July 10, 1956 C. F. BALL 2,753,971

MATERIAL GATHERING, RECEIVING, STORING AND DELIVERING APPARATUS

Filed Dec. 22, 1949

6 Sheets-Sheet 1

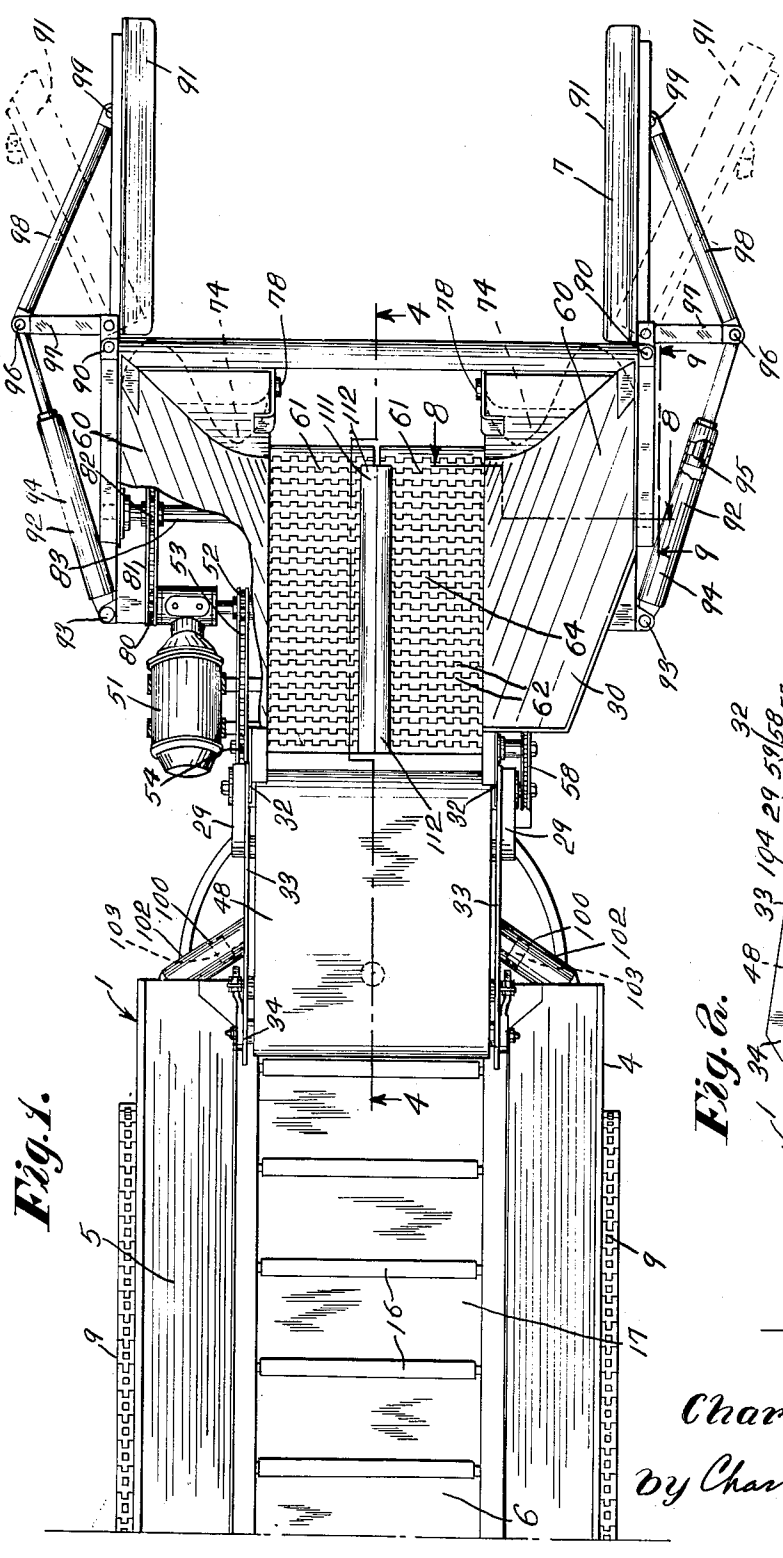

Fig. 1.

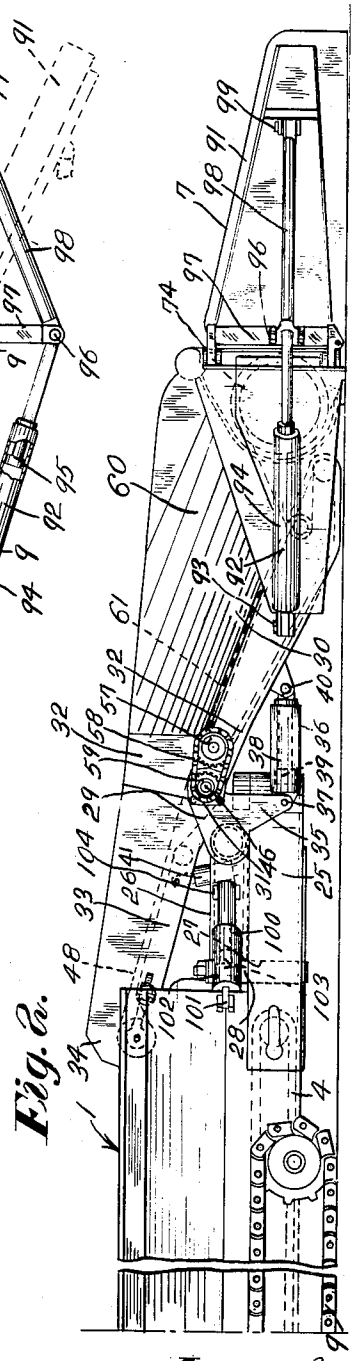

Fig. 2.

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July 10, 1956 C. F. BALL 2,753,971

MATERIAL GATHERING, RECEIVING, STORING AND DELIVERING APPARATUS

Filed Dec. 22, 1949 6 Sheets-Sheet 2

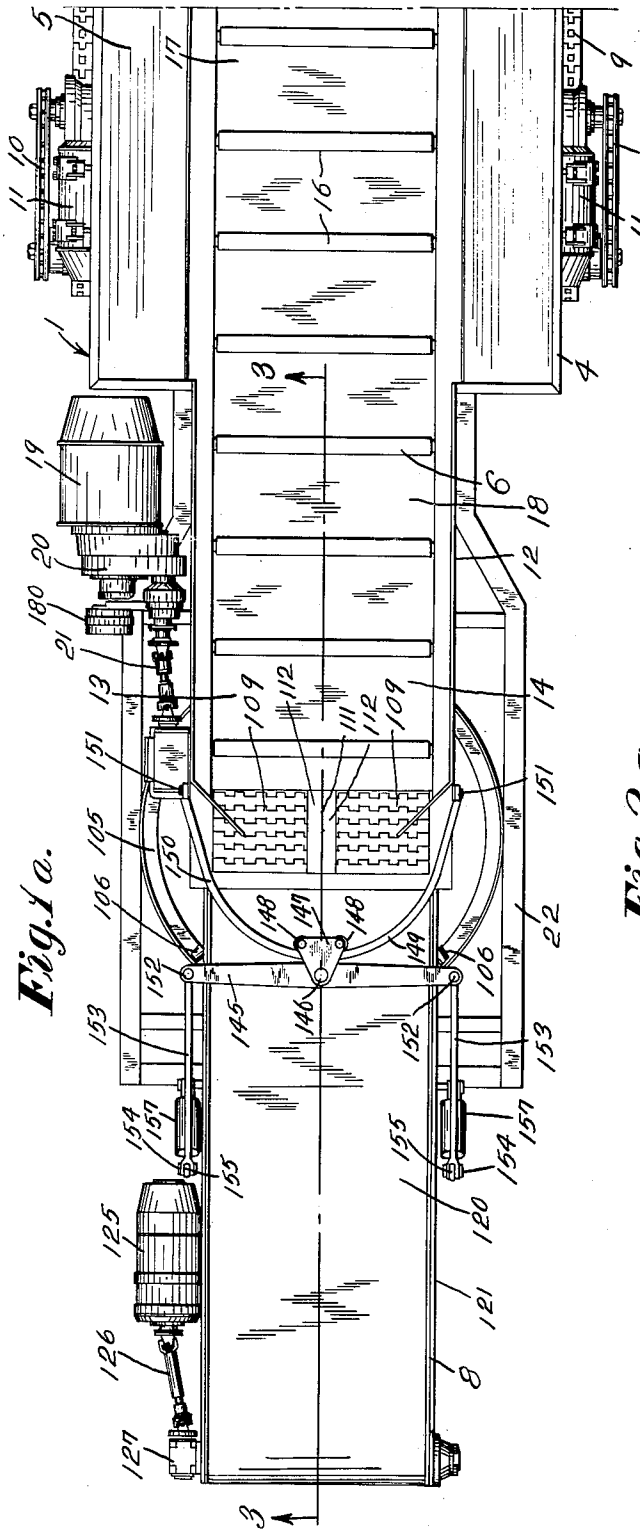

Fig. 1 a.

