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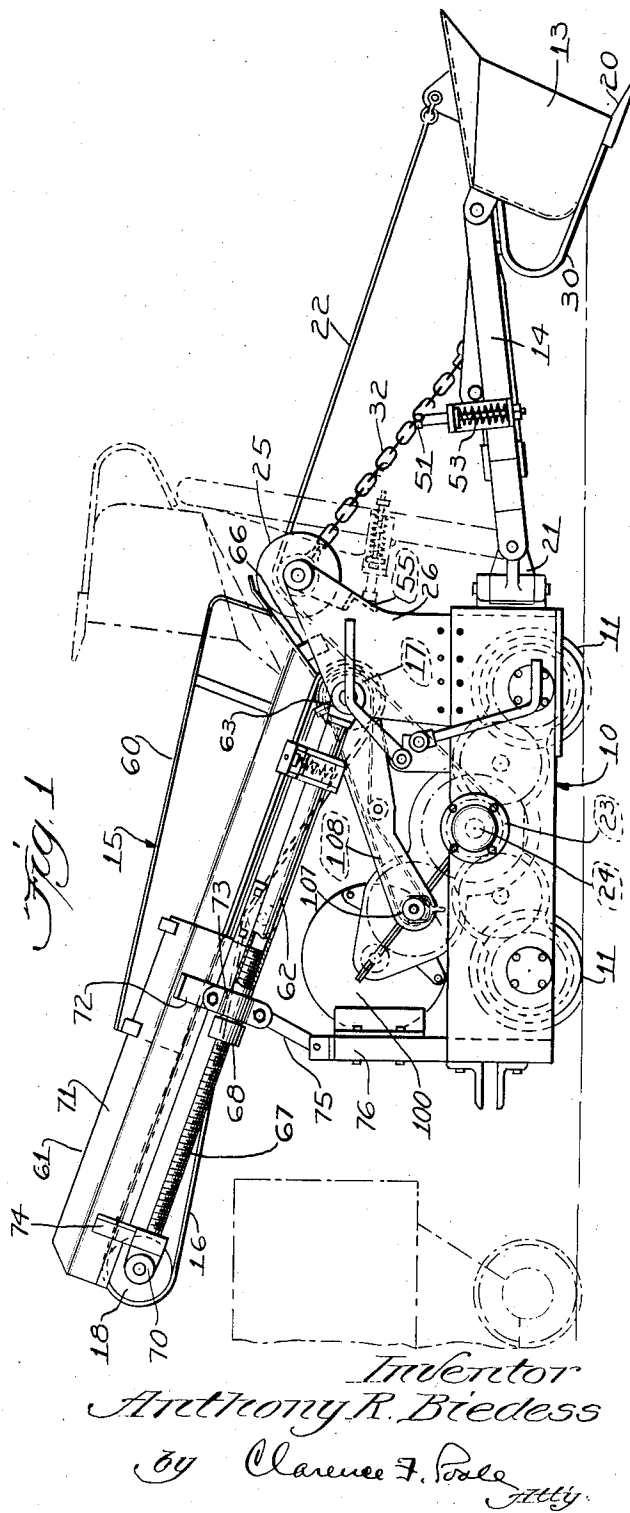
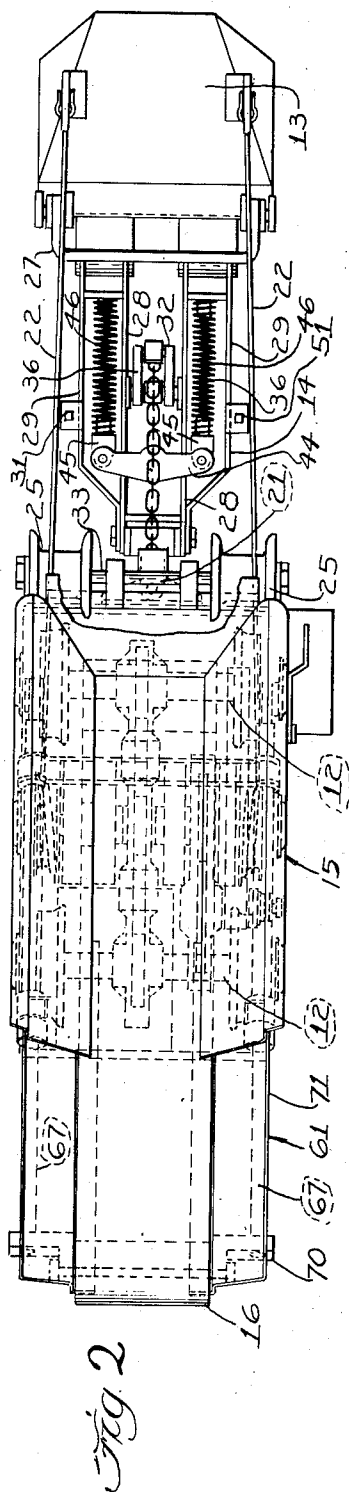
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2,301,241

MUCKING MACHINE

Filed Jan. 21, 1941

5 Sheets-Sheet 1



Nov. 10, 1942.

