Nov. 23, 1937. J. F. JOY 2,099,981

MATERIAL LOADING APPARATUS

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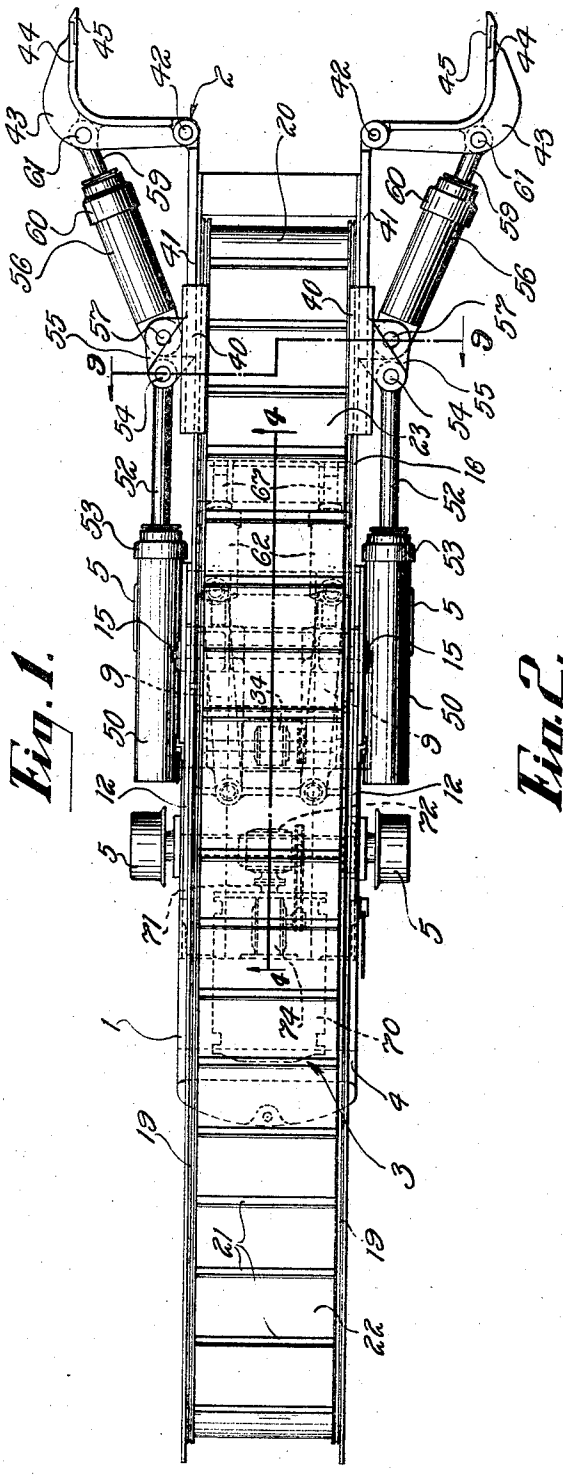


Fig. 1.

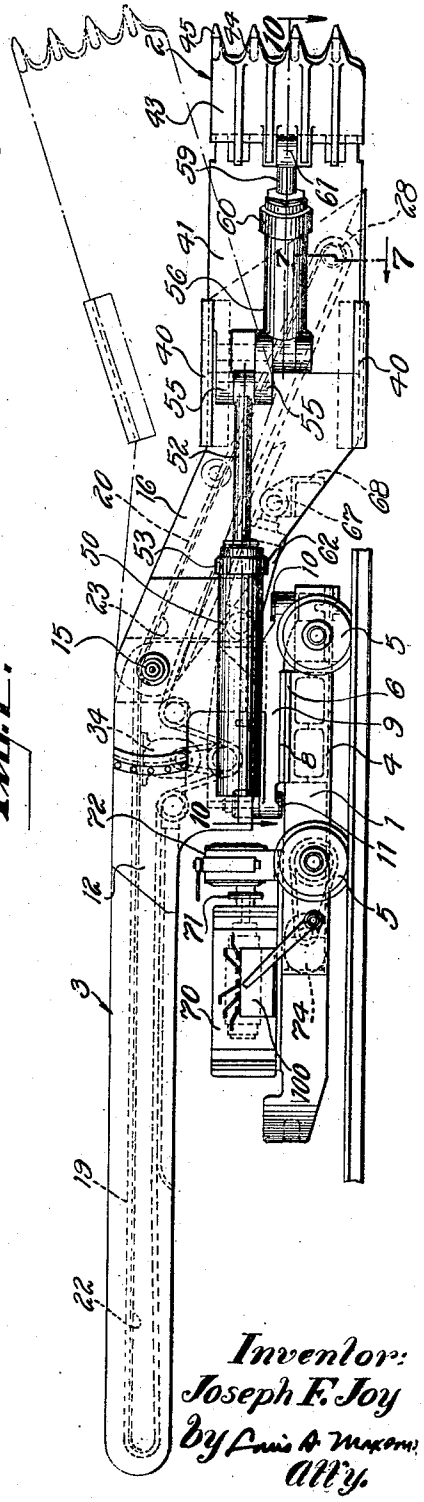


Fig. 2.

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Fig. 3.