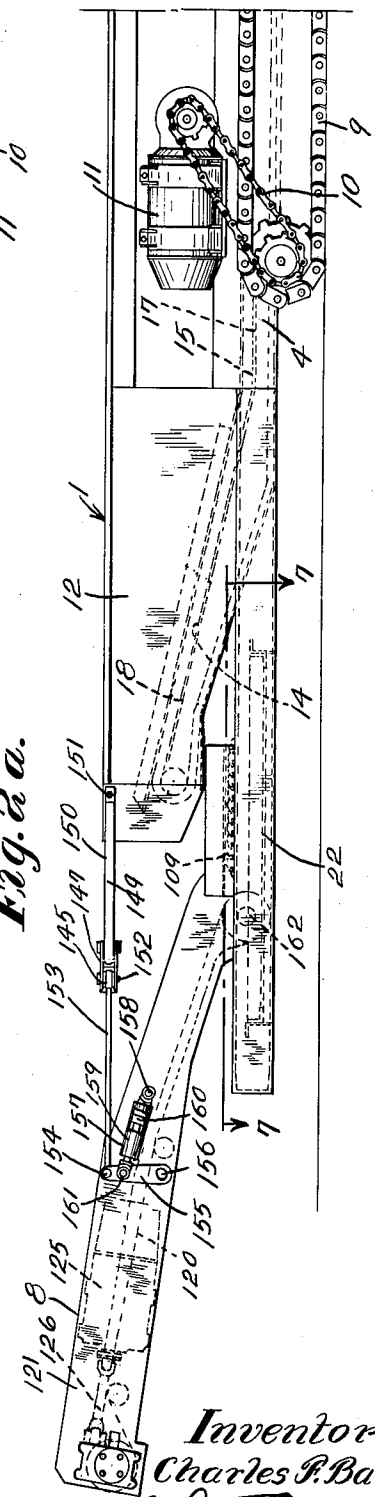

Fig. 2 a.

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MATERIAL GATHERING, RECEIVING, STORING AND DELIVERING APPARATUS

Filed Dec. 22, 1949 6 Sheets-Sheet 3

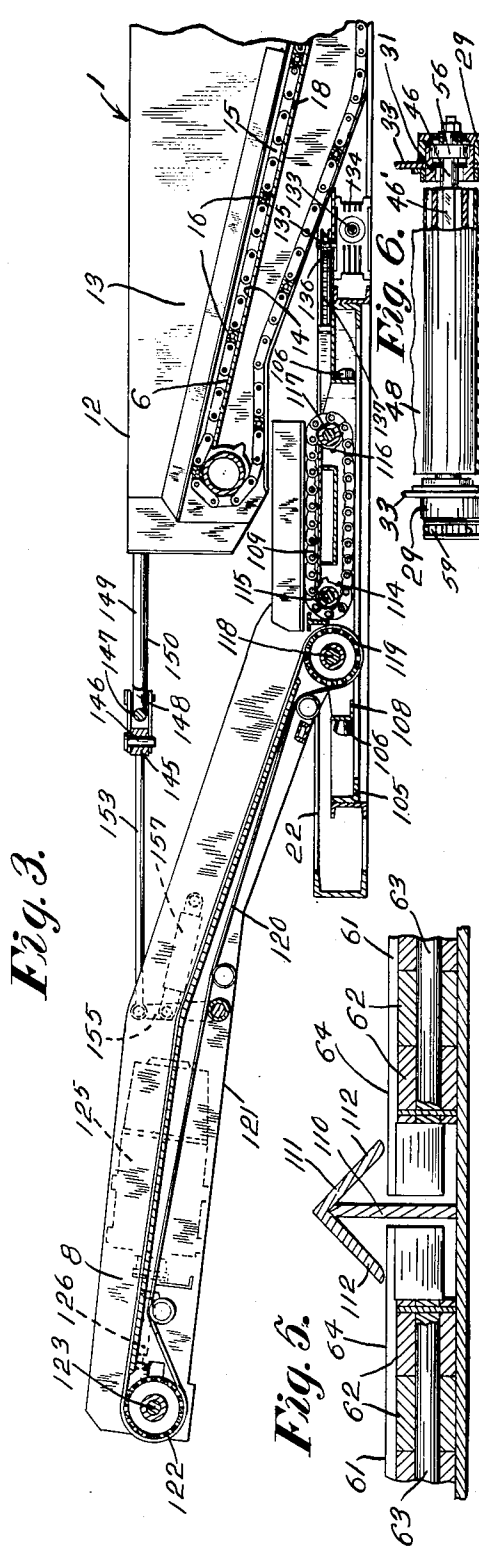

Fig. 3.

Fig. 5.

Fig. 6.

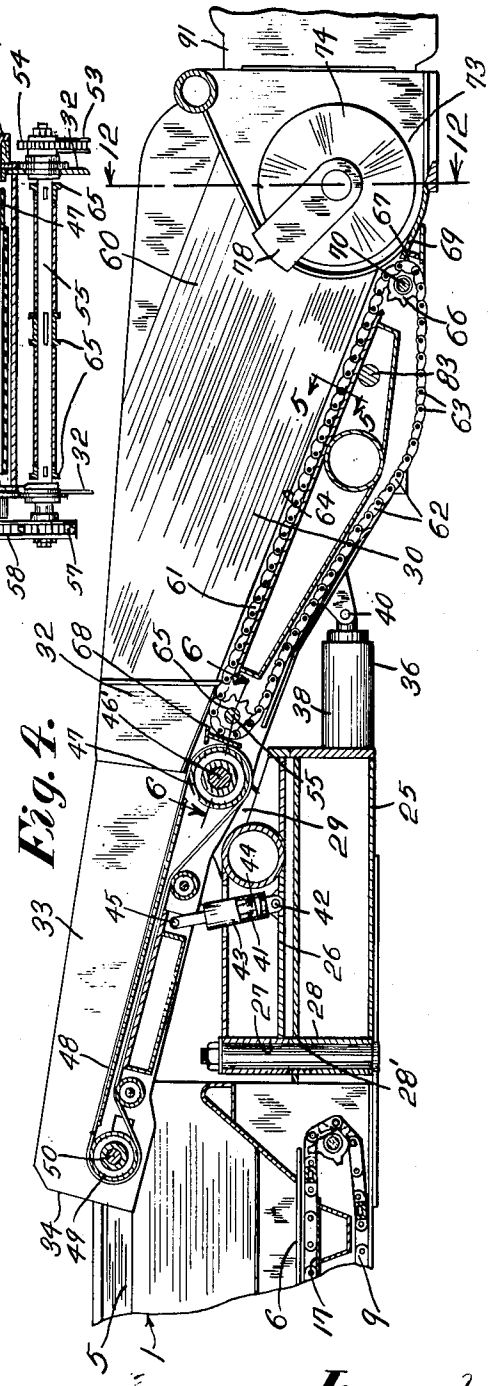

Fig. 4.