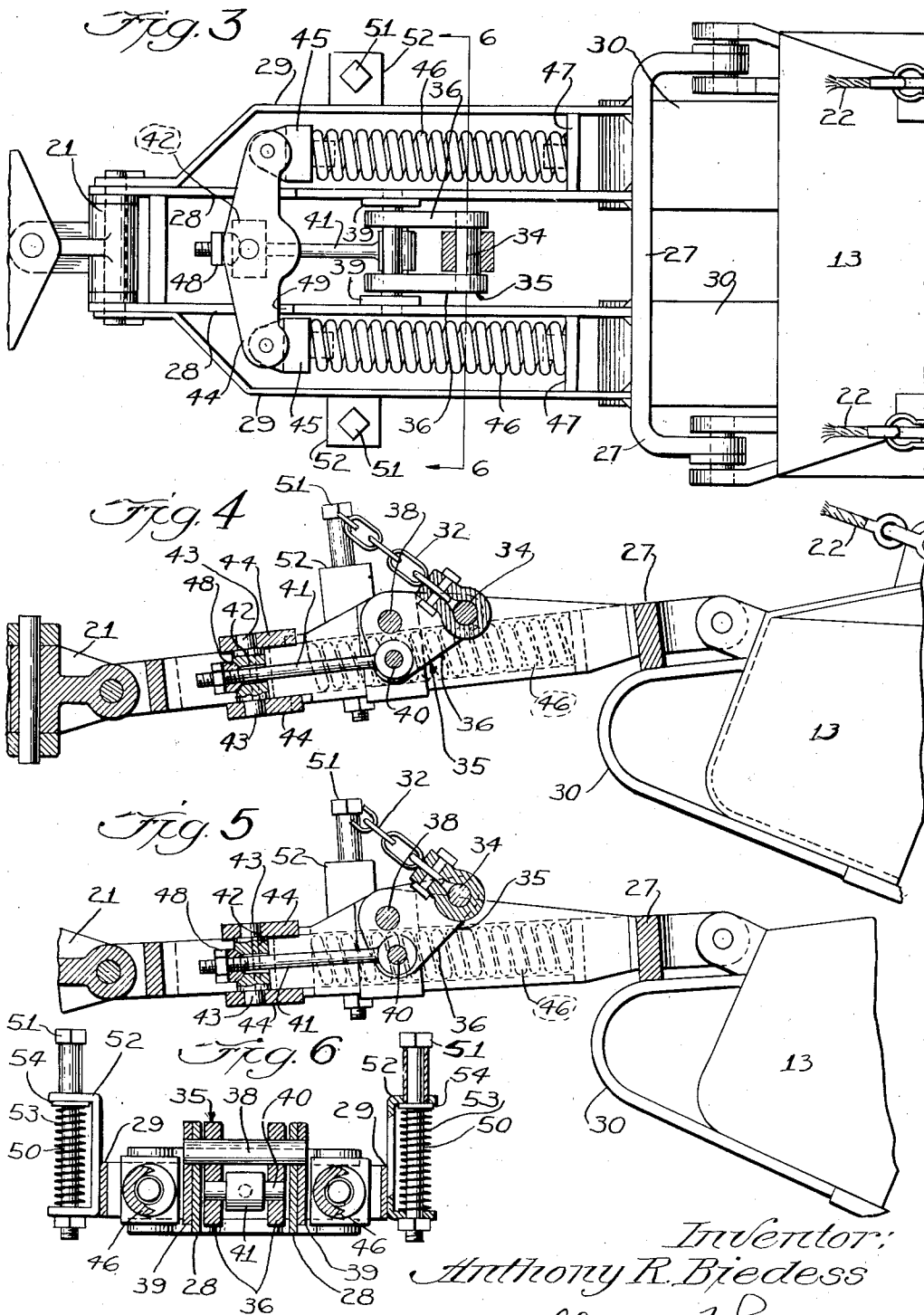
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MUCKING MACHINE

