

Sept. 1, 1953

C. N. BEBINGER

2,650,692

MATERIAL LOADING APPARATUS

Filed Nov. 28, 1947

7 Sheets-Sheet 1

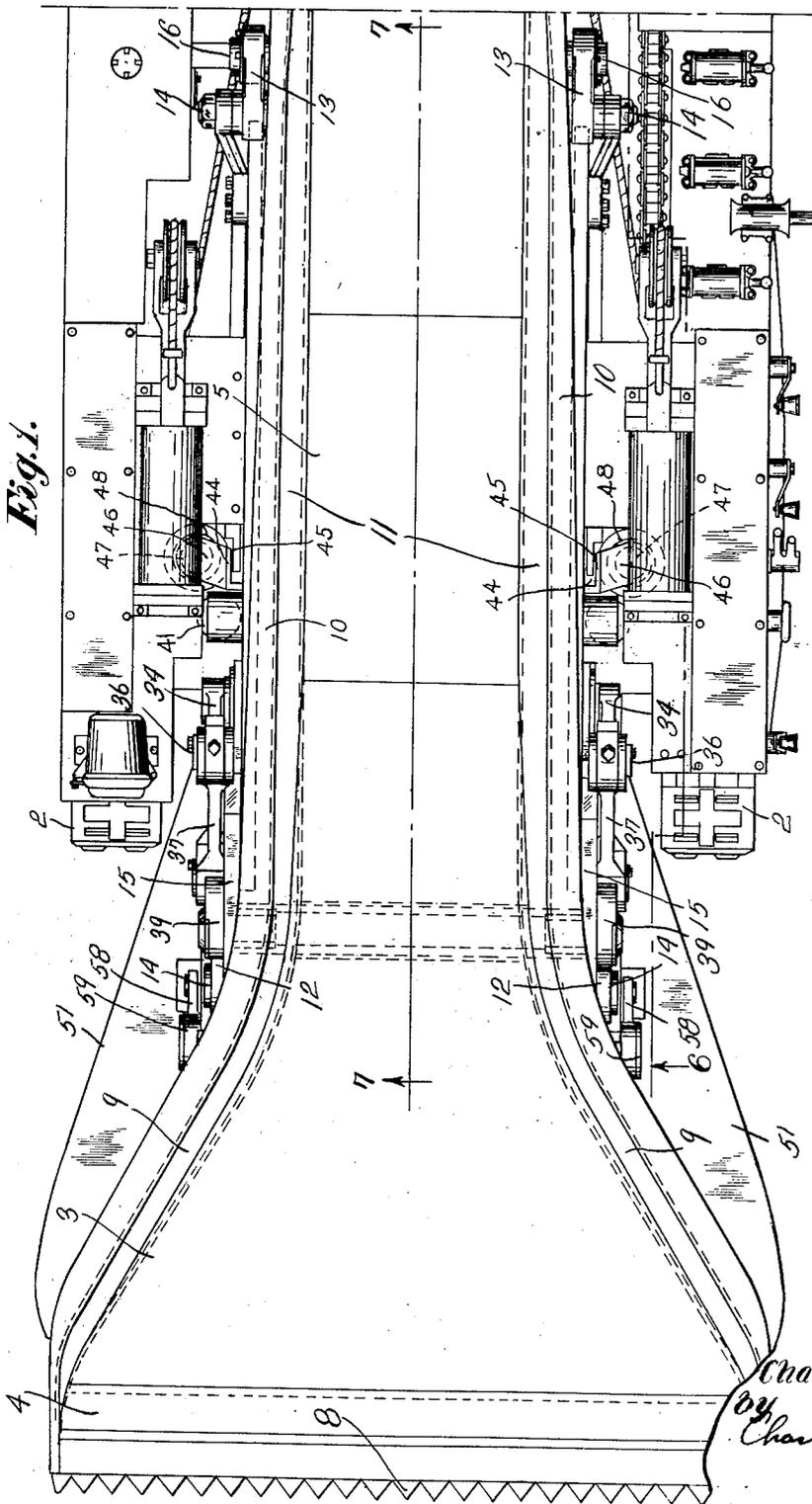


Fig. 1.