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July 10, 1956 C. F. BALL 2,753,971

MATERIAL GATHERING, RECEIVING, STORING AND DELIVERING APPARATUS

Filed Dec. 22, 1949 6 Sheets-Sheet 4

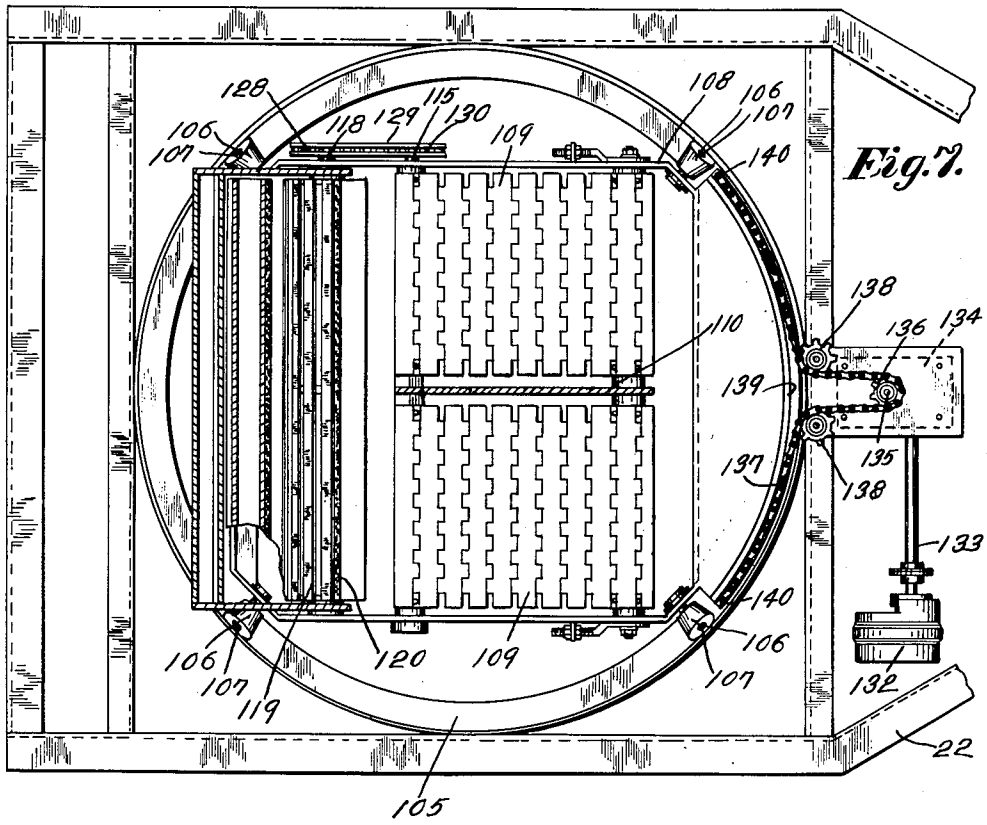


Fig. 7.

Fig. 8.

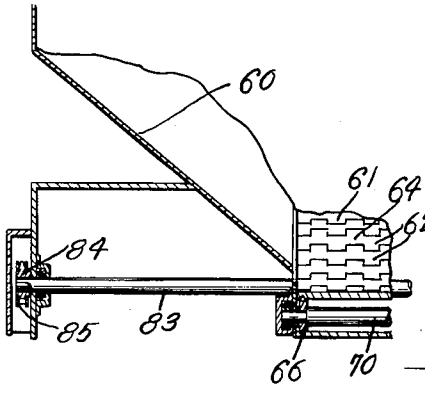
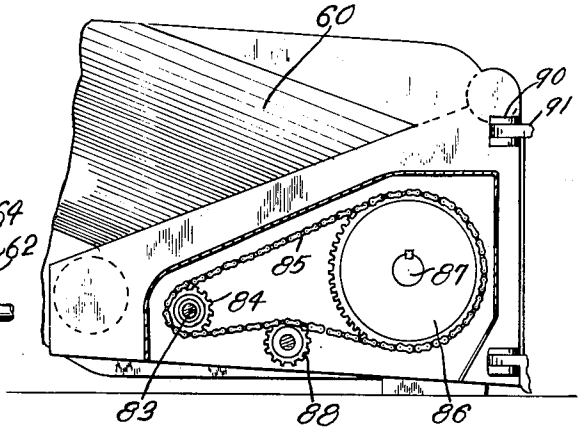


Fig. 9.



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MATERIAL GATHERING, RECEIVING, STORING AND DELIVERING APPARATUS

Filed Dec. 22, 1949 6 Sheets-Sheet 5

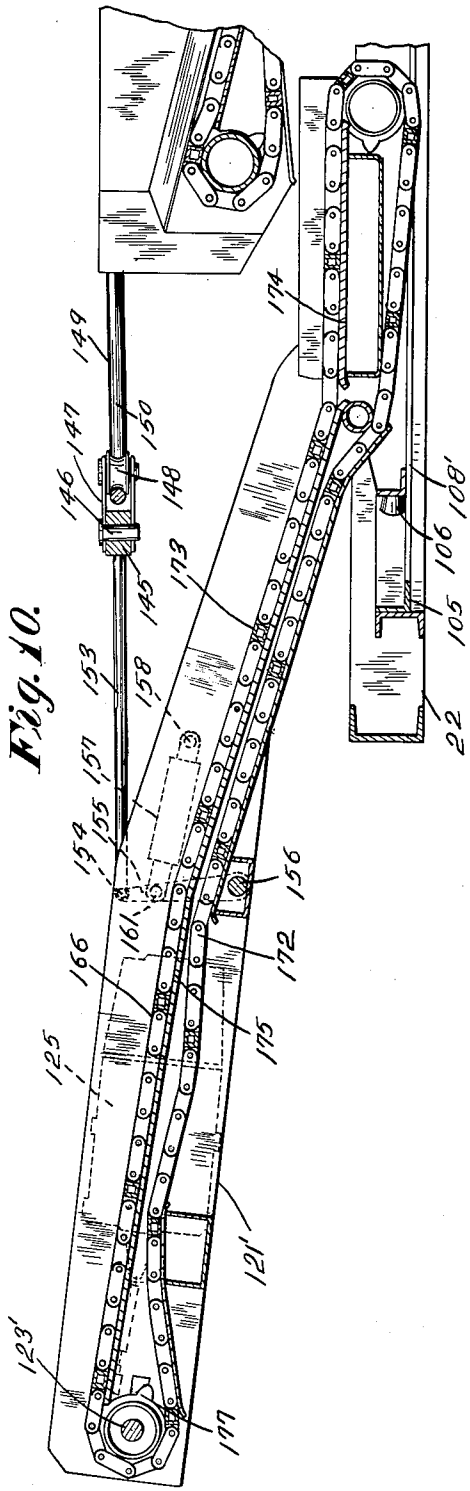

Fig. 10.

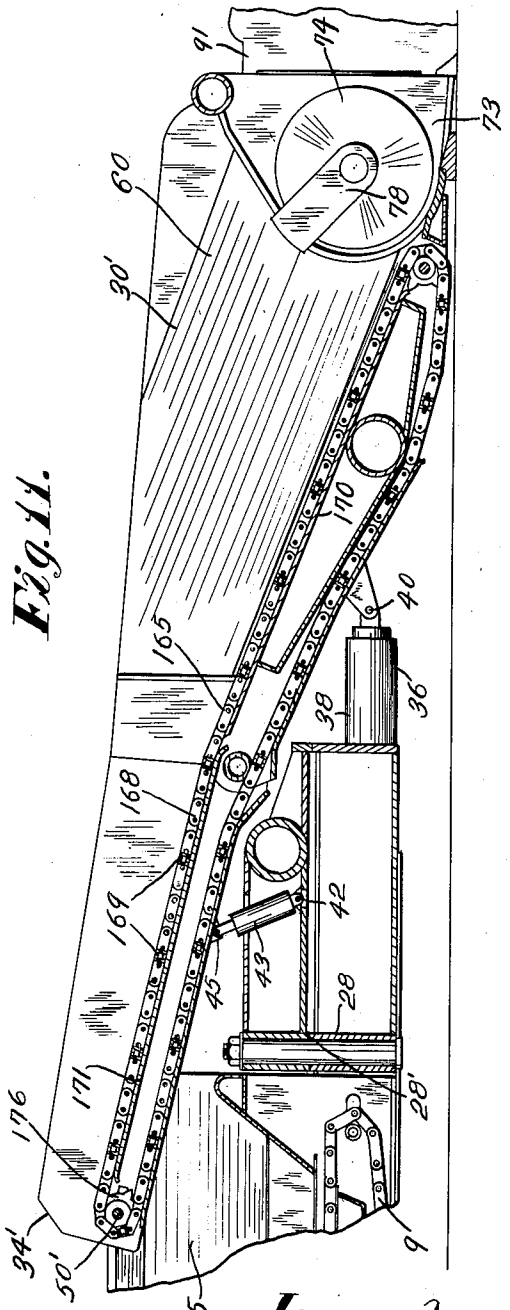

Fig. 11.

