May 5, 1953 A. L. BARRETT 2,637,457

MATERIAL RECEIVING, STORING, AND DISCHARGING APPARATUS

Filed July 9, 1948 2 SHEETS—SHEET 1

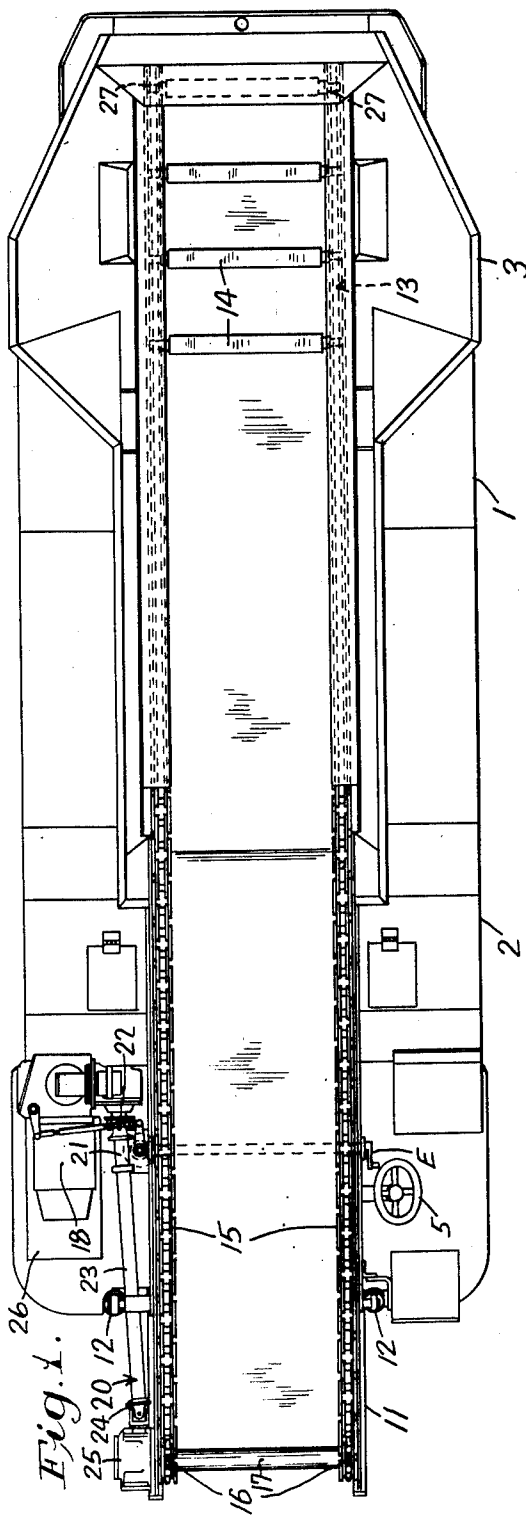


Fig. 1.