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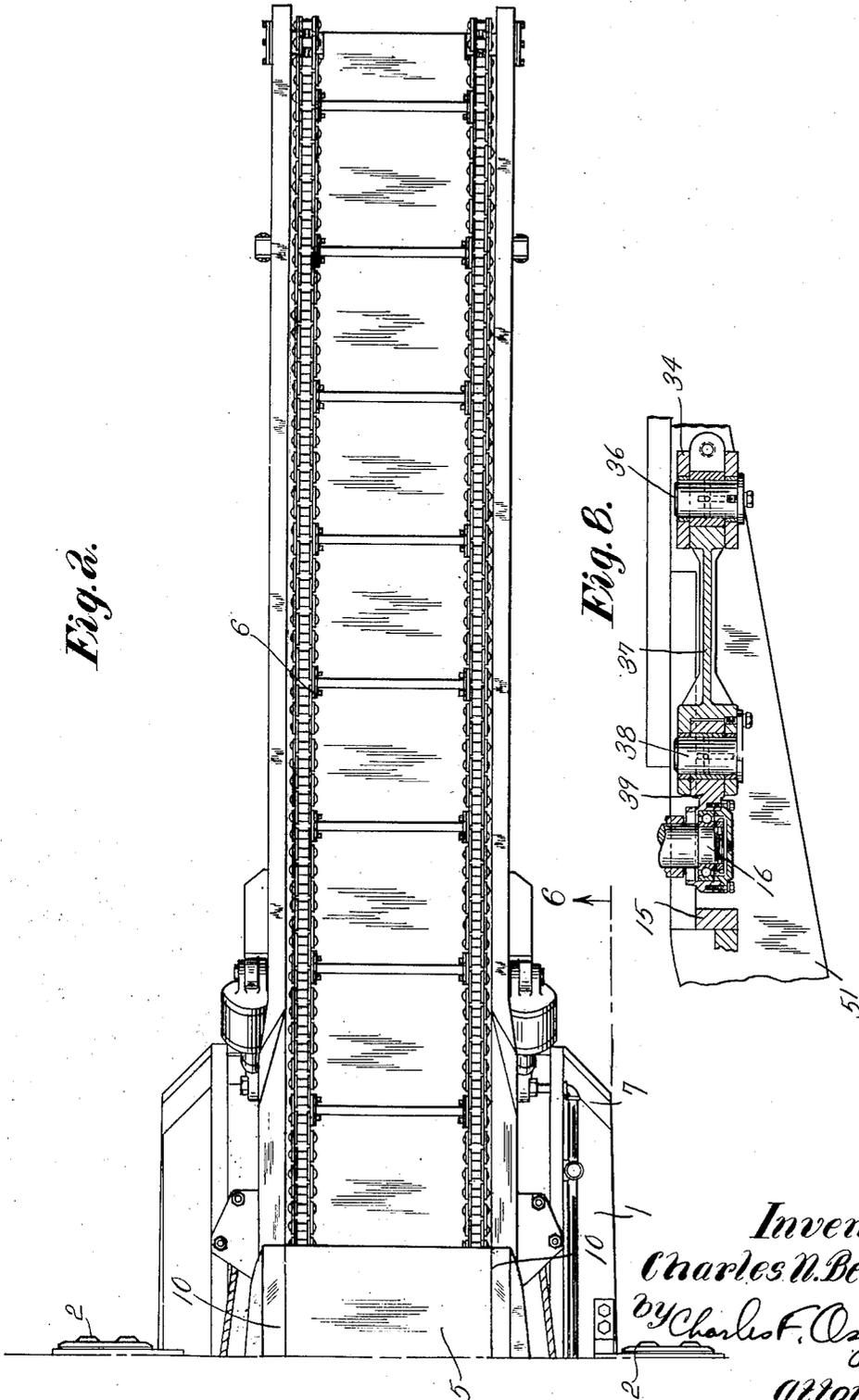


Fig. 6.

Fig. 8.

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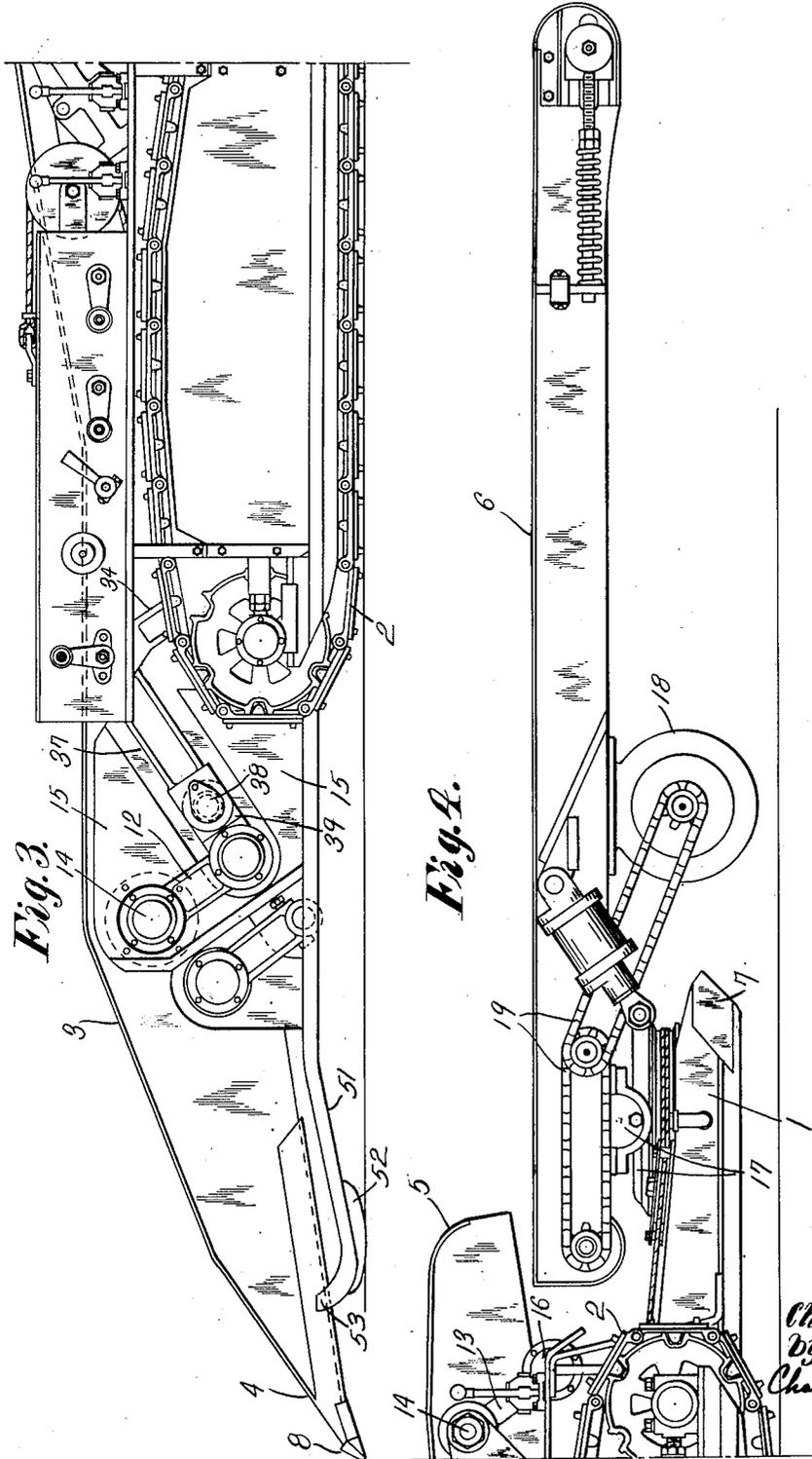
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7 Sheets-Sheet 3



