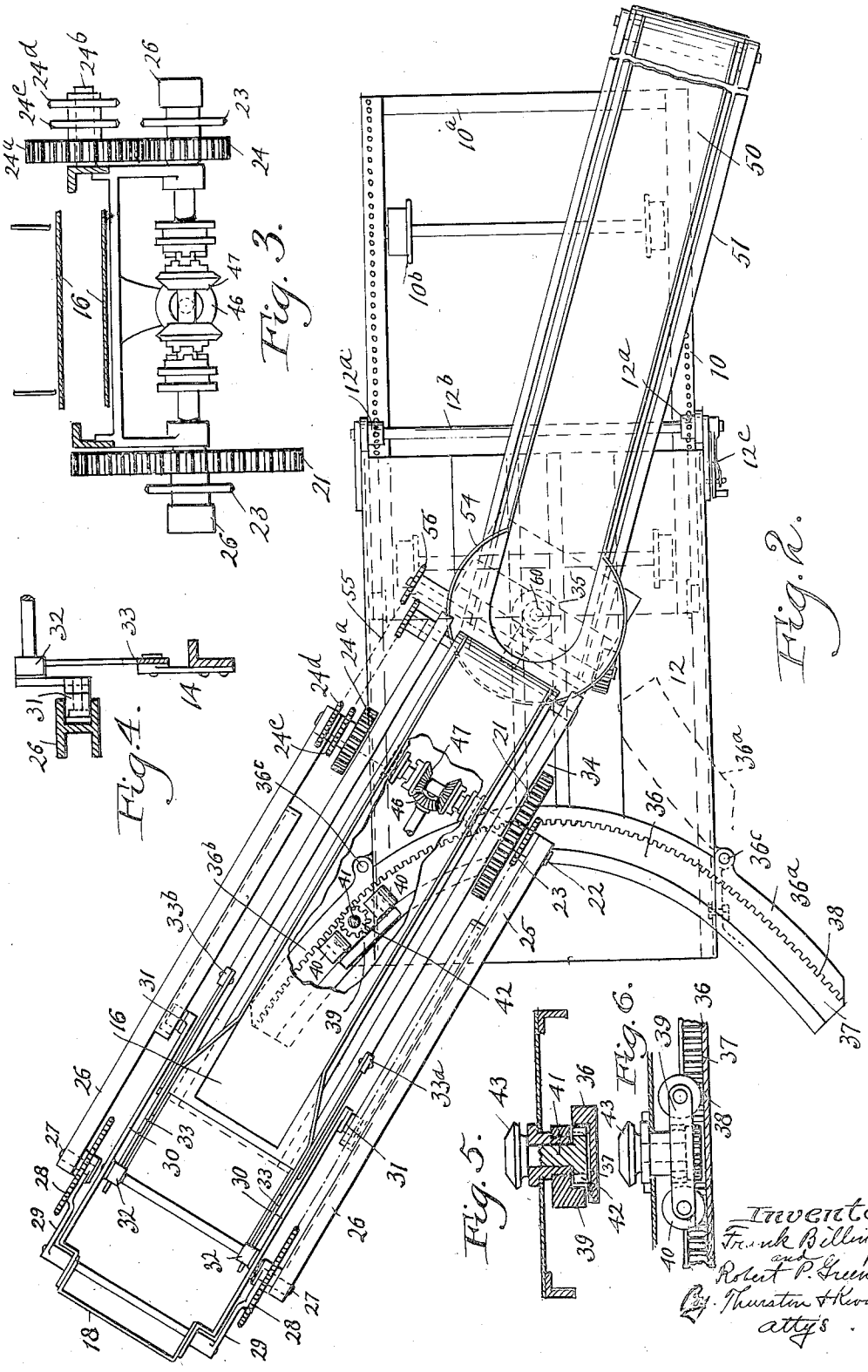


Fig. 3.

Fig. 2.

Fig. 4.

Fig. 5.

Fig. 6.