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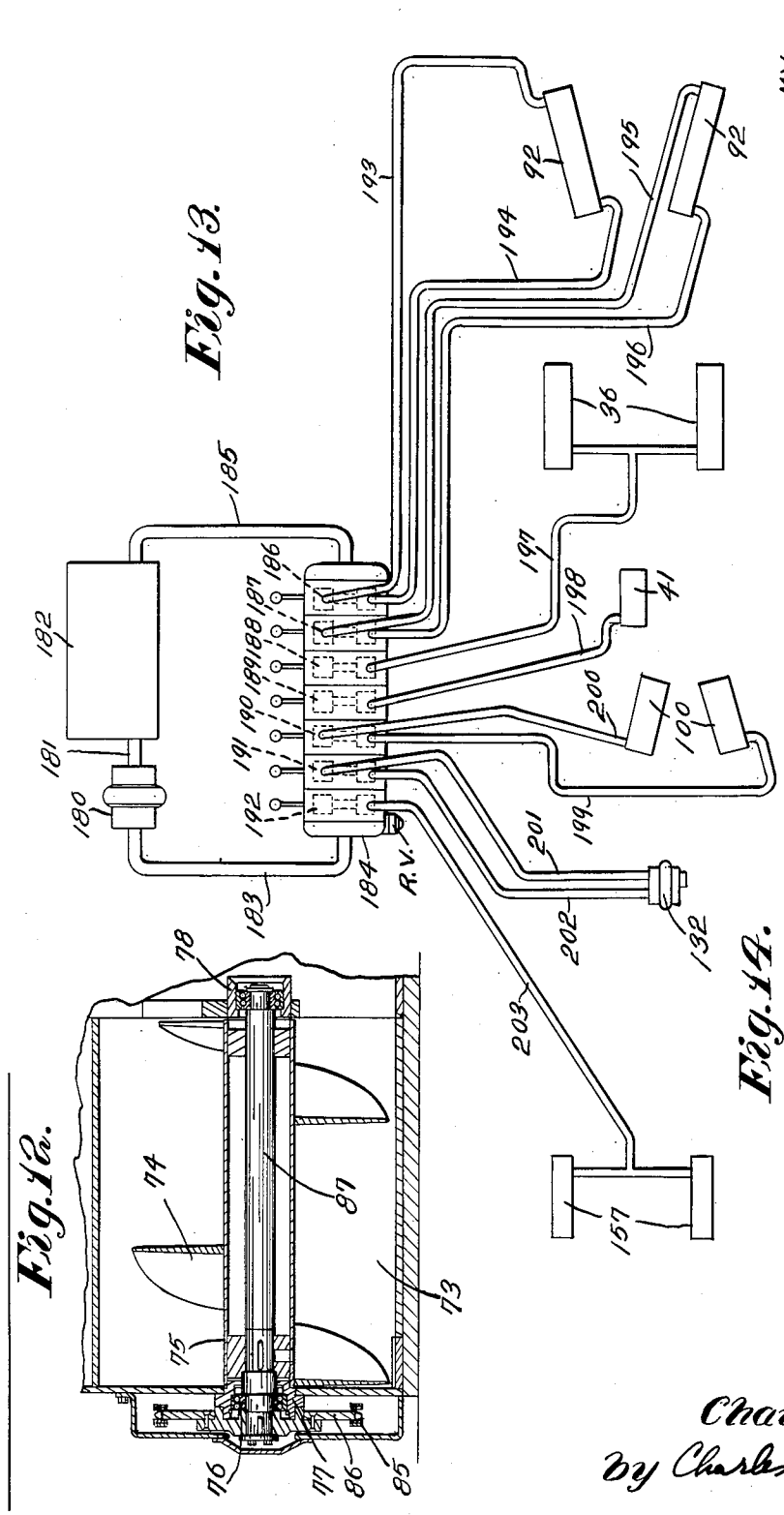
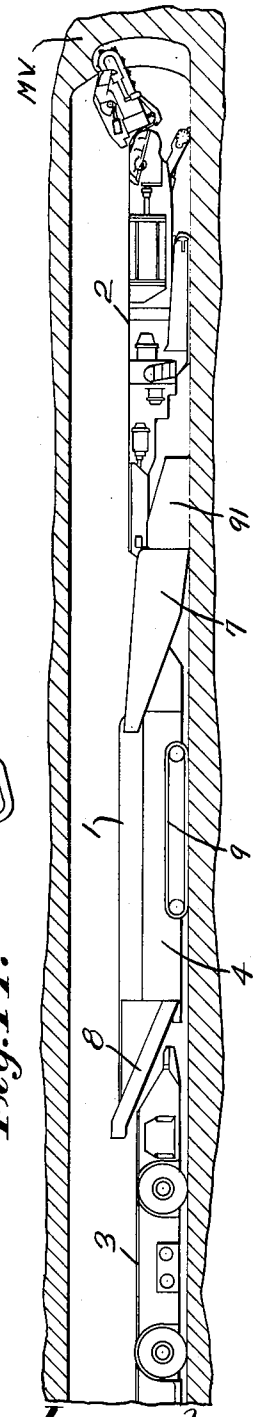
July 10, 1956 C. F. BALL 2,753,971

MATERIAL GATHERING, RECEIVING, STORING AND DELIVERING APPARATUS

Filed Dec. 22, 1949 6 Sheets-Sheet 6





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United States Patent Office 2,753,971 Patented July 10, 1956

2,753,971

MATERIAL GATHERING, RECEIVING, STORING AND DELIVERING APPARATUS

Charles F. Ball, Franklin, Pa., assignor to Joy Manufacturing Company, Pittsburgh, Pa., a corporation of Pennsylvania

Application December 22, 1949, Serial No. 134,563

9 Claims. (Cl. 198—7)

This invention relates to apparatus for gathering, receiving, storing and discharging loose material such as coal in underground mines and more especially to such an apparatus designed for use with a continuous miner for receiving material discharged from the miner, for storing material, for cleaning up any loose material which has fallen to the mine floor during the mining operation, and for discharging material into a material haulage unit such as a shuttle car.

In a continuous miner of a known type coal or other mineral is dislodged from the mine vein and is conveyed by the miner in a disintegrated state and discharged from the miner into a suitable haulage or transportation unit such as a conventional shuttle car. The disintegrated material is discharged in relatively large quantity from the miner, and while there are certain interruptions during the mining operation, the discharge is substantially continuous thereby providing a serious problem of storing the material discharged from the miner during travel of the shuttle car back and forth with respect to its discharge point or during switching of loaded and empty cars with respect to the miner. Also, during the mining operation some of the disintegrated material falls to the mine floor thereby presenting a rather serious floor clean-up problem. The present invention contemplates improvements over known types of material receiving apparatus in that not only is the apparatus capable of effectively receiving, storing and discharging loose material but is also capable of gathering up any loose material which has fallen to the mine floor during the mining operation. The apparatus of the present invention receives the disintegrated material which is substantially continuously discharged from the miner and discharges the material at a controlled rate into the shuttle car, and during traveling of the shuttle car back and forth relative to its discharge point or during switching of loaded and empty cars the apparatus has the capacity to store a substantial quantity of disintegrated material so that the miner may continue to operate in a substantially uninterrupted manner thereby enabling a substantially continuous flow of disintegrated material from the miner to the storage means. Moreover, the apparatus of the present invention embodies improved gathering means which operates at the rear discharge end of the miner so that any loose material which falls to the mine floor during the mining operation may be effectively cleaned up and moved into the receiving means of the apparatus. Conveying means is also provided for the receiving and storing means of the apparatus whereby the material may be quickly transferred from the apparatus to the shuttle car. The gathering, receiving, storing and discharging apparatus is relatively simple and compact in design and due to the provision of hydraulical operating and controlling means, has relatively great flexibility in operation. Furthermore, the apparatus is readily mobile and may be rapidly moved about the mine.