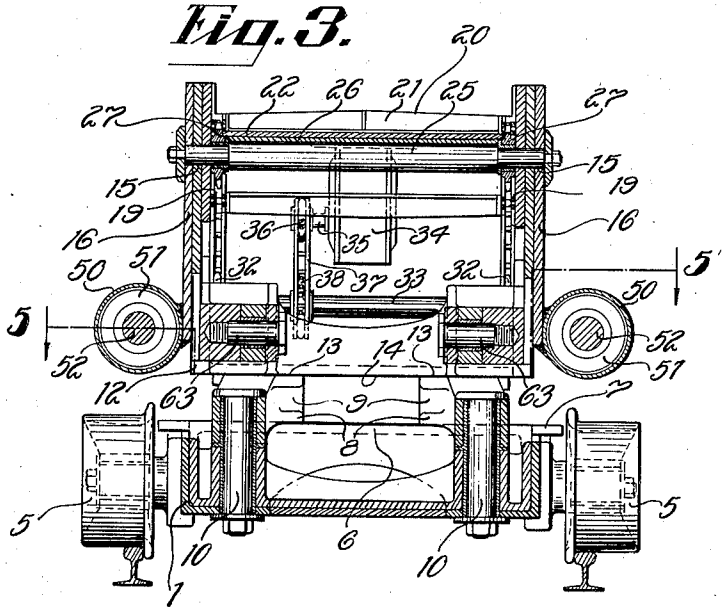
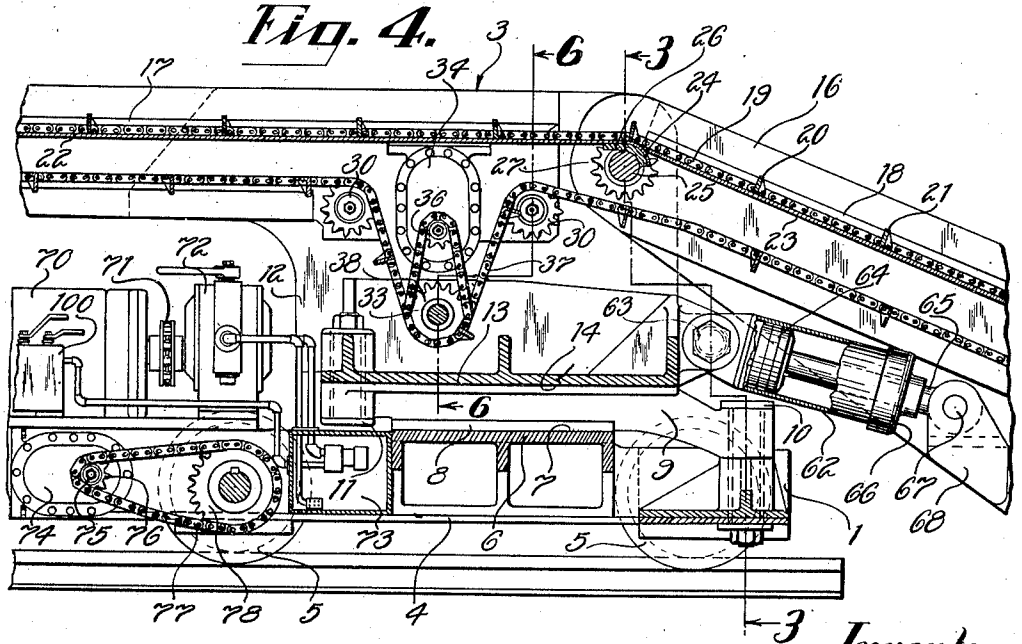


Fig. 4.



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Fig. 5.

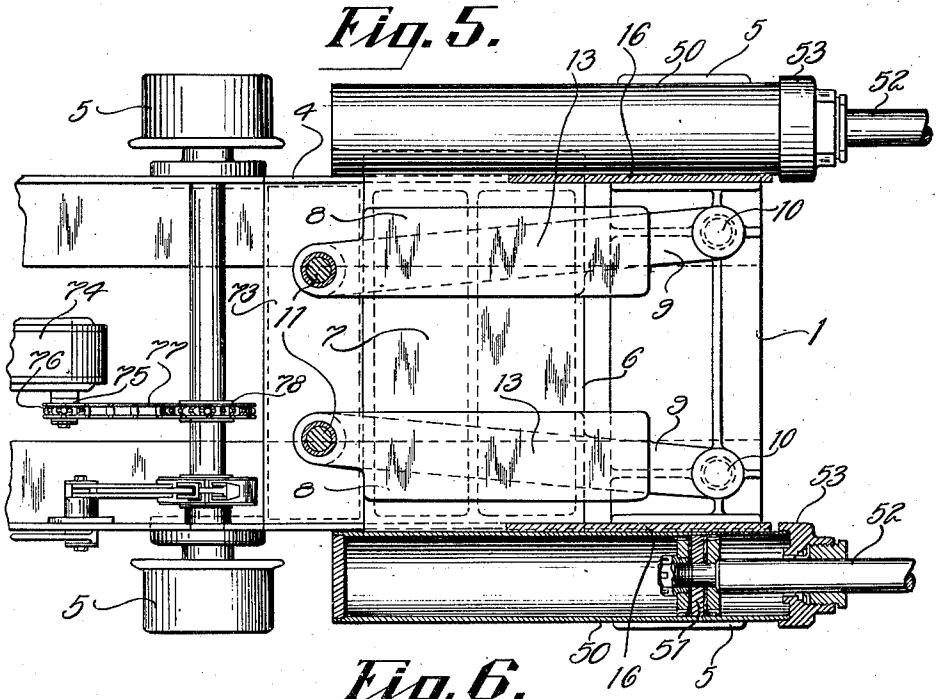


Fig. 6.