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LOADING MACHINE

Filed March 18, 1918 4 Sheets-Sheet 3

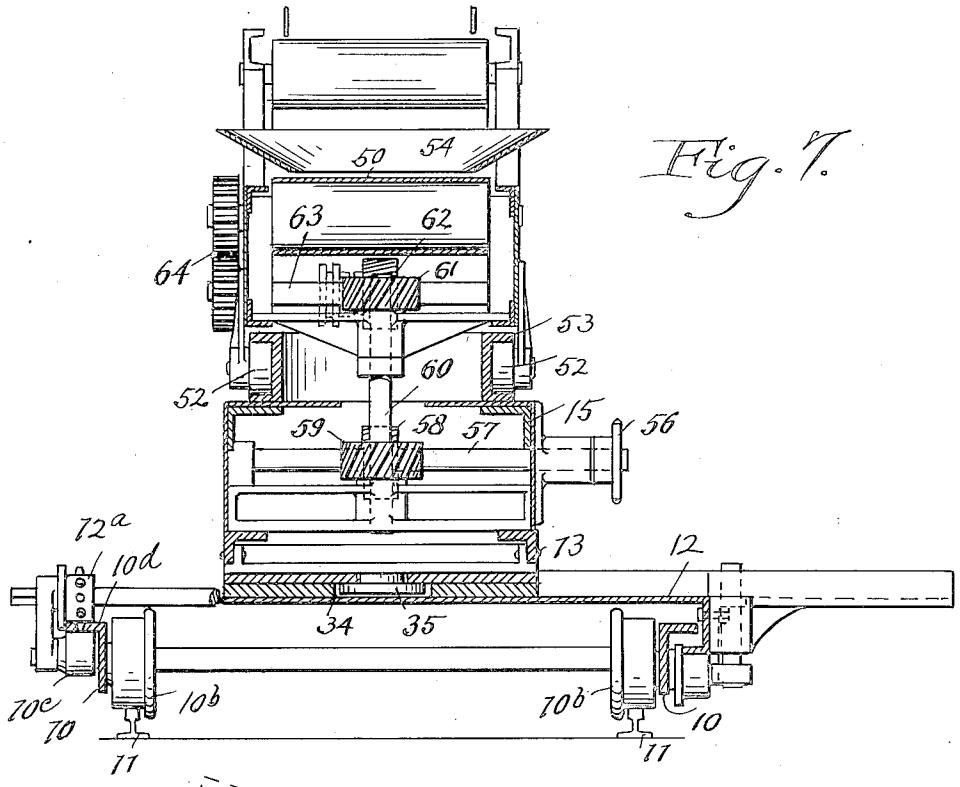


Fig. 7.

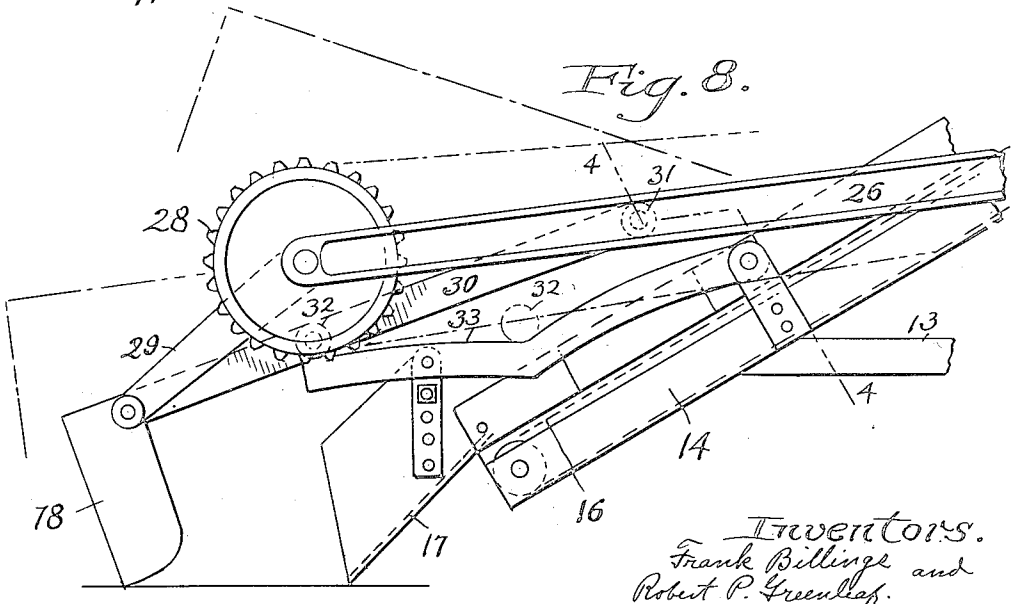


Fig. 8.