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5 Sheets-Sheet 2



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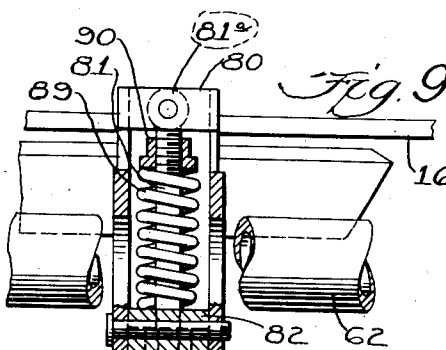
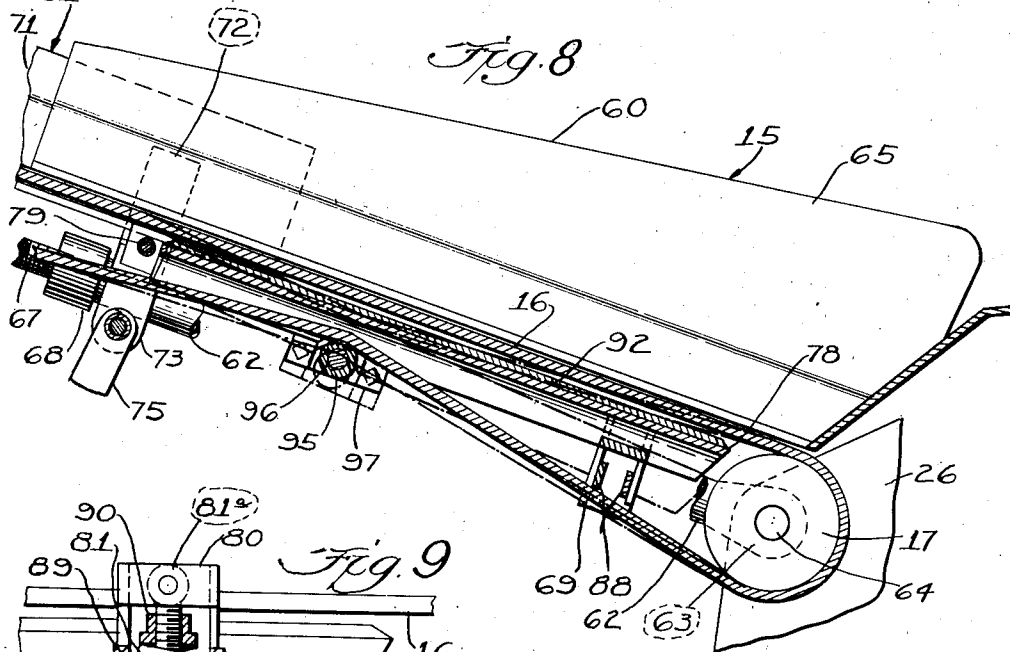
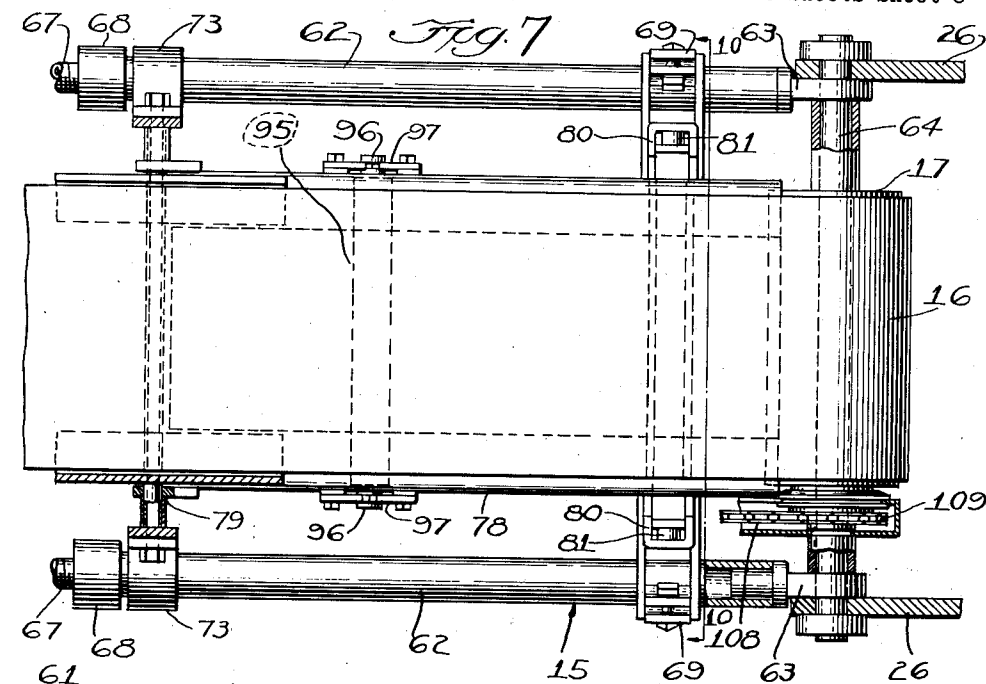
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5 Sheets-Sheet 3



