Oct. 13, 1953 C. N. BEBINGER 2,655,246

MATERIAL LOADING APPARATUS

Filed July 21, 1947 8 Sheets-Sheet 1

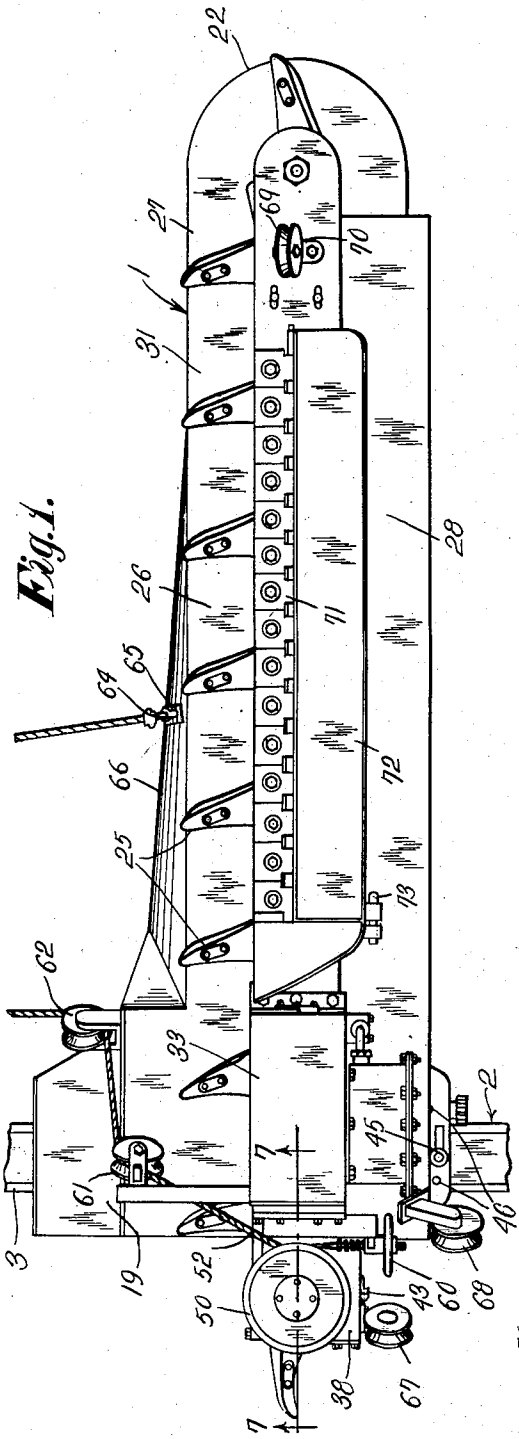


Fig. 1.

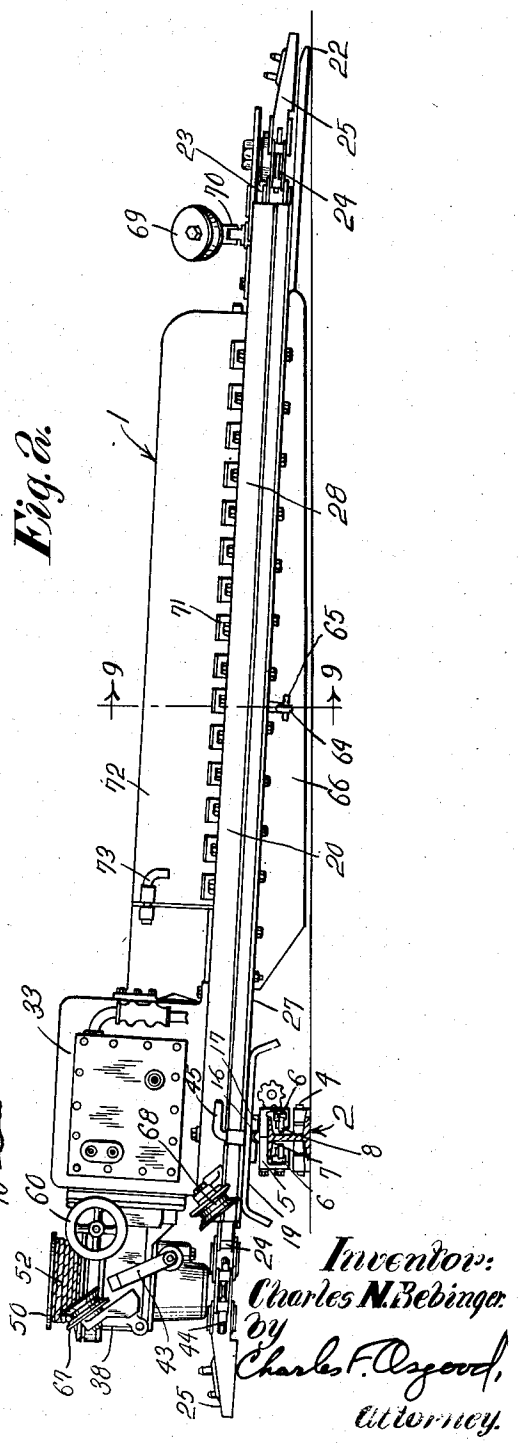


Fig. 2.

Inventor:
Charles N. Bebinger
by
Charles F. Osgood,
Attorney.

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MATERIAL LOADING APPARATUS

Filed July 21, 1947 8 Sheets-Sheet 2

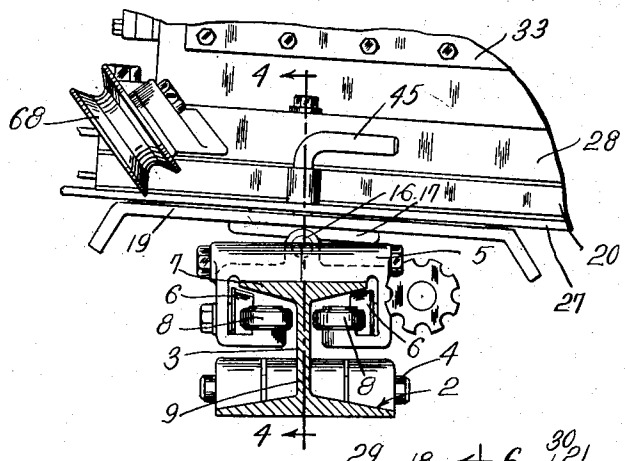


Fig. 3.

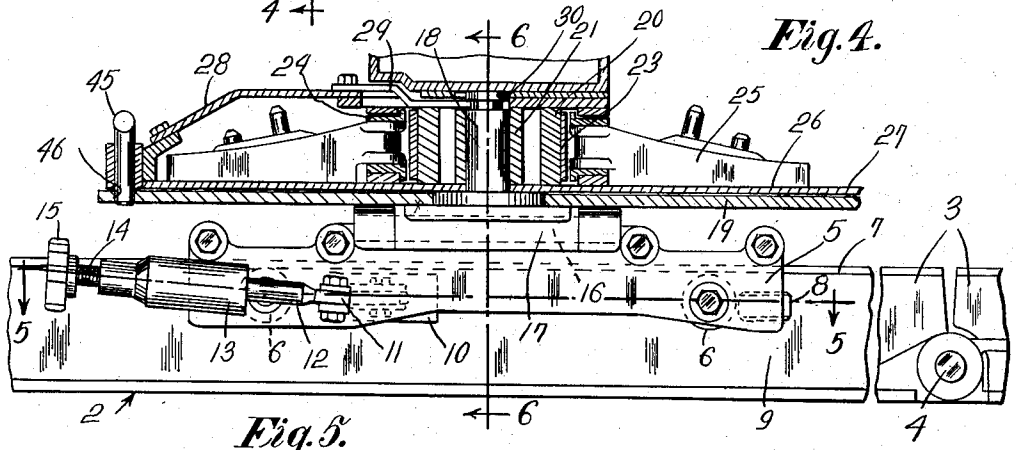
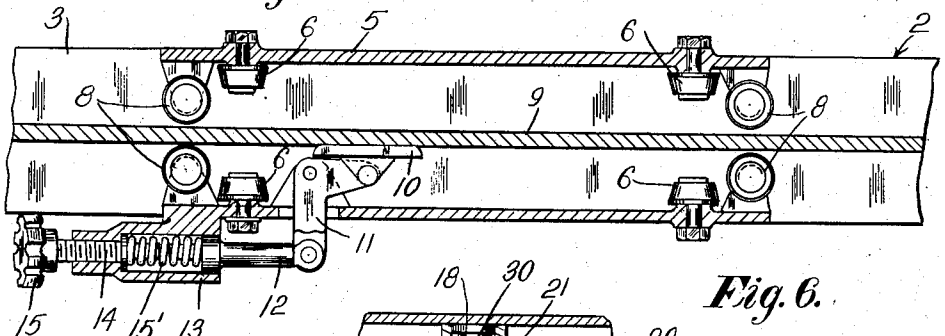


Fig. 4.

Fig. 5.



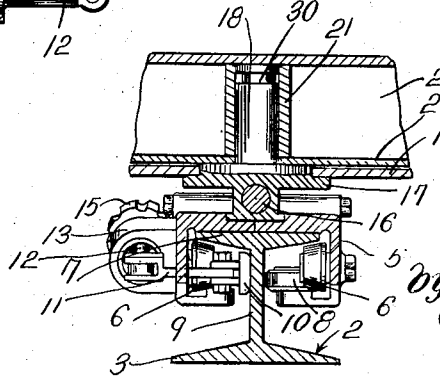


Fig. 6.

Inventor:
Charles N. Bebinger.
by Charles F. Osgood,
Attorney.

Oct. 13, 1953 C. N. BEBINGER 2,655,246

MATERIAL LOADING APPARATUS

Filed July 21, 1947 8 Sheets-Sheet 3

Fig. 7.