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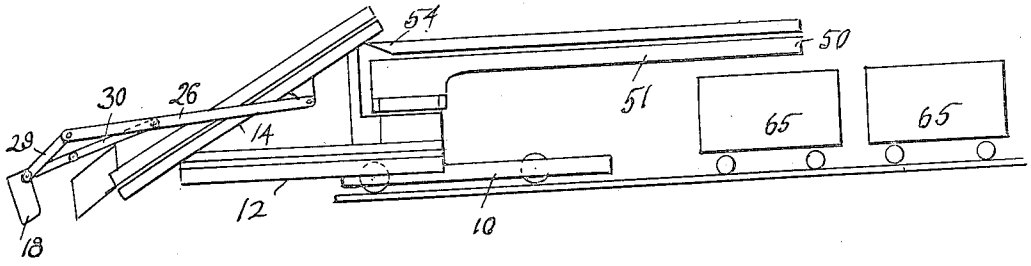
F. BILLINGS ET AL

LOADING MACHINE

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4 Sheets-Sheet 4

Fig. 9.



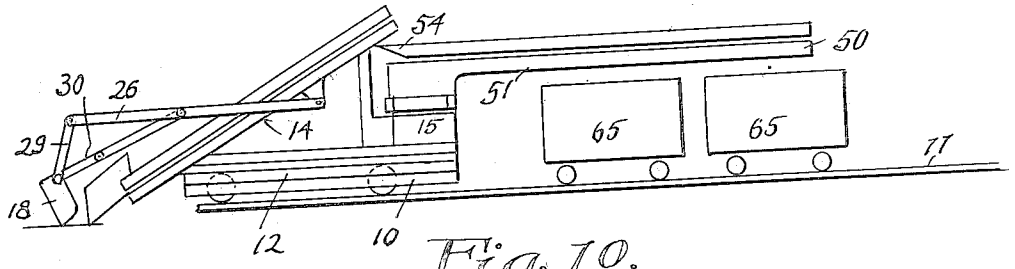


Fig. 10.

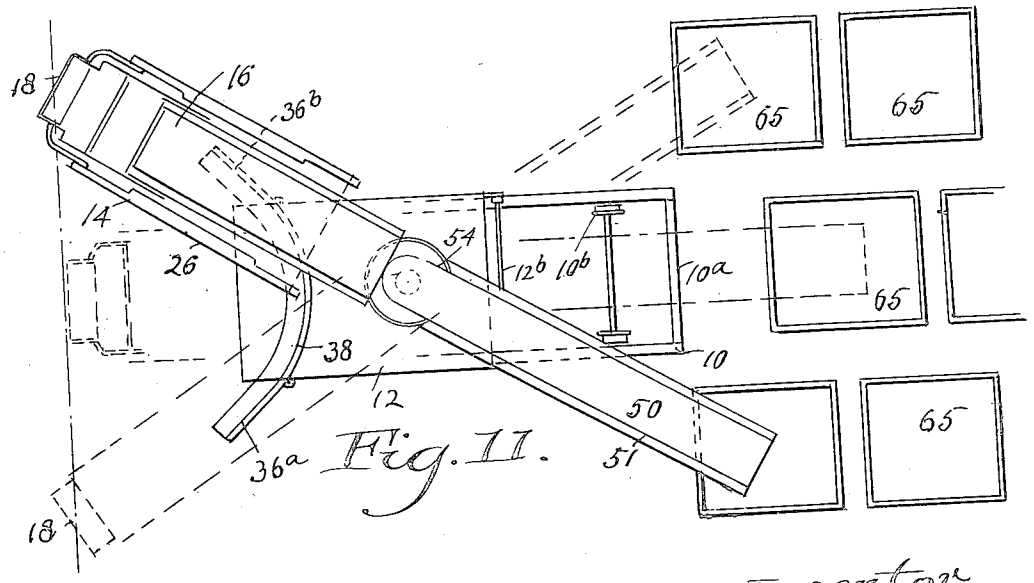


Fig. 11.

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Patented Aug. 14, 1923. 1,464,742

UNITED STATES PATENT OFFICE.

FRANK BILLINGS AND ROBERT P. GREENLEAF, OF CLEVELAND, OHIO; SAID GREENLEAF ASSIGNOR TO SAID BILLINGS.