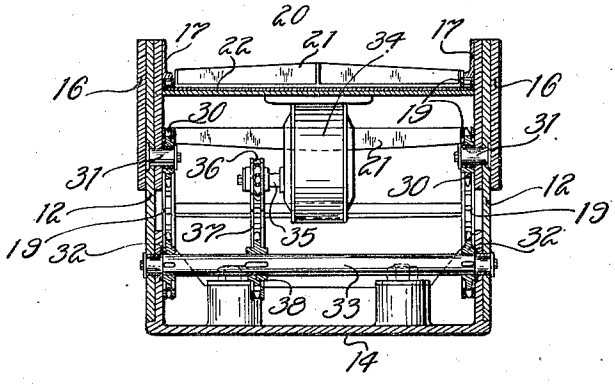
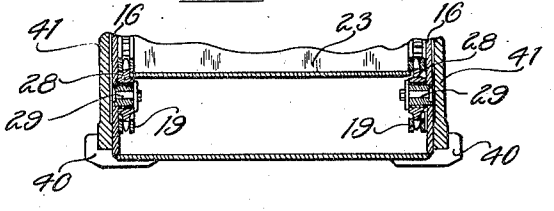


Fig. 7



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MATERIAL LOADING APPARATUS

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Fig. 8.

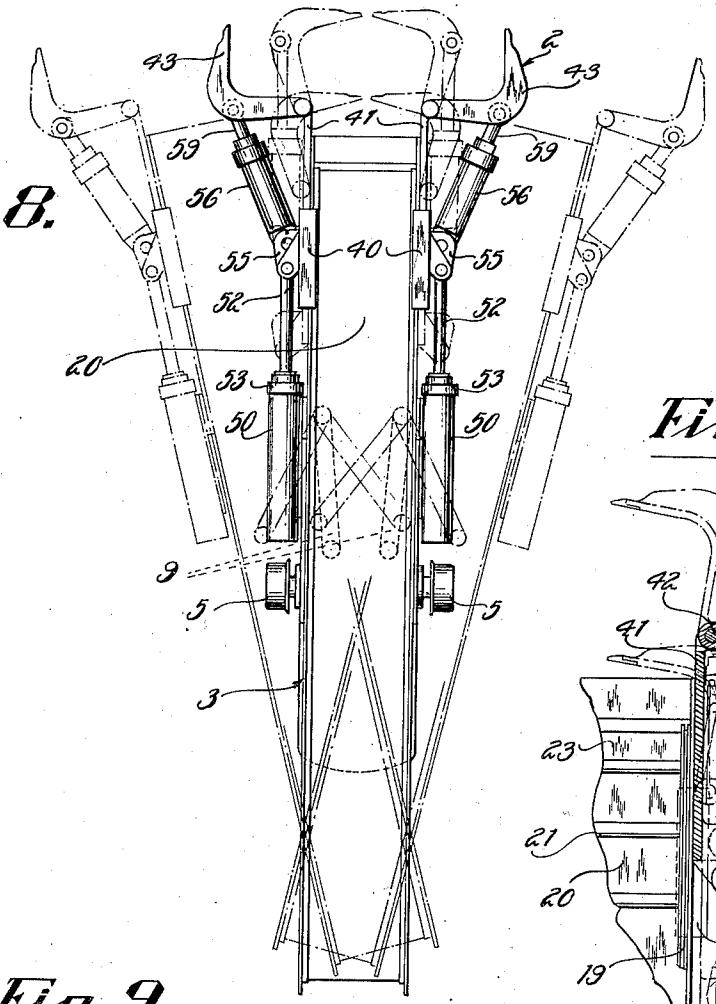


Fig. 10.

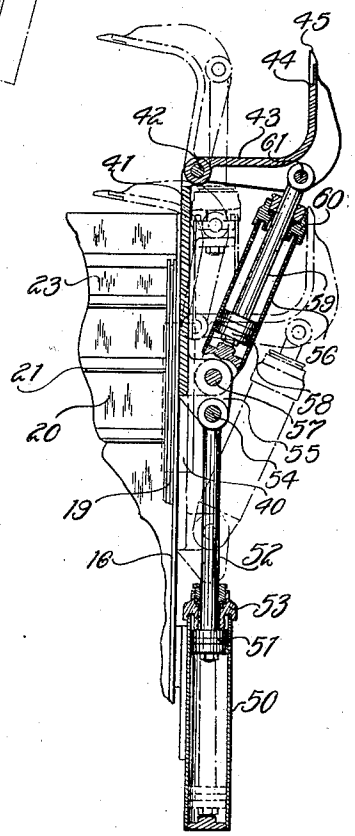
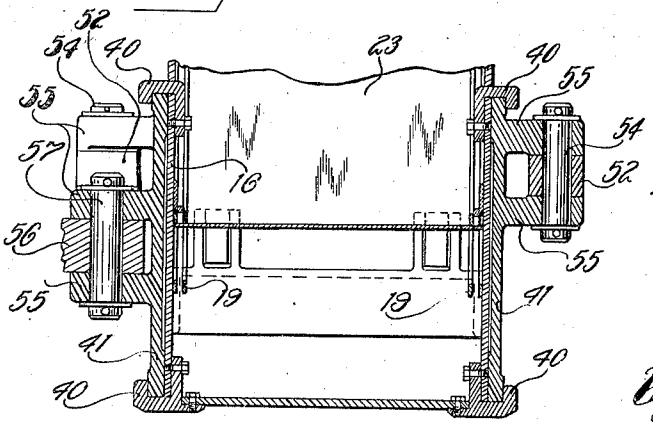


Fig. 9.



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Fig. 11.