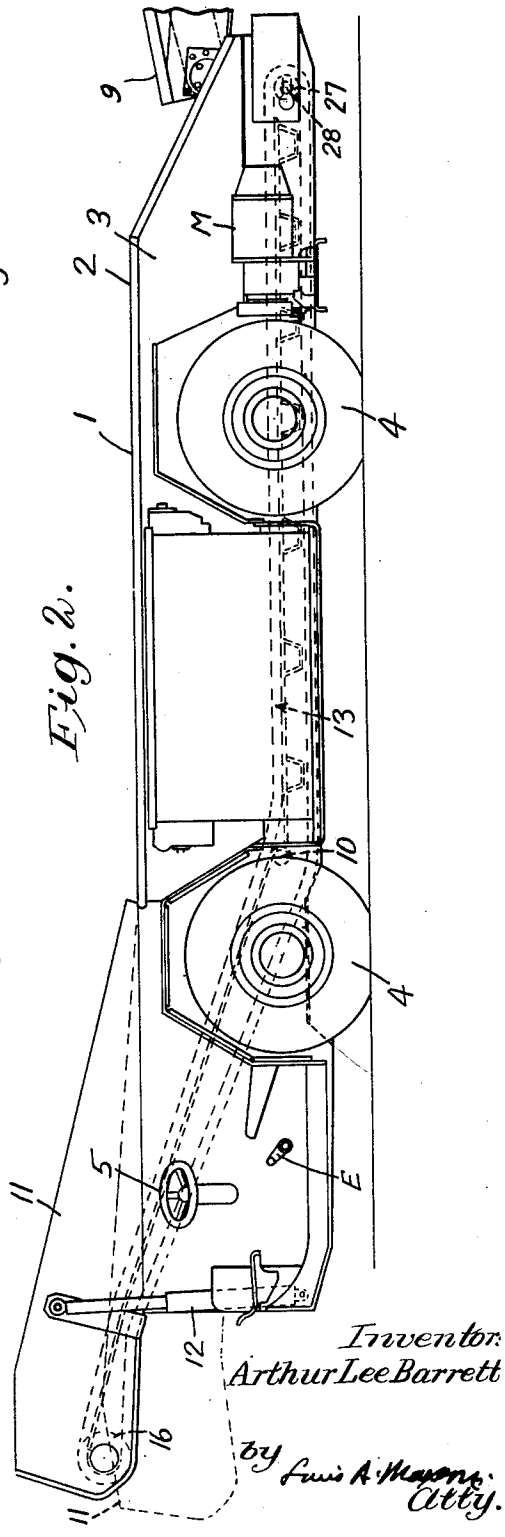


Fig. 2.

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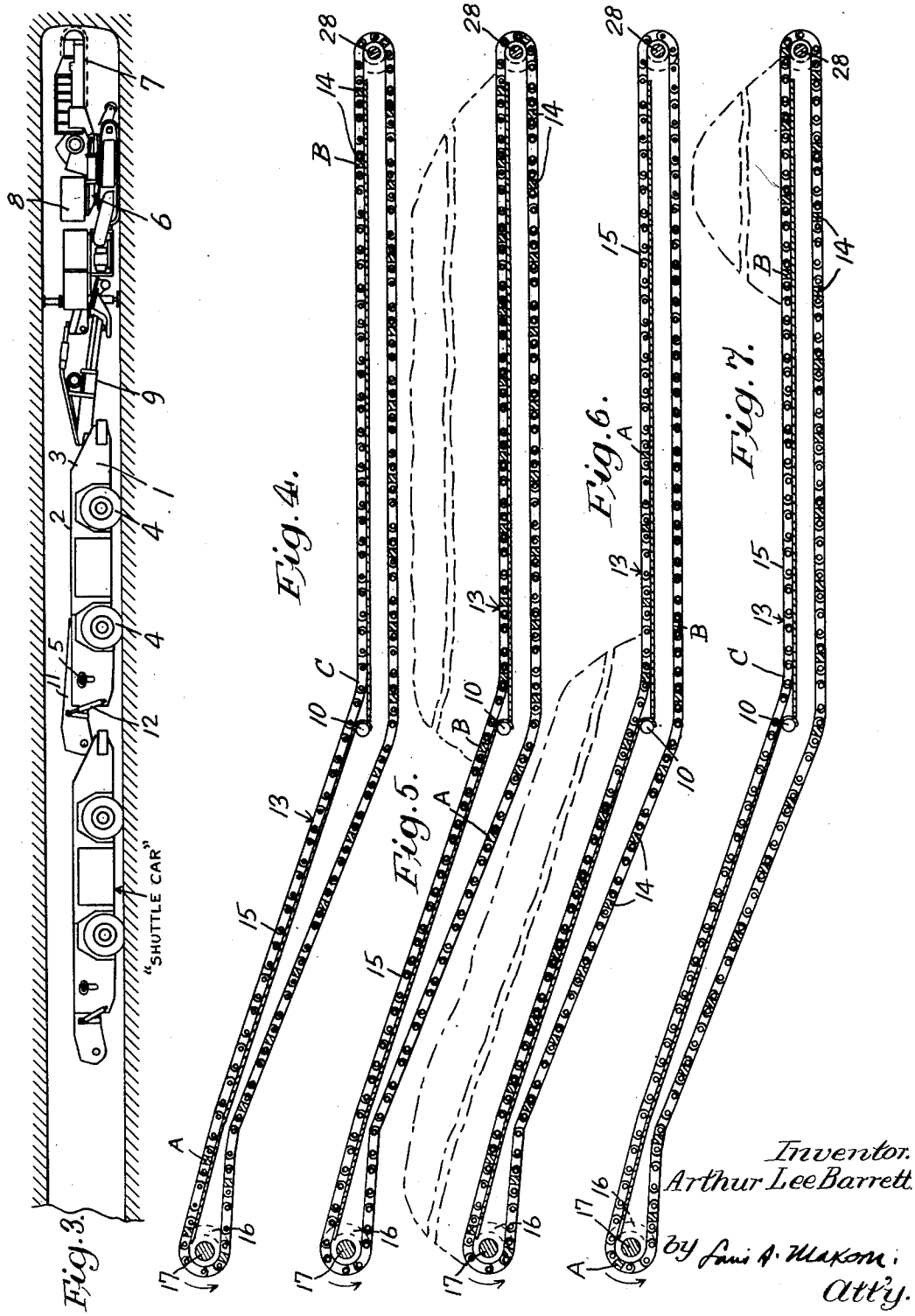


Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

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Patented May 5, 1953

2,637,457

UNITED STATES PATENT OFFICE

2,637,457

MATERIAL RECEIVING, STORING, AND DISCHARGING APPARATUS

Arthur Lee Barrett, Franklin, Pa., assignor to Joy Manufacturing Company, Pittsburgh, Pa., a corporation of Pennsylvania

Application July 9, 1948, Serial No. 37,943

11 Claims. (Cl. 214—83.36)

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My invention relates to material receiving, storing and discharging apparatus, and more particularly to such apparatus especially adapted for use with "Continuous Miners" or similar vein disintegrating and material delivering apparatus.

The introduction of the "Continuous Miner" has presented a new problem in material handling to the mining industry. Bands of mineral such as coal, of substantial width, height and depth, are disintegrated and loaded out and delivered to a delivery point by these "Miners" in rapid succession and in periods of a fraction of a minute, so that a face of a height of say six feet, and a horizontal arcuate extent of twelve feet, can be disintegrated to a depth of on the order of eighteen inches and have its disintegrated material discharged from the apparatus in a matter of less than three minutes; and the apparatus can be repositioned for the next series of cuts in a fraction of a minute. Accordingly, four or five tons of coal are made available for transport away from these "Miners" every three minutes or so, with no intervals of substantial duration of interruption of material delivery, although the delivery will not be completely continuous, in view of the very short times required for repositionings of the apparatus. The figures given are but illustrative, and, under favorable conditions, and with larger and more powerful disintegrating apparatus, the figures mentioned are substantially reduced. It will thus be appreciated that, with the relatively continuous and very rapid disintegration of a vein and delivery of material, the effective and adequate carrying away of the material is a major problem. It is possible to use with "Miners," belt or shaker conveyor arrangements, but the necessity for elongation or extension of these devices as the "Miners" advance when working in rooms or entries at times involves a shut down which would be wholly unnecessary from the standpoint of the operation of the "Miner" itself. The use of shuttle cars in conjunction with "Continuous Miners" is a highly desirable procedure, but if, without the employment of a storage hopper of some variety, one shuttle car is to receive a load and then withdraw and have its place taken by another shuttle car, there is, if a load is to be supplied directly from the "Miner," both an inefficient use of equipment, since the loading period of a shuttle car receiving material directly from the "Miner" may be on the order of say three minutes, whereas the car could be loaded much