LOADING MACHINE.

Application filed March 18, 1918. Serial No. 223,011.

To all whom it may concern:

Be it known the we, FRANK BILLINGS and ROBERT P. GREENLEAF, citizens of the United States, and residents, respectively, of Cleveland, in the county of Cuyahoga and State of Ohio, and Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Loading Machines, of which the following is a full, clear, and exact description.

This invention relates to loading machines adapted particularly for use in mines.

In one of our prior Patents, No. 1,420,681, granted June 27, 1922, we disclose a loading machine having a construction such that the digging and conveying mechanism can be advanced as the work progresses without the necessity of advancing the machine as a whole, or without frequently extending the track. This was brought about by providing a machine with a so-called sub-base which may be supported on a track, and a so-called intermediate base which is movable forwardly and rearwardly along the sub-base and may be projected a considerable distance forwardly beyond the same, and which carried the digging and conveying mechanism, the latter being laterally movable with reference to the intermediate base so as to reach material at the side as well as directly in front of the machine. Provision was also made for advancing a receiving car up onto the sub-base so that it can be kept close to the rear end of the intermediate base and to the discharge point of the conveying mechanism carried thereby.

In the present application the same generic idea is carried forward with a specifically different form of machine, which like the machine of our prior patent, has the digging and conveying mechanism capable of being moved forwardly relative to the sub-base. With the construction of this application, however, provision is made for conveying to and discharging material into mine cars or other receiving devices without the necessity of advancing the latter up onto the sub-base. This is accomplished through the medium of an auxiliary conveyor which is in receiving relationship with respect to the main digging and conveying mechanism, and is movable forwardly with the same as the work progresses, and which is so constructed and arranged that it can be made to load material into either a single line of cars or into cars on a plurality of tracks if the conditions of the mine or other work with which this machine is used, are such as to permit the use of a plurality of tracks for receiving cars.

The invention comprises also a loading machine having digging and conveying mechanism which may be swung laterally to reach material at the sides as well as the front of the machine and when so swung the digging element in whatever form it may be, such as a hoe or a shovel, will move approximately in a straight line rather than in an arc of a circle, so that the material will be cleaned up squarely with respect to the breast of the mine, without leaving at the corners, material which cannot be reached by the digging device.

The above and other features of importance are embodied in the machine involving our present invention, which may be further briefly summarized as consisting in certain novel details of construction and combinations and arrangements of parts which will be described in the specification and set forth in the appended claims.

In the accompanying sheets of drawings, Fig. 1 is a side view of the front part of the machine; Fig. 1ª is a side view of the rear end on a slightly reduced scale; Fig. 2 is a top plan view; Fig. 3 is a section substantially along the line 3—3 of Fig. 1; Fig. 4 is a detail or fragmentary sectional view substantially along the irregular line 4—4 of Fig. 8; Fig. 5 is a fragmentary sectional view substantially along the line 5—5 of Fig. 1; Fig. 6 is a sectional view through the same parts, but taken at right angles to the section of Fig. 5, showing certain parts in elevation; Fig. 7 is a vertical sectional view substantially along the line 7—7 of Fig. 1; Fig. 8 is a side view of the forward end of the digging and conveying mechanism showing various dotted line positions of the digging elements, which in this instance is a hoe. Figs. 9, 10 and 11 are diagrammatic views.

Referring now to the drawing, 10 represents a truck which corresponds to the so-called sub-base of our prior patent above referred to, this truck comprising a frame 10^a with wheels 10^b, which as here shown, are adapted to run on the rails of a mine track 11. Supported on the truck of sub-base 10 is an intermediate frame or base

12 which is movable forwardly and rearwardly of the truck, so that it can be extended well beyond the forward end of the latter, thus advancing the digging and conveying mechanism without advancing the track and without moving the machine as a whole, including the truck 10, until all the material within reach of the machine when fully extended, has been loaded. After this is done a new track section will be laid, and the machine as a whole will be advanced onto the same.

The intermediate frame is supported from the truck frame or sub-base 10 through rollers 10^e which are at the forward corners of the truck frame and engage the under side of the intermediate frame or base 12, and through two sets of upper and lower rollers 12^a and 12^b which are at the rear corners of the intermediate frame and engage respectively the upper and lower faces of flanges 10^d which extend along the sides of the truck frame 10^a. Any convenient means may be provided for moving the intermediate frame along the truck frame or sub-base, but in this case the two upper rollers 12^a are secured to a transverse shaft 12^b which may be turned by a crank 12^c these rollers 12^a having peripheral teeth adapted to engage in openings on the flanges 10^d so as to have an action similar to that of a rack and pinion construction.