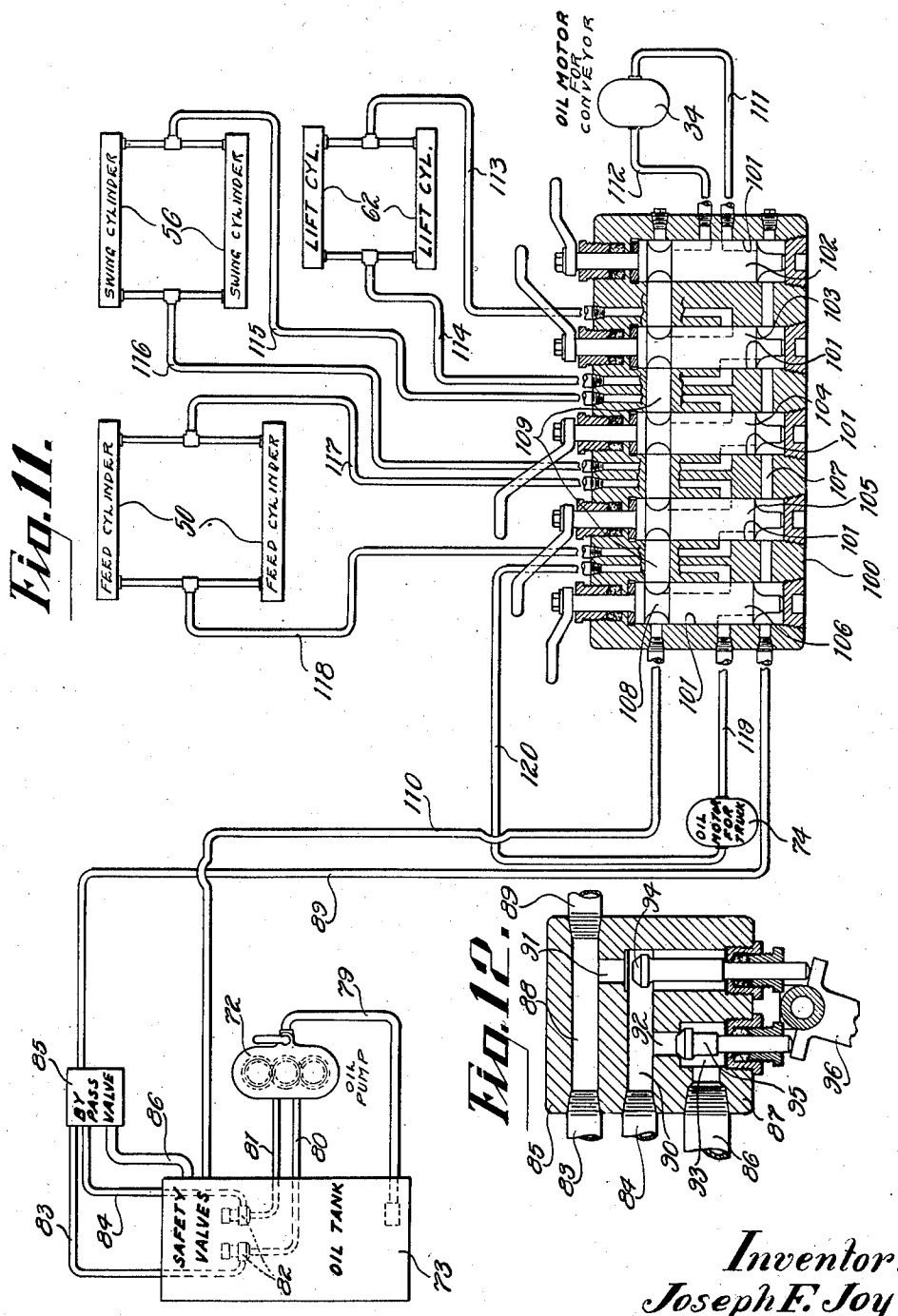


Fig. 12.

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Patented Nov. 23, 1937

2,099,981

UNITED STATES PATENT OFFICE

2,099,981

MATERIAL LOADING APPARATUS

Joseph F. Joy, Claremont, N. H., assignor to Sullivan Machinery Company, a corporation of Massachusetts

Application July 1, 1935, Serial No. 29,309

10 Claims. (Cl. 198—10)

This invention relates to material loading apparatus, and more particularly, but not exclusively, to improvements in a loading apparatus of the type known as a mucking machine for loading muck piles in tunnel entry work.

An object of this invention is to provide an improved material loading apparatus. Another object is to provide an improved mucking machine for loading muck piles in tunnel entry work and having embodied therein an improved gathering mechanism. Yet another object is to provide in a loading apparatus of the above character an improved adjustable supporting structure for the gathering mechanism and improved mechanism for adjusting and actuating the gathering mechanism. A still further object is to provide an improved conveying means associated with the gathering mechanism. Yet another object is to provide an improved loading apparatus having relatively great flexibility, while an extremely simple and rugged design is attained. Other objects and advantages of the invention will, however, hereinafter more fully appear.

In the accompanying drawings there is shown for purposes of illustration one form which the invention may assume in practice.

In these drawings,—

Fig. 1 is a plan view of the illustrative embodiment of the improved coal loading apparatus.

Fig. 2 is a side elevational view of the apparatus shown in Fig. 1, the uppermost tilted position of the gathering mechanism being indicated in dotted lines.

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

Fig. 4 is a view in longitudinal section taken substantially on line 4—4 of Fig. 1.

Fig. 5 is a horizontal sectional view taken substantially on line 5—5 of Fig. 3.

Fig. 6 is a cross sectional view taken substantially on line 6—6 of Fig. 4.

Fig. 7 is a cross sectional view taken substantially on line 7—7 of Fig. 2.

Fig. 8 is a somewhat diagrammatic view showing in full and dotted lines the different positions of the gathering mechanism.

Fig. 9 is a cross sectional view taken substantially on line 9—9 of Fig. 1.