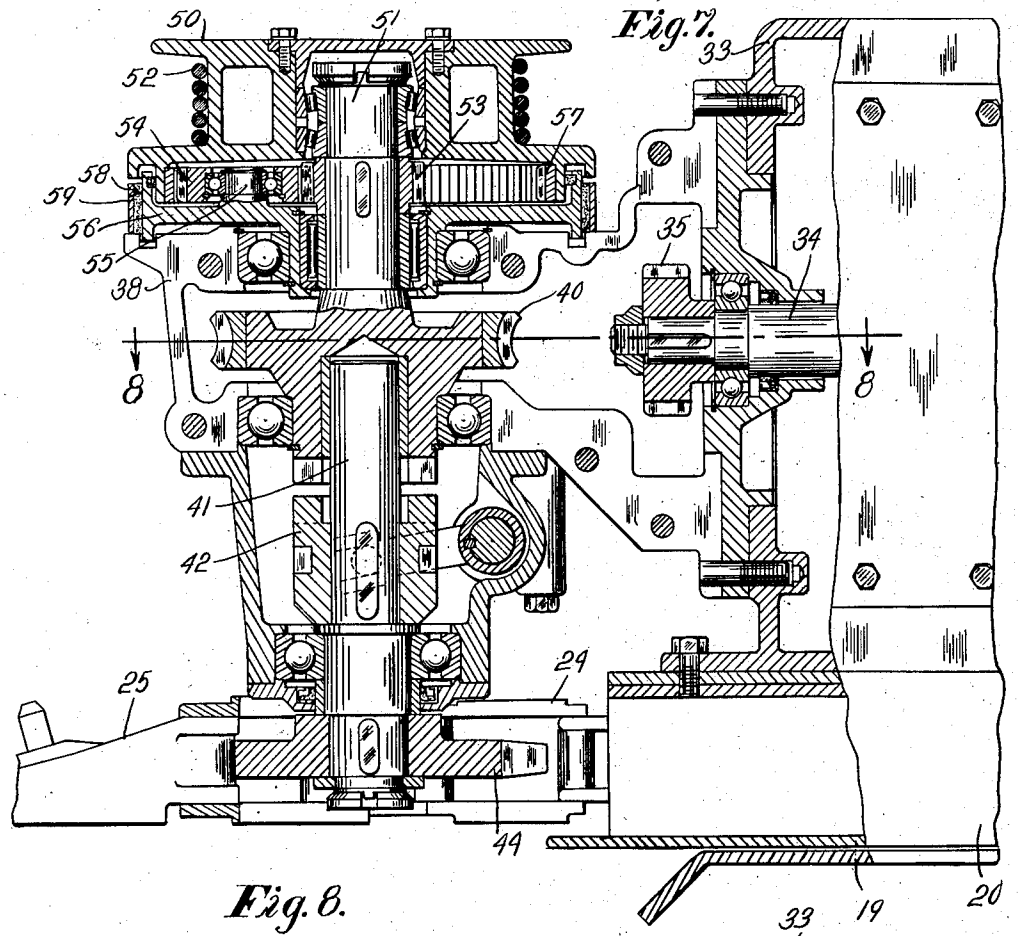
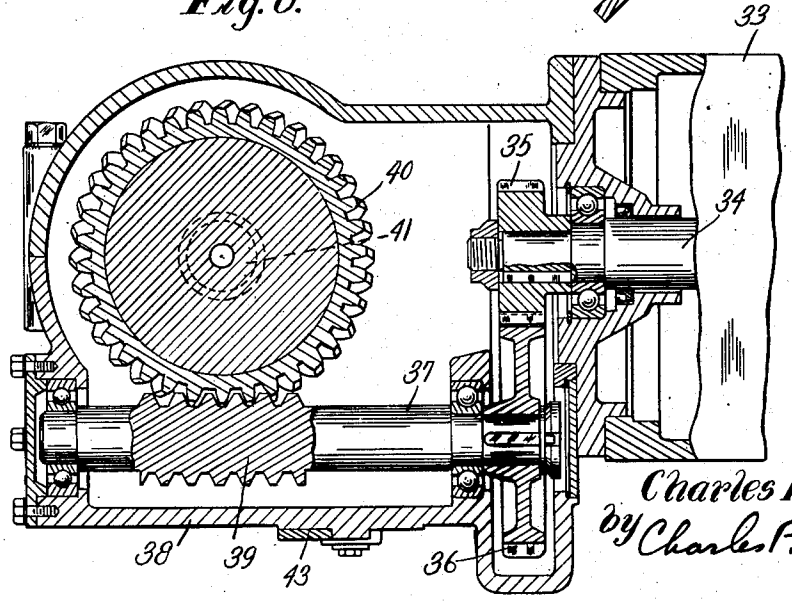


Fig. 8.



Inventor:
Charles N. Bebinger.
by Charles F. Osgood,
attorney.

Oct. 13, 1953 C. N. BEBINGER 2,655,246

MATERIAL LOADING APPARATUS

Filed July 21, 1947 8 Sheets-Sheet 4

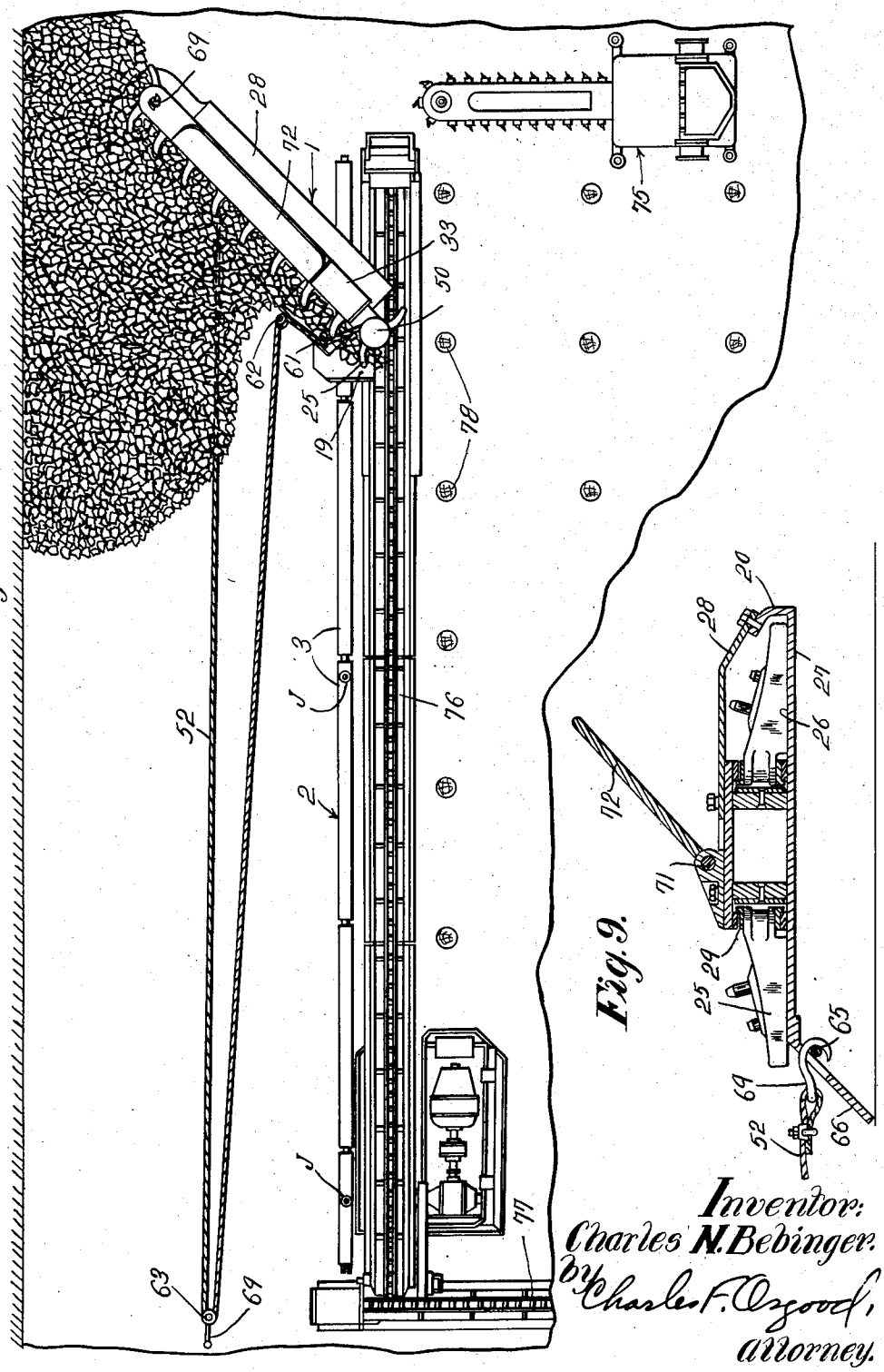


Fig. 10.

Fig. 9.

Inventor:
Charles N. Bebinger
by Charles F. Osgood,
Attorney.

Oct. 13, 1953 C. N. BEBINGER 2,655,246

MATERIAL LOADING APPARATUS

Filed July 21, 1947 8 Sheets-Sheet 5

Fig. 11.