It is accordingly an object of the present invention to provide an improved apparatus for gathering, receiving, storing and discharging loose material. Another object is to provide an improved self-contained mobile apparatus adapted to travel in back of a continuous miner for receiving and storing disintegrated material discharged from the miner and for discharging the material into a conventional transportation unit, and embodying gathering means for cleaning up any loose material which has fallen to the mine floor during the mining operation. Yet another object is to provide an improved apparatus having a relatively large material receiving and storing compartment and having improved conveying means for loading material into the compartment and for discharging material from the compartment. A further object is to provide an improved mobile apparatus adapted to travel in back of a continuous miner for receiving disintegrated material discharged from the miner, and having improved means for cleaning up any loose material which has fallen to the mine floor during the mining operation. Another object is to provide improved conveyors arranged in longitudinal alignment with one discharging onto the other, and the latter operating at a higher speed than the first, so that proper distribution of the material being conveyed is attained. A still further object is to provide in such an apparatus, improved conveying means embodying a rapidly moving conveyor for throwing material back into the compartment to insure proper piling up of the material. Still another object is to provide an improved loading apparatus having improved material gathering and loading means. A further object is to provide an improved gathering head having hopper means associated therewith whereby material may be stored, when desired, within the head itself. Anothed object is to provide an apparatus of the above character having novel features of construction and arrangements 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 one form and a modification which the invention may assume in practice.

In these drawings:

Figs. 1 and 1*a*, taken together, constitute a plan view of a gathering, receiving, storing and discharging apparatus constructed in accordance with one illustrative embodiment of the invention.

Figs. 2 and 2*a*, taken together, constitute a side elevational view of the apparatus shown in Figs. 1 and 1*a*.

Fig. 3 is an enlarged longitudinal vertical sectional view taken substantially on line 3—3 of Fig. 1*a*.

Fig. 4 is an enlarged central longitudinal vertical sectional view taken substantially on line 4—4 of Fig. 1.

Fig. 5 is an enlarged transverse sectional view taken on line 5—5 of Fig. 4.

Fig. 6 is an enlarged detail sectional view taken on line 6—6 of Fig. 4.

Fig. 7 is an enlarged horizontal sectional view taken substantially on line 7—7 of Fig. 2*a*.

Fig. 8 is an enlarged transverse vertical sectional view taken on line 8—8 of Fig. 1.

Fig. 9 is an enlarged longitudinal vertical sectional view taken on line 9—9 of Fig. 1.

Fig. 10 is a central longitudinal vertical sectional view, similar to Fig. 3, illustrating a modified rear discharge conveyor structure.

Fig. 11 is a central longitudinal vertical sectional view, similar to Fig. 4, illustrating a modified front gathering conveyor structure.

Fig. 12 is an enlarged transverse vertical sectional view taken substantially on line 12—12 of Fig. 4.

Fig. 13 is a diagrammatic view illustrating the hydraulic fluid system and the associated control valve means.

Fig. 14 is a diagrammatic side view showing the im-

proved apparatus operating in a mine in conjunction with a continuous miner and a shuttle car.

In this illustrative construction, as shown in the drawings, the improved apparatus for gathering, receiving, storing and discharging material is generally designated 1 and is adapted for association with a continuous miner generally designated 2 and a shuttle car generally designated 3 (Fig. 14). The apparatus is adapted to receive disintegrated material discharged from the continuous miner and to discharge the material received thereby into the shuttle car, and has sufficient storage capacity that the material discharged in a substantially uninterrupted manner from the miner may be stored within the apparatus during travel of the shuttle car relative to its discharge point in the mine or during switching of loaded and empty shuttle cars with respect thereto. The apparatus is also adapted to gather up any loose material which has fallen to the mine floor during the mining operation and to move the material so gathered into the receiving means of the apparatus.

The apparatus 1 generally comprises a portable base or mobile frame 4 having a relatively large material receiving compartment 5 provided with a bottom conveyor 6, a front gathering head 7, and a rear discharge conveyor 8. The frame of the apparatus is desirably mounted on tractor or crawler treads 9, 9 which may be independently operated in a conventional manner through chain and sprocket connections 10 from motors 11 arranged at the sides of the frame 4 as shown in Figs. 1*a* and 2*a*. By properly controlling the relative speeds of these motors, in a well-known manner, the crawler treads may be driven and controlled to propel and steer the apparatus. The compartment 5 is of generally rectangular shape providing relatively large capacity and the frame has a narrow rearward portion or projection 12 which provides a rear discharge passageway 13 extending rearwardly from the compartment 5 as shown in Fig. 1*a*, and the bottom conveyor 6 extends along the bottom of the compartment 5 and rearwardly along the upwardly and rearwardly inclined bottom 14 of the passageway 13. The conveyor 6 is of the conventional endless flight type having side chains 15 suitably guided in guideways within the frame and a series of cross bars or flights 16 are connected between the side chains and travel along plates 17 and 18 extending along the bottoms of the compartment and the rear discharge passageway. The conveyor 6 is driven by a suitable motor 19 located within a recess at one side of the narrow portion 12 of the machine frame and connected to the conveyor side chains 15 through usual connections including a speed reducer 20 and a universal telescopic shafting 21 as shown in Fig. 1*a*. Mounted on a rearward extension 22 of the frame beneath the frame portion 12 is the rear discharge conveyor 8 as shown in Fig. 3.

Now referring to the front gathering head 7 it will be noted that the frame 4 has a longitudinal horizontal forward projection 25 (Figs. 2 and 4) which carries a horizontal swivelled frame 26 pivoted at 27 on a vertical pivot member 28 supported at 28' within the bottom projection 25 as shown in Fig. 4. Secured to the sides of the forward portion of the swivelled frame 26 are upstanding brackets 29, 29 on which a tiltable front head frame 30 is pivotally mounted to swing in vertical planes with respect to the swivelled frame 26. The brackets 29 have circular pivot portions or trunnions 31 at their inner sides and side plates 32 of the tiltable head frame are pivotally mounted on these trunnions. Also, pivotally mounted on the pivot portions 31 are side plates 33 of a tiltable rearward frame portion 34 of trough-like construction. The side brackets 29 have depending portions 35 to which single acting hydraulic jacks 36 are pivotally connected at 37. These jacks include cylinders 38 containing reciprocable pistons 39 having their piston rods extending forwardly from the cylinders and pivotally connected at 40 to lugs integral with the tiltable head frame 30. A centrally located, single acting hydraulic jack 41 is pivoted at 42 on the swivelled frame 26 and includes a cylinder 43 containing a reciprocable piston 44 having its piston rod extending upwardly from the cylinder and pivotally connected at 45 to the bottom of the tiltable rear frame portion 34. Aligned with the pivot for the frames 30 and 34 is a transverse shaft 46 (Fig. 6) secured, as by a hexagonal portion 46' of the shaft, to a pulley 47 arranged between the side plates 32 and engaging and driving an endless conveyor belt 48. A pulley 49 arranged parallel with the pulley 47 is journalled on a transverse shaft 50 suitably supported by the rearward portions of the side plates 33 of the rear conveyor portion 34, and this pulley guides the rearward portion of the conveyor belt. A conventional motor 51 (Fig. 1) is mounted at one side of the tiltable head frame 30 and has a drive sprocket 52 secured to its drive shaft and this sprocket drives an endless chain 53 which in turn engages and drives a sprocket 54 secured to the rear end of a transverse shaft 55 herein arranged parallel with and in front of a pulley shaft 46 (see Fig. 6). The shaft 46 is suitably journalled in bearings 56 supported by the side plates 32 of the tiltable head frame. Secured to the opposite end of the shaft 55 is a sprocket 57 engaging an endless chain 58 which in turn engages and drives a smaller sprocket 59 secured to the pulley shaft 46. The conveyor belt may thus be driven at a relatively high speed by the motor 51.