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more rapidly if it could be charged from an accumulated supply of material; and, moreover, during the moving away of one car from the loading end of the "Miner" and the movement of another shuttle car into load receiving relationship to the "Miner" a shut down of the "Miner" would be necessary to prevent the discharge of a considerable mass of material onto the mine floor. The use of a shuttle car of standard construction traveling along in step with and in load receiving relation to a "Miner" and discharging to one or more other shuttle cars which actually transport the disintegrated material from the car acting as a hopper to some desired point of delivery as, for example, a loading station associated with a belt conveyor, fails of satisfactory solution of the problem because as a full load is moved out of the shuttle car at a relatively rapid rate (unloading can be effected in one-half to three-quarters of a minute), there will be, if the "Miner" continues to operate, a fairly thin but by no means ignorable load of disintegrated material spread through the length of the shuttle car while the main load is being discharged, and this relatively thin layer will be dumped on the mine floor while the shuttle car which is being used as a hopper is subsequently receiving a full load. It is therefore important that there shall be provided, for the satisfactory solution of the problem, not only means for receiving over a period measured in minutes a full load directly from a "Continuous Miner" or the like, and for discharging the load in a comparatively small fraction of the time required for the reception of the load—discharge of the load being, say, to a mine car or preferably to a shuttle car—but there must be in addition some arrangement whereby there will not be spread through the length of the car serving as a hopper a layer of material while the main load is being discharged, which layer of material will be later, during the next loading of the car serving as a hopper, dumped on the mine bottom.

An effective mode of accomplishing this third and very important function is provided by my invention, and very satisfactory results may be accomplished, in a preferred form of the invention, by the modification of the material distributing and unloading means which forms a portion of a shuttle car-like structure utilized as a hopper so that while portions thereof may function to unload material from the receiver or hopper body, there shall be no significant movement of material by other portions of such

moving means. Preferably, this may be accomplished, when a flight type conveyor is employed, by the omission of a number of consecutive flights, so that, say, in a preferred arrangement, over a length approximately equal to the distance from the discharge end of the apparatus back to a point so located that loading may take place thereon without the necessity for redistribution of the load, there shall be no flights present. The remainder of the flight conveyor may be of conventional construction.

It will be appreciated, however, that this preferred embodiment is but illustrative of various means for providing for material movement by devices which include in a circulating endless loop, as it were, portions which may move without imparting substantial movement to material and other portions whose movement in engagement with material moves the latter, the relative lengths of the different portions determined to enable the reception and distribution of a load and the unloading thereof without spreading material received during discharge in such a manner as to cause it to be dumped as a new load is received.

An object of the invention is to provide an improved material receiving, storing and discharging apparatus so constructed and arranged that the distribution of a layer of material over the bottom thereof during the unloading therefrom of an accumulated load may be prevented. Another object of the invention is to provide an improved material receiving, storing and discharging apparatus having improved means for distributing the material received thereby during loading thereof throughout its length, for unloading the material rapidly when it is desired to discharge it, and for, at the same time, preventing material which may continue to be delivered to one end of the apparatus from being spread throughout its length during the unloading of the load therefrom. A further object of the invention is to provide an improved material-receiving, storing and discharging apparatus having improved material handling apparatus associated therewith whereby material may be moved from one portion thereof for discharge while material delivered to another portion thereof may be allowed to remain where it falls from an apparatus constituting a source of material supply. Other objects and advantages of the invention will hereinafter more fully appear.

In the accompanying drawings, in which one illustrative embodiment which my invention may assume in practice is shown for purposes of illustration,

Fig. 1 is a plan view of a material receiving, storing and discharging apparatus constructed in accordance with the illustrative embodiment of the invention.

Fig. 2 is a side elevation of the structure shown in Fig. 1, showing a portion of the delivery end of an apparatus which furnishes the loads for the material receiving, storing and discharging apparatus.

Fig. 3 is a generally diagrammatic view showing the invention in use.

Figs. 4, 5, 6 and 7 are semi-diagrammatic views showing the flight conveyor of the preferred embodiment of the invention with its portions in different relative positions with respect to its guides and the load carrying bottom of the apparatus.