Fig. 10 is a fragmentary horizontal sectional view taken substantially on line 10—10 of Fig. 2.

Fig. 11 is a diagrammatic view showing the improved hydraulic fluid system and the associated control means.

Fig. 12 is a detail sectional view of the by-pass valve mechanism.

In this illustrative embodiment of the invention there is shown a material loading machine of the type commonly known as a mucking machine for loading muck piles in entry driving work, although it will be evident that the improved apparatus may be utilized for loading various other materials in other types of work. In this illustrative construction there is shown a self-propelled portable base 1 having mounted thereon a gathering mechanism, generally designated 2, for gathering the material to be loaded and moving the same onto a conveying means, generally designated 3. The self-propelled base 1 is herein in the form of a truck frame 4 supported on wheels 5 adapted to run along a trackway laid on the ground surface. Mounted on and rigidly secured to the truck frame 4 and extending substantially thereacross is a horizontal plane table 6 having a smooth plane upper surface 7 and overlying and slidably engaging this plane table surface are sliding bottom supports in the form of shoes 8 formed on horizontal arms 9, 9 pivotally mounted at their forward ends on vertical pivot pins 10, 10 secured within the truck frame near the forward end of the latter. The rearmost extremities of the arms 9, 9 are pivotally connected to vertical pivot pins 11, 11 supported within the lower portion of a rear supporting frame 12 of the conveyor mechanism 3, and these arms have formed on their upper portions plane surfaces 13, 13 slidably engaging plane bottom surfaces 14 formed on the lower portion of the rear frame 12. The arms, as shown in Fig. 5, are arranged in non-parallel relation with their points of pivotal connection with the conveyor frame spaced closer together than their points of pivotal connection with the truck frame, so that as the conveyor frame is swung horizontally with respect to the truck frame, in a manner to be later described, the gathering mechanism supported by the forward portion of the conveyor frame moves in a substantially greater arc than the rear end of conveyor 3. Pivotally mounted at 15 on a horizontal axis on the forward portion of the rear frame 12 for swinging movement in a vertical direction with respect thereto is a frame 16 supporting the gathering mechanism 2. Guided in channel-like guideways 17 and 18 formed on the sides of the rear and front frames 12 and 16 respectively are endless side chains 19, 19 of an endless conveyor 20. Secured to certain of the chain blocks or links of the endless side chains 19, 19 are transverse scraper bars 21 which are adapted to move along bottom pans 22 and 23 secured to the conveyor frames 12 and 16, respec-

tively, the transverse scraper bars moving along the top surfaces of these bottom pans as the conveyor chains are circulated within their guideways. To provide for continuity between the bottom pans on the conveyor frames irrespective of the vertical tilted position of the front frame 16, the forward portion of the bottom conveyor pan 22 is curved downwardly at 24 so that the rear transverse edge of the pan 23 always slidingly engages this curved portion during vertical tilting of the front frame 16. Arranged with its axis alined with the pivotal axis 15 of the front frame 16 and on which the latter is pivotally mounted is a rigid shaft 25 supported at its ends within the sides of the frame 12 in the manner shown in Fig. 3, and this shaft suitably supports a curved backing plate 26 over which the forward extremity of the bottom pan 22 is curved downwardly, and journaled on bearing sleeves supported by this stationary shaft are guide sprockets 27, 27 for the conveyor side chains. The forward portions of the endless side chains of the conveyor 20 are guided by sprockets 28 journaled on bearing sleeves supported by studs 29 secured to the sides of the front frame 16 in the manner shown in Fig. 7, and similar guide sprockets may be mounted near the rearward end of the rear frame 12 for guiding the rear portions of the conveyor side chains. The intermediate portions of the lower strands of the endless side chains of the conveyor 20 pass around vertical guide sprockets 30, 30 journaled on horizontal studs 31 supported by the sides of the rear frame 12 and the intermediate portions of the side chains extend downwardly about these guide sprockets 30 into engagement with drive sprockets 32, 32 keyed to a horizontal transversely extending shaft 33 journaled at its ends within bearing sleeves supported within the side frames of the rear frame 12. In this instance secured to the bottom pan 22 of the rear frame 12 is a hydraulic motor 34 preferably of the conventional gear type having fixed to its power shaft 35 a chain sprocket 36 connected by an endless chain 37 to a chain sprocket 38 keyed to the shaft 33. It will thus be seen that when the motor 34 is running, the conveyor side chains 19, 19 of the conveyor 20 are rapidly circulated within their guideways on the frames 12 and 16 through the chain and sprocket connection 36, 37, 38, transverse shaft 33 and the drive sprockets 32 engaging the conveyor side chains between the guide sprockets 30, 30.