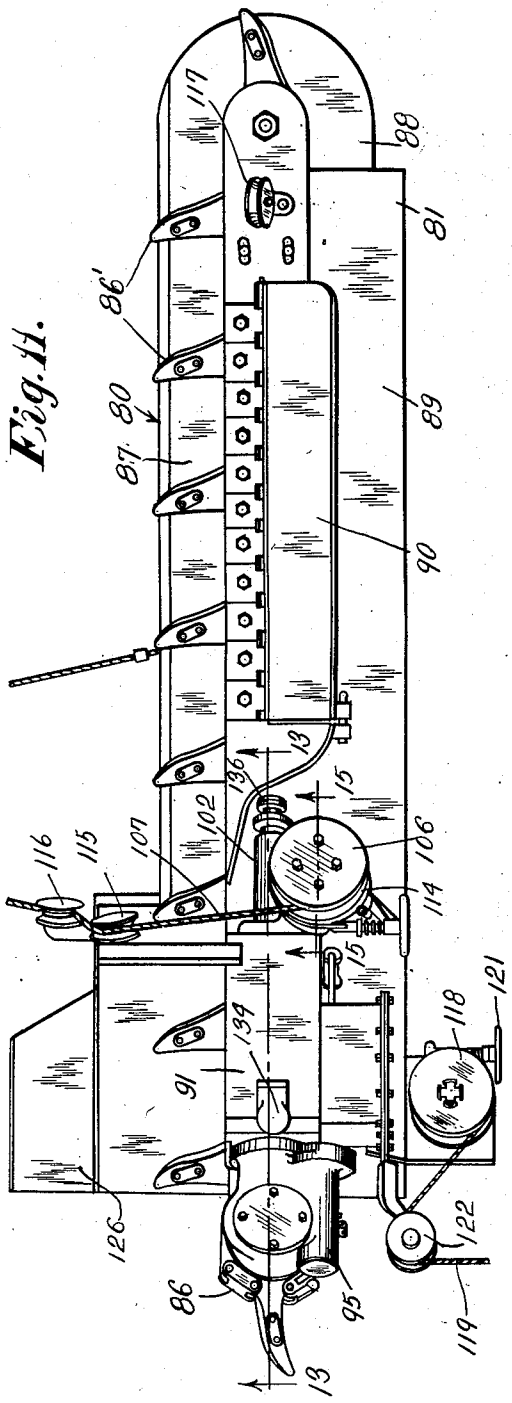
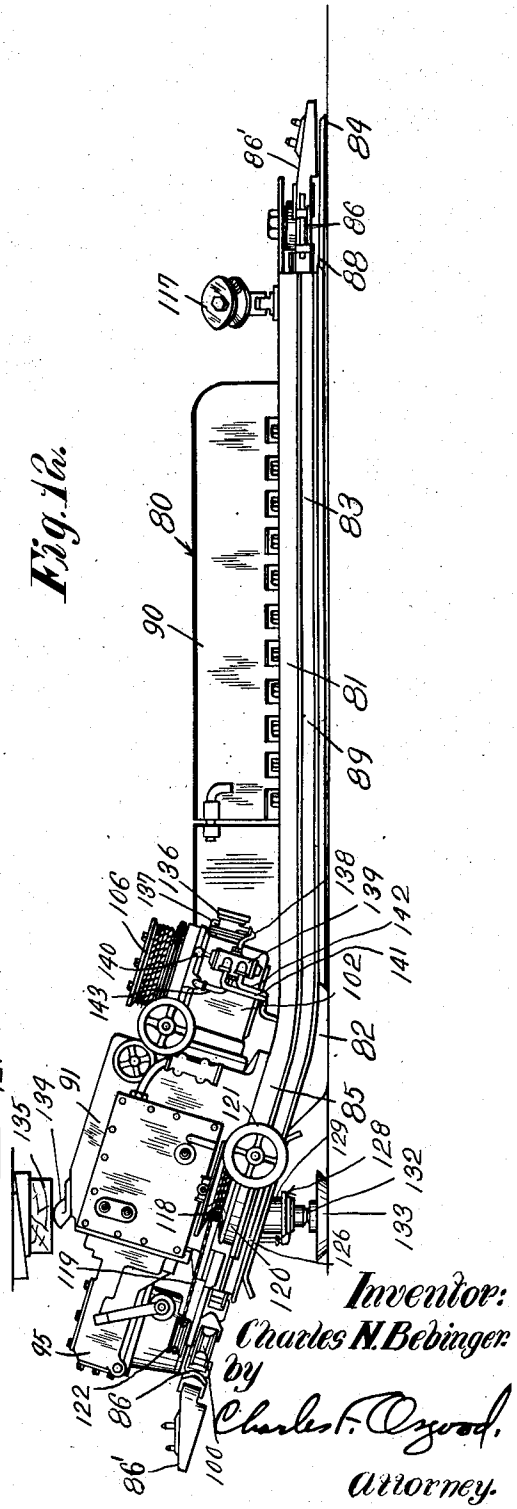


Fig. 12.



Inventor:
Charles N. Bebinger
by
Charles F. Ozzard
Attorney.

Oct. 13, 1953 C. N. BEBINGER 2,655,246

MATERIAL LOADING APPARATUS

Filed July 21, 1947 8 Sheets-Sheet 6

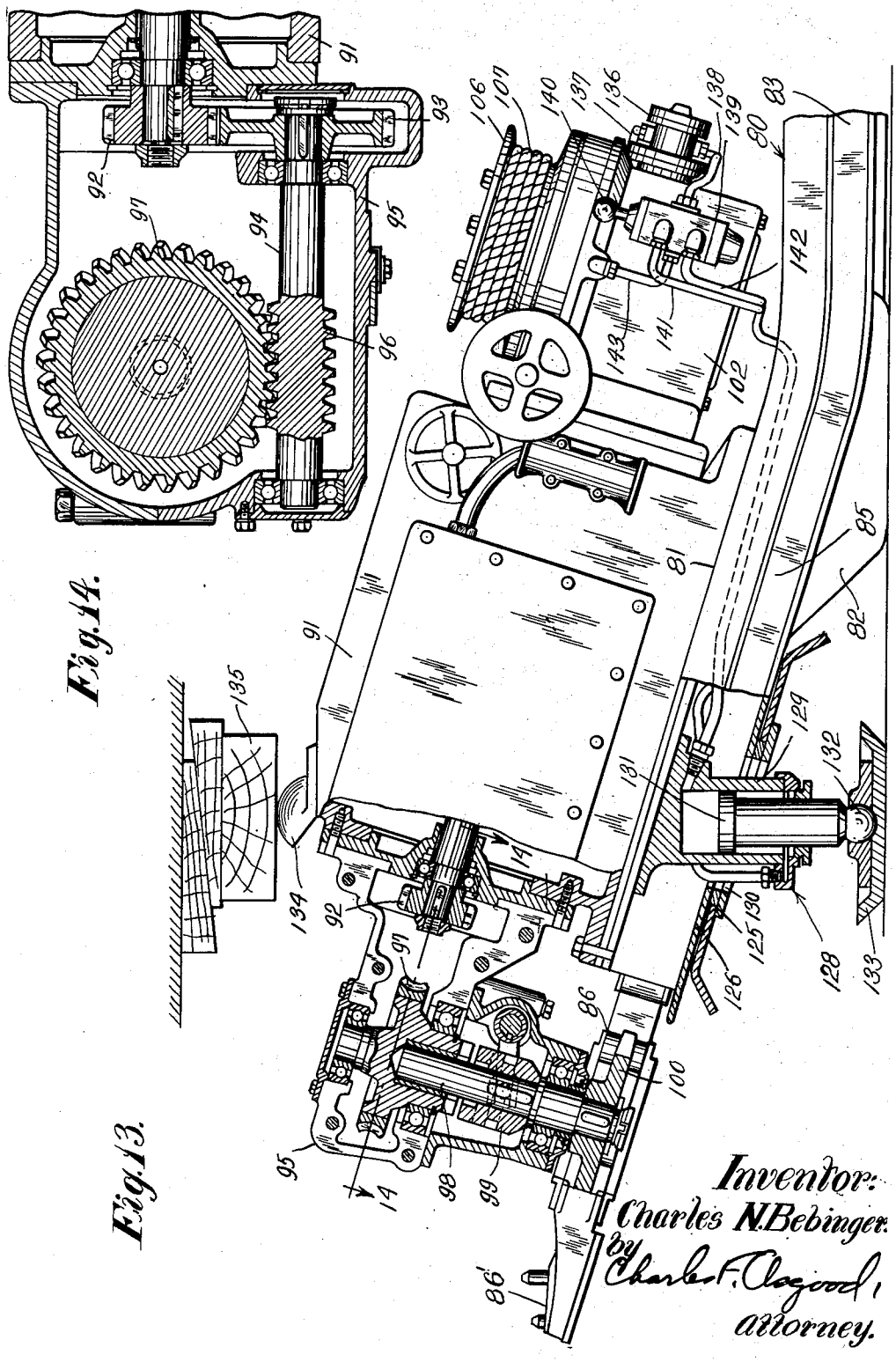


Fig. 14.

Fig. 13.

Inventor:
Charles N. Bebinger.
By Charles F. Clapp,
attorney.

Oct. 13, 1953 C. N. BEBINGER 2,655,246

MATERIAL LOADING APPARATUS

Filed July 21, 1947 8 Sheets-Sheet 7

Fig. 15.

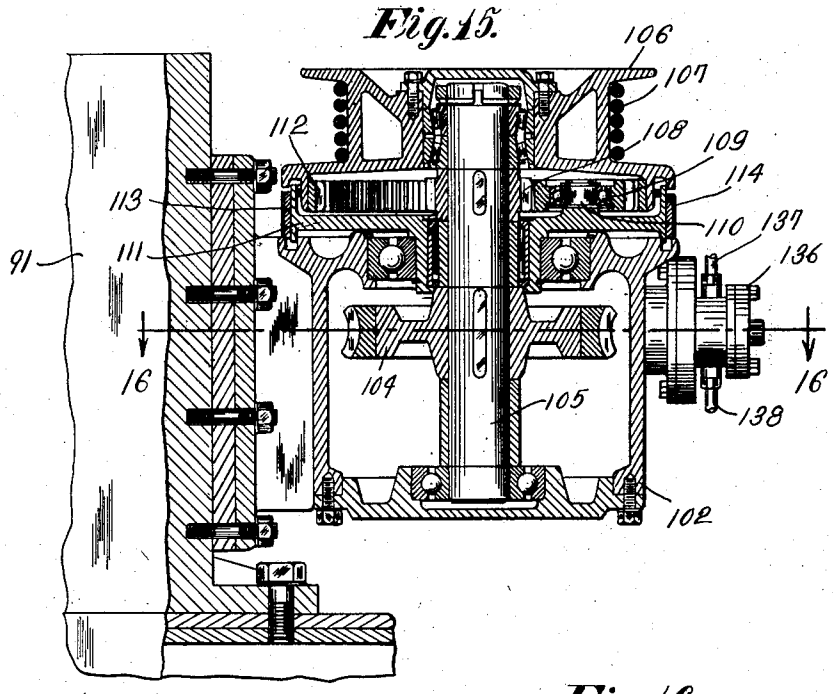
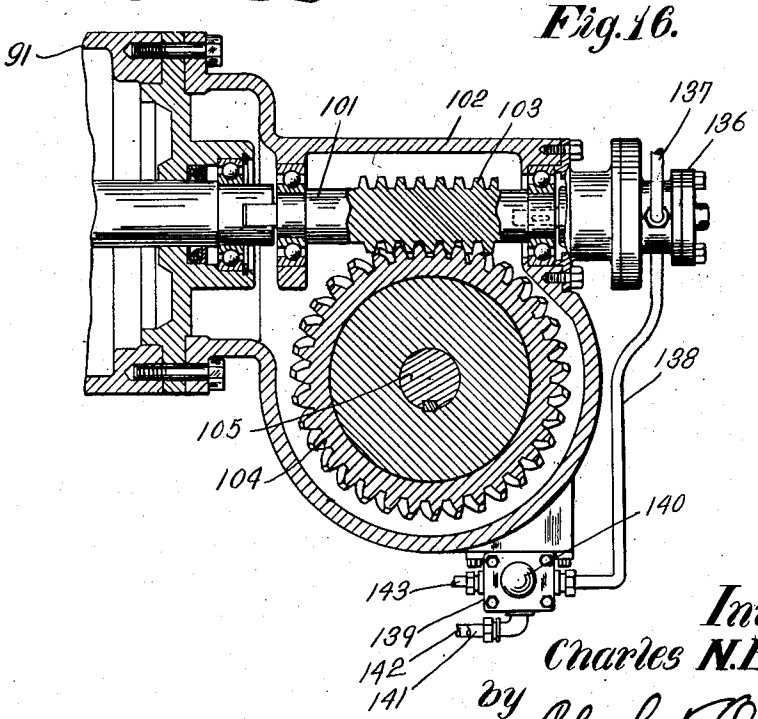