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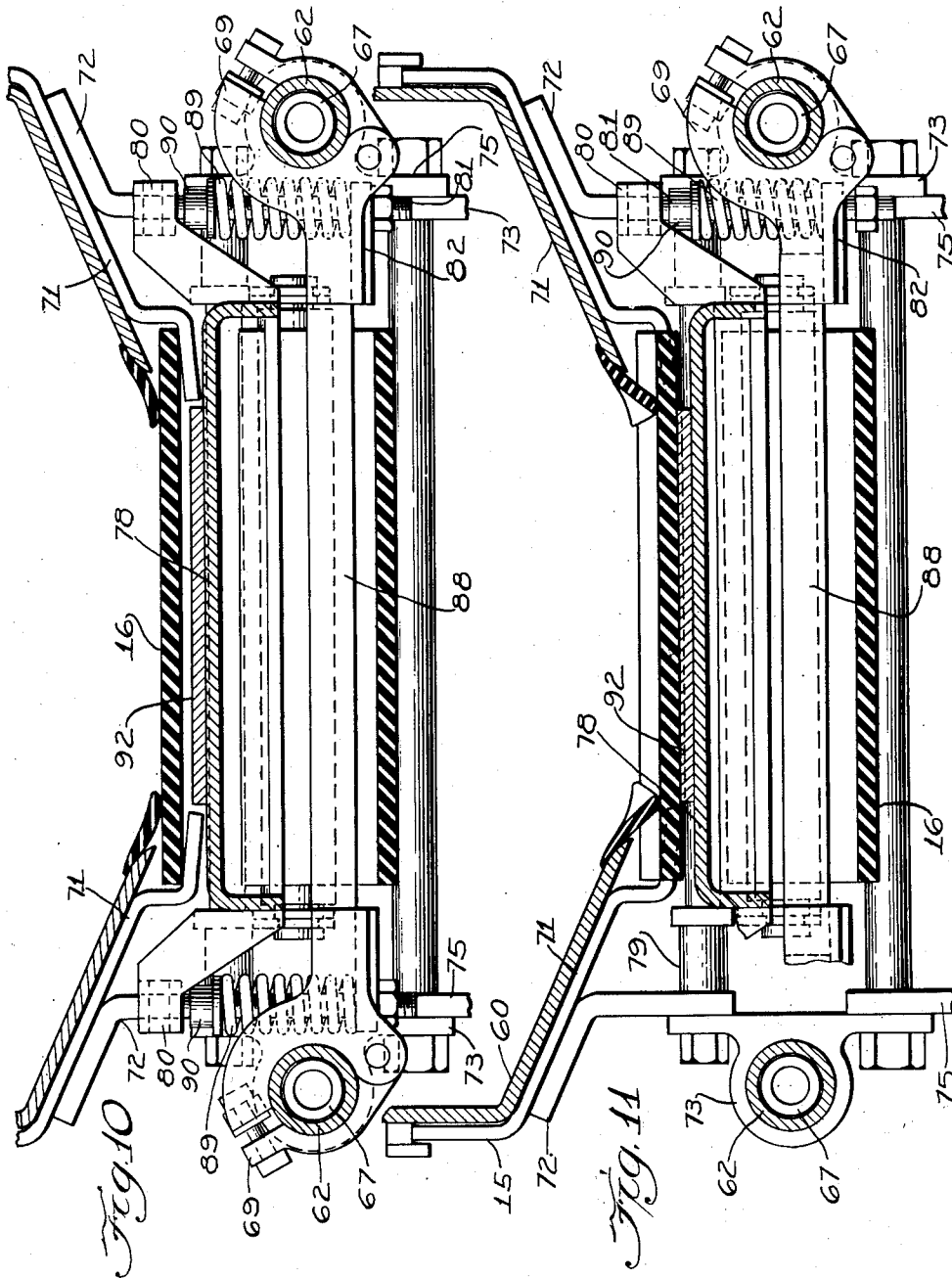
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MUCKING MACHINE

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5 Sheets-Sheet 4



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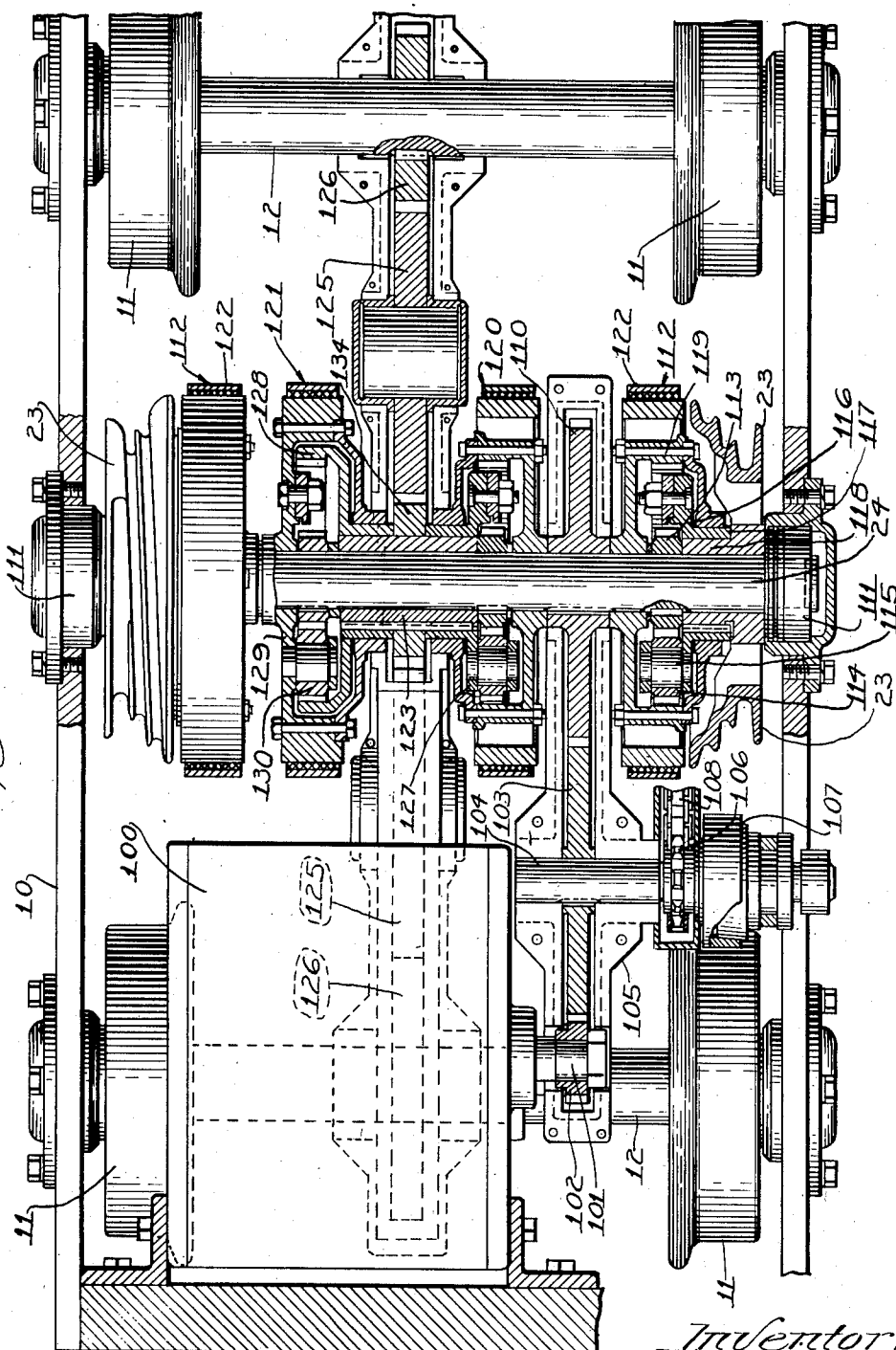
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MUCKING MACHINE