Now referring to the improved material gathering mechanism 2, it will be noted that mounted for rectilinear sliding movement in parallel guideways 40, 40 supported by the tiltable frame 16 at the opposite sides of the latter are slide members in the form of vertical plates 41, 41, and pivotally mounted at 42 on the forward extremities of these plates is a pair of swingable gathering elements 43, 43. These swingable gathering elements are herein in the form of digging and gathering arms or fingers of scoop or claw-like shape having formed on their vertical penetrating edges claw-like penetrating fingers or teeth 44 herein arranged in horizontal superimposed relation, and each comprising a detachable tooth 45. The means for rectilinearly moving the vertical plates 41 within their guideways longitudinally with respect to the frame 16 comprises a pair of hydraulic cylinders 50, 50 (see Figs. 1 and 5) rigidly secured in a suitable manner to the opposite sides of the tiltable frame 16 and each containing a reciprocable piston 51 having a forwardly projecting piston rod 52. These piston rods extend forwardly through the packed front heads 53 of the cylinders and are pivotally connected at 54, 54 to vertical pivot pins mounted within lateral lugs 55 formed integral with the sliding plates 41. It will thus be seen that when hydraulic pressure is supplied to one end or the other of the rectilinear feed cylinders 50, 50, the pistons thereof may be moved in a direction to slide the plates 41 back and forth in their guideways. Hydraulically operated means is provided for swinging the gathering elements 43 about their pivots with respect to the sliding plates comprising hydraulic cylinders 56 (see Figs. 1 and 10) pivotally mounted at 57 on vertical pivot pins supported within lugs integral with the sides of the sliding plates 41, and each of these cylinders contains a reciprocable piston 58 having a forwardly projecting piston rod 59. These piston rods extend forwardly through the packed front heads 60 of the cylinders and are pivotally connected to vertical pivot pins 61 supported by the gathering elements 43. When hydraulic pressure is supplied to one end or the other of the swing cylinders 56, the gathering elements 43 may be swung either inwardly or outwardly about their pivots with respect to the slide plates. The hydraulically operated means for vertically tilting the frame 16 to vary the elevation of the gathering mechanism comprises a pair of hydraulic lift cylinders 62, 62, (see Fig. 4) pivotally mounted to swing in vertical planes on horizontal pivot pins 63 supported within projecting lugs formed integral with the lower portion of the frame 12 and each containing a reciprocable piston 64 having a forwardly projecting piston rod 65. These piston rods extend forwardly through the packed front head 66 of the cylinders and are pivotally connected at their forward extremities at 67 to horizontal pivot pins supported within projecting lugs 68 formed on the lower portion of the tiltable frame 16. It will thus be seen that when hydraulic pressure is supplied to one end or the other of the lift cylinders 62, the frame 16 may be vertically tilted either upwardly or downwardly to vary the elevation of the gathering mechanism. By trapping the liquid within these cylinders, the gathering mechanism may be locked in its adjusted position.

In this illustrative construction, mounted on the rearward portion of the truck frame 4 below the overhanging end of the conveyor is a motor 70 having its power shaft connected by a conventional flexible coupling 71 to the drive shaft of a pump 72 herein of the conventional gear type. Formed within the lower portion of the truck frame is a reservoir 73 containing a liquid, preferably oil, and this pump is adapted to supply liquid under pressure to a hydraulic motor 74 supported by the truck frame and having fixed to its drive shaft 75 a chain sprocket 76 connected by an endless chain 77 to a chain sprocket 78 keyed to the rear truck wheel axle. The motor 74 is of the reversible type to effect drive of the truck wheels in either of opposite directions, thereby to effect propulsion of the loading apparatus during transport either forwardly or rearwardly along the trackway.

As shown in Fig. 11, the intake of the oil pump 72 is connected by a conduit 79 to the reservoir 73, while the discharge side of the pump is connected by conduits 80 and 81 through suitable safety valves 82 to conduits 83 and 84 respectively, these latter conduits being connected to a by-pass valve 85 for varying the liquid pressure in the hydraulic system. This by-pass valve 85 is con-

nected through a discharge conduit 86 to the reservoir 73. As shown in Fig. 12, the by-pass valve 85 comprises a valve casing 87 having formed therein a passage 88 for connecting the conduit 83 with a main supply conduit 89, while the conduit 84 communicates with a passage 90 communicable through a passage 91 with the passage 88 and through a passage 92 with a chamber 93 with which the discharge conduit 86 communicates. The passages 91 and 92 are controlled by end seating valves 94 and 95 respectively, having a suitable operating lever 96. When the lever 96 is swung into the position shown in Fig. 12, both the pressure supply conduits 83 and 84 communicate with the supply conduit 89, while the passage 92 is closed by the valve 95. When the lever 96 is swung into its opposite position the passage 91 is closed by the valve 94, while the passage 92 is open so that when the conduit 83 communicates through the passage 88 with the supply conduit 89, the conduit 84 is connected to the discharge conduit 86 through the passage 92 and chamber 93. Supported on the truck frame at one side of the motor 70 is a control valve box 100 having formed therein a series of valve bores 101 containing, respectively, rotary control valves 102, 103, 104, 105, 106, each having a manual control handle. As shown in Fig. 11, the main liquid pressure supply conduit 89 leading from the by-pass valve 85 is connected with a supply passage 107 formed in the valve box 100 and connecting the lower ends of the valve bores together. Each of these valves is formed near its upper end with a channel 108, and these channels communicate with an upper exhaust passage 109 communicating with the upper ends of the valve bores, and this discharge passage is connected by a discharge conduit 110 to the reservoir. The valve bore for the valve 102 is connected by a conduit 111 to the intake of the hydraulic motor 34 for driving the endless conveyor 20 and a conduit 112 connects the discharge side of the motor 34 with the valve bore. The bore of the valve 103 is connected by a conduit 113 with the forward ends of the lift cylinders 62 for the front frame 16 and a conduit 114 connects the valve bore with the rear ends of the lift cylinders 62. The bore of the valve 104 is connected by a conduit 115 with the forward ends of the swing cylinders 56, while the rear ends of these cylinders are connected through a conduit 116 to the valve bore. The bore of the valve 105 is connected by a conduit 117 with the forward ends of the feed cylinders 50 and through a conduit 118 with the rear ends of the cylinders 50. The valve 106 is connected by a conduit 119 with the intake of the hydraulic motor 74 for driving the truck wheels and a conduit 120 communicating with the discharge side of this motor leads back to the valve bore. When the valve 102, which controls the conveyor driving motor 34, is in the position shown in Fig. 11, liquid pressure may flow from the supply passage 107 through a passage on the valve and conduit 111 to the intake of the motor, while the discharge side of the motor is connected by the conduit 112 and a passage on the valve with the discharge passage 109. When the valve 103, which controls the supply of liquid pressure to the frame lifting cylinders 62, is in the position shown in Fig. 11, liquid under pressure may flow from the supply passage 107 through a passage on the valve and conduit 114 to the rear ends of the cylinders 62, while the forward ends of the cylinders are connected by conduit 113 and a passage on the valve with the discharge passage 109. When the valve 104, which controls the supply of liquid pressure to the swinging cylinders 56 for the gathering elements, is in the position shown in Fig. 11, liquid under pressure may flow from the supply passage 107 through a passage on the valve and conduit 116 to the rear ends of the cylinders 56, while the forward ends of these cylinders are connected by conduit 115 and a passage on the valve with the discharge passage 109. When the valve 105, which controls the supply of liquid pressure to the feed cylinders 50, is in the position shown in Fig. 11, liquid under pressure may flow from the supply passage 107 through a passage on the valve and conduit 118 to the rear ends of the cylinders 50, while the forward ends of these cylinders are connected through conduit 117 and a passage on the valve with the discharge conduit 109. When the valve 106, which controls the truck driving motor 74, is in the position shown in Fig. 11, liquid under pressure may flow from the supply passage 107 through a passage on the valve and conduit 119 to the intake of the motor, while the discharge side of this motor is connected by conduit 120 and a passage on the valve with the discharge passage 109. When the position of the valve 106 is reversed, the conduit 120 is connected to the supply passage 107, while the conduit 119 is connected to the discharge passage 109, and as a result, the truck driving motor 74 is reversed. When the valve 105 is turned into its reverse position, the conduit 117 is connected to the supply passage 107, while the conduit 118 is connected to the discharge passage 109. When the position of the valve 104 is reversed, the conduit 115 is connected to the supply passage 107, while the conduit 116 is connected to the discharge passage 109. When the position of the valve 103 is reversed, the conduit 114 is connected to the discharge passage 109, while the conduit 113 is connected to the supply passage 107. By reversing the positions of the valves 103, 104, and 105, the direction of movement of the pistons contained in the cylinders controlled thereby is of course reversed.