Fig. 16.



Inventor:
Charles N. Bebinger.
by Charles F. Osgood,
attorney.

Oct. 13, 1953 C. N. BEBINGER 2,655,246

MATERIAL LOADING APPARATUS

Filed July 21, 1947 8 Sheets-Sheet 8

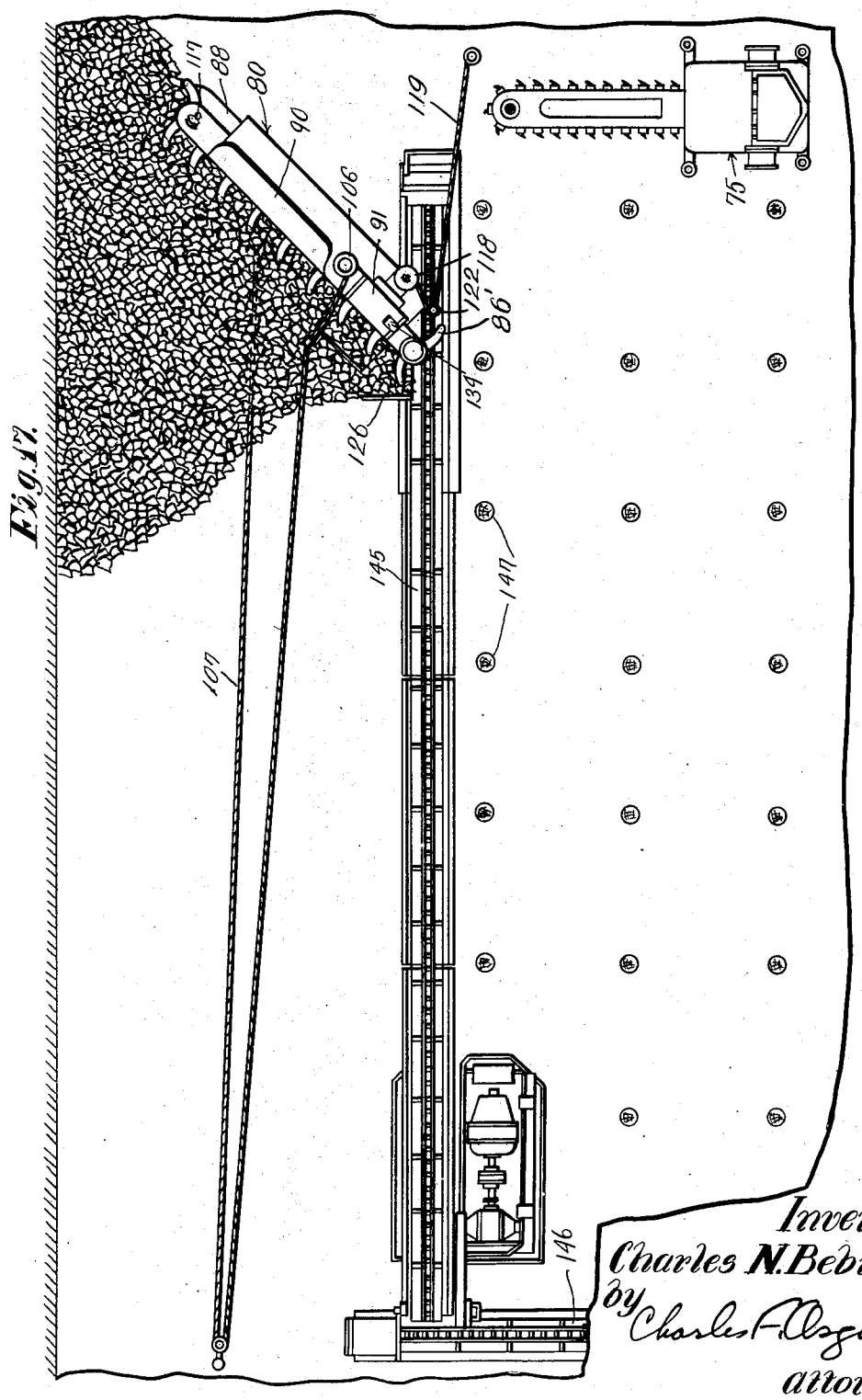


Fig. 17.

Inventor:
Charles N. Bebinger
by Charles F. Osgood,
attorney.

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2,655,246

UNITED STATES PATENT OFFICE

2,655,246

MATERIAL LOADING APPARATUS

Charles N. Bebinger, New Philadelphia, Ohio, assignor to Joy Manufacturing Company, a corporation of Pennsylvania

Application July 21, 1947, Serial No. 762,377

16 Claims. (Cl. 198—7)

1

This invention relates to material loading apparatus and more particularly to an improved floor type loading machine for loading loose material, such as coal, in underground mines having low head room.

In floor type loading machines, such as those designed for use in relatively low coal, it has been common practice to slide the machine over the mine floor and to guide the machine, both during maneuvering and during the loading operations, by means of feed and tail ropes, and there is usually provided a loading conveyor to gather the loose coal on the mine floor and to elevate the coal as it is conveyed away from the face to a suitable point of discharge, for example, discharge onto a face conveyor. The feed and tail ropes are usually operated in the same general manner as a conventional room and pillar coal cutter by cable drums on the machine, as is well known to those skilled in the art, and the gathering conveyor is sumped bodily endwise into the loose coal at the face and thereafter the conveyor is moved transversely along and guided relative to the face to gather and load the coal. In another known instance, the loading machine is guided directly by the face conveyor without the use of a tail rope and is rigidly held at substantially right angle to the face conveyor as it moves laterally along the coal face, and, accordingly, such a machine is restricted to use in open-end longwall work since no facilities for sumping the conveyor laterally into the coal pile are afforded. Usually such known floor type machines lack any means for laterally swinging the loading conveyor to sump the conveyor into the coal pile so that loading out of closed-end corners is impossible. In known loading machines designed for use in room and pillar work and which are moved bodily endwise in a manner similar to a conventional room and pillar coal cutter to sump the loading conveyor endwise beneath the coal to load out a corner, a relatively large space is necessary at the face, which precludes close setting of the roof props, a substantial disadvantage, particularly in longwall work. Further, it has been common practice pivotally to mount a loading conveyor on a wheeled truck adapted to travel along a trackway, but such track mounted machines are used on narrow development work, such as driving entries, where the track is carried straight along the entry to accommodate the necessary mine cars and the loading machine. Such track mounted machines are not adapted for use in low coal, and due to their relatively great length and bulk, could not

2

be used in longwall work where close propping is imperative.

The present invention, from a broad aspect, contemplates a floor type coal loading machine, capable of operating in accordance with either the room and pillar or longwall systems of mining and especially designed for use in low coal, which overcomes the disadvantages of floor type loaders of known types in that loading out of closed-end corners is possible while still permitting the close setting of roof props. The machine is compactly designed and is so arranged and constructed that, while permitting close setting of roof props, the loading conveyor may be swung laterally about a pivot into the coal pile effectively to load out corners in closed-end work. The machine of the present invention, in a desirable embodiment thereof, may comprise a loading conveyor pivotally connected to a carriage which travels along a guide rail laid on the mine floor along the inner side of the face conveyor and suitably jacked in place so that when the carriage is locked to the guide rail, the loading conveyor may be swung laterally to load out a corner. After the initial sumping movement of the loading conveyor is completed and the loading conveyor has assumed a position at substantially right angles to the face conveyor, the carriage lock may be released and the machine may be fed laterally along the coal face to gather the loose coal and load the coal onto the face conveyor. The machine may be fed laterally by the feed cable and the angle of the machine with respect to the coal face may be controlled by utilizing the carriage lock as a retarding brake. In another embodiment, the loading machine in which the invention is incorporated may embody a jacking device whereby the loading conveyor may be jacked in position between the roof and floor, with the jack device providing the pivotal point for the loading conveyor so that the latter may be swung laterally to load out a corner without the use of a guide rail. In this machine, feed and tail ropes may be provided for feeding and guiding the machine during loading along the coal face, and during such lateral movement, the jacking device is, of course, released. If desired, during the lateral loading operation, the machine may be jacked between the roof and floor to permit swinging of the loading conveyor into the desired angular position with respect to the coal face. The loading machine is so constructed that the face conveyor may be arranged relatively close to the face with the machine projecting over

the face conveyor, thereby to provide for close setting of roof props.