Supported on the intermediate frame or base 12 is the digging and conveying mechanism which may be of any suitable form such as the shovel or bucket as in our prior patent above referred to, or it may be in the form of a conveyor and a hoe for scraping material up onto the same, as shown in this case, or it may be of any other suitable form. In this case, the frame of the digging and conveying mechanism includes a base 13 with an inclined conveyor frame 14, at the rear of which is a suitable platform to be referred to subsequently. The conveyor frame 14 through suitable rollers supports a belt conveyor 16, at the front of which is an inclined apron 17 which extends upwardly from the ground so that material can be scraped by a hoe 18 up onto the conveyor, and by the latter conveyed upwardly and rearwardly to the rear end of the conveyor frame.

The frame of the digging and conveying mechanism supports also the driving devices or mechanism. This includes a motor, in this case a rotary electric motor 19, although any other suitable type of motor may be utilized. The motor has a pinion 20 which drives a relatively large gear 21 fixed to a transverse shaft 22 carrying hoe actuating sprockets 23, and a gear 24 which meshes with a gear 24^a mounted on a short shaft 24^b, which is above shaft 22 as shown in Fig. 3, this shaft 24^b having two sprockets 24^c and 24^d the former of which drives the main conveyor 16, and the latter of which drives an auxiliary conveyor to be referred to presently. Mounted on the outer ends of this shaft 22 is the rear end of a hoe frame 25, including a pair of side bars 26, which are designed to swing up and down about the axis of the shaft 22. At the forward ends of these side bars are short shafts 27, to which are secured sprockets 28, which are adapted to be driven by suitable sprocket chains by the rearward sprockets 23. These short shafts 27 are provided at the inner ends with rotating cranks 29 which are connected to a pair of hoe arms 30 (see particularly Fig. 1), the rear ends of these arms having rollers 31 which travel in guide-ways extending lengthwise of the arms 26. Additionally these hoe arms 30 are provided between their ends with rollers 32 which travel on guides 33 to control the path of movement of the hoe when the latter is being retracted, these guides 33 being adjustably secured at 33^a and 33^b to the conveyor frame 14 and to the apron 17 respectively. These guides are given a peculiar shape so that when the hoe is retracted, the point of the hoe will travel in a substantially horizontal plane until the apron is reached, and then will travel upwardly in a plane parallel to the base of the apron. This will be apparent from an inspection of Fig. 8.

From the above description it will be seen that the motor 19 operating continuously, will cause the hoe to have a continuous motion such that the hoe is moved forwardly and downwardly, then in a straight line rearwardly, then up along the apron, then upwardly, forwardly and downwardly again, this motion being continued until the motor is stopped or unclutched from the shaft 22.

The digging and conveying mechanism is movably mounted on the intermediate frame or base 12, and this is done in a novel way which results in the attainment of what we believe to be an entirely new result in mechanically loading loosened material. The digging and conveying mechanism is not mounted to turn laterally about a fixed axis as is usually the case, and which results in the forward end swinging through an arc of a circle at the front of the machine, but the mounting is such that as the digging and conveying mechanism is swung laterally across the front of the machine the front end thereof will travel in a substantially straight line which is at right angles to the axis of the machine, or at right angles to the track on which the machine is supported. To accomplish this, the rear part of the frame of the digging and conveying mechanism is arranged to slide in a guideway extending longitudinally of the intermediate frame 12, this guideway being in

the form of a slot 34 (see Figs. 2 and 7) which is engaged by a suitably shaped guide 35, at the lower rear side of the base 13 of the frame of the digging and conveying mechanism. Additionally we provide at the front of the intermediate frame or base 12, a curved guide-way which receives a supporting guide member on the frame of the digging and conveying mechanism, this guide-way being so shaped that with the cooperation of the forwardly and rearwardly extending guide-way 34, the result previously stated is accomplished. This guide-way, in this case, consists of a casting 36 which is in the form of a curve which is concave forwardly and approximates a parabolic curve, this casting having a guide groove 37, and in addition, teeth constituting a curved rack 38, both the groove and rack extending the full length of the casting and conforming to the curvature thereof. The outer sections 36^a and 36^b of this casting extend laterally beyond the sides of the intermediate frame, and are hinged at 36^c so that they can be extended laterally as shown in Fig. 2, or can be swung rearwardly so that they will be out of the way when not in use.