The general mode of operation of the improved material loading apparatus is as follows: The apparatus is propelled at a transport speed from one working place to another by the hydraulic motor 74 operated by the motor driven pump 72. When the working place is reached, for instance, when the machine is operating as a mucking machine on a muck pile in a tunnel entry, the hydraulic lift cylinders 62 are operated to swing the material gathering mechanism 2 downwardly from its transport position indicated in dotted lines in Fig. 2 to its operative gathering position near the ground surface, as indicated in full lines in that figure. The hydraulic conveyor driving motor 34 operated by the motor driven pump 72 is then started, thereby to effect rapid circulation of the endless conveyor 20 within its guideways. With the claw-like gathering elements in their outermost position, as indicated in Fig. 1 and in full lines in Fig. 8, hydraulic pressure is admitted to the rear ends of the feed cylinders 50, 50, thereby sliding rectilinearly the vertical plates 41 forwardly along their guideways longitudinally with respect to the front frame 16 to advance the claw-like gathering elements toward the muck pile into material gathering position. Hydraulic pressure is then supplied to the rear ends of the swing cylinders 56, thereby to effect swinging of the claw-like gathering elements inwardly about their

pivots from the full line position shown in Fig. 8 to the innermost dotted line position in that figure, thereby causing the gathering elements to penetrate and grasp a portion of the material to be loaded. Hydraulic pressure is then supplied to the forward ends of the rectilinear feed cylinders 50, 50, thereby moving the claw-like gathering elements bodily rearwardly along their guideways with respect to the frame 16, thereby moving the material to be loaded grasped thereby rearwardly toward the forward receiving end of the conveyor. These rectilinear penetrating, arcuate swinging and rectilinear withdrawal movements of the claw-like gathering elements are rapidly repeated during the loading operation. When it is desired to vary the horizontal gathering position of the gathering mechanism with respect to the material to be loaded, the gathering mechanism may be swung manually or otherwise horizontally with respect to the truck frame in either direction to the lateral positions indicated in dotted lines in Fig. 8. During this horizontal swinging operation, the pivoted supporting arms 9, 9, due to their non-parallel relation, cause the gathering mechanism to swing through a relatively wide arc while the rear discharge end of the conveyor has a relatively slight movement, thereby enabling the conveyor to discharge material into a mine car placed beneath the discharge end thereof regardless of the horizontally swung position of the gathering mechanism.

As a result of this invention, it will be noted that an improved material loading apparatus is provided having improved material gathering means whereby the material to be loaded may be gathered and loaded in an extremely effective manner. It will further be evident that an improved loading apparatus of the type known as a mucking machine is provided for loading muck piles in tunnel entry work and having embodied therein an improved gathering mechanism whereby the material to be loaded may be gathered in an extremely rapid manner. It will still further be evident that by the provision of the improved hydraulically operated means for the claw-like gathering elements, the material to be loaded is penetrated, grasped, and thereafter moved rearwardly onto the conveyor in an improved manner. These and other uses and advantages of the improved loading apparatus will be clearly apparent to those skilled in the art.

