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(71) Applicant: **Snead, Edwin Desteiger, 701 University P.O. Box 1000, Georgetown Texas 78626 (US)**
Applicant: **Snead, William Brazelton, 701 University P.O. Box 1000, Georgetown Texas 78626 (US)**

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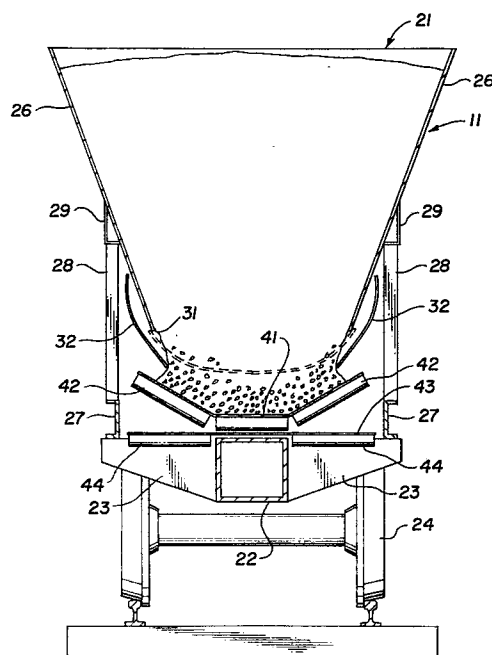
(72) Inventor: **Snead, Edwin Desteiger, 701 University P.O. Box 1000, Georgetown Texas 78626 (US)**
Inventor: **Snead, William Brazelton, 701 University P.O. Box 1000, Georgetown Texas 78626 (US)**

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(74) Representative: **Stuart, Ian Alexander et al, MEWBURN ELLIS & CO. 2/3 Cursitor Street, London EC4A 1BQ (GB)**

(54) **Self-unloading train for bulk commodities.**

(57) A unit train consists of a plurality of hopper cars (11, 12, 13) and a multi-purpose trailer car (15). The hopper cars (11, 12, 13) have one or more hoppers (21) each having a bottom discharge opening (31) and a controllable gate (32). An endless belt conveyor (40) traverses the length of the train including a portion of the trailer car (15), and underlies the hopper discharge gates (32) so that the hoppers (21) may be emptied sequentially onto the train conveyor (40) to unload the entire train. The trailer car (15) includes a lift portion (45) of the train conveyor (40) to elevate the material for discharge onto a transfer conveyor (50) carried on the trailer car (15). The elongated transfer conveyor (50) is pivotally mounted (51) at the receiving end to be swung laterally to discharge the material received from the train conveyor (40) at some selected point alongside the track. The trailer car (15) may include the power system and control system for operating the conveyors (40, 50) and the hopper gates (32). The train is self-unloading by depositing the train load in a windrow alongside the track while the train is moving slowly. For unloading the train in a stationary position, the transfer conveyor (50) may deposit the material onto a portable stacking conveyor (60) which may then deposit the entire train load in one or more stockpiles which may be thirty feet (9 meters) high and located some distance from the track.



SELF-UNLOADING TRAIN FOR BULK COMMODITIES

This invention relates to a train for the transportation of bulk commodities, which train has on-board facilities for the unloading of the bulk commodities; and to a method for rail transport of bulk commodities and the unloading of such commodities from the rail transport.

Rail transportation is generally recognized as being more economical than truck transportation for bulk commodities such as aggregates. Large quantities of such commodities can be moved by a small crew at low cost. However, rail transportation frequently loses out in competitive situations because of the cost of unloading, stock piling, and delivering the commodity to the ultimate destination.

Even though large quantities of bulk material can be transported at low cost from one terminal to another, the burden is placed on the unloading facility to maintain the economics of this method of transportation to the purchaser of the commodity. If the unloading is slow, and the train is therefore delayed for a substantial period of time for the unloading to be accomplished, there is an added investment cost per ton handled for the use of the railroad equipment. One problem, in this regard, is that rail transportation is a 24-hour operation while many of the industries it serves operate only during daylight hours. Often a train makes good speed from origin to destination, only to be delayed several hours waiting to be unloaded. Each hour of delay adds to the transportation cost as much as an additional 25 to 50 miles (40.2 to 80.4 km) of haul.

As an example of the efficiency of rail transport for bulk commodities, a train with a two-man crew pulling

1600 net tons (1451.5 M.T.) at 55 miles per hour (88.5 km. per hour) would be producing 32 times as many ton-miles per hour (M.T. - km. per hour) as a dump truck driver hauling 25 tons (22.7 M.T.) at 55 miles per hour (88.5 km. per hour).

Another problem effecting the efficiency of rail transportation for bulk commodities is that, under current methods, the quick unloading of a commodity train requires high capacity equipment and facilities which are idle most of the time. Such high capacity equipment and facilities are expensive, and add significantly to the investment cost per ton handled.