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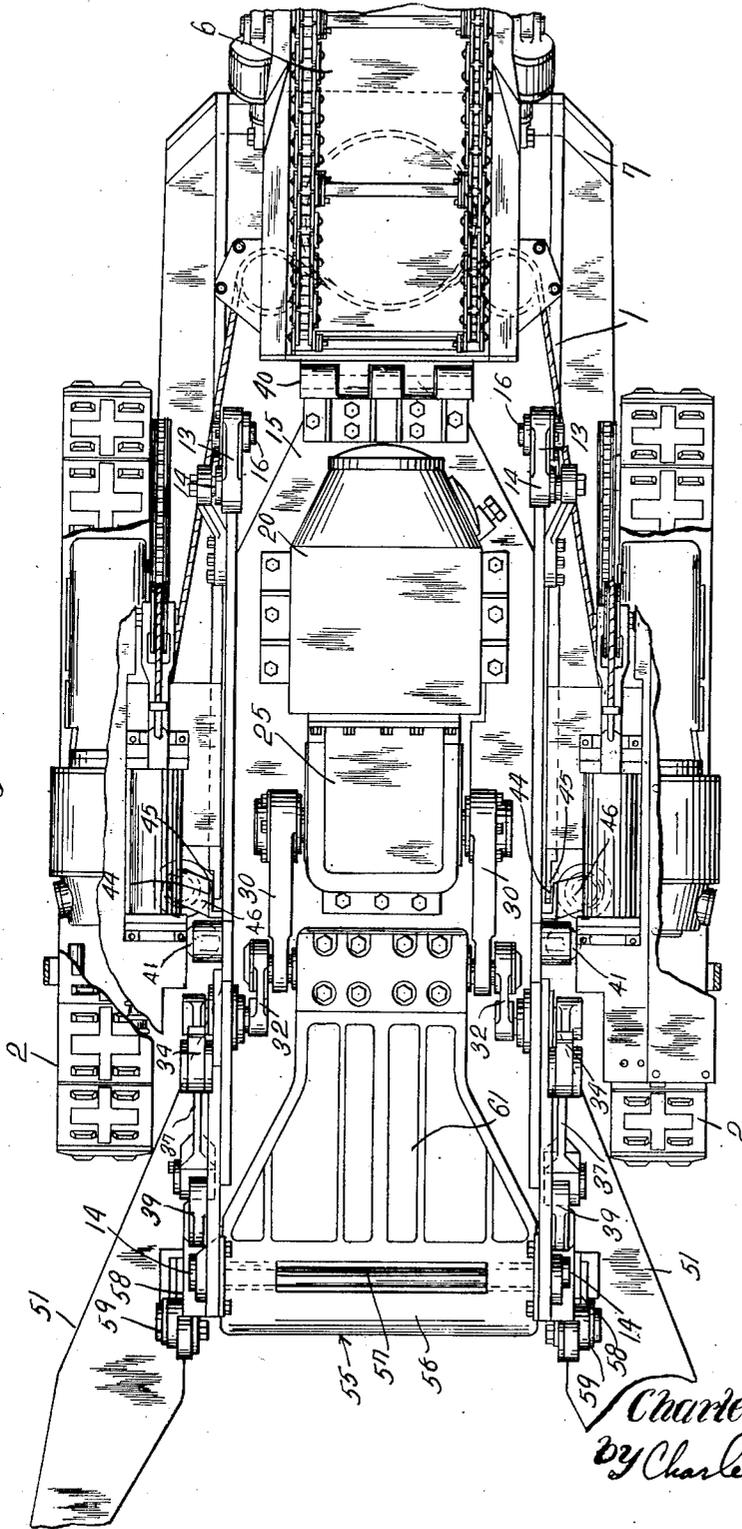
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MATERIAL LOADING APPARATUS

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Fig. 5.



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Fig. 6.

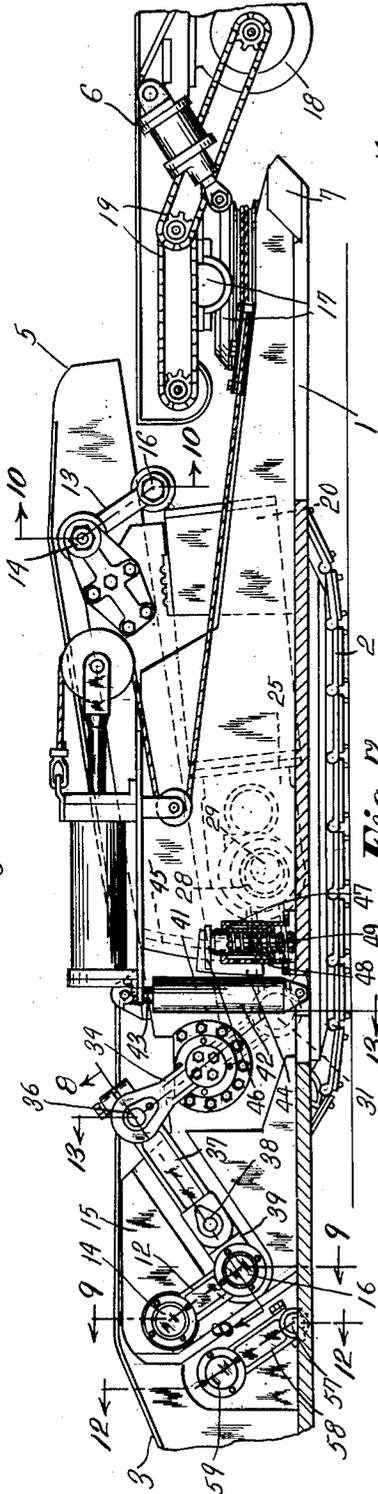
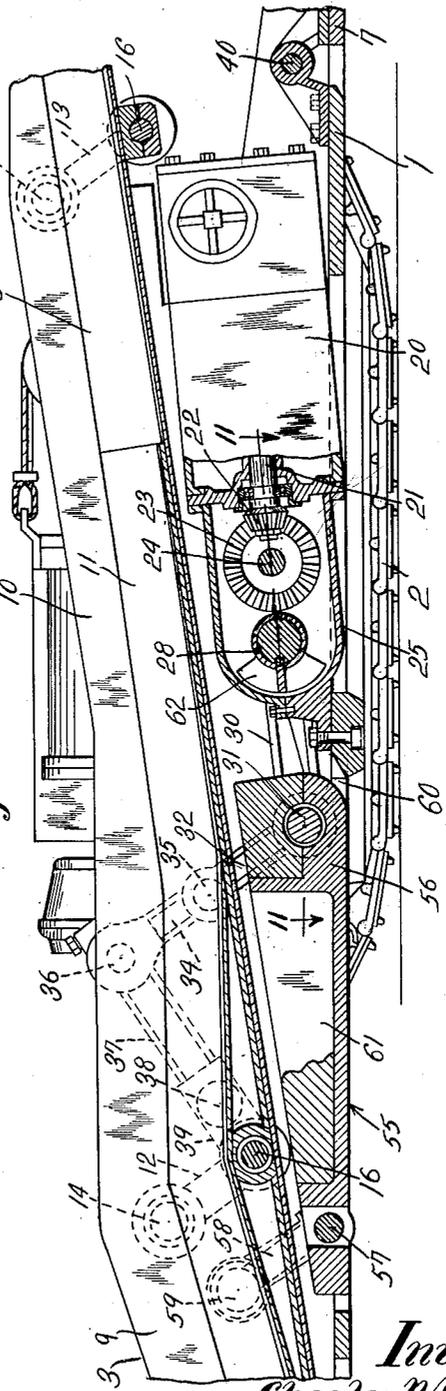