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Fig. 12



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UNITED STATES PATENT OFFICE

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MUCKING MACHINE

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5 Claims. (Cl. 214—90)

This invention relates to improvements in mucking machines of the general type known as "Conway" machines, illustrated in Patent No. 1,514,008 issued to J. P. Mosier on November 4, 1924, which machines have been used extensively in tunnels or mines for shovelling rock or muck and delivering it to cars.

Among the objects of my invention is to provide an improved, simplified and more compact construction especially adapted for relatively small and light weight machines of the above named type, but not necessarily limited to such machines. A further object is to provide a cushioning and automatic pressure relief mechanism for the boom operable to reduce the tendency to derail the machine under excessive forward crowding pressures. Other objects are to provide an improved buffer and centering device for the boom, an improved cushioning device for the conveyer belt, and an improved drive mechanism for operating the boom and propelling the machine.

Still other objects of my invention will appear from time to time as the accompanying description proceeds.

The invention will be more clearly understood by reference to the accompanying drawings, in which—

Figure 1 is a view in side elevation of a mucking machine constructed in accordance with my invention, showing the boom in forward, crowding position (full lines) and in upward discharging position (dotted lines).

Figure 2 is a plan view of the machine shown in Figure 1.

Figure 3 is an enlarged detail plan view of the boom.

Figure 4 is a detail side view of the boom, with the crowd relief mechanism in normal position.

Figure 5 is a view similar to Figure 4, but showing the crowd relief mechanism in partially released position.

Figure 6 is a transverse detail section taken on line 6—6 of Figure 3.

Figure 7 is a detail plan view of the front end of the conveyer, with the hopper removed to show details of the cushioning device.

Figure 8 is a detail longitudinal section of the front end of the conveyer.

Figure 9 is an enlarged detail of one of the spring mountings for the cushioning device at one side of the conveyer.

Figure 10 is an enlarged cross section taken on line 10—10 of Figure 7, showing the conveyer belt in normal, unloaded position.

Figure 11 is a view similar to Figure 10, but showing the conveyer belt in loaded position, with the cushioning device depressed.

Figure 12 is a fragmentary plan view of the chassis of the machine taken in a generally horizontal plane, showing details of the power transmission mechanism, with parts broken away to show details of the gearing.

Referring now to details of the embodiment of my invention illustrated in the drawings, the machine comprises generally a truck or main frame 10 mounted on track wheels 11, 11 and axles 12, 12 and forming a support for a scoop 13 carried in advance thereof on a boom 14. Said scoop and boom are so arranged that said scoop may gather material in front of and to each side of the track by movement of the truck along the track, the scoop, when loaded, being swingable upwardly to discharge the material directly upon an upwardly inclined conveyer, indicated generally at 15, extending beyond the rear end of the truck.

The conveyer 15, as herein shown, includes a belt 16 trained about a drive roller 17 at the front end and an idler roller 18 at the rear end of said conveyer. Further details of the conveyer and its drive mechanism will hereinafter more fully appear.

The scoop 13 is pivoted at opposite sides on the boom 14 so as to be open forwardly with its digging lip 20 at a depressed angle as it is forced into the material, to gather the latter, as shown in full lines in Figure 1. The rear end of the boom is connected by a universal joint 21 at the front end of the truck so that the scoop can be swung for digging at various angles in front of the machine. The boom is swung upwardly for discharge on the front end of the conveyer 15, as indicated in dotted lines in the same figure. The scoop 13 is elevated to a discharge position and swung from side to side by means of a pair of cables 22, 22 connected to opposite sides of the upper corners thereof. Said cables are wound on or payed off of a pair of winding drums 23, 23 mounted on a transverse shaft 24. Details of the driving and control means for said winding drums will hereinafter more fully appear.

From each of the drums 23, the cables 22 pass over horizontally journaled guide rollers 25, respectively mounted on a cross shaft 33 extending between upright support members 26 at the opposite sides of the truck, and overhanging the front end thereof. When both of the cables are wound in, the scoop will be elevated directly to a discharge position. When it is desired to swing the scoop to one side or the other, power is ap-

plied to the winding drum on the side it is desired to swing. The general mode of operation of the scoop just described is similar to that employed in previous mucking machines of the "Conway" type, excepting that in the present instance, the material is discharged from the scoop directly onto the conveyer, instead of being passed along an intermediate chute on the boom, and thence discharged onto the conveyer.