The tiltable head frame 30 has forwardly and outwardly flared side plate portions 60 which provide a storage hopper as shown in Fig. 1, and suitably guided for circulation within the bottom of the head frame at the bottom of the hopper are endless chain conveyors 61, 61 arranged in parallel side by side relation as shown in Fig. 1 and in longitudinal alignment with the belt conveyor 48 as shown in Fig. 4. Each conveyor 61 is desirably of the closed-link type and comprises a series of relatively wide cross links 62 pivotally connected together by continuous hinges 63 and which cooperate to provide an uninterrupted top conveyor surface 64 which receives the material to be conveyed and conveys the material rearwardly along the bottom portion of the head frame to discharge onto the belt conveyor. The outer surfaces of the conveyor chains 61 are symmetrically curved so that, as the links pass around rearwardly located chain drive sprockets 65 and front chain guide sprockets 66, substantially smooth nearly semi-circular surfaces 67 are provided. Scraper plates or deflectors 68 and 69 (Fig. 4) secured to the sides of the head frame lie closely to the curved surfaces 67 of the conveyor so that any material moved by the conveyors may be scraped off and deflected out of the conveyor paths. The drive sprockets 65 are keyed to the shaft 55 while the guide sprockets 66 are secured to a transverse shaft 70 suitably journalled within the forward portion of the head frame. The conveyors 61 operate at a relatively slow speed, substantially slower than the speed of the belt conveyor 48, and the material conveyed rearwardly by the conveyors 61 is discharged onto the front receiving portion of the high speed belt conveyor. The specific structure of the chain conveyors 61 is fully disclosed in my copending application Ser. No. 86,516 filed April 9, 1949, now matured into Patent No. 2,705,626, granted April 15, 1955, and therefore further description thereof is herein unnecessary. Formed in the forward portion of the head frame at the outer sides of the parallel chain conveyors are transverse chambers 73 in which conveyor screws or scrolls 74 are arranged. These scrolls are mounted on and secured to transverse shafts 75 (Fig. 12) suitably journalled in bearings 76 supported in outer and inner bearing brackets 77 and 78. The outer bearing brackets are secured to the side plates of the head frame while the inner brackets are relatively narrow and are secured to the upper rear walls of the chambers 73. These narrow inner brackets permit the material to be dis-

charged inwardly by the scrolls toward the front receiving portions of the chain conveyors **61**.

The motor **51** also drives a sprocket **80** which is connected by an endless drive chain **81** to a chain sprocket **82** secured to a horizontal cross shaft **83**. The shaft **83** is suitably journalled in the head frame and extends transversely through the orbits of the conveyor chains **61** as shown in Fig. 4. Fixed to the ends of the cross shaft are chain sprockets **84** (see Figs. 8 and 9) connected by endless drive chains **85** to sprockets **86** secured to the scroll drive shafts **87** to which the scrolls are secured. Each drive chain **85** desirably is provided with a conventional take up idler **88**.

Pivotally mounted at **90** on upright axes at the sides of the forward end of the head frame at the outer sides of the scroll chambers **73** are upright deflecting and gathering arms or plates **91** which are adapted to extend to the sides of the mine passageway for deflecting the material on the mine floor inwardly and rearwardly toward the conveyor scrolls and these deflector plates are independently swingable horizontally about their pivots to gather the material on the mine floor and to move the material inwardly toward the conveyor scrolls so that the latter may direct and move the material toward the front receiving ends of the parallel chain conveyors **61**. For swinging the arms a pair of double acting hydraulic jacks **92** is provided. Each jack is pivotally connected at **93** to a side of the head frame and includes a cylinder **94** containing a reciprocable piston **95**. The pistons have their piston rods extending forwardly from the cylinders and the piston rods are pivotally connected at **96** to lateral arms **97** integral with the gathering arms **91**. Brace rods or links **98** extend from the pivots **96** to pivotal connections **99** with the gathering arms for bracing the latter. Thus the gathering arms may be independently swung horizontally inwardly and outwardly about their pivots.

In order to facilitate negotiation of the sharply curved passageways of the mine during tramming of the apparatus and during the loading operation the gathering head may be swung horizontally in one direction or the other relative to the frame **4** of the apparatus. To accomplish this cooperating hydraulic jacks **100** are pivotally connected at **101** to the sides of the front end of the frame **4** and include cylinders **102** containing reciprocable pistons **103** having their piston rods extending forwardly from the cylinders. The piston rods are pivotally connected at **104** to the sides of the swivelled frame **26**. Thus by properly operating the hydraulic jacks **100** the gathering and loading head may be swung horizontally in one direction or the other about the pivot **27** and by trapping liquid in the jacks the head may be locked in adjusted position.

Now referring to the specific structure of the rear discharge conveyor **8** it will be noted that the frame portion **22** carries an annular bearing frame **105** (see Fig. 7) which is engaged by supporting rollers **106** journalled on inclined pivot shafts **107** carried by a swivelled frame **108** (Figs. 3 and 7). The annular bearing frame **105** has its roller engaging surface lying in the surface of a cone so that the swivelled frame is properly maintained centered with respect thereto. The swivelled frame **108** is desirably of generally rectangular shape and has guided for circulation thereon endless chain conveyors **109**, **109** arranged in parallel side by side horizontal relation in a manner similar to the conveyors **61** above described. Both the conveyors **61** and **109** are desirably laterally separated by a central longitudinally extending plate **110** (Fig. 5) to which an angle plate **111** is fixed with its apex pointed upwardly and with its sides **112** diverging laterally and downwardly above the adjacent edges of the conveyors so that the material to be conveyed is deflected laterally onto the conveyors. The conveyors **109** are substantially the same functionally and structurally as the conveyors **61**. The bottom conveyor **6** of the receiving and storing compartment **5** of the apparatus at its rear end overlies the conveyors **109** and discharges onto the conveyors **109** in the manner shown in Fig. 3. The conveyors **109** are driven by drive sprockets **114** fixed to a transverse shaft **115** suitably journalled within the sides of the swivelled frame **108**, and the conveyors pass around idler sprockets **116** secured to a parallel shaft **117** similarly journalled within the sides of the swivelled frame **108**. Arranged rearwardly of the drive shaft **115** is a parallel transverse shaft **118** to which a pulley **119** is secured. The pulley **119** engages an endless, relatively high speed conveyor belt **120** suitably supported by a vertically tiltable conveyor frame **121** of troughlike construction. The conveyor belt extends rearwardly along the conveyor frame and at its rearward portion passes around a pulley **122** fixed to a transverse shaft **123** suitably journalled on the rearward portion of the conveyor frame **121**. A conventional motor **125** is mounted at one side of the rearward portion of the conveyor frame **121** (Fig. 1*a*) and this motor drives through a universal telescopic shafting **126** and a conventional gear speed reducer **127** the shaft **123** for the rear pulley which drives the conveyor belt. The drive sprockets **114** for the chain conveyors **109** are driven by the sprocket **128** (Fig. 7) fixed to and driven by the pulley shaft **118** and connected by an endless drive chain **129** to a larger sprocket **130** secured to the sprocket drive shaft **115**. Thus the chain conveyors **109** are driven by the motor **125** through the belt conveyor **120** at a speed slower than the speed of the belt conveyor, in a manner like the chain conveyors **61**.

The means for rotating the swivelled frame **108** to adjust the lateral position of the discharge end of the rear conveyor **8** comprises a conventional reversible hydraulic motor **132** carried by the frame projection **22** and having its power shaft coupled to a drive shaft **133** which drives through speed reducing gearing **134** a vertical shaft **135**. Fixed to the shaft **135** is a chain sprocket **136** which engages the intermediate portion of a link-chain section **137**. The end portions of this chain section pass around idler sprockets **138** and extend in opposite directions around a curved plate **139** to points of connection at **140** with the sides of the swivelled frame **108**. Thus when the motor **132** is operating one portion of the chain section is drawn in while the other is payed out thereby to effect turning of the swivelled frame in one direction or the other. The swivelled frame may be locked in its adjusted position simply by trapping the liquid within the hydraulic motor.

The tiltable frame **121** of the rear conveyor is suspended from the upper rear portion of the frame **4** of the apparatus as shown in Figs. 1*a*, 2*a* and 3. The suspension supporting means comprises a cross arm **145** centrally pivoted at **146** to a roller-carriage **147**. This carriage has rollers **148** engaging a curved track **149** of a generally U-shaped member **150** secured at its ends at **151** to the rear end of the frame **4**. The ends of the cross arm are pivotally connected at **152** to the front ends of links **153** which extend horizontally and rearwardly along the sides of the conveyor frame. The rear ends of the links are pivotally connected at **154** to the upper ends of levers **155** which are pivotally mounted on transverse axes at their lower ends at **156** at the sides of the conveyor frame. Hydraulic jacks **157** are pivotally mounted at **158** on the sides of the conveyor frame and comprise cylinders **159** containing reciprocable pistons **160** having their piston rods extending rearwardly from the cylinders and pivotally connected at **161** to the levers **155**. By properly operating the jacks **157** the conveyor frame **121** may be swung in a vertical direction about a pivot **162** coincident with the axis of the pulley shaft **118**. By trapping liquid within the jack cylinders the conveyor frame may be locked in its adjusted position.