It is an object of the present invention to provide an improved material loading apparatus which embodies advantages over known types of loading machines, whereby loading may be effected in an improved and more efficient manner. Another object is to provide an improved floor type coal loading machine especially designed for use in mines having low head room. A further object is to provide an improved floor type coal loading machine embodying a loading conveyor which may be swung laterally to effect loading out of a corner in closed-end work. Yet another object is to provide an improved floor type coal loading machine of an extremely compact design, thereby requiring a minimum of space between the face and the line of the roof props. A still further object is to provide an improved floor type coal loading machine adapted for association with a face conveyor and having improved means for guiding the machine and for swinging the loading conveyor with respect to the face conveyor. Another object is to provide an improved floor type coal loading machine and an improved guide rail structure for guiding the machine during its movement along the coal face. A still further object is to provide an improved floor type coal loading machine embodying a jacking device wherein the jacking device provides a pivot for the loading conveyor whereby the latter may be swung laterally to effect loading. A still further object is to provide an improved loading machine so constructed and arranged that it may be located in the relatively restricted space between the coal face and a face conveyor, thereby to permit close setting of roof props. Still another object is to provide an improved coal loading machine having novel arrangements and combinations of parts. These and other objects and advantages of the invention will, however, hereinafter more fully appear.

In the accompanying drawings there are shown for purposes of illustration two forms which the invention may assume in practice.

In these drawings:

Fig. 1 is a top plan view of a floor type loading machine constructed in accordance with a preferred illustrative embodiment of the invention.

Fig. 2 is a side elevational view of the loading machine shown in Fig. 1, with the guide rail shown in cross section.

Fig. 3 is a fragmentary elevational view, on an enlarged scale, of a portion of the loading machine shown in Fig. 2, illustrating structural details.

Fig. 4 is a cross-sectional view taken substantially on line 4—4 of Fig. 3.

Fig. 5 is a substantially horizontal sectional view taken on line 5—5 of Fig. 4, illustrating the guide rail, carriage, and carriage lock.

Fig. 6 is a vertical sectional view taken on line 6—6 of Fig. 4, illustrating the pivotal mounting for the loading conveyor.

Fig. 7 is an enlarged view in longitudinal vertical section taken substantially on line 7—7 of Fig. 1.

Fig. 8 is a horizontal sectional view taken on line 8—8 of Fig. 7.

Fig. 9 is an enlarged cross-sectional view taken substantially on line 9—9 of Fig. 2.

Fig. 10 is a somewhat diagrammatic view in plan, showing the loading machine in operative loading position in a mine.

Fig. 11 is a top plan view illustrating a modified embodiment of the improved loading machine.

Fig. 12 is a side elevational view of the loading machine shown in Fig. 11.

Fig. 13 is an enlarged view in longitudinal vertical section taken substantially on line 13—13 of Fig. 11.

Fig. 14 is a detail sectional view taken on line 14—14 of Fig. 13, showing details of the conveyor drive.

Fig. 15 is a view in longitudinal vertical section taken on line 15—15 of Fig. 11, showing the feed drum.

Fig. 16 is a detail sectional view taken on line 16—16 of Fig. 15.

Fig. 17 is a somewhat diagrammatic view in plan, showing the loading machine of the modified embodiment in operative loading position in a mine.

In the preferred illustrative embodiment shown in Figs. 1 to 10 inclusive, the loading machine is generally designated 1 and is guided for movement along a guide rail, generally designated 2, laid on the mine floor and firmly held in position by suitable roof jacks J. The guide rail preferably may be of a lightweight cast aluminum construction to facilitate handling and is preferably made up in I-beam sections 3 pivotally connected together, as by transverse hinge pins 4, in end to end relation (Figs. 3 and 4). Carried on the top of the guide rail is a sliding support or carriage 5, preferably made in two parts held together by cross bolts, and the carriage parts carry vertical beveled rollers 6 on the carriage which engage the under sides of the top I-beam flanges 7, while horizontal rollers 8, carried by the carriage-parts, engage the opposite sides of the vertical I-beam web 9. For locking the carriage to the guide rail there is provided a locking shoe 10 engageable with the vertical rail-web 9 and pivotally supported on one arm of a bell crank lever 11, the latter in turn being pivotally mounted on the carriage. A rod 12 is pivotally connected to the other bell crank lever arm and is guided in a bore in a bracket 13 integral with the carriage. Threaded within the bracket is an adjusting screw 14 provided with an operating handle 15, and arranged between the inner end of this screw and a collar on the rod 12 is a coil spring 15' arranged in the bracket bore. When the screw 14 is adjusted inwardly, the spring is compressed, thereby moving the rod 12 outwardly to swing the bell crank lever to move the locking shoe into frictional locking engagement with the rail web. This locking shoe may, at times, be used as a retarding brake for a purpose to be later explained.

Supported in aligned bores in upstanding bosses at the top of the carriage and extending longitudinally of the latter is a horizontal pivot pin 16, and pivotally supported by this pin intermediate the bosses is a pivoted member 17 provided with an upstanding pivot portion or pivot shaft 18. The pivoted member 17 is suitably secured to a bottom plate 19, and pivotally mounted on the member 17 above this bottom plate is the rear portion of a conveyor frame 20 which has a sleeve-like bearing portion 21, in whose bore is received the pivot portion 18. The conveyor frame extends forwardly and downwardly, as shown in Fig. 2, and is slidingly supported at its outer end at 22 on the mine floor. As the conveyor frame moves over an uneven floor or undulating bottom, it is free to swing upwardly or downwardly about its horizontal pivot

on the carriage to accommodate itself to the bottom-contour. Formed along the central portion of the conveyor frame is a guideway 23 in which an endless conveyor chain 24 is guided for circulation in an orbital path, and certain links of this conveyor chain have secured thereto scraper flights 25 which travel over a bed or way 26 on the top of the inclined bottom plate 27 of the conveyor frame 20. The conveyor flights are preferably armed with teeth to improve their digging action. The return side of the conveyor at the trailing side of the machine is enclosed in a suitable housing 28, and secured to the top of this housing, as shown in Fig. 4, is a bent locking plate 29 which projects at its inner end within an annular groove 30 on the pivot portion 18 to lock the conveyor frame on its pivotal mounting on the member 17. By removing the locking plate, the loading conveyor may be removed bodily from its pivotal mounting on the member 17. The forward side of the conveyor is open at 31 so that the conveyor flights may engage the loose coal on the mine floor and move the coal rearwardly and upwardly along the inclined bed or way 26 to discharge in an elevated position at the rear end of the machine.

In this improved construction, arranged on the conveyor frome above the carriage 5 is a motor 33, herein preferably an electric motor, having fixed to its rearwardly and upwardly inclined power shaft 34 a spur pinion 35 (Figs. 7 and 8) meshing with and driving a spur gear 36 fixed to a parallel shaft 37, herein suitably journaled within a gear housing 38 arranged at the rear end of the conveyor frame. Secured to the shaft 37 is a worm 39 meshing with and driving a worm wheel 40. The hub of this worm wheel is suitably journaled in the gear housing and has journaled therein the upper end of an upwardly inclined shaft 41, the lower portion of this shaft being likewise suitably journaled within the gear housing. Splined to this shaft is a sliding jaw clutch member 42 for connecting the shaft 41 to the worm wheel 40, and a shipper yoke engages this clutch member and is provided with suitable operating means including an operating handle 43 conveniently arranged exteriorly of the gear housing. Keyed to the lower end of the shaft 41 is a chain sprocket 44 which engages and drives the conveyor chain 24. Thus, as desired, the endless conveyor may be driven by the motor or, when the clutch is disconnected, may remain idle during running of the motor. The conveyor frame 20 may be swung in a horizontal direction on its pivotal mounting on the member 17 and may be secured to the bottom plate in different predetermined angular positions by a locking pin 45 arranged in an opening in a boss integral with the conveyor frame and insertible in suitably spaced holes 46 in the bottom plate. During lateral swinging of the conveyor during sumping thereof in the coal, this locking pin is, of course, removed, as will later be explained.

The feeding means for the machine comprises a feed drum 50 journaled at the upper end of an upright inclined shaft 51, herein secured to the hub of the worm wheel 40 (Fig. 7), and wound on this drum is a feed cable 52. The drum is adapted to be driven by the worm wheel 40, and keyed to the shaft 51 is a spur gear 53 meshing with planet gears 54 journaled on stub shafts 55, herein formed integral with a rotatable carrier member 56, the latter being suitably journaled within the gear housing 38. The planet gears 54 mesh with an internal gear 57 secured to the drum 50. The carrier member 56 is formed with a peripheral braking surface 58 with which a contractible brake band 59 cooperates, and this brake band is provided with suitable operating means including a hand wheel 60 arranged exteriorly of the gear housing near the clutch handle 43 (Figs. 1 and 2). When the brake band is applied, the carrier member 56 is held against rotation, and when the worm wheel 40 is driven by the motor, the drum 50 is driven by the shaft 51, through spur gear 53, planet gears 54 and internal gear 57. Upon release of the brake band 59, the carrier member 56 may freely rotate, thereby interrupting drum drive. The feed cable 52 may be extended from the drum around appropriately located guide sheaves 61 and 62 on the forward side of the conveyor frame, as shown in Fig. 1, and may be extended forwardly from the machine and around the guide sheave 63 carried by a suitable anchor jack 64 and may then be extended rearwardly from the guide sheave 63 for connection to the advancing side of the conveyor frame. The free end of the cable carries a hook 64 attached to a suitable connection such as a slot and pin 65 on a downwardly bent front flange 66 on the conveyor frame. Thus with the feed cable so arranged, the loading conveyor may be swung about its pivotal mounting or may be moved bodily along the guide rail. Arranged at the rear side of the conveyor frame are appropriately located guide sheaves 67 and 68 so that the feed cable may be extendsd to an anchor jack located at the rear side of the machine in order that the machine may be fed rearwardly along the guide rail in an obvious manner. A guide sheave 69 carried by a swing arm 70 is arranged near the outer receiving end of the conveyor frame, and the feed cable 52 may be extended around this sheave and attached to a suitable anchor jack during certain operations of the machine, for example, during movement of the machine toward the coal face. Hinged at 71 on a longitudinal pivot on the top of the conveyor frame is an upwardly and rearwardly inclined deflector plate 72 suitably held in position by a locking pin 73 (Figs. 1, 2 and 9).