Fig. 7.



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MATERIAL LOADING APPARATUS

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Fig. 9.

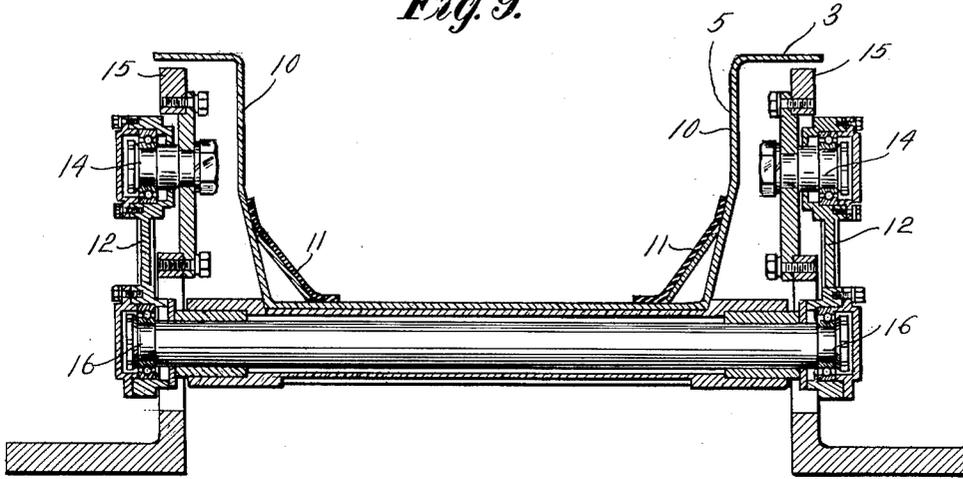


Fig. 10.

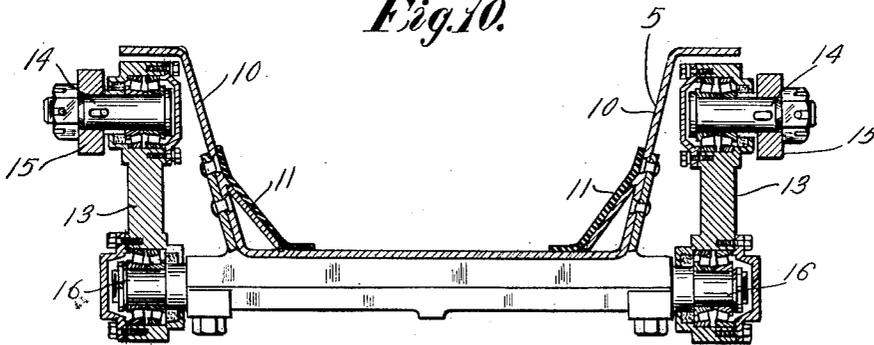
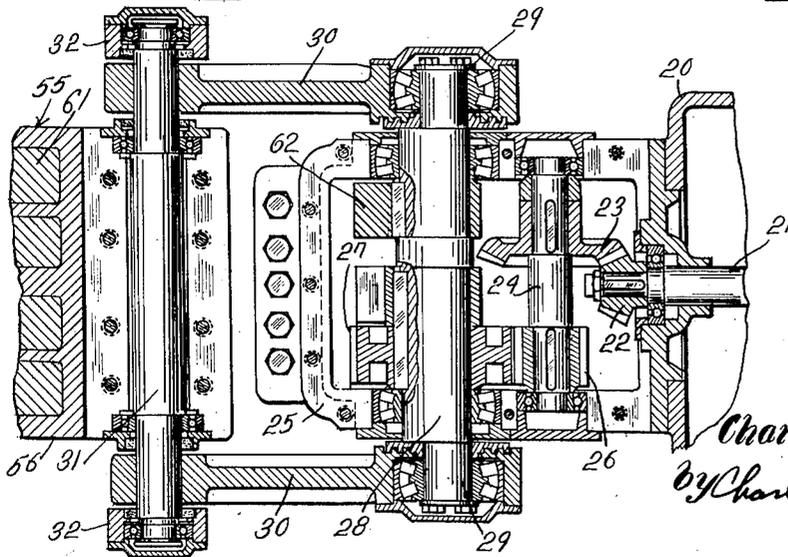


Fig. 11.



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2,650,692

MATERIAL LOADING APPARATUS

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Fig. 12.