Referring now more particularly to the novel features of construction of the boom 14, the scoop 13 is pivotally mounted between the forwardly extending arms of a U-shaped yoke 27 at the front end of the boom. Said yoke is secured as by welding to the ends of two laterally spaced beams, each consisting of an inner plate 28 and an outer plate 29 spaced apart at the intermediate part of the boom but with the rear ends of plates 28 converging toward their respective plates 29 where they are pivotally connected at opposite sides of the universal joint 21 on a transverse axis.

The scoop 13 has curved extensions 30, 30 at the rear end thereof adapted to engage the under face of the yoke 27 when the scoop is in the lowered, forward-crowding position shown in Figure 1, so as to limit further rearward pivotal movement of the scoop relative to the boom.

The novel means for relieving crowding pressure on the boom includes a flexible member 32, herein a length of chain, suitably anchored at one end to the cross shaft 33 extending transversely between the upright support members 25, 26 on the truck, and connected at its lower end to a pin 34 at the forward end of a rocking member 35. Said rocking member consists of a pair of spaced plates 36, 36 pivotally mounted on a transverse shaft 38 supported at opposite ends on the inner plates 28, 28 which are widened upwardly intermediate the ends of the boom, as shown in Figures 4, 5 and 6. Said boom plates are also reinforced by plates 39, 39 at this point.

The rocking member 35 has a transverse pin 40 adjacent but below the shaft 38, so as to form in effect a bell crank lever, with pins 34 and 40 disposed at an angle to each other and rocking about shaft 38. A rod 41 is pivotally connected to pin 40 and extends rearwardly through a block 42 having a pair of upper and lower studs 43, 43 thereon pivotally connected to upper and lower cross arms 44, 44 extending, respectively, above and below the boom plates 28, 28. The outer ends of said cross arms have blocks 45, 45 pivotally connected therewith, which form end stops for a pair of compression coil springs 46, 46 disposed, respectively, between the plates 28 and 29 along each side of the boom and extending forwardly into engagement with fixed abutments 47, 47 adjacent the yoke 27.

The coil springs 46, 46 are normally held under desired compression by means of an adjustable nut 43 threaded on the rear end of the rod 41.

The operation of the crowding relief mechanism just described may now be described as follows: The chain 32 serves to limit the downward swinging movement of the boom at a predetermined level as shown in full lines in Figure 1, for forward crowding movement of the shovel as it is forced into the material by forward tractive effort of the machine. It will be observed that as the boom is dropped into this crowding position, the shock on the chain 32 is absorbed by the springs 46, 46 acting through the rocking member 35, rod 41, and cross arms 44. In addition to the cushioning effect just described, it will be

observed that when the boom 14 is held at its normal crowding angle relative to the truck, as shown in Figures 2 and 4, ordinary crowding pressures exerted on the boom in a horizontal direction will not affect the springs, or the normal angular position of the boom. However, when an abnormal crowding pressure is exerted on the scoop, the angular inclination of the digging lip 20 of the latter is such as to tend to force the scoop downwardly, so as to exert a substantial downward pull on the boom as a whole. In practice, the load or compression of the coil springs 46, 46 may be adjusted so that the exertion of a predetermined downward pressure on the boom, resulting in an increased tension on the chain 32, will cause the rocking arm 35 to swing upwardly into substantially the position shown in Figure 5, in which it will be seen that the boom becomes slightly depressed from its normal angle. In this manner excessive crowding stress on the chain 32 is substantially relieved, and the tendency to derail the machine as a whole due to such excessive crowding stresses is greatly reduced.

Moreover, the operation of the pressure relief mechanism, resulting in the downward swing of the boom, can be observed by the machine operator as a warning that an excessive crowding pressure is being exerted on the scoop.

The improved buffing and centering device employed on the boom consists of a pair of spring pressed buffer pins 50, 50 mounted in widely spaced relation at opposite sides of the boom 14 with their upper ends or heads 51 extending a substantial distance above the top of the boom, as shown in Figures 2 to 6, both inclusive. Said buffer pins are mounted on C-shaped brackets 52, 52 at opposite sides of the outer boom plates 29, 29. Each includes a coil spring 53 having its upper end engaging a collar 54 on the pin 50 and its lower end abutting the lower end of the bracket 52.

The heads 51 are adapted to engage a cross plate 55 mounted between the upright supports 25, 26 on the truck 10 when the boom is swung into its upward discharging position, as shown in dotted lines in Figure 2, thereby acting as a cushioning device to limit the elevating movement of said boom. In addition, it will be understood that when the boom is swung laterally to one side or the other and elevated in that position, the buffer pin 50 on the side of the boom to which it is swung will engage the cross plate 55 before the boom is fully raised to its discharging position, thereby exerting a rotative force on the boom, tending to swing it to its normal centered position in front of the truck, when the scoop is finally discharged on the conveyer. Accordingly, the buffer pins 50, 50 serve not only as a cushioning device but as an automatic centering device for the boom.