The preferred embodiment of the invention is shown incorporated in an apparatus 1 which is quite similar in construction, except as hereinafter explained, to a shuttle car. This construction includes a body 2 having a widened material receiving portion 3, and having wheels 4, certain of which may be controllable by a steering wheel 5 in a well known manner, and others of which may be driven, as by motors one of which is shown at M, also in a well known manner.

The apparatus 1 is adapted to move along behind, but in close adjacency to, a "Continuous Miner" 6 (see Fig. 3), and to receive the disintegrated material which the latter discharges. This close adjacency may be maintained by the steering and propulsion means of the apparatus 1, as shown, or could be effected by the use of a suitable draw-bar or equivalent connection between the "Miner" and such apparatus. The "Continuous Miner" 6 may be of various forms, but is shown for purposes of illustration as similar to the structure disclosed and claimed in the copending application of Samuel Leven, Serial No. 19,698, filed April 8, 1948, which application is owned by my assignee. It includes a disintegrating apparatus 7, a driving motor therefor 8, suitable feeding, retracting, laterally positioning, and vertically swinging means not all shown in this present case, but fully shown in the application above mentioned, and adapted to permit the "Miner" to attack and disintegrate the full desired width of a mineral vein for the full desired height of the latter and to form its own floor and roof. The "Miner" has a delivery conveyor 9 at the rear end thereof, and this conveyor is adapted to discharge to the apparatus 1 (see Fig. 3).

At the end of the body 2 remote from the "Miner" there is shown, pivotally connected at 10 to the body, a discharge section 11 which is vertically adjustable and which is shown in full lines in Fig. 2 in a relatively raised position, this discharge section being shown in dotted lines in the same figure in a lowered position. The discharge section 11 may be raised and lowered by hydraulic jacks 12 whose lower ends are pivotally connected to the car body and whose upper ends are similarly connected to the discharge section. Any suitable means may be provided on the apparatus 1 for providing liquid under pressure for supply to the hydraulic jacks and for venting the fluid from these jacks when lowering of the discharge section is desired. The provision of a pivoted delivery section is not essential to my invention in its broader aspects. The hopper portion of the body 2 and the discharge section 11 may be regarded as cumulatively providing a material receiving hopper, since both can be loaded with material in the interval between successive material discharges.

A flexible conveyor 13 provided with scraper flights 14 in a manner hereinafter more fully explained and including flight moving side chains 15, has an upper run extending throughout the bottom of the hopper portion of the body 2 and throughout the bottom of the discharge section 11, any may be employed for delivery of material from the body 2 and for distributing the material in the body during loading thereof. To apply driving power to the conveyor its side chains 15 are driven by sprockets 16 that are connected to a driven shaft 17 at the outer end of the discharge section, power for the drive being supplied by a motor 18 which is borne on the body 2 near its end most remote from the "Miner." The conveyor drive may assume various forms, but is

herein shown as comprising an articulated shaft 20 which extends from a cross shaft (not shown) driven by the motor 18 to the outer end of the discharge section, the shaft comprising an inner section 21 connected with the motor through a universal coupling 22, and a telescopically arranged outer section 23 connected by a universal coupling 24 to a worm and worm gear conveyor drive 25 for the cross shaft 17. The motor 18 is provided with suitable controlling means 26 which may be manipulated to inch the load along or to effect its discharge at a relatively uniform, more rapid rate, and drive of the conveyor is also controllable by the manipulation of a drive clutch controlling handle E. The flight carrying chains 15 are guided by sprockets 27 on a cross shaft 28 at the load receiving end of the body 2. It will be noted that the body is located to receive material over an area of a dimension longitudinally of the body equal to a couple or perhaps three of the spaces between flights.