In the modifications shown in Figs. 10 and 11 a single endless chain conveyor **165** is substituted for the chain

conveyors 61 and the belt conveyor 48 and a single endless chain conveyor 166 is substituted for the chain conveyors 109 and the belt conveyor 120. The chain conveyor 165 is of the endless flight type consisting of side chains 168 to which cross bars 169 are secured and these cross bars travel along a bottom plate 170 on the tiltable head frame 30' and a bottom plate 171 on the tiltable rear conveyor portion 34'. The rear conveyor 166 is also of the chain flight type comprising endless side chains 172 to which cross bars 173 are secured and these cross bars adapted to travel along a bottom plate 174 on the swivelled frame 198' and along a bottom plate 175 on the tiltable conveyor frame 121'. The chains of the front conveyor 165 are driven by chain sprockets 176 which are secured to a cross shaft 50' suitably journalled within the sides of the frame portion 34' and driven by the motor 19 in the same manner as that of the preferred embodiment above described. The rear discharge conveyor 166 is driven by the motor 125 through a cross shaft 123' and chain sprockets 177 likewise in a manner similar to the preferred embodiment. Otherwise, these modified structures are similar to those above described, although the advantages of differential conveyor speeds to provide for improved distribution of the material, are lacking.

Now referring to the hydraulic fluid system and the associated control valve means, shown diagrammatically in Fig. 13, it will be noted that a motor driven pump 180 has its intake connected by a conduit 181 to a liquid reservoir or tank 182 and the pump discharge is connected by conduit 183 to the intake passage of a valve box 184 of a conventional control valve mechanism. The discharge passage of the valve box is connected by a return conduit 185 back to the tank. The valve box consists of a plurality of valve box sections suitably secured together and these sections have bores containing conventional slide valves 186, 187, 188, 189, 190, 191 and 192 each having a suitable control handle. The valve box has a conventional relief valve device RV for relieving the pressure in the fluid system upon overload. The bore containing the valve 186 is connected by conduits 193 and 194 to the opposite ends of the cylinder of one of the jacks 92 for swinging the gathering arms 91 and the bore containing the valve 187 is connected by conduits 195 and 196 to the opposite ends of the cylinder of the other jack. Thus the gathering arms 91 may be independently swung under the control of the valves 186 and 187 in either direction about their pivots. The bore containing the valve 188 is connected by conduit 197 to the cylinders of the jacks 36 for tilting the head frame, while the bore containing the valve 189 is connected by conduit 198 to the cylinder of the jack 41 for tilting the rear conveyor frame 34. The bore containing the valve 190 is connected by conduits 199 and 200 to the outer rear ends of the cylinders of the jacks 100 for horizontally swinging the gathering and loading head. The bore containing the valve 191 is connected by conduits 201 and 202 to the opposite sides of the motor 132 for horizontally swinging the rear discharge conveyor. The bore containing the valve 192 is connected by conduit 203 to the cylinders of the jacks 157 for tilting the conveyor frame of the rear discharge conveyor. The several valves may be positioned to effect supply of liquid under pressure, to effect discharge, or to trap liquid flow all in a well-known manner.

The general mode of operation of the improved gathering, receiving, storing and discharging apparatus is as follows: In Fig. 14 the continuous miner 2 is shown in operating position wherein it dislodges and disintegrates the solid mineral of a mine vein MV, and the disintegrated material is conveyed rearwardly of the miner to discharge at its rear end. The structure of the continuous miner and its mode of operation are fully disclosed in a copending application to John R. Sibley, Serial No. 102,996 filed July 5, 1949. The gathering, receiving, storing and discharging apparatus 1 is arranged during its operation with its loading and gathering head 7 underlying the rear discharge end of the continuous miner near the floor level so that the disintegrated material discharged from the miner is received by the chain conveyors 61 and the material is moved rearwardly of the head by these conveyors onto the belt conveyor 48. Since this belt conveyor operates at a relatively high speed the material discharged therefrom is thrown rearwardly into the compartment 5 and due to the high speed of the belt conveyor the material is properly piled up in the compartment. As the material is discharged by the belt conveyor into the storage compartment, the bottom conveyor 6 may be intermittently operated to move the material rearwardly in the compartment until the latter is completely filled with material. The bottom conveyor 6 of the compartment 5 may be operated to move the material received in the compartment rearwardly from the compartment through the relatively narrow passageway 13 to discharge onto the chain conveyors 109 of the rear discharge conveyor 8. These chain conveyors move the material rearwardly onto the rear belt conveyor 120 which operates at a relatively high speed and which in turn moves the material rapidly along the rear conveyor frame which overlies the material receiving compartment of the shuttle car 3 shown in Fig. 14, and the material is rapidly discharged from the conveyor into the shuttle car. During travel of the shuttle car back and forth with respect to its discharge point in the mine or during shifting of loaded and empty shuttle cars the bottom conveyor 6 may be stopped while the disintegrated material continues to be discharged from the continuous miner onto the loading head 7 and into the compartment 5 and the latter has sufficient capacity so that a substantial quantity of material may be stored therein while the shuttle car is moved away from its position beneath the discharge end of the miner. The conveyors 61 and the belt conveyor 48 of the gathering head may be stopped while the bottom conveyor 6 operates to discharge completely the material from the compartment 5, and the continuous miner may continue to discharge into the hopper of the head, thereby storing a substantial quantity of material within the head itself. The loose material which falls to the mine floor during the mining operation may be cleaned up by the loading head 7 and the deflecting and gathering arms or plates 91 deflect the material on the mine floor inwardly and rearwardly toward the conveyor scrolls 74 for loading by the conveyors 61 as the apparatus is advanced, and the deflector plates may be independently operated to sweep loose material on the mine floor between the sides of the mine passageway laterally inwardly toward the conveyor scrolls 74 which move the material so gathered toward the front receiving ends of the conveyors 61. At times the gathering arms may remain in their outward position, so that upon forward advance of the apparatus bodily over the mine floor, the gathering arms may be forced into the material collected on the mine floor, thereby causing the arms to gather the material and deflect the same toward the receiving ends of the conveyors 61. When the arms are swung outwardly their outer ends are disposed close to the sides of the mine passageway. Thus, a clean path may be maintained at the rear of the continuous miner as mining progresses. Moreover, in case of delay of transportation some material discharged from the continuous miner may be stored on the mine floor in advance of the loading head 7 and when discharge from the apparatus is resumed this stored material may be quickly cleaned up by the loading head and moved rearwardly of the apparatus into the shuttle car. The gathering head 7 during the loading operation may be forced into the material to be loaded by the crawler treads 9 of the apparatus and due to the relatively great weight of the apparatus adequate traction of the treads is attained. The conveyors of the loading head as the material is

gathered may quickly transfer the material rearwardly into the receiving and storage compartment. The mode of operation of the modifications shown in Figs. 10 and 11 is similar to that above described and the primary differences between the structures the modified conveyors and the conveyors of the preferred embodiment is that of structure, in that in the modified structures single conveyors are employed instead of conveyors arranged to operate in tandem.

As a result of this invention an improved apparatus for gathering, receiving, storing and discharging loose material is provided whereby not only may the material be received, stored and discharged when desired but also any loose material on the mine floor may be quickly gathered and loaded. By the provision of an apparatus of the character disclosed not only is some of the material gathered from the mine floor but also a substantially continuous flow of material in relatively large quantity is discharged from the continuous miner onto the conveyors of the loading apparatus. By the provision of a relatively large storage capacity within the apparatus provided by both the storage compartment and the storage hopper of the loading head, material may be continuously received from the continuous miner while the material transportation unit or shuttle car is away from its position beneath the discharge end of the apparatus. Thus material may be stored in relatively large quantity within the apparatus while the transportation unit or shuttle car is travelling back and forth with respect to its discharge point in the mine or during shifting of loaded and empty car units. The novel loading head of the apparatus enables effective cleaning up of the floor between the sides of the mine passageway in back of the continuous miner so that a clean floor is maintained as mining progresses. The novel conveyor arrangement enables ready and quick transfer of material rearwardly of the apparatus and by the provision of the high speed belt conveyors operating in conjunction with the other conveyors the material is effectively piled up and distributed so that proper filling of the compartments of the apparatus and the transportation unit is assured. Other manners of use and advantages of the invention will be clearly apparent to those skilled in the art.