The mode of operation of this embodiment of the improved loading machine is as follows: In accordance with the room and pillar system of mining, the working place is first undercut by a coal cutting machine, and when cutting is completed, the cutting machine, which is designated 75 in Fig. 10, is withdrawn from the face to the position shown. The undercut face is then drilled and made ready to shoot, and the guide rail 2 and the loading machine are moved up by the feed cable close to the face of the coal with the loading conveyor swung back out of the way in a position substantially parallel with the guide rail, and the guide rail is firmly secured in position on the mine floor by the roof jacks J. The face conveyor 76 is then moved forwardly to a position underlying the rear end of the loading machine close to the guide rail, as shown in Fig. 10, and the rib conveyor 77 is extended, and the necessary roof props 78 placed close to the outer side of the face conveyor, to protect the workmen. The cable jack 64 is then set near the left hand rib and the feed cable 52 is extended forwardly from the machine, around the jack sheave 63, and then rearwardly with its free end attached to the advancing side of the conveyor frame. The feed cable, when so arranged, lies on the mine floor, and the coal is

then shot down from the face. The shooting can be done at different times or all of the shots may be fired at once, as desired. The carriage 5 is then locked by the locking shoe 10 to the guide rail, the conveyor connected to its drive, and the feed drum 50, upon application of the planetary drive control brake 59, is driven by the motor to effect winding in of the cable, thereby to swing the loading conveyor horizontally on its pivotal mounting relative to the bottom plate 19, it being understood that the locking pin 45 is at that time removed. As the feed cable is wound in, the loading conveyor is swung horizontally into the coal, thus gathering the loose coal from the floor and moving the coal rearwardly and upwardly to discharge onto the face conveyor 76. When the loading conveyor has thus been sumped into the coal and has assumed a position at substantially right angles to the guide rail, the locking pin 45 is reinserted in the proper holes to lock the conveyor frame to the bottom plate 19, thereby rigidly to hold the conveyor against horizontal swinging movement with respect to the guide rail. The locking shoe is then released, and as the feed cable continues to be wound in, the loading machine is moved bodily laterally relatively to the guide rail along the coal face to load the coal. The bottom plate 19 may engage the inner side of the face conveyor and serve to direct the coal toward the face conveyor as the coal is moved rearwardly by the conveyor flights irrespective of the angular position of the conveyor frame with respect to the bottom plate. After the loading machine has loaded out the corner of the room at the right hand rib and the loading machine has advanced a short distance from the right hand rib, the cutting machine is moved in to make a sumping cut beneath the solid coal; and as the loading machine is moved across the face, the cutting machine follows the loading machine to make a transverse cut beneath the solid coal. Thus loading of the shot coal and cutting of the advance face may be carried on simultaneously. As the loading machine moves across the coal face, the locking shoe 10 may be applied to serve as a retarding brake so that when the pin lock 45 is removed, the angle of the loading conveyor with respect to the coal face may be readily controlled. When the loading machine approaches the left hand rib of the room, the locking pin 45 may be removed, the locking shoe 10 may be applied to lock the carriage to the guide rail, and the loading conveyor may be swung horizontally forwardly to load out the corner at the left hand rib. The cutting machine 75 may be operated to complete the cut at the left hand rib and then be returned to a position ready to sump at the right hand rib. Upon completion of the loading operation, the loading conveyor may be jacked up and again be swung into substantial parallelism with the guide rail wherein it rests on top of the rail, and the feed cable may be extended around the guide sheaves 67 and 68 in the opposite direction from the rear side of the machine so that when the feed drum is rotated, the cable is wound in to feed the machine bodily back toward the right hand rib to its starting position. It will be evident that as the loading machine moves across the coal face along the guide rail, the rail jacks in advance of the machine are taken down and replaced at the rear of the machine in an obvious manner. When operating in accordance with the longwall system of mining, the loading conveyor may be sumped into the coal pile at the open end of the face, with the loading conveyor in a right angle position in rigid relation with the carriage, although, if desired, during the loading along the longwall face, the loading conveyor may be swung into different angular positions with respect to the carriage, as desired.

Now referring to the modified embodiment shown in Figs. 11 to 17 inclusive, it will be noted that the guide rail and carriage structure of the preferred embodiment are omitted. In this improved construction, the loading machine is generally designated 80 and comprises a conveyor frame 81 slidably supported by a bottom shoe 82 directly on the mine floor and having its forward portion 83 slightly inclined forwardly and downwardly with its outer end engaging the mine floor at 84. The rearward portion 85 of the conveyor frame is upwardly and rearwardly inclined, as shown in Figs. 12 and 13. Extending centrally of the conveyor frame is a guideway, similar to the guideway 23 of the other embodiment, for an endless conveyor chain 86, and secured to certain links of the chain are scraper flights 86' movable along a bed or way 87 on the bottom plate 88 of the conveyor frame. As in the other embodiment, the return side of the conveyor is enclosed in a housing 89, and the forward side of the conveyor is open so as to receive the material to be loaded. Arranged at the top of the conveyor frame is a deflector plate 90 similar to the deflector plate 72 and similarly held in position by a locking pin. Carried by the inclined rearward portion of the conveyor is a motor 91, likewise preferably an electric motor, having a spur pinion 92 (Figs. 13 and 14) fixed to the rear end of its power shaft, the latter being upwardly and rearwardly inclined as shown in Fig. 13. The gear 92 meshes with a spur gear 93 fixed to an upwardly and rearwardly inclined shaft 94 suitably journaled in a gear housing 95 arranged at the rear end of the conveyor frame. Fixed to this shaft is a worm 96 (Fig. 14) meshing with and driving a worm wheel 97, likewise suitably journaled in the gear housing. This worm wheel is arranged with its axis upwardly inclined and has aligned therewith a shaft 98 connectible by a sliding jaw clutch 99 to the worm wheel in a manner similar to the other embodiment. Keyed to the lower end of the shaft 98 is a chain sprocket 100 (Fig. 13) which engages and drives the conveyor chain. As shown in Fig. 16, coupled to the front end of the motor power shaft is an aligned shaft 101 suitably journaled within a gear housing 102 mounted on the conveyor frame at the forward end of the motor. Secured to this shaft is a worm 103 (Fig. 16) meshing with and driving a worm wheel 104. This worm wheel is keyed to an upwardly inclined shaft 105 likewise suitably journaled within the gear housing, and journaled at the upper end of this shaft is a feed drum 106 having a feed cable 107 wound thereon. Keyed to and driven by the shaft 105 is a spur gear 108 meshing with planet gears 109 journaled on stub shafts 110 supported by a rotatable carrier member 111, the latter having its hub suitably journaled within the gear housing 102. The planet gears 109 mesh with an internal gear 112 secured to the drum. The carrier member 111 is formed with a peripheral braking surface 113 with which a contractible brake band 114 cooperates, and this brake band is provided with suitable manual operating means similar to the operating means for the brake band 59 of the other embodiment. When the brake band is applied, the carrier member 111 is held

against rotation, and when the worm wheel 104 is driven by the motor, the drum 106 is driven by the shaft 105 through spur gear 108, planet gears 109 and internal gear 112. Upon release of the brake band 114, the carrier member 111 may freely rotate, thereby interrupting drum drive. The feed cable 107 may be extended from the drum around appropriately located guide sheaves 115 and 116 mounted at the advancing side of the conveyor frame, forwardly of the machine and around a guide sheave carried by an anchor jack similar to the jack 64 at the left hand rib, and then rearwardly from the jack sheave with its free end attached to the advancing side of the conveyor frame, as shown in Fig. 11. The feed cable 107 may be extended rearwardly directly from the drum to an anchor jack located at the right hand rib for feeding the machine in the reverse direction. As in the other embodiment, a guide sheave 117 is mounted at the front end of the conveyor frame for guiding the feed cable in a forward direction. Mounted on the conveyor frame at the trailing side of the machine is a tail rope drum 118 having a tail rope 119 wound thereon and having its rotation controlled by a brake band 120 operated by a hand wheel 121. The tail rope cable may be extended around a guide sheave 122 on the rear side of the conveyor frame to an anchor jack at the right hand rib, and rotation of the drum may be controlled by the brake band to control the angle of the loading machine with respect to the coal face as it advances across the face, in a manner well known to those skilled in the art. As shown most clearly in Fig. 13, swiveled at 125 on the bottom of the upwardly inclined rear portion of the conveyor frame is a bottom plate 126 for a purpose to be later explained.

For providing a pivotal point for the loading conveyor during horizontal swinging thereof during the loading operation, there is provided at the bottom of the upwardly inclined rear portion of the conveyor frame, as shown in Fig. 13, a hydraulic jack device 128 comprising a vertical cylinder 129 extending through an opening 130, preferably arranged centrally of the swivel 125 for the bottom plate 126. Reciprocable in this cylinder is a piston 131 having its piston rod extending downwardly through the lower cylinder head and having a ball and socket type pivotal connection at 132 with a bottom shoe 133 engaging the mine floor. Mounted at the top of the casing of the motor 91 is a knob-like projection 134 providing a point of pivotal contact in alignment with the pivotal connection 132. The knob-like projection, when the lower jack device is extended, engages an abutment, such as a timber 135, placed against the mine roof so that when the loading machine is firmly jacked in position, the loading conveyor may be swung horizontally about the pivot provided by the jack device. Supported at the forward end of the front gear housing 102 is a pump 136 coupled to and driven by the shaft 101, and the pump intake is connected through a pipe 137 to any suitable source of operating fluid, for example, a liquid reservoir provided within the gear housing 102. The pump discharge is connected by a pipe 138 to the casing of a control valve 139 mounted on the side of the gear housing and provided with a suitable operating handle 140. Pipes 141 and 142 extend from the valve casing to the opposite ends of the cylinder 129. The discharge passage of the valve is connected by a pipe 143 back to the liquid reservoir. Thus under suitable control of the valve 139, liquid under pressure may be supplied to the opposite ends of the jack cylinder either to raise or lower the rear end of the conveyor frame. When the valve is closed, the liquid is trapped in the cylinder to lock the parts in adjusted position.