The flights 14 of the flight conveyor are pivotally connected at their opposite ends to the side chains 15, and are adapted to scrape material along over the bottom of the body 2 and discharge section 11. Whenever material is engaged by a flight it will, as the latter moves, be scraped or moved along. Accordingly, since there is a nearly continuous discharge of material, at a rate of upwards of a ton per minute into the body 2 from the discharge conveyor 9, there would be, if the flights were, in uniformly spaced relation, carried by the full lengths of the side chains 15, during the half minute or so required for the complete discharge of the load of material from the apparatus 1, half-a-ton or more of material distributed between the point of discharge of the delivery conveyor 9 and the delivery end of the discharge section 11, and all of this material would be swept out of the car and onto the mine floor while a new load was being received and distributed within the apparatus preliminary to discharge to another mine vehicle. I avoid this undesirable result, in the preferred embodiment of the invention illustrated, by leaving out a substantial number of flights, as, for example, but without limitation thereto, thirteen flights from a chain which would normally contain thirty-five flights, with the result that there is a blank spot of such length that from a flight, marked A (see Fig. 7) for identification, just passing around the shaft 17 there may, in a predetermined position of the flight conveyor, be no following flight clear back to a flight marked B, spaced on the order of four flight spaces from the shaft 28. This four-flight space substantially brackets the area lengthwise of the conveyor onto which the material will fall and spread from the delivery conveyor 9. With such an arrangement (which may be modified within the scope of my invention from its broader aspects), it will be clear that as the discharge of the load is completed by the flights preceding the flight A and, if necessary, by that flight, there will have been no distribution of material along the discharge section and the body beyond the point occupied by flight B, because of the gap produced by omission of flights, which gap I designate C.

The mode of operation of the invention may be clearly understood from the semi-diagrammatic views of Figs. 4 to 7. The discharge section 11 is shown in its maximum elevated position. In Fig. 4, the hopper car apparatus 1 may be considered as being empty, a condition which may be brought about at any time by interrupting the operation of the "Continuous Miner" with which it is associated for a relatively small period of time. It will be observed that the portion C of the flight conveyor from which the flights have been removed in this view extends from the end of the body 2 nearer the "Continuous Miner" to a point near the upper end of the discharge section 11. When the "Continuous Miner" now commences to deliver material into the hopper car body 2, it will be allowed to fall to the bottom of the latter, and by appropriate control of conveyor drive by the conveyor driving motor, the load will be distributed along the length of the body 2, until the body is loaded as indicated in Fig. 5. Not over two minutes will probably be required, at a maximum, to load the body 2 fully. In Fig. 6, the flight conveyor has been utilized to discharge a portion of the load and the remainder still rests in the discharge section. Some material has been falling into the right hand end of the apparatus, but this is simply piling up on the bottom at that end. In Fig. 7 the load has been fully discharged, and the flight B and three other flights are shown as having moved under the pile of material that fell into the right hand end of the body during discharge of the load, but from the flight B all the way forward to flight A, the presence of the gap C has prevented the spreading of a layer of material over the bottom of the apparatus which would be dumped on the mine floor in the interval between the leaving of one transport vehicle and the arrival of the next, during which interval a load will be received and distributed within the apparatus.

Reverting to Fig. 3, it will be seen that the discharge 9 is delivering to the apparatus 1, and that a shuttle car is positioned with its load receiving end under the end of the discharge section, and, having in mind the characteristic of shuttle cars that these may be loaded comparatively rapidly by moving the conveyors which extend along their bottoms at an appropriate rate, it will be noted that, if the shuttle car and the hopper car are of similar capacity and construction, by operating their conveyors at like rates and continuously, there may be a complete unloading of the hopper car and filling of the shuttle car in a time interval on the order of 30 to 35 seconds, say; and Fig. 7 illustrates the position assumed by the flight conveyor of the hopper car at the time when one load has been completely discharged. If, as earlier noted, during the period of discharge the flight conveyor had had flights uniformly spaced over its full length, that is, throughout its full orbital length, there would have been distributed over the bottom of the car from the point of discharge thereto of the "Continuous Miner" clear up to the end of the discharge section a layer of distintegrated material, perhaps only a few inches thick, but all of this material would be dumped on the ground as the flight conveyor would be operated during the reception of a full load by the car and the movement of the conveyor again to a position corresponding to that of Fig. 7. However, because of the omission of the flights in the manner and to the extent disclosed, there will have been no distribution of the material which is dumped into the bottom of the car, along the major portion of the length of the body and along the discharge end, as the material is moved out by the flights which are disposed ahead of the flight marked A. Accordingly, at the conclusion of the relatively rapid discharge movement of the flight conveyor, there may be accumulated a new full load in the hopper car, without spillage, or any necessity for

shoveling at the discharge end of the discharge section in the interval between the leaving of one shuttle car and the returning, perhaps minutes afterwards, of another shuttle car.