The following are some of the methods which are currently used for the unloading of bulk materials from trains.

Bottom dumping hopper cars are equipped with automatic doors that are opened automatically as the cars move over a pit, where the pit facility includes a feeder and a conveyor. Either a pit or an elevated trestle is required for this method, so that this method is ruled out at many locations. Obviously the providing of a pit or trestle facility with associated conveyor systems is expensive.

Another method involves the use of rotary car dumpers; and these are commonly used for unloading coal at electric generating plants. Again, the equipment for unloading the cars is highly specialized and expensive.

Side dumping cars have been used for many years, but cannot be dumped on level ground. They require elevated track on a built up embankment for example, so that the dumped material will flow over the side of the embankment and not flow back over the track.

Finally, backhoes or other unloading equipment are used to unload standard gondola cars. These methods are generally slow, promoting the delay problems mentioned above.

To take maximum advantage of the efficiencies of rail transportation, a special type of train is needed to deliver bulk commodities on any track, at any time of the day or night, with no labor required other than the train crew. Such a train would make optimum use of labor while providing incentive wages for the crew, and thereby reduce overall labor costs.

A self-unloading train which overcomes many of the above discussed disadvantages of rail transportation for bulk materials may be a "unit train" consisting of a plurality of hopper cars and a trailer car, the unit train to be pulled by a conventional locomotive.

Each of the hopper cars may include several hoppers having bottom discharge openings and associated gates for discharging onto an endless belt conveyor which runs the entire length of the train. The trailer car includes a transfer conveyor which receives the material from the train conveyor, and is movable on the trailer car to transfer the material to a selected point relative to the train.

With the unit train moving along a straight section of track, the material may be deposited in a windrow alongside the track by the transfer conveyor. Alternatively, the unit train may be unloaded while stationary, with the transfer conveyor discharging onto a portable stacking conveyor, for example, which will enable the deposit of the material in piles thirty feet (9 meters) high at least forty feet (12 meters) away from the track for example.

An object of this invention is to provide improved equipment and methods for the rail transport and unloading of bulk materials.

Another object of this invention is to provide such improved equipment and methods whereby the unloading may be

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accomplished by the train crew at any time of the day or night, thereby eliminating idle time of the train equipment while waiting for the opening of an unloading facility or while waiting for the arrival of material receiving equipment or vehicles.

A further object of this invention is to provide such equipment and methods wherein the unloading does not require highly specialized and expensive unloading facilities or equipment.

Still another object of this invention is to provide such apparatus and methods wherein the unloading of the train may be accomplished efficiently in a very short time.

Another object of this invention is to provide such equipment and methods to minimize the expense of unloading bulk material from a transport train.

Another object of this invention is to provide such equipment and methods wherein the equipment includes self-unloading apparatus.

A still further object of this invention is to provide such equipment and methods wherein the equipment is a unit train having a train length conveyor.

Still another object of this invention is to provide such equipment and methods which take advantage of the efficiency of rail transportation by eliminating the need for a specialized unloading facility.

One or more of these objects may be accomplished by an embodiment of the invention which is a self-unloading train which includes a plurality of hopper cars and a trailer car coupled together to be pulled by a locomotive. Each hopper car includes one or more hoppers having bottom discharge openings for gravity unloading and selectively operable gates for those discharge openings. An endless belt train conveyor is supported on the cars, underlying

the hopper discharge openings to receive material discharged therefrom, and extending the length of the hopper cars. An elongated transfer conveyor is mounted on the trailer car for receiving material from the train conveyor and is movable to transfer the material from the train conveyor to a selected point relative to the train. Suitable controls may allow operation of the hopper gates sequentially to discharge the several train hoppers onto the belt one at a time.

The invention also provides a method for transporting bulk materials and unloading the same which includes at least some of the following steps. The bulk materials are loaded onto a train including a plurality of hopper cars, each having one or more hoppers, and a trailer car. An endless belt train conveyor is carried on the cars traversing the length of the train and underlying the hoppers. The hoppers are provided with bottom discharge openings and associated selectively operable gates for controlling the discharge of materials onto the train conveyor. A transfer conveyor is mounted on the trailer car in a manner to swing from one side to the other. The material is discharged from the train conveyor onto the transfer conveyor for deposit at selected points relative to the train. The hopper gates are controlled in a manner to discharge the hoppers successively onto the train conveyor.

Preferably each gate has a long dimension parallel to the train conveyor of at least 80% of the longitudinal top dimension of the associated hopper.

The novel features and the advantages of the invention, as well as additional objects thereof, will be understood more fully from the following description when read in connection with the accompanying drawings, in which

Fig. 1 is a diagrammatic perspective view of a self-unloading train embodying the invention, including hopper cars and a trailer car;

Fig. 2 is a diagrammatic cross-sectional view of a typical hopper car;

Fig. 3 is a diagrammatic side elevation view of the trailer car illustrated in Fig. 1;

Fig. 4 is a diagrammatic end view of the trailer car and associated transfer conveyor illustrated in Figs. 1 and 3, with portions of the trailer car structure omitted, and illustrating one unloading method; and

Fig. 5 is a diagrammatic side elevation view of a portable stacking conveyor used in association with the transfer conveyor of the trailer car, and illustrating another unloading method.