The central forward portion of the frame of the digging and conveying mechanism has a suitable support which extends into, and is designed to travel along the guide groove 37. In this instance, this includes a yoke 39, having a pair of rollers 40 which engage in and rest on the base of the guide groove, this yoke, as will be observed from Figs. 5 and 6 being swiveled to turn about the axis of a short shaft 41 at the lower end of which is a pinion 42 which engages the rack 38. At the top of the shaft 41 is fixed a bevel gear 43, which engages a similar bevel gear 44 secured to a diagonally disposed shaft 45 which extends upwardly and rearwardly toward the shaft 22, and is provided at its upper rear end with a bevel gear 46 engaging a pair of similar bevel gears 47 which are normally loose on, but may be clutched to the shaft 22.

Thus the motor 19 not only operates the conveyor 16 and the hoe which moves material up onto the conveyor, but whenever desired, can be caused to rotate the pinion 42 and thus shift the digging and conveying mechanism to the right or left. In so doing, the forward end travels in a substantially straight line, and the rear end moves forwardly or rearwardly to accommodate or permit this movement.

In order that the material may be deposited in mine cars as efficiently as possible, we attach to the rear end of the conveying and digging mechanism so far described, an auxiliary or distributing conveyor which receives the material from the main conveyor 16, regardless of the position which it may be in, and which conveys the material rearwardly or rearwardly and laterally to the mine cars. This auxiliary conveyor which is shown at 50, is supported in a substantially horizontal frame 51 which is swiveled to turn about its forward end just beneath the rear of the discharging end of the main conveyor 16. This is accomplished through the medium of rollers 52 which engage in the peripheral groove of a casting 53 supported on the platform 15, which is at the extreme rear end of the base 13 of the frame of the digging and conveying mechanism. A hopper 54 is just above the conveyor 50, this hopper having a frustro-conical portion concentric with the axis about which the auxiliary conveyor frame may swing, so as to receive the material from the conveyor 16, and feed the same onto the conveyor 50. The rear end of the conveyor frame 51 may be supported if necessary, by any suitable means.

The motor 19 is utilized also to operate the conveyor 50. This is accomplished by the following mechanism. The sprocket 24^d, shown in Figs. 2 and 3, through a downwardly and rearwardly extending sprocket chain 55, drives a sprocket 56 (see particularly Fig. 7) secured to a shaft 57 which is mounted in the rear platform 15, and is provided with a spiral toothed gear 58 which meshes with a similar gear 59 on a vertical shaft 60, which constitutes the axis about which the swinging conveyor frame 51 turns. This shaft 60 is provided at its upper end with a spiral toothed gear 61 which meshes with a similar gear 62 (see Fig. 7) designed to be clutched to a transverse shaft 63, which turns with the frame 51 of the auxiliary conveyor, and through gearing 64 drives the auxiliary conveyor. This driving mechanism does not interfere with the movement of the auxiliary conveyor laterally, which can be shifted as desired, without stopping the operation of the conveyor 50.

This auxiliary conveyor constitutes a part of the movable digging and conveying mechanism, and while it may be turned or swung about the vertical axis, its forward end is always in position to receive material from the forward elevating conveyor, these two conveyors maintaining their proper relationship, and moving together when the digging and conveying mechanism is shifted laterally to pick up material at either side of the machine, or is shifted back to central position.

Thus it will be seen since the digging and conveying mechanism can be advanced relative to the truck by advancing the intermediate frame or base, a considerable depth of material can be loaded without requiring an extension of the track or a forward advancing of the machine as a whole.