The mode of operation of this modified embodiment is as follows: As in the other embodiment, when operating in accordance with the room and pillar system of mining, the working place is first undercut by the coal cutting machine, and the undercut face is then drilled and made ready to shoot. The loading machine is then moved by the feed cable up close to the face, and the face conveyor 145 is thereafter moved forward in a position underlying the rear end of the loading machine, as shown in Fig. 17, with the bottom plate 126 of the loading machine engaging the inner side of the face conveyor; and the rib conveyor 146 is extended. The loading conveyor may be positioned back from the face substantially in parallelism with the face conveyor and the necessary roof props 147 are placed near the outer side of the face conveyor, to protect the workmen. The cable jack is then set near the left hand rib and the feed cable 107 is extended forwardly from the machine, around the jack sheave and then rearwardly with its free end attached to the advancing side of the conveyor frame. The tail rope 119 is extended from the tail rope drum 118 to an anchor jack at the right hand rib. The feed cable, when so arranged, lies on the mine floor and the coal is then shot down from the face. The jack device 128 is then operated to jack the loading machine in position between the roof and floor, the conveyor is connected to its drive, and when the feed drum, upon application of the planetary drive control brake 114, is rotated to wind in the feed cable, the loading conveyor is swung horizontally about the pivot provided by the jack device, thus gathering the loose coal from the floor and moving the coal rearwardly and upwardly to discharge onto the face conveyor. When the loading conveyor has thus been sumped beneath the coal pile and has assumed a position at substantially right angles to the coal face and the face conveyor, the roof jack device is released and the loading machine is fed bodily laterally by the feed cable and drum, under the control of the tail rope, along the coal face to load the coal. When the loading conveyor has loaded out the corner of the room near the right hand rib and the loading machine has advanced a short distance from the right hand rib, the coal cutting machine is moved in to make a sumping cut beneath the solid coal, and as the loading machine is moved across the face, the cutting machine follows the loading machine to make a transverse cut beneath the solid coal. Thus, as in the other embodiment, loading of the shot coal and cutting of the advance face may be carried on simultaneously. The bottom plate 126 of the loading machine, which may slide against the inner side of the face conveyor, serves to direct the coal toward the face conveyor as the coal is moved rearwardly by the conveyor flights irrespective of the angular position of the loading conveyor with respect to the bottom plate. As the loading machine moves across the coal face, the tail rope may be operated to control the angle of the loading conveyor with respect to the face. When the loading machine approaches the left hand rib, it may again be jacked in position by the jack device 128 and the loading conveyor may be swung forwardly about the pivot provided by

the jack device to load out the left hand corner of the room. The cutting machine may be operated to complete the cut at the left hand rib and then be returned to a position ready to sump at the right hand rib, as in the other embodiment. Upon completion of the loading operation, the loading conveyor may be swung into substantial parallelism with the face conveyor and the feed cable may be extended rearwardly of the machine to an anchor jack at the right hand rib so that when the feed drum is rotated to wind in the cable, the loading machine is moved back across the coal face to its starting position. Also, in this embodiment, the loading machine may operate in accordance with the longwall system of mining, and the loading conveyor may be sumped into the loose coal at the open end of the face while held in substantially right-angular relation with the face conveyor by the feed and tail ropes. Also if desired, during the loading of a longwall face, the jack device 128 may be operated at intervals so that the loading conveyor may be swung horizontally into different angular positions with respect to the coal face and face conveyor under the control of the tail rope.

In order to obtain greater compactness during longwall work, an open-sided shaker trough line of a conventional design may be placed, in lieu of the face conveyor above described, on the mine floor relatively close to the loading machine beneath the discharge end of the latter, thereby to reduce the distance between the line of the roof props and the coal face.

As a result of this invention, an improved material loading apparatus is provided having advantages over known types of loading machines whereby loading in low coal may be effected in an improved and more efficient manner. It will further be evident that an improved floor type coal loading machine is provided especially designed for use in mines having low head room and which is not only extremely compact but which also embodies a horizontally swingable loading conveyor which may be sumped into a coal pile at a closed end corner of a room. By the provision of a stationary pivotal point for the loading conveyor, a low height floor type loading machine is provided which may operate with facility in the relatively restricted quarters encountered in underground mining work. It will also be evident that by the provision of the improved guide rail structure for the loading machine together with the means for locking a part of the machine to the guide structure to provide a stationary pivotal point, a floor type loading machine is provided having relatively greater flexibility in operation well adapted for use in accordance with either the room and pillar or longwall systems of mining. The machine, due to its novel construction, is relatively compact, enabling relatively close setting of roof props, a feature of particular advantage in longwall work. The machine may not only be sumped into the coal with a horizontal swinging motion but also the angular relation of the machine with respect to the coal face may be readily controlled as the machine moves along the face during the loading operation. Other advantages of the invention will be clearly apparent to those skilled in the art.

While there are in this application specifically described two forms which the invention may assume in practice, it will be understood that these forms of the same are shown for purposes of illustration and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a material loading apparatus for loading loose material along the face of a coal mine, the combination comprising a single elongated guide rail laid on the floor of the mine at the inner side of a face conveyor in substantial parallelism with the coal face and firmly held in position, a carriage guided on said guide rail for guided movement longitudinally therealong along a substantially rectilinear path as determined by said rail, material gathering and loading means pivotally mounted on and supported at its rearward portion by said carriage to swing horizontally into different angular positions relative thereto and normally assuming a position with its major axis disposed at substantially right angles to said path of rectilinear movement of said carriage and to the coal face during the gathering and loading operation, said gathering and loading means at its rearward portion overlying said carriage whereby the material being loaded may be discharged onto the face conveyor and having an outward side gathering portion extending longitudinally close to and slidably supported by the mine floor for gathering loose material on the floor, releasable locking means for securing said gathering and loading means in said different horizontal angular positions with respect to said carriage, releasable locking means for locking said carriage against lateral movement relative to said guide rail, and means for feeding said gathering and loading means and said carriage bodily laterally in unison along said guide rail when said carriage-locking-means is released and said gathering and loading means is held fixed as regards horizontal swinging movement with respect to said carriage, said feeding means including a feeding element operatively connected to said gathering and loading means to effect swinging of said gathering and loading means horizontally on its pivotal mounting relative to said carriage when said carriage-lock is applied and said first mentioned locking means for said gathering and loading means is released whereby the angular operating position of said gathering and loading means with respect to the coal face may be varied.

2. In a material loading apparatus for loading loose material along the coal face of a coal mine, a combination comprising a single elongated guide rail extending in substantial parallelism with the coal face and made up of a series of sections arranged end to end and hinged together on transverse axes to permit limited flexibility of the guide rail in a vertical direction whereby said rail may rest on an uneven mine floor, material gathering and loading means supported and guided at its rearward portion by said guide rail for lateral movement bodily longitudinally therealong along a substantially rectilinear path as determined by said rail and having its outer portion supported by and slidingly engaging the mine floor, said rearward portion of said gathering and loading means overlying and projecting rearwardly beyond said guide rail and said gathering and loading means having a longitudinal side gathering portion lying close to the mine floor for gathering loose material from the floor, means for pivotally mounting said gathering and loading means on said guide rail for horizontal swinging movement into different angular posi-

tions with respect thereto and normally assuming a position with its major axis disposed at substantially right angles to its direction of rectilinear movement along said guide rail and to the coal face during the gathering and loading operation, and means for feeding said gathering and loading means bodily laterally along said guide rail and for swinging said gathering and loading means on its pivotal mounting into different angular positions relative to said guide rail and to the coal face during the gathering and loading operation.

3. In a material loading apparatus for loading loose material along the coal face of a coal mine, the combination comprising a single elongated guide rail disposed in substantial parallelism with the coal face and made up of a series of sections arranged end to end and hinged together on transverse axes to permit limited flexibility in a vertical direction whereby said rail may rest upon an uneven mine floor, a carriage movable along said guide rail in a longitudinal direction whereby said carriage is guided along a substantially rectilinear path as determined by said rail, material gathering and loading means pivotally mounted at its rearward portion on said carriage and at its forward end supported by and slidably engaging the mine floor, said gathering and loading means swingable horizontally into different angular positions relative to said carriage and normally assuming a position with its major axis disposed at substantially right angles to said path of rectilinear movement and to the coal face during the gathering and loading operation, said rearward portion of said gathering and loading means overlying and projecting rearwardly beyond said carriage, releasable locking means for locking said carriage to said guide rail to hold said carriage in a stationary position, releasable locking means for securing said gathering and loading means to said carriage to hold said gathering and loading means against horizontal swinging movement relative to said carriage, and means for feeding said carriage and said gathering and loading means bodily laterally in unison along said guide rail when said carriage locking means is released, said feeding means including a feeding element operatively connected to said gathering and loading means to effect swinging of the latter horizontally on its pivotal mounting when said second mentioned locking means is released and said carriage is held stationary by said first mentioned locking means.

4. In a material loading apparatus for loading loose material along the coal face of a coal mine, the combination comprising a single elongated guide rail laid on the floor of the mine in substantial parallelism with the coal face, a carriage movable along said guide rail in a longitudinal direction whereby said carriage traverses a substantially rectilinear path as determined by said rail, a rear frame pivotally mounted on said carriage to swing freely in vertical planes relative thereto about a horizontal axis extending lengthwise of said carriage, and gathering and loading means pivotally mounted on said rear frame to swing horizontally into different angular positions with respect thereto and normally assuming a position with its major axis disposed at substantially right angles to the direction of movement of said carriage and to the coal face during the gathering and loading operation, said gathering and loading means having its rearward portion overlying and projecting rearwardly beyond said carriage and having a longitudinal side gathering portion lying close to the mine floor to gather loose material on the mine floor during both said lateral and said swinging movements of said gathering and loading means.