Referring now in greater detail to the novel form of conveyer and belt-cushioning device therefor, the conveyer indicated generally at 15 consists of a main or lower section 60 and an upper or rear extensible section 61. The lower section 60 has two tubular side frame members 62, 62, the front ends of which are each provided with an eye 63, which are connected to the upright supports 25, 26 adjacent the front end of the truck 10, as by means of a cross shaft 64 which in the form shown also supports the front drive roller 17 for the conveyer belt 16. A hopper 65 having flared front and side walls is suitably supported above the lower end of the conveyer, as

by side brackets 66, 66, connected to the upright supports 26, 26.

The rear extensible section 61 of the conveyer includes a pair of side rods 67, 67, telescopically mounted in the rear ends of the tubular side frame members 62, 62, as shown in Figure 2, and supporting journal members 70, 70 for the idler roller 18 at the rear end of the conveyer. The side rods 67, 67 have nuts 68, 68 threaded thereon which abut the rear ends of the tubular side frame members 62, 62.

Side trough members 71, 71 are telescopically mounted relative to the hopper 65, the front ends of said trough members being slidably supported on braces 72, 72 projecting upwardly from clamps 73, 73 mounted on the tubular side frame member 62, and other braces 74 connected to the journal members 70. The clamps 73, 73 are supported by links 75, 75 on an upright support 76 at the rear end of the truck. The rear conveyer frame section 61 can be telescopically adjusted relative to the front or lower section 60 by screwing the nuts 68, 68 in one direction or the other.

The belt cushioning device includes a flanged plate 78 hinged on a transverse shaft 79 which is supported at opposite ends in the clamps 73, 73 at opposite sides of the conveyer frame. The plate 78 extends forwardly below the belt 16 to a point closely adjacent the drive roller 17 at the front of the machine. The front end of the plate 78 is mounted for vertical yielding movement relative to the conveyer frame, as herein shown, this yielding movement being provided through a pair of brackets 80, 80 connected to the side flanges of plate 78 and each having a depending rod 81 with an eye 81a pivotally connected to its outer end and extending downwardly through a horizontal abutment 82 forming part of clamp 69 secured to the adjacent tubular side frame member 62, as shown in Figures 7 to 11, both inclusive. The two clamps 69, 69 at opposite sides of the frame are cross connected by braces 88, 88. Each of the depending rods 81 has a coil spring 89 mounted thereon in compression between the abutment 82 and a collar 90 threaded near the upper end of said rod. In the preferred form shown, the plate 78 is provided with a wearing strip 92 on its upper surface which is narrower than the plate 78 so that said wearing strip will fit between the side plates 71, 71 of the rear extension member 61, as shown in Figures 10 and 11.

An idler roller 95 is mounted on a transverse shaft 96 supported at opposite ends in a depending bracket 97 at opposite sides of the plate 78 intermediate its ends, as clearly shown in Figures 7 and 8. Said idler roller provides a tensioning support for the under surface of the lower or return reach of the belt 16.

The operation of the belt cushioning device just described is as follows: When normal loads are being carried by the belt, the latter will slide along the upper surface of the wearing strip 92 but without causing substantial compression of the springs 89, 89 supporting the front end of the cushioning plate 78. When excessive loads are deposited on the front end of the conveyer belt, as by dropping excessively large lumps of material from the scoop, the cushioning plate 78 and the wearing strip 92 will be depressed to a position shown in dotted lines in Figure 8 and in full lines in Figure 11. It will be noted, however, that the idler roller 95 moves with the hinged cushioning plate 78, so as to release tension on the lower or return reach of the belt 16, thereby compensating for the downward movement of

the upper reach of the belt as it is moved into its depressed position. In this manner the belt is not only protected against excessive shocks and resulting wear due to excessive loads deposited thereon, but it is maintained at substantially uniform tension at all times.

Referring now to the propelling mechanism for the truck and the drive mechanism for the winding drums 23, 23 which control the scoop operating cables 22, 22, details of said mechanism are shown in Figure 12 of the drawings. A motor 100, such as an electric motor, has an armature shaft 101 and pinion 102 driving a gear 103 keyed on shaft 104 having suitable bearing in a casing 105. The shaft 104 has a chain sprocket 106 loosely mounted thereon and adapted to be operatively engaged at will with the shaft 104, by means of a cone clutch 107 of any suitable form. A drive chain 108 is trained over the sprocket 106 and is led forwardly to drive a sprocket 109 connected to the drive roller 17 for the conveyer belt 16 (see Figures 2 and 7).

The gear 103 is meshed with a gear 110 keyed to the transverse shaft 24 which as previously mentioned has the winding drums 23, 23 mounted thereon for controlling the movement of the scoop 13. Said shaft has suitable bearings 111, 111 at opposite sides of the truck 10. Each of the drums 23 is driven by a planetary gear device indicated generally at 112. These planetary gears are similar, so a description of one will suffice for an understanding of both.

A sun gear 113 is keyed on the shaft 24 and is meshed with one or more planetary gears 114. Each gear 114 is mounted on a shaft 115 supported in a cage 116 having a hub 117 keyed to a hub 118 of the drum 23. Each planetary gear 114 is meshed with an internal gear member 119 loosely mounted on shaft 124 and controlled as usual by a friction band 122 mounted on the periphery of said internal gear member. The arrangement is such that when the friction band is released, the internal gear member 119 is free to rotate so that there is no power transmitted from shaft 24 to the drum 23. When the friction band is tightened to restrain movement of the internal gear member 119, the planetary gear 114 is driven within the internal gear so as to rotate the cage member 116 at a reduced speed and thus drive the drum 23 which is connected to the latter.