The invention is simple, highly effective, rugged, involves in a preferred embodiment a minimum of departure from standard devices, and enables the meeting of the problem of material handling presented by the "Continuous Miner" in a very effective manner. It will be evident that this apparatus will also find potential utility in connection with loading machines.

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 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 described, including a body for receiving and storing material and having a discharge portion connected at its inner end to said body and through which discharge portion stored material is adapted to be discharged, an endless flight conveyor having an upper run extending through said body and said discharge portion, for distributing material delivered to said body in the latter and for effecting discharge of material from said body through said discharge portion, and driving means for said conveyor for effecting circulation thereof, the improvement which consists in that said endless flight conveyor is provided with flights throughout but a portion of its circuit and, in a predetermined position thereof, relative to said body and said discharge portion, has along its upper run flights only adjacent the forward end of said discharge portion and adjacent the end of the body remote from the discharge portion, but elsewhere along its circuit is provided with flights.

2. In an apparatus of the character described, including a body for receiving and storing material and having a discharge portion connected at its inner end to said body and through which discharge portion stored material is adapted to be discharged, a continuous flexible flight conveyor having an upper run extending throughout the bottom of the body and of said discharge portion, and driving means for said conveyor for moving the same intermittently to distribute material delivered to said body therein and for moving said conveyor continuously to effect discharge of material from said body through said discharge portion, the improvement which consists in that the conveyor is equipped with flights save for a portion thereof equal to the combined length of said body and said discharge portion, less the part of the length of said body at one end thereof to which material may be delivered directly, but is devoid of flights along such portion whereby the conveyor is able to unload completely material stored in said body without distributing over the length of the bottom of said body material which may be delivered to the end thereof remote from said discharge portion during discharge of the load.

3. In an apparatus of the character described, including a body to receive and store material, said body having at one end thereof a material-receiving portion, a discharge portion having an outer discharge end and pivotally connected at its inner end to said body, at the end of the latter away from said material-receiving portion, for vertical adjustment of its discharge end through a substantial arc, a continuous flexible flight conveyor having an upper run extending throughout the bottoms of said body and of said discharge portion, and driving means for said conveyor, the improvement which consists in that said conveyor, though otherwise equipped with flights, has, in a predetermined position thereof relative to said body and said discharge portion, no flights from a point in said body within the material-receiving portion thereof to a point in said discharge portion adjacent the discharge end of the latter, whereby said conveyor shall be able to unload completely material stored in said body without distributing over the length of the bottom of said body material which may be delivered to the end thereof remote from said discharge portion during discharge of the load.

4. In an apparatus for receiving and storing a quantity of disintegrated material and for periodically discharging the stored material to a mine transport vehicle, in a period shorter than the time consumed in the receiving and storing of a load, in combination, a portable hopper having a bottom and of sufficient capacity to receive and store a quantity of material sufficient to load a mine transport vehicle adapted to receive a load from it, and means for distributing material within the hopper during loading of the latter and for moving the load out of the hopper including an orbitally moving flight conveyor having drive and guide means at its opposite ends and chain flight moving means passing in a closed orbit around said drive and guide means and including upper and lower runs, the former extending through said hopper and traversing the bottom of said hopper and the latter moving outside of said hopper, said conveyor equipped with flights along a portion thereof equal in length to the extent of said lower run plus but a small portion of the extent of said upper run.