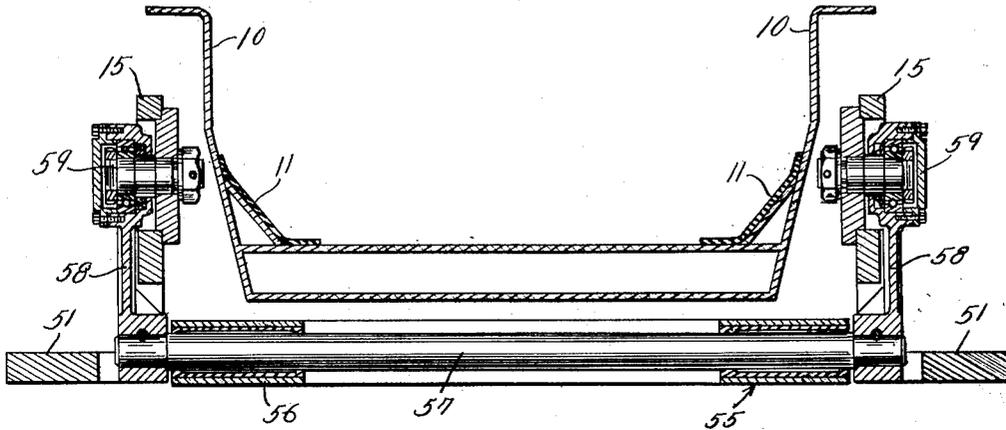


Fig. 13.

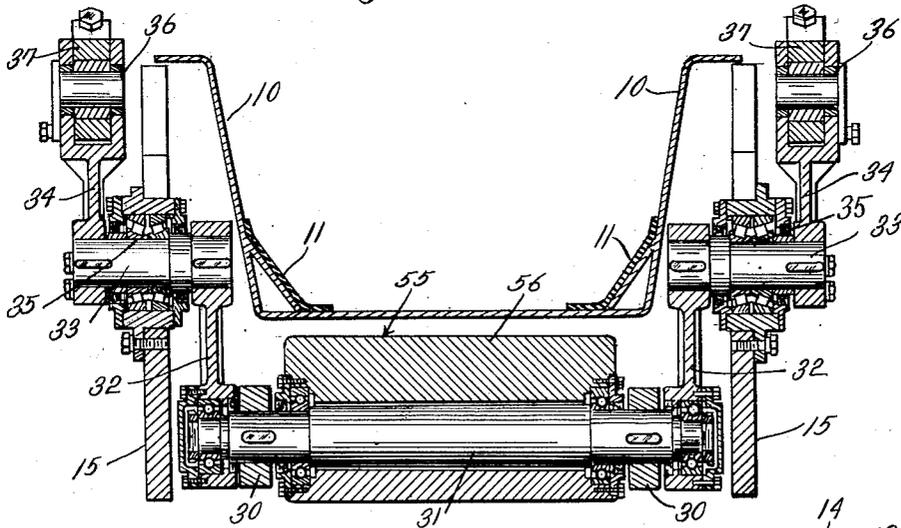
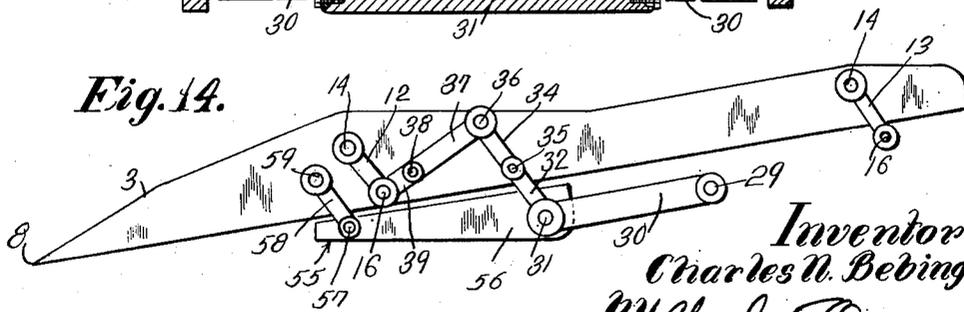


Fig. 14.



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UNITED STATES PATENT OFFICE

2,650,692

MATERIAL LOADING APPARATUS

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Application November 28, 1947, Serial No. 788,703

6 Claims. (Cl. 198—14)

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This invention relates to loading apparatus and more particularly to improvements in loading apparatus having a vibratory gathering head for gathering the loose material to be loaded. From one aspect, the invention relates to improved counterbalancing means for the vibratory gathering head whereby the unbalanced forces are kept at a minimum, thereby substantially reducing vibrations set up within the machine during its operation.

In mobile loading machines, such as are used in loading loose material in underground mines, not only are loading efficiency and ease in maneuverability necessary, but also extreme compactness is essential due to the relatively restricted spaces in which the machine must operate. In order to obtain compactness and efficiency in the gathering of loose material in underground mines, a machine of the vibratory gathering head type, more or less similar to that of the present invention, was developed by me, as disclosed in Patent No. 2,234,071, granted March 4, 1941.

The present invention contemplates improvements over the previous machine disclosed in the patent above referred to, in part in the provision of improved counterbalancing means associated with the vibratory gathering head, whereby an improved smoothness of operation and an increase in overall efficiency may be obtained, and in part in the provision of improved shovel supporting means, whereby dependence on hydraulic shovel positioning means may be replaced by improved mechanical support, and occasion for shovel readjustment may be minimized. By the improved construction and arrangement of parts in my present invention not only are unbalanced forces kept at a minimum, but also the counterbalancing means is arranged and mounted in a novel manner so that extreme compactness is obtained. Due to the novel arrangement of the counterweight means close to the center of gravity of the head, an effective minimization of vibration is made possible. Further, by the provision of the guiding and supporting means for the forward gathering end of the head, the head is adequately guided, and has its penetrating edge maintained steadily in desired relation to the bottom.