Two planetary gear devices 120 and 121 are also mounted on shaft 24 to afford driving connections in opposite directions to the axles 12, 12 and their track wheels 11, 11. The planetary gear device 120 may be substantially the same as the planetary gear devices 112 and 114 and includes a cage 127 keyed to a sleeve 123, which sleeve also has a pinion 134 keyed thereon. Said pinion is meshed with idler or reach gears 125, 125, which in turn are meshed with gears 126 keyed to the axles 12, 12.

The planetary gear device 121 differs from the planetary gear devices 112 and 120 in that it has an internal gear member 128 keyed to the sleeve 123, whereas its cage member 129 which carries a planetary gear 130 thereon, is rotatably mounted on the shaft 24 under control of a friction band 131.

When the cage member 129 is held from rotation by the friction band 131, there will be a direct geared drive to the sleeve 123 through the planetary pinion 130 and the internal gear 128, keyed to said sleeve. The internal gear 128 of the planetary 121 thus serves as a driving mem-

ber while the internal gear of the planetary 120, which is held from rotation, serves as a reaction member, and the planetary pinion of said planetary walks about the inside of said internal gear and drives the cage 127 within which it is mounted by its orbital movement about said internal gear, which causes said cage to rotate in a direction which is reverse from the direction said internal gear 123 is driven by the pinion 123.

It will be observed that in the gearing arrangement disclosed herein the drums 23 are driven by the planetaries 112 in the same direction of rotation as the shaft 24. The same applies to the planetary 120 which is arranged to drive the truck wheels in a forward direction for forcing or crowding the scoop into the material being dug. This arrangement wherein both the driving and driven members rotate in the same direction, is found to afford maximum efficiency in planetary gear devices of this character. Moreover, the arrangement of all of the planetary gear devices on the same shaft, as herein disclosed, provides a most compact and efficient design, which is particularly desirable in loading machines of this character which must operate within limited spaces such as in mines or tunnels.

While I have herein shown and described one form in which my invention may be embodied, it will be understood that the construction thereof and the arrangement of the various parts may be altered without departing from the spirit and scope thereof. Furthermore, I do not wish to be construed as limiting my invention to the specific embodiment illustrated, excepting as it may be limited in the appended claims.

I claim as my invention:

1. In a mucking machine, a main frame mounted on track wheels, a boom hinged to and projecting forwardly from said frame, a scoop pivotally mounted on the end of said boom and adapted to dig by bodily movement of the machine along the track, flexible means between said main frame and said boom for limiting the downward swinging movement of said boom at a predetermined digging level, said flexible means having yieldable connection with said boom including normally loaded spring means adapted to relieve endwise tilting stresses transmitted to the machine under excessive digging pressures exerted on the scoop.

2. In a mucking machine, a main frame mounted on track wheels, a boom hinged to and projecting forwardly from said frame, a scoop pivotally mounted on the end of said boom and adapted to dig by bodily movement of the machine along the track, flexible means between said main frame and said boom for limiting the downward swinging movement of said boom at a predetermined digging level, said flexible means having yieldable connection with said boom and including a flexible member connected to said

main frame, a rocking member pivoted on said boom and having said flexible member connected thereto, and normally loaded spring means disposed longitudinally of said boom adapted to resist pivotal movement of said rocking member against the tension of said flexible member.

3. In a mucking machine, a main frame mounted on track wheels, a boom hinged to and projecting forwardly from said frame, a scoop pivotally mounted on the end of said boom and adapted to dig by bodily movement of the machine along the track, flexible means between said main frame and said boom for limiting the downward swinging movement of said boom at a predetermined digging level, said flexible means having yieldable connection with said boom and including a flexible member connected to said main frame, a rocking member pivoted on said boom and having said flexible member connected thereto, spring means disposed longitudinally of said boom to resist pivotal movement of said rocking member against the tension of said flexible member, and means for adjusting the tension of said spring means so as to yield at a predetermined tension on said flexible means.

4. A loading machine comprising a frame, a conveyer mounted thereon, a boom pivotally mounted on said frame adjacent the receiving end of said conveyer, a scoop on said boom, a pair of independently controlled chains connected to said boom for swinging the same sidewise in opposite directions to engage material located to either side of the machine, and to lift said boom into discharging position relative to said conveyer, and a pair of projecting buffer pins at opposite sides of said boom arranged to engage an abutment on said main frame when said boom is partially elevated while swung to either side of the machine, and thereby cause said boom to swing toward the center of the machine before it is fully elevated to discharging position relative to said conveyer.

5. In a loading machine, a main frame mounted on track wheels, a boom pivotally mounted at the front end of said frame and adapted to dig by bodily movement of the machine along the track, a pair of winding drums having flexible means connected to opposite sides of said boom for swinging the latter vertically and sidewise, said winding drums being rotatably mounted on a power driven shaft disposed transversely of said frame, friction-controlled planetary gear devices on said transverse drive shaft affording independent or simultaneous operative connection between said shaft and said winding drums, and other friction-controlled planetary gear devices on said transverse drive shaft affording reversible operative connection between said shaft and the track wheels of the machine to propel said machine in opposite directions.

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