When this forward movement takes place, or when the digging and conveying mechanism moves forwardly or rearwardly by reason of the lateral movement of this mechanism relative to the intermediate frame to reach material at the sides of the machine (this forward movement resulting from the fact that the digging member travels in a substantially straight line across the front of the machine) the feeding or loading of material into receiving cars such as shown at 65 in Figs. 9, 10 and 11 is not interrupted, for the auxiliary conveyor at all times projects beyond the rear end of the truck so that it is capable of uninterruptedly feeding the material into one or more cars at the rear or sides of the machine. Thus there is eliminated the necessity of advancing the material receiving car, or the necessity of maintaining the receiving car a definite distance from the rear end of the intermediate frame as the digging and conveying mechanism is advanced. This is illustrated in diagrammatic views of Figs. 9, 10 and 11, which show a number of receiving cars capable of being reached by the auxiliary conveyor as the digging and conveying mechanism is moved forwardly, Fig. 9 showing the intermediate frame and digging and conveying mechanism advanced relative to the truck, and Fig. 10 showing the same retracted. In Fig. 11, which is a diagrammatic plan view, we have shown how the forward end of the digging and conveying mechanism may be moved laterally across the front of the machine, and have also shown by full and dotted lines, how the auxiliary conveyor may be swung laterally to load material into cars on tracks at the sides of the machine as well as at the rear thereof in the event that the available space in which the machine is used permits the use of two or more parallel tracks.

While we have shown only one construction, it will be apparent that changes may be made in details or form of some of the devices or mechanisms without departing from the spirit and scope of our invention. Particularly we wish it understood that we are not limited to the use of a hoe and elevating conveyor to pick up and carry rearwardly the material from in front of the machine. We therefore aim in our claims to cover all modifications which do not involve a departure from the spirit and scope of our invention in its broadest aspects.

Having described our invention, we claim:

1. In a loading machine, a sub-base adapted to rest on a track, a frame normally stationary on the sub-base and movable forwardly and rearwardly with respect to the sub-base and adapted to be projected forwardly beyond the same, digging and conveying mechanism supported on said frame and movable forwardly and rearwardly therewith, said digging and conveying mechanism comprising a front unit for conveying material rearwardly from in front of the machine, and a rear unit which extends rearwardly beyond the machine, the front end of the front unit being movable laterally with respect to the frame, and the rear end of the rear unit being movable laterally with respect to the frame and with respect to the forward unit, and the forward end of the rear unit being at all times in receiving relationship with the rear end of the front unit.

2. In a loading machine, a sub-base adapted to rest on a track, a frame normally stationary on the sub-base and movable forwardly and rearwardly with respect to the sub-base and adapted to be projected forwardly beyond the same, digging and conveying mechanism supported on said frame and including a front unit having means for conveying material rearwardly from in front of the machine and mounted for swinging movement about a vertical axis at the rear of said unit, and a rear unit adapted to receive material from the front unit and to convey the same to the rear of the machine, said rear unit being mounted for swinging movement laterally about said axis with respect to which the front unit swings.

3. In a loading machine, a sub-base adapted to rest on a track, a frame normally stationary on the sub-base and movable forwardly and rearwardly with respect to the sub-base and adapted to be projected forwardly beyond the same, digging and conveying mechanism supported on said frame and movable forwardly and rearwardly therewith, said digging and conveying mechanism comprising a front unit for conveying material rearwardly from in front of the machine, and a rear unit which extends rearwardly beyond the machine, the front end of the front unit being movable laterally with respect to the frame, and the rear end of the rear unit being movable laterally with respect to the frame and with respect to the forward unit, and the forward end of the rear unit being at all times in receiving relationship with the rear end of the front unit, said front unit comprising an endless conveyor, and means for moving material onto the same.

4. In a loading machine, a supporting frame, digging and conveying mechanism supported thereon and movable laterally with respect thereto so as to reach material at the sides as well as in front of the machine, and co-operating guides by which the forward end of the digging and conveying mechanism travels in a substantially straight line across the front of the machine when lateral movement is given to it, said digging and conveying mechanism having

means for conveying material rearwardly from in front of and at the sides of the machine.

5. In a loading machine, a supporting frame, digging and conveying mechanism movably supported thereon, co-operating guides which permit the digging and conveying mechanism to be swung laterally and moved forwardly with respect to the frame, one of said guides being concave forwardly, said digging and conveying mechanism having means for conveying material rearwardly from in front of and at the sides of the machine.

6. In a loading machine, digging and conveying mechanism, a supporting frame for said mechanism, and cooperating guide members on the frame and said mechanism respectively for constraining the latter to simultaneously move forwardly and laterally outward relative to the frame, said digging and conveying mechanism having means for conveying material rearwardly from in front of and at the sides of the machine.