An object of the present invention is to provide an improved loading apparatus constituting a substantial improvement over previously known generally similar apparatus. Another object is to provide an improved loading apparatus of the vibratory gathering head type whereby

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loose material may be easily and relatively smoothly gathered and loaded by a substantially continuous operation. Still another object is to provide an improved mobile loading machine especially designed for use in loading loose material in underground mines. A still further object is to provide a machine of the vibratory gathering head type having improved means for keeping the unbalanced forces at a minimum, thereby effectively reducing the vibration set up within the machine as a result of the vibratory action of the gathering head. Yet another object is to provide improved counterweight means associated with the vibratory gathering head in a novel manner for substantially reducing vibration. A further object is to provide a novel and extremely compact arrangement of counterweight means within the body of the machine in adjacency to the center of gravity of the loading head. Another object is to provide improved mechanism for operatively connecting the counterweight to the loading head, together with improved actuating means for the loading head. These and 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:

Figs. 1 and 2, taken together, constitute a plan view of a loading machine in which an illustrative form of the invention is embodied.

Figs. 3 and 4, taken together, constitute a side elevational view of the machine shown in Figs. 1 and 2.

Fig. 5 is a fragmentary plan view, with parts of the vibratory gathering and elevating head removed and parts broken away and in section.

Fig. 6 is a fragmentary longitudinal vertical sectional view taken substantially on line 6—6 of Figs. 1 and 2, with parts omitted.

Fig. 7 is a longitudinal vertical sectional view taken substantially on line 7—7 of Fig. 1.

Fig. 8 is a detail sectional view taken on line 8—8 of Fig. 6.

Fig. 9 is an enlarged cross-sectional view taken substantially on lines 9—9 of Fig. 6.

Fig. 10 is an enlarged cross-sectional view taken substantially on line 10—10 of Fig. 6.

Fig. 11 is a substantially horizontal sectional view taken on lines 11—11 of Fig. 7.

Fig. 12 is an enlarged cross-sectional view taken substantially on line 12—12 of Fig. 6.

Fig. 13 is an enlarged cross-sectional view taken substantially on line 13—13 of Fig. 6.

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Fig. 14 is a somewhat schematic view of the vibratory gathering and elevating head and associated counterweight means.

The improved loading apparatus, as shown in the drawings, is of the tractor mounted, frontal attack type, although, evidently, the invention may be embodied in loading machines mounted in other manners and may be used for purposes other than loading.

The machine generally comprises a mobile base including a main frame 1 carried by conventional crawler treads 2, 2 at the opposite sides of the frame, and these crawler treads are driven and may be controlled to effect propulsion and steering of the machine in a well known manner. Carried above the main frame is a vibratory gathering and elevating head 3 having, as shown in Fig. 1, a relatively wide front gathering head portion 4 and a relatively narrow troughlike portion 5 extending rearwardly of the widened portion and arranged to gather and elevate the material to be loaded and to discharge the material onto a rear discharge conveyor 6 carried by a rearward projection 7 of the main frame 1. The front widened gathering head portion 4 has a serrated front penetrating edge at 8, and is formed with forwardly diverging side walls 9 which converge into the side walls 10 of the narrow troughlike portion 5 in the manner fully described in my Patent No. 2,234,071 above referred to. As shown in Figs. 7, 9, 10, 12 and 13, the troughlike portion 5 of the gathering and elevating head is provided with strips of resilient material, along portions of the sides and bottom thereof, as indicated at 11, such strips preferably composed of rubber impregnated material, for providing a high coefficient of friction and to attain greater resiliency for reducing the disintegration of the material being loaded. The gathering and elevating head 3 is mounted for oscillatory movement on pairs of forward and rearward hanger arms 12 and 13 (Figs. 6 and 14) of equal length and arranged in parallel relation and pivotally mounted at their upper ends at 14 on the vertical sides of a tiltable upper frame 15 and pivotally connected at their lower ends at 16 to the sides of the gathering and elevating head. The rear discharge conveyor is pivotally mounted at 17 on the rearward projection 7 of the main frame 1 to swing horizontally and vertically relative to the gathering and elevating head, and this conveyor is driven by an independent motor 18 through suitable transmission connections 19. The specific structure of the rear discharge conveyor and its swinging and tilting means may be generally similar to those described in the patent above referred to, and since they do not per se enter into the present invention, further description thereof is herein unnecessary.

In accordance with this invention, carried centrally by the upper frame 15 of the machine beneath the vibratory gathering and elevating head is a motor 20, having keyed to the forward end of its power shaft 21 a bevel pinion 22 (see Fig. 11) meshing with a bevel gear 23 keyed to a transverse shaft 24 suitably journaled within a gear housing 25 carried by the upper frame 15. Keyed to and driven by the transverse shaft 24 is a spur pinion 26 meshing with a spur gear 27 keyed to a transverse shaft 28, likewise suitably journaled within the gear housing 25. The shaft 28 projects horizontally through the sides of the gear housing and has formed at the projecting sides thereof eccentric or crank portions 29 which are engaged by parallel connecting rods 30 arranged exte-

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riorly of the housing at the sides thereof. The forward ends of these connecting rods are pivotally connected to a transverse shaft 31. The shaft 31 is suitably journaled at its opposite ends within crank arms 32, 32 (Fig. 13) secured to aligned transverse shafts 33, 33 suitably journaled within the sides of the upper frame 15. Secured to the outer ends of the shafts 33 at the outer sides of the upper frame and spaced 180° with respect to the crank arms 32 are crank arms 34. The shafts 33 provide the pivots 35 for the crank arms 32 and 34 on the sides of the upper frame. The crank arms 34 are pivotally connected at 36 to links 37, in turn pivotally connected at 38 to arms 39 integral with the front hanger arms 12. Thus, when the eccentrics or cranks 29 are rotated by the motor 20, the gathering and elevating head 3 is rapidly oscillated back and forth on its arm mountings, for a purpose to be later explained, through the connecting rods 30, crank arms 32 and 34, links 37 and arms 39 integral with the front hanger arms 12. The gathering and elevating head is rapidly oscillated with relatively short strokes of uniform length.