5. In an apparatus for accumulating a quantity of disintegrated material and for delivering the accumulated material periodically, in a time period materially shorter than the period taken for its accumulation, to a mine transport vehicle, in combination, a hopper having a bottom portion and of sufficient capacity to receive and store a quantity of material sufficient to load a mine transport vehicle adapted to receive a load from it, and means for distributing material within the hopper during loading of the latter and for moving the load out of the hopper without spreading a thin layer of material between the point of material reception and the point of material discharge including an orbitally moving flight conveyor having an upper run passing through the bottom portion of said hopper and having mutually spaced flights distributed over the major portion of its length but with no flights for a distance equal to several flight-spacings.

6. In an apparatus for receiving a load from a vein disintegrating apparatus and delivering it periodically to shuttle cars, a material transfer device including a hopper having sufficient capacity to receive and store a load for a shuttle car, means for maintaining said hopper in load receiving relation to a vein disintegrating apparatus, and means for discharging a load from said hopper to a shuttle car while preventing the distribution of disintegrated material received at the other end of the hopper over the bottom

of said hopper during the unloading thereof, said last mentioned means including a conveyor having, following each other through said hopper, a portion provided with flights and another portion having no flights over a distance only slightly less than the length of said hopper.

7. In an apparatus of the character described, the combination of a body for receiving and storing material positionable to receive material from a vein attacking apparatus and having adjacent one end thereof a portion upon which such material is receivable and having at its other end a discharge end portion for delivering material to a mine transport vehicle, a continuous flexible flight conveyor having an upper run extending throughout the bottom of said body and of said discharge end portion, and driving means for said conveyor, said conveyor having a portion thereof free of flights extending, in a predetermined relation of said conveyor to said body, from said discharge end back to said material-receiving portion.

8. In an apparatus of the character described, the combination of a body for receiving and storing material and adapted to receive material at one end thereof for distribution and storage therein and having a discharge portion from which stored material is adapted to be delivered, flexible flight moving means extending in a closed orbit from the first mentioned end of said body through said body and through said discharge portion and back to the first mentioned end of said body, means for driving said flexible flight moving means, and material engaging and moving elements connected to said flexible flight moving means for movement thereby and distributed over but slightly more than half of the whole overall length thereof.

9. In an apparatus of the character described, the combination of a body for receiving and storing material and adapted to receive at one end thereof material for distribution and storage therein and having at its other end a discharge portion for the delivery of stored material, continuous flexible flight moving means extending in a closed orbit from the first mentioned end of the body through the latter and through said discharge portion and back to the first mentioned end of the body, means for driving said flexible flight moving means, and a plurality of material engaging and moving elements connected to the said flexible flight moving means for movement thereby, said flexible flight moving means having no material engaging and moving elements connected thereto for a distance substantially equal to half the length thereof minus the distance at the receiving end of said body upon which material is received, whereby said body

can be cleared of a load of material while further material is received thereon without substantial action of said material engaging and moving elements upon such further material.

10. In an apparatus of the character described, the combination of a body for receiving and storing material and having at one end thereof an area for receiving material and having at its other end a discharge portion for delivering material to a mine transport vehicle, a continuous flexible flight conveyor having an upper run extending through the bottom of said body and through said discharge portion, and driving means for said conveyor for moving the same intermittently to distribute material delivered to said area of the body in the latter and for moving said conveyor continuously to effect discharge of material from said body via said discharge portion, said conveyor having flights along a portion thereof and having another portion without flights thereon, said latter portion of such length that the trailing flight of said first portion completes its material discharge effecting function before the leading flight in said portion moves beyond the end of said material receiving area which is nearer said discharge end, whereby the conveyor is able to unload completely material stored in said body without distributing over the length of the body material which may be delivered to the material-receiving end of the latter during discharge of a load.

11. In an apparatus of the character described, the combination of a body for receiving and storing material, said body having a bottom upon which material rests and being adapted to receive at one end thereof material for distribution and storing therein and to discharge stored material at the other end thereof, and means for distributing material in said body and discharging it therefrom including an orbitally movable material-moving device comprising two portions, one slightly longer than the other and only that one equipped with material-moving means, and each of said portions connected with the other at its opposite ends whereby a continuous loop is formed, and means for circulating such device with a run thereof passing through said body, in adjacency to said bottom, from said one end to the other.

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