While there are in this application specifically described one form and a modification thereof which the invention may assume in practice, it will be understood that this form of the same are shown for and modification purposes of illustration, and that the invention may be further 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 an apparatus of the character disclosed, a mobile frame having a material receiving compartment, a conveyor extending along the bottom of said compartment for discharging material therefrom, said frame having a forward horizontal projection in advance of said compartment, a frame swivelled on said projection to swing horizontally relative to said mobile frame, a loading head frame pivotally mounted on said swivelled frame to tilt in a vertical direction with respect thereto, a rear frame pivotally mounted on said swivelled frame to tilt in a vertical direction about an axis coincident with the pivotal axis of said head frame, said rear frame overlying said compartment, conveying means guided on said head frame and said tiltable rear frame for circulation relative thereto, said conveying means at its rear end discharging into said compartment, and gathering means carried at the front end of said loading head frame for gathering loose material on the mine floor between the sides of the mine passageway and for moving the material so gathered inwardly toward the front receiving end of said conveying means.

2. In an apparatus of the character disclosed, a mobile frame having a material receiving compartment, a conveyor extending along the bottom of said compartment for discharging material therefrom, said frame having a forward horizontal projection in advance of said compartment, a frame swivelled on said projection to swing horizontally relative to said mobile frame, a loading head frame pivotally mounted on said swivelled frame to tilt in a vertical direction with respect thereto, a rear frame pivotally mounted on said swivelled frame to tilt in a vertical direction about an axis coincident with the pivotal axis of said head frame, conveying means guided on said head frame and said tiltable rear frame for circulation relative thereto, and including a conveyor on said head frame and a cooperating conveyor on said tiltable rear frame, said conveyor on said rear frame overlying said compartment, and gathering means carried at the front end of said loading head frame for gathering loose material on the mine floor between the sides of the mine passageway and for moving the material so gathered inwardly toward the front receiving end of said conveying means.

3. In an apparatus of the character disclosed a mobile frame having a material receiving compartment, a conveyor extending along the bottom of said compartment for discharging material therefrom, said frame having a forward horizontal projection in advance of said compartment, a frame swivelled on said projection to swing horizontally relative to said mobile frame, a loading head frame pivotally mounted on said swivelled frame to tilt in a vertical direction with respect thereto, a rear frame pivotally mounted on said swivelled frame to tilt in a vertical direction about an axis coincident with the pivotal axis of said head frame, conveying means guided on said head frame and tiltable rear frame for circulation relative thereto, and gathering means carried at the front end of said loading head frame for gathering loose material on the mine floor between the sides of the mine passageway and for moving the material so gathered inwardly toward the front receiving end of said conveying means, said gathering means including upright deflecting and gathering plates extending forwardly and outwardly in opposite directions laterally from said head frame into adjacency to the sidewalls of the mine passageway, said plates disposed at opposite sides of the receiving end of said conveying means and while remaining in adjacency to the sidewalls deflecting the material on the mine floor rearwardly and inwardly toward said conveying means as the apparatus is advanced.

4. In an apparatus of the character disclosed, a mobile frame having a material receiving compartment, a conveyor extending along the bottom of said compartment for discharging material therefrom, said frame having a forward horizontal projection in advance of said compartment, a frame swivelled on said projection to swing horizontally relative to said mobile frame, a loading head frame pivotally mounted on said swivelled frame to tilt in a vertical direction with respect thereto, a rear frame pivotally mounted on said swivelled frame to tilt in a vertical direction about an axis coincident with the pivotal axis of said head frame, conveying means guided on said head frame and tiltable rear frame for circulation relative thereto, and gathering means carried at the front end of said loading head frame for gathering loose material on the mine floor between the sides of the mine passageway and for moving the material so gathered inwardly toward the front receiving end of said conveying means, said gathering means including upright deflecting and gathering plates extending in opposite directions laterally from said head frame into adjacency to the sidewalls of the mine passageway, said plates disposed at the opposite sides of the receiving end of said conveying means and while remaining in adjacency to the sidewalls deflecting the material on the mine floor toward said conveying means as the apparatus is advanced, and said plates being pivotally mounted to swing horizontally on upright axes

to move the deflected material inwardly toward the receiving end of said conveying means.

5. In an apparatus of the character disclosed, a mobile frame having a material receiving compartment, a conveyor extending along the bottom of said compartment for discharging material therefrom, said frame having a forward horizontal projection in advance of said compartment, a frame swivelled on said projection to swing horizontally relative to said mobile frame, a loading head frame pivotally mounted on said swivelled frame to tilt in a vertical direction with respect thereto, a rear frame pivotally mounted on said swivelled frame to tilt in a vertical direction about an axis concident with the pivotal axis of said head frame, conveying means guided on said head frame and tiltable rear frame for circulation relative thereto, and gathering means carried at the front end of said loading head frame for gathering loose material on the mine floor between the sides of the mine passageway and for moving the material so gathered inwardly toward the front receiving end of said conveying means, said gathering means including upright deflecting and gathering plates extending forwardly and outwardly in opposite directions laterally from said head frame into adjacency to the sidewalls of the mine passageway, and conveyor screws arranged transversely of said head frame at the opposite sides of the front end of said conveying means for moving material received from said plates and for moving the material inwardly toward said conveying means, said plates mounted at the opposite sides of the receiving end of said conveying means in advance of said conveyor screws near the outer ends of the latter, said plates while remaining in adjacency to the sidewalls deflecting the material on the mine floor rearwardly and inwardly toward said conveyor screws.

6. In an apparatus of the character disclosed, a mobile frame, a conveyor frame pivotally mounted on said mobile frame to swing in vertical planes, a conveyor on said conveyor frame, a conveyor scrolls arranged transversely of the outer portion of said conveyor frame at opposite sides of said conveyor for moving material on the mine floor inwardly toward said conveyor, and laterally adjustable upright deflector plates projecting forwardly and laterally in opposite directions from the opposite sides of said conveyor frame for directing material on a mine floor inwardly toward said conveyor scrolls, said plates while remaining in their laterally projecting positions directing the material on the mine floor rearwardly and inwardly toward said scrolls as the apparatus is advanced.

7. In an apparatus of the character disclosed, a mobile frame having a material receiving compartment, and a gathering and loading head mounted on said frame at one end of said compartment for gathering loose material on the mine floor and for moving the material so gathered into said compartment, said head including a conveyor, conveyor scrolls arranged transversely at the opposite sides of the forward portion of said conveyor for moving material on the mine floor toward said conveyor, and laterally adjustable upright deflecting and gathering plates diverging forwardly and outwardly in opposite directions from the outer ends of said scrolls into adjacency with the side walls of the mine passageway for directing loose material on the mine floor inwardly toward said scrolls, said plates while remaining in adjacency to the sidewalls deflecting the material on the mine floor rearwardly and inwardly toward said scrolls as the apparatus is advanced.

8. In an apparatus of the character disclosed adapted for association with a continuous miner for disintegrating the face of a solid mine vein, a mobile frame having a relatively large material receiving and storing compartment, a loading head at the front end of said frame in advance of said compartment for gathering and loading loose material on the mine floor in the space between the sides of the passageway excavated by the miner and having laterally adjustable upright side deflector plates extending angularly forwardly and outwardly to the sides of the passageway, said deflector plates adjustable laterally to the sides of passageways of varying width, said head having conveying means for receiving the material gathered by said head and for moving the material rearwardly into said compartment, said deflector plates while remaining adjusted laterally to the sides of the passageway serving to deflect the material on the mine floor rearwardly and inwardly toward said conveying means as the apparatus is advanced, said head having movable conveyors disposed near the floor level at the opposite sides of the receiving end of said conveying means, said conveyors receiving the material deflected inwardly and rearwardly by said deflector plates and conveying the material laterally inwardly toward said conveying means, said head adapted to underlie the discharge end of the continuous miner in a position to receive material discharged from the miner at a point a substantial distance above the floor level, and said conveying means operating to move the material received from the continuous miner rearwardly to discharge into said compartment.

9. An apparatus as set forth in claim 8 wherein adjusting devices are provided for said deflector plates for at intervals adjusting said plates laterally and rearwardly toward said movable conveyors for crowding the material on the mine floor toward said conveyors.

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