The tiltable upper frame 15 on which the vibratory gathering and elevating head 3 is mounted is pivoted at 40 at its rearward end on the main frame 1 to swing in a vertical plane relative thereto, thereby to raise and lower the front penetrating edge 8 of the front widened gathering portion 4 of the head. The means for swinging the upper frame about its pivot 40 comprises a pair of upright extensible hydraulic jacks 41 arranged at the opposite sides of the forward portion of the main frame. These jacks include cylinders 42 pivoted at their lower ends on the main frame and contain reciprocable plungers 43 pivoted at their upper ends to the sides of the upper frame 15. By trapping liquid in these jacks, the tiltable frame may be locked in adjusted position. The upper frame has guides 44 slidably engaging arcuate guideways 45 on the forward portion of the main frame for guiding the upper frame as it is swung in a vertical direction about its pivot. The pivoted upper frame and its swinging means are similar to those described in the above mentioned patent. The guides 44 have outer lateral projections 46 at their tops which engage plungers 47 guided in vertical cylinders 48 secured to the main frame. Springs 49 in the cylinders act on the plungers to urge the latter upwardly, thereby to support a major portion of the weight of the swinging frame when the latter is in its lowered position. When the shovel is raised, the plungers do not engage the projections 46. By virtue of the fact that the springs receive the major portion of the weight of the swinging frame when the shovel is lowered, leakage from the cylinders 42 due to high pressures in the hydraulic jacks 41 is eliminated.

In this improved construction, to prevent the front penetrating edge 8 of the widened front portion 4 of the head from digging into the floor, the forward part of frame 15 has forward side projections 51 extending beneath the head and provided with bottom floor engaging shoes 52 and upper guide portions 53 engaging the sides of the forward widened portion of the head for guiding the latter during its oscillation. These floor engaging shoes 52 serve to prevent the penetrating edge of the head from running into the floor in the lowered position of the head, in the manner shown in Fig. 3.

Now referring to the improved counterbalancing means, generally designated 55, for offsetting

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the unbalanced forces of the vibrating gathering and elevating head 3 to keep vibration of the machine at a minimum, it will be noted that arranged beneath the vibratory head on the upper frame 15, in advance of the main frame, is an oscillatory counterbalancing weight 56. This weight is arranged in substantial parallelism with the vibratory head and is of a substantial width and length, as shown in Fig. 5, providing a relatively flat construction to enable location thereof close to the bottom of the vibratory head in the restricted space provided, as shown. This weight is pivotally mounted at its rear end on the transverse shaft 31 and at its forward end on a transverse shaft 57 secured to arms 58 pivotally mounted at 59 on the sides of the upper frame 15. The bottom of the upper frame is cut away at 60 to clear the sides and ends of the weight, thereby to permit oscillatory motion of the weight with respect thereto. The weight is hollowed out at its upper side to receive a heavy mass 61, such as lead or other heavy metal. In this novel construction, the counterweight is of substantially equal mass with the gathering and elevating head 3, and is arranged to oscillate in a path extending in the same general direction as the path of oscillation of the head, and its center of gravity and the center of gravity of the vibratory head lie in common planes parallel to the parallel arms 12 and 13, and these centers of gravity are relatively close to each other. Thus, a nearly perfect balance between the head and counterweight is afforded, keeping the unbalanced forces at a minimum. Of course, with the arrangement shown, the instantaneous directions of motion of the head and counterweight are in opposition, to cancel out the unbalanced forces. Another counterweight 62 is keyed to the shaft 28 to counterbalance the offset crank portions 29 and the weight supported thereby. The connections between the crank pins 29 and the head 3 are such that rearward movements of the head always have an upward component while the forward movements of the head have a downward component.

The general mode of operation of the loading apparatus may be described as follows: The loading machine may be propelled about the mine and maneuvered with respect to the work by the crawler treads 2 in a well known manner. During transport, the forward ends of the gathering and elevating head 3 and the tiltable upper frame 15 are held raised above the floor level by the hydraulic jacks 41, and when the working place is reached, the jacks may be operated to lower the frame shoes 52 into contact with the floor to bring the penetrating edge 8 of the head into adjacency with the floor. The motor 20 may then be operated to impart, through the arms and links, a rapid oscillatory motion to the head in a direction generally lengthwise thereof, and, concurrently, the crawler treads may be operated to advance the head toward the material to be loaded, to feed the widened front head portion 4 beneath the loose material. As the head is rapidly oscillated, the loose material is gathered thereon and moved rearwardly and upwardly along the trough portion 5 to discharge at its rear end on the rear discharge conveyor 6, by which the material is conveyed rearwardly of the machine to a suitable point of disposal. The vibratory action of the gathering and elevating head 3, resulting from the coordination of the relatively high speed and short stroke reciprocal movement with the angle and disposition of

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the hanger arms 12 and 13 produces a gathering and elevating motion which causes the loose material to move steadily and relatively smoothly along the inclined trough portion 5, thus reducing disintegration of the material; and due to the novel counterbalancing means associated with the head, such vibratory action of the head produces comparatively little vibration within the machine as a whole. The counterbalancing means so offsets the unbalanced forces resulting from the vibratory action of the head that there is little vibration transmitted to the frame of the machine, thereby enabling the latter to move with comparative ease under the propulsion of the crawler treads during the gathering and loading operation. As the connecting rods 30 are rapidly oscillated by the cranks 29, the gathering and elevating head is rapidly oscillated, and during the rearward stroke of the head, the material on the head is carried rearwardly and upwardly; and during the forward stroke of the head, the latter passes beneath the material thereon, and during such head oscillation, the material is thrown a slight distance upwardly from the head bottom during the rearward stroke so that the head may move forwardly relative to the suspended material during its forward stroke, and when the end of the forward stroke is reached, the material has again settled down on the head in such manner as again to be moved rearwardly and upwardly during the rearward stroke. Thus, the rear stroke of the head imparts sufficient momentum to the material to carry it rearwardly and upwardly a slight distance while the material is freely falling during the forward stroke of the head. Thus the improved vibratory gathering and elevating head rapidly and continuously gathers and conveys the material with substantially no disintegration, and the material moves in a substantially steady stream rearwardly and upwardly along the trough to discharge. Since the manner in which the gathering and elevating head 3 operates to gather and convey the material is fully described in the above mentioned patent, further description of its mode of operation is herein unnecessary.