7. In a loading machine, digging and conveying mechanism, a supporting frame for said mechanism, and co-operating guide members on the frame and said mechanism respectively for permitting the latter to simultaneously move forwardly and laterally relative to the frame, said guide members including a forwardly concaved curved guide extending crosswise of the frame, and a straight guide extending forwardly and rearwardly of the frame, said digging and conveying mechanism having means for conveying material rearwardly from in front of and at the sides of the machine.

8. In a loading machine, digging and conveying mechanism, and a supporting frame therefor, co-operating guides by which said digging and conveying mechanism may be moved laterally across the front of the machine and comprising a forwardly concaved curved track at the front of the frame, and a longitudinally extending guide at the rear thereof, and members on said digging and conveying mechanism engaging said track and guide respectively, said digging and conveying mechanism having means for conveying material rearwardly from in front of and at the sides of the machine.

9. In a loading machine, a supporting frame, digging and conveying mechanism movably mounted thereon, one part of said mechanism being guided for forward and rearward movement on the frame, and a forward part guided for a combined lateral and forward or lateral and rearward movement, said digging and conveying mechanism having means for conveying material rearwardly from in front of and at the sides of the machine.

10. In a loading machine, a sub-base, an intermediate base mounted on the sub-base for movement lengthwise thereof, digging and conveying mechanism movably mounted on the intermediate base, and having its forward portion guided so that its forward end may be moved laterally outward in substantially a straight line, said digging and conveying mechanism having means for conveying material rearwardly from in front of and at the sides of the machine.

11. In a loading machine, a frame, a conveyor for conveying material rearwardly from in front of the machine, a hoe for scraping material onto the conveyor, a pivoted hoe frame, a crank at the end of the hoe frame and connected to the hoe, and an arm connected to the hoe and at its rear end having sliding engagement with the hoe frame.

12. In a loading machine, a conveyor frame, a conveyor supported thereby, a hoe frame pivoted to the conveyor frame and extending forwardly from its pivotal axis, a rotatable crank supported at the forward end of the hoe frame and connected to the hoe, an arm connected to the hoe and rearwardly of the hoe having sliding engagement with the hoe frame, a guide supported on the conveyor frame, and means on said arm adapted to engage said guide to control the path of movement of the hoe.

13. In a loading machine, a frame, a conveyor supported thereby, a pair of arms pivoted at their rear ends to the frame and extending forwardly from the pivotal axis, a pair of cranks at the forward ends of said arms, a hoe pivotally connected to the cranks, means for operating the cranks, arms projecting rearwardly from the hoe and at their rear ends having sliding engagement with said first-named arms, a pair of guide members supported by the frame, and means on said second named arms engaging said guide members for controlling the path of movement of the hoe as the latter is drawn rearwardly.

14. In a loading machine, a frame, loading mechanism supported thereby, and including a conveyor for conveying material rearwardly, said conveyor being mounted so that it may be swung laterally with the front portion thereof moving in substantially a straight line across the front of the machine.

15. In a loading machine, a frame, loading mechanism supported thereby, and including a conveyor for conveying material rearwardly, the conveyor being movably supported on the frame and having its rear portion guided thereon for movement longitudinally on the frame, and its forward portion guided for a combined lateral and forward motion as the front end is moved away from the center line of the frame and

a combined lateral and rearward motion as it is moved toward the center line of the frame.

16. In a loading machine, a supporting frame, front and rear conveyors movably supported thereon and movable relatively, the forward end of the rear conveyor and the rear end of the forward conveyor being guided for simultaneous movement forwardly and rearwardly of the frame, and the forward portion of the front conveyor being guided so that it may be moved laterally and substantially in a straight line across the front of the machine.

17. A loading machine, a supporting frame and a mechanism for receiving material at the front end thereof and for conveying the same so as to discharge the same rearwardly of the machine, comprising a front conveyor and a rear conveyor, the rear portion of the rear conveyor being movable laterally in an arc of a circle, the front portion of the front conveyor being movable in substantially a straight line across the front of the machine, and the adjacent portions of the two conveyors being guided for simultaneous forward and rearward movement.

In testimony whereof, we hereunto affix our signatures.

FRANK BILLINGS.
ROBERT P. GREENLEAF.

Witnesses:
HULL SEARCY,
W. J. BOWEN, Jr.