While I have in this application specifically described one form which my invention may assume in practice, it will be understood that this form of the same is 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 loading apparatus, a portable base, conveying means, and material loading mechanism on said base for moving the material to be loaded onto said conveying means including supports mounted for rectilinear movement at the opposite sides of said conveying means, cooperating claw-like digging and gathering elements pivotally mounted on the forward extremities of said supports to swing horizontally with respect thereto about upstanding axes, means for moving said supports forwardly rectilinearly relative to said conveying means to move bodily said gathering elements into gathering relation with the material to be loaded, means for thereafter swinging said gathering elements inwardly to dig into and grasp a portion of the material, and means for thereafter moving said supports rectilinearly rearwardly relative to said conveying means to move said gathering elements bodily rearwardly into a position to discharge the material grasped thereby onto said conveying means.

2. In a loading apparatus, a support having guideways along the sides thereof, a conveyor mounted centrally on said support between said guideways, frames slidable rectilinearly along said guideways, cooperating digging and gathering jaws pivotally mounted on said sliding frames respectively to swing toward and from one another in common planes, and devices for sliding said frames along said guideways relative to said conveyor and for swinging said digging and gathering jaws about their pivots relative to said frames.

3. In a loading apparatus, a support having guideways along the sides thereof, a conveyor mounted centrally on said support between said guideways, frames slidable rectilinearly along said guideways, cooperating digging and gathering jaws pivotally mounted on said sliding frames respectively, to swing horizontally with respect thereto, and devices for sliding said frames along said guideways relative to said conveyor to move said jaws bodily toward and from the material to be loaded and for swinging said gathering elements about their pivots relative to said frames to dig said jaws into and grasp the material.

4. In a loading apparatus, a support having guideways along the sides thereof, a conveyor mounted centrally on said support between said guideways, frames slidable rectilinearly along said guideways, cooperating digging and gathering jaws pivotally mounted on said sliding frames respectively, hydraulic cylinders for moving said frames longitudinally along said guideways relative to said conveyor, and hydraulic cylinders for swinging said digging and gathering jaws about pivots relative to said sliding frames.

5. In a loading apparatus, a support having guideways along the sides thereof, a conveyor mounted centrally on said support between said guideways, frames slidable rectilinearly along said guideways, cooperating digging and gathering jaws pivotally mounted on said sliding frames respectively, hydraulic cylinders mounted on the sides of said support and containing pistons having piston rods connected to said sliding frames for moving the latter along said guideways relative to said conveyor, and hydraulic cylinders pivotally mounted on said sliding frames and containing pistons having their piston rods pivotally connected to said digging and gathering jaws for swinging said jaws about their pivots.

6. In a loading apparatus, a portable base, conveying means on said base, and material gathering mechanism including cooperating claw-like digging and gathering jaws, sliding supports mounted at the sides of said conveying means and on which said claw-like jaws are pivotally mounted for swinging movement, means for moving said sliding supports forwardly rectilinearly relative to said conveying means to move said digging and gathering jaws into gathering relation with the material to be loaded, means for thereafter swinging said digging and gathering jaws inwardly about their pivots to grasp a portion of the material, and means for thereafter moving said sliding supports rearwardly relative to said conveying means to move the digging and gathering jaws rearwardly into a position to discharge the

material grasped thereby onto said conveying means.

7. In a loading apparatus, a portable base, a conveyor on said base having a conveyor frame, guideways on the sides of said conveyor frame, frames slidably guided on said guideways, cooperating digging and gathering jaws pivotally mounted on the forward extremities of said sliding frames respectively, means connected to the rearward extremities of said sliding frames for sliding said sliding frames along said guideways, and cooperating means connected between said sliding frames and said jaws for swinging said digging and gathering jaws about their pivots relative to said sliding frames, said digging and gathering jaws being movable bodily forwardly relative to said conveyor frame into gathering relation with the material to be loaded, thereafter swingable about their pivots inwardly to dig into and grasp a portion of the material and thereafter movable bodily rearwardly with said sliding frames to move the material grasped thereby onto said conveyor.

8. In a loading apparatus, a portable base, a conveyor on said base, guides extending longitudinally of the apparatus along the opposite sides of the forward portion of said conveyor, sliding supports mounted on said guides, a pair of cooperating digging and gathering jaws swingable horizontally in advance of said conveyor, one jaw pivotally mounted on each sliding support to swing about an upright axis, means connected to said supports for sliding the same longitudinally back and forth along said guideways to move said jaws bodily forwardly and rearwardly relative to the conveyor, and means connected to said jaws for swinging the same horizontally to dig into and grasp a portion of the material to be loaded.

9. In a loading apparatus, a portable base, a conveyor on said base, guides extending longitudinally of the apparatus along the opposite sides of the forward portion of said conveyor, sliding supports mounted on said guides, a pair of cooperating digging and gathering jaws swingable horizontally in advance of said conveyor, one jaw pivotally mounted on each sliding support to swing about an upright axis, fluid operated rams connected to said supports for sliding the same longitudinally back and forth along said guideways to move said jaws bodily forwardly and rearwardly relative to the conveyor, and fluid operated rams connected to said jaws for swinging the same horizontally to dig into and grasp a portion of the material to be loaded.

10. In a loading apparatus, a portable base, a conveyor on said base, guides extending longitudinally of the apparatus along the opposite sides of the forward portion of said conveyor, sliding supports mounted on said guides, a pair of cooperating digging and gathering jaws swingable horizontally in advance of said conveyor, one jaw pivotally mounted on each sliding support to swing about an upright axis, fluid operated rams connected to said supports for sliding the same longitudinally back and forth along said guideways to move said jaws bodily forwardly and rearwardly relative to the conveyor, and fluid operated rams connected to said sliding supports and said jaws for swinging the latter horizontally to dig into and grasp a portion of the material to be loaded.

JOSEPH F. JOY.