As a result of this invention, an improved loading apparatus is provided which has not only relatively large loading capacity and ease in maneuverability, and compactness, but which also operates smoothly and with relatively little vibration, resulting in more economical operation. By mounting the vibratory gathering and elevating head in the manner disclosed, the material to be loaded is moved substantially continuously and relatively smoothly toward its elevated discharge position. By the provision of the improved counterbalancing means associated with the head, the unbalanced forces are kept at a minimum, thereby substantially reducing vibrations set up within the machine during its operation. By mounting and arranging the counterbalancing means in the manner disclosed, close to the center of gravity of the gathering and conveying head, not only is vibration kept at a minimum, but also extreme compactness is attained. The shoes and guides on the frame projections beneath the vibratory head prevent the penetrating edge of the head from digging into the floor when in lowered position, and serve adequately to guide the forward portion of the head during its operation. Other manners of use and advantages of the

invention will be clearly apparent to those skilled in the art.

While there is in this application specifically described one form which the 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 material loading apparatus, the combination comprising a support, an oscillatory gathering and elevating head, means for mounting said head in a forwardly and downwardly inclined position on said support for oscillatory movement relative to the latter, said mounting means including parallel arms pivotally mounted on said support and pivotally connected to said head for supporting the latter for oscillatory motion, means operatively connected to said head for imparting a rapid oscillatory motion thereto, and means for substantially counterbalancing said head to reduce vibration set up within the apparatus during its operation comprising a counterweight arranged in substantial parallelism with said head beneath the latter, and means including parallel arms pivotally mounted on said support and pivotally connected to said weight for supporting the latter for oscillatory motion relative to said head, and certain of said weight supporting arms constituting a portion of said motion imparting means.

2. In a material loading apparatus, the combination comprising a support, an oscillatory gatherer and conveyor element, means including parallel arms pivotally mounted on said support and pivotally connected to said gatherer and conveyor element for supporting the latter for oscillatory motion, a counterweight element, means including parallel arms pivotally mounted on said support and pivotally connected to said counterweight element for supporting the latter for oscillatory motion relative to said gatherer and conveyor element, and certain of said last mentioned arms being connected to certain of said first mentioned arms to cause oscillatory movement of said gatherer and conveyor and said counterweight in relatively opposite directions to keep the unbalanced forces at a minimum, and means for actuating certain of said arms.

3. In a material loading apparatus, the combination comprising a mobile support, an elongated oscillatory gathering and elevating head extending longitudinally above said support and having a front penetrating edge disposable near the ground surface, means for mounting said head in a forwardly and downwardly inclined position on said support for oscillatory movement relative to the latter with its penetrating edge close to the ground surface, said mounting means including parallel arms pivotally mounted on said support and pivotally connected to said head for supporting said head for oscillatory motion, means for imparting a short-stroke oscillatory motion to said head to effect gathering and loading of loose material comprising a lever arm pivotally mounted on said support, and means for operatively connecting said arm to said head, and counterweight means for said head to reduce the vibration set up within the apparatus during its operation comprising an elongated counterweight disposed beneath and in substan-

tial parallelism with said head between the latter and said support, parallel swingable supporting elements mounted on said support for supporting said counterweight for oscillatory motion relative to said head in opposition to head-movement, said lever arm of said motion imparting means connected to and swingable with one of said supporting elements for said counterweight.

4. In a material loading apparatus, the combination comprising a mobile base, an elongated vibratory conveyor for conveying loose material, an elongated vibratory counterweight disposed between said conveyor and said base and having its path of vibratory motion generally parallel with the direction of the path of vibratory motion of said conveyor, means for mounting said conveyor and said counterweight both at longitudinally spaced points on said base with a point of mounting of said conveyor located longitudinally of said base intermediate said spaced points of said mounting means for said counterweight, said counterweight being of substantially equal mass with said conveyor with its center of gravity relatively close to the center of gravity of said conveyor, means for effecting relatively rapid vibratory motion of said conveyor, and means for operatively connecting said counterweight to said conveyor to effect a similar motion of said counterweight in opposition to and of substantially the same amplitude as the vibratory motion of said conveyor to attain a nearly perfect balance between said conveyor and said counterweight thereby to keep the unbalanced forces at a minimum during the conveying operation.

5. In a material loading apparatus, the combination comprising a support, a vibratory gatherer for gathering and loading loose material, parallel arms for mounting said gatherer at longitudinally spaced points on said support for vibratory movement relative thereto, a vibratory counterweight arranged relatively close to and in substantial parallelism with said gatherer, parallel arms for mounting said counterweight at longitudinally spaced points on said support for vibratory movement relative to said gatherer in the same general direction as the path of vibratory motion of said gatherer, said gatherer and said counterweight being of substantial equal mass and arranged with their centers of gravity in close adjacency, and means for vibrating said gatherer and said counterweight embodying means associated with certain of said arms for operatively connecting said gatherer and said counterweight for relative vibratory movements in opposed relation and of substantially the same amplitude substantially to counteract the unbalanced forces as a result of the vibratory motion of one by the unbalanced forces as a result of the vibratory motion of the other.

6. In a material loading apparatus, the combination comprising a vibratory conveyor, a support, means comprising parallel pivoted links for mounting said conveyor on said support for vibratory movement relative thereto, means for effecting rapid vibratory motion of said conveyor comprising a link parallel with said first mentioned links and pivoted midway between its ends, a vibratory counterweight arranged in substantial parallelism with said conveyor and having its path of vibratory motion generally in the direction of the path of vibratory motion of said conveyor, said counterweight being of substantially equal mass with said conveyor with its center of gravity relatively close to the center

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of gravity of said conveyor, said counterweight supported by a pivoted link parallel with said first mentioned link and by said second mentioned link at the opposite side of the pivot of the latter from said conveyor so that said counterweight has a similar vibratory motion in opposition to and of substantially the same amplitude as the vibratory motion of said conveyor thereby to reduce vibrations set up within the apparatus during its operation.

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