5. In a material loading apparatus for loading loose material along the coal face of a coal mine, the combination comprising a rear frame adapted to move bodily laterally along a substantially rectilinear path at the inner side of a face conveyor arranged parallel to the coal face in a direction substantially parallel with the latter, releasable locking means for holding said rear frame in a stationary position with respect to the face conveyor as regards horizontal bodily movement along said rectilinear path with respect thereto, material gathering and loading means pivotally mounted on said rear frame to swing horizontally into different angular positions with respect thereto when said rear frame is held stationary as aforesaid and normally assuming a position with its major axis disposed at substantially right angles to said rectilinear path of movement of said rear frame and to the coal face and to the face conveyor during the lateral gathering and loading operation, said gathering and loading means at its rearward portion overlying said rear frame and projecting rearwardly beyond the latter above the face conveyor to discharge on the latter whereby said gathering and loading means at all times discharges onto the conveyor, said gathering and loading means having a forward side gathering portion extending longitudinally in adjacency to the mine floor to gather loose material on the floor, and means effective when said locking means is released for feeding said rear frame and said gathering and loading means bodily laterally in unison along said rectilinear path in a direction lengthwise of the face conveyor in parallelism with the coal face.

6. In a material loading apparatus for loading loose material along the coal face of a coal mine, the combination comprising a rear frame movable laterally over the floor of the mine along a substantially rectilinear path in substantial parallelism with the coal face and adapted to be held stationary as regards horizontal bodily movement in the mine, locking means for holding said rear frame stationary as aforesaid, material gathering and loading means pivotally mounted on said rear frame to swing horizontally into different angular positions relative thereto and normally assuming a position with its major axis disposed at substantially right angles to said rectilinear path of movement and to the coal face during the gathering and loading operation, said gathering and loading means at its rearward portion overlying and projecting rearwardly beyond said rear frame and having a forward longitudinal side gathering portion disposed in adjacency to the mine floor for gathering loose material on the mine floor, and said rear frame having a retaining portion and serving to direct the material being loaded by said conveyor rearwardly towards discharge irrespective of the horizontal angular position of said gathering and loading means relative to said rear frame and to the coal face.

7. In a material loading apparatus for loading loose material along the coal face of a coal mine, the combination with a face conveyor arranged parallel with but spaced outwardly from the coal face of the mine, a laterally movable rear frame movable bodily horizontally along a substantially rectilinear path at the inner side

of said face conveyor lengthwise of the latter and in substantial parallelism with the coal face, said rear frame adapted to be held stationary in the mine as regards horizontal bodily movement relative to the face conveyor, locking means for holding said rear frame stationary as aforesaid, material gathering and loading means pivotally mounted on said rear frame to swing horizontally into different angular positions with respect thereto and normally assuming a position with its major axis disposed at substantially right angles to said rectilinear path of movement and to said conveyor and to the coal face during the gathering and loading operation, said gathering and loading means at its rearward portion overlying and projecting rearwardly in an elevated position beyond said rear frame in a position to discharge onto the face conveyor and having a longitudinal forward side gathering portion disposed in adjacency to the mine floor for gathering loose material from the mine floor, and said rear frame having a retaining portion and serving to direct the material moved rearwardly toward discharge on said face conveyor irrespective of the horizontal angular position of said gathering and loading means relative to said rear frame and to said face conveyor and the coal face.

8. In a material loading apparatus for loading loose material from the coal face of a coal mine, the combination comprising a single elongated guide rail laid on the floor of the mine in substantial parallelism with the coal face, a carriage movable along said guide rail in a longitudinal direction, locking means for locking said carriage to said guide rail to hold said carriage stationary, material gathering and moving means pivotally mounted on said carriage and swingable horizontally relative thereto into different angular positions and normally assuming a position with its major axis disposed at substantially right angles to said guide rail and to the coal face during the gathering and loading operation, said gathering and loading means having its rearward portion overlying said carriage and having a longitudinal front side gathering portion disposed in adjacency to the mine floor for gathering loose material on the floor, and means effective when said locking means is released for feeding said carriage and said gathering and loading means bodily laterally in unison along said guide rail, said feeding means including a feeding element operatively connected to said gathering and loading means for swinging the latter horizontally about its pivot relative to said carriage, and said locking means cooperating with said rail to operate as a brake during such lateral movement of said carriage and gathering and loading means along said guide rail for controlling the angle of said gathering and loading means with respect to said carriage and to the coal face, thereby to control the operating position of said gathering and loading means with respect to the material to be loaded.

9. In a material loading apparatus for loading loose material along the coal face of a coal mine, the combination comprising a rear frame movable over the floor of the mine along a substantially rectilinear path in substantial parallelism with the coal face, material gathering and loading means supported at its rear portion on said rear frame and at its forward portion on the mine floor, said gathering and loading means having its rearward portion overlying and projecting rearwardly in elevated position beyond said rear frame and having a longitudinal front gathering portion disposed in adjacency to the mine floor for gathering loose material from the floor, means for freely pivotally supporting said rear frame for swinging movement in vertical planes about a horizontal axis, and means for pivotally mounting said gathering and loading means on said rear frame for horizontal swinging movement into different angular positions relative thereto and to the coal face and said gathering and loading means normally assuming a position with its major axis disposed at substantially right angles to said rectilinear path of movement and to the coal face during the gathering and loading operation.

10. In a material loading apparatus for loading loose material along the coal face of a coal mine, the combination comprising a single elongated guide rail laid on the floor of the mine just inside of a face conveyor with the latter and said rail extending in substantial parallelism with the coal face, a carriage movable along said guide rail in a horizontal direction whereby said carriage may move along a substantially rectilinear path in substantial parallelism with the coal face, a bottom plate mounted on and overlying said carriage and guidedly engaging the inner side of the face conveyor, and material gathering and loading means pivotally mounted on said bottom plate to swing horizontally into different angular positions relative thereto and normally assuming a position with its major axis disposed at substantially right angles to said path of rectilinear movement of said carriage along said guide rail and to the coal face during the gathering and loading operation, said gathering and loading means having its rearward portion elevated and overlying said bottom plate and having a front longitudinal side gathering portion disposed in adjacency to the mine floor for gathering loose material from the floor.

11. In a material loading apparatus for loading loose material along the coal face of a coal mine, the combination with a face conveyor arranged parallel with but spaced outwardly from the face of the mine, a rear support movable bodily laterally over the mine floor along a substantially rectilinear path at the inner side of said face conveyor in substantial parallelism with the coal face, releasable locking means for securing said support in a stationary position as regards horizontal bodily movement along said rectilinear path relative to the face conveyor, material gathering and loading means pivotally mounted on said rear support to swing horizontally into different angular positions with respect thereto for gathering loose material on the mine floor and for moving such material rearwardly to discharge onto the face conveyor, said gathering and loading means normally assuming a position with its major axis disposed at substantially right angles to said rectilinear path of movement and to the coal face during gathering and loading operation, said gathering and loading means at its rearward portion overlying said rear support and projecting rearwardly beyond said support in elevated position above the face conveyor and having a front longitudinal gathering portion lying close to the mine floor for gathering loose material on the floor, and means effective when said securing means is released for feeding said rear support and said gathering and loading means bodily laterally in unison along said rectilinear path

relative to the face conveyor, and said feeding means including a feeding element operatively connected to said gathering and loading means to effect, when said support is held stationary as aforesaid by said holding means, swinging of said gathering and loading means horizontally on its pivotal mounting relative to said rear support.

12. In a material loading apparatus for loading loose material along the coal face of a coal mine, the combination with a face conveyor extending longitudinally in parallelism with the coal face, of a gathering mechanism comprising an inclined rear plate having a downwardly bent rear edge overlying the face conveyor, said rear plate having guided lateral movement along a substantially rectilinear path substantially parallel to the inner side of the face conveyor and to the coal face, a forwardly and downwardly inclined frame pivotally mounted at its rearward portion on and overlying said rear plate and providing a guideway, an endless gathering and loading conveyor guided for orbital circulation along said guideway and having a side receiving portion extending longitudinally in adjacency to the mine floor, the rearward discharge portion of said conveyor projecting rearwardly above the face conveyor whereby the material to be loaded is discharged at the rear upper side of said inclined frame onto the face conveyor, releasable locking means for holding said rear plate in a stationary position as regards horizontal bodily movement along said substantially rectilinear path, and means connected to said plate and to said frame for effecting, when said holding means is released, movement of said rear plate, said inclined frame and said conveyor laterally in unison along said path, said moving means effective when said rear plate is held stationary as aforesaid to swing said inclined frame and said conveyor horizontally relative to said rear plate to locate said conveyor in different operating positions with respect to the coal face.

13. A loading apparatus of the character set forth in claim 12 wherein releasable locking means is provided for locking said inclined frame in its different angular positions relative to said rear plate, and said conveyor normally assuming a position with its major axis disposed at right angles to said substantially rectilinear path and to the coal face during the gathering and loading operation.

14. A loading apparatus of the character set forth in claim 12 wherein said rear plate has an upright retaining wall at the advancing side thereof and serving in the different angular positions of said frame and said conveyor relative thereto to direct the material being loaded onto the face conveyor.

15. In a material loading apparatus, the combination comprising a frame movable laterally over the floor of a mine, an endless material gathering and loading conveyor guided on said frame for orbital circulation relative thereto, housing means on said frame for enclosing the return run of said endless conveyor, said housing having a longitudinal opening at its forward side whereby the forward run of said endless conveyor is exposed whereby the material to be loaded may be received by said conveyor as said frame is moved laterally, an upstanding deflector plate mounted on said frame above said conveyor and arranged longitudinally of said housing means intermediate the exposed and enclosed runs of said conveyor for obstructing movement of the material to be loaded rearwardly over the top of said housing, said plate inclined upwardly and rearwardly in such manner as to direct the material tending to move over the top of said conveyor forwardly and downwardly toward the exposed run of said conveyor, said deflector plate pivotally mounted at its lower edge on said frame, and releasable means engaging said plate for locking the latter in its raised operative position and releasable to permit lowering of said plate downwardly into its inoperative position on the top of said housing means.

16. Loading apparatus of the character set forth in claim 15 wherein a rigid deflector portion is mounted on said frame rearwardly of said plate and having an inclined surface which cooperates with said plate in directing the material toward the exposed run of said conveyor, and said releasable locking means engages both said plate and said cooperating rigid deflector portion.

CHARLES N. BEBINGER.

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