Fig. 1 of the drawing is a diagrammatic perspective view illustrating the rear end of a self-unloading train according to the invention, illustrating three hopper cars 11, 12 and 13, and a trailer car 15 which, in the illustrated embodiment, is the last or rearmost car of the train.

The train, according to the invention, may be constructed as a "unit train", in the sense that the cars of the train are permanently coupled together, and would not be uncoupled unless it is necessary to remove one of the cars to a service facility. A self-unloading train according to the invention is particularly suitable for the transport of aggregates. By way of example, a train according to the invention may include ten hopper cars, each hopper having a net capacity of eighty tons (72.6 M.T.) of aggregate, and an associated trailer car. Such train, then, would have the capacity to haul eight hundred tons (726 M.T.) of aggregate; and such train would be pulled by one conventional locomotive.

Further by way of example, each hopper car may include three separate hoppers, each having a bottom discharge opening and an associated discharge gate.

The hopper cars are designed to support an endless belt train conveyor, which traverses the length of the train including the hopper cars and a portion of the trailer car; and this train conveyor underlies the discharge gates of the several hoppers.

Fig. 2 is a diagrammatic cross-sectional view of a typical hopper car 11, the section being taken through one of the hoppers 21 of the hopper car. As seen in Fig. 2, the hopper car 11 is of conventional construction including a main frame consisting of a center sill 22 and side beam members 23, which would be supported on trucks 24 in a

conventional manner. While this particular form of basic rail car structure is illustrated, it will be understood that the hopper car may be constructed using other known techniques where the center sill is eliminated.

The hopper body 21 may be rectangular as viewed from the top, including planar side walls 26 and corresponding planar end walls 30. As seen in Figs. 2 and 3, the hopper walls are inclined at least 65° and preferably at least 70° from the horizontal to assure the complete discharge of the aggregate or other material from the hopper. The hopper is supported by means of longitudinal channel stringers 27 supported at the outer ends of the side beams 23, in turn supporting vertical posts 28 which bear on angle brackets 29 suitably secured to the side walls 26 of the hopper.

The bottom discharge opening 31 of the hopper then is quite wide and quite long, the width being at least 50% of the distance between the hopper car wheels as illustrated in Fig. 2, and the length being at least 80% of the longitudinal top dimension of the hopper as illustrated in Fig. 3. The discharge opening is closed by a suitable clam shell gate 32 consisting of a pair of coacting members which are movable toward and away from each other in a direction transverse to the longitudinal axis of the hopper car. The hopper 21 is supported sufficiently high relative to the hopper car frame to allow for the support of the endless belt conveyor 40 as will now be described. The conveyor belt has a width substantially greater than that of the hopper discharge openings 31 about 33% greater for example, as illustrated in Fig. 2. The supply belt 41, which is the upper run of the endless belt conveyor 40 is supported in the form of a trough by troughing idlers 42, which may be catenary troughing rollers. This trough of course confronts the discharge openings 31 of the several hoppers. The return belt 43, which is the return portion of the endless belt conveyor 40, is supported immediately under the supply belt in a flat condition by return idlers 44. As seen in Fig. 2, the return idlers are split idlers mounted on either side of the car center sill 22 to support the return run 43 as close as possible to the upper surface of the center sill. The troughing idlers 42 are necessarily supported in catenary fashion to enable positioning of the supply run 41 as close as possible to the center sill. With this belt support arrangement, the entire hopper car structure will have the lowest possible centre of gravity.

The clam shell gates 32 are preferably operated between the closed and opened positions by power means such as hydraulic cylinders (not shown) which may be operated under the control of suitable control valves to be described subsequently.

As mentioned, the train conveyor 40 traverses the entire length of the hopper car portion of the unit train and a portion of the length of the trailer car 15 as best seen in Fig. 3. The adjacent cars of the unit train have suitable support structures for supporting the train conveyor over the car couplers.

The trailer car 15 is a multi-purpose car and, as best seen in Fig. 3, may consist of a conventional flat-bed car carrying certain structures to be described. The portion of the train conveyor 40 which is carried on the trailer car, is a lift portion 45 which elevates the conveyed material for discharge onto a transver conveyor 50. This lift portion 45 is supported by a suitable frame structure 46 of the trailer car.

The transfer conveyor 50 is an elongated endless belt conveyor, having a length of about thirty feet (9 meters) for example, which is carried at the rearward end of the trailer car 15. The forward end of the transfer conveyor is mounted on a post 51 underlying the rearward end of the train conveyor 40, with the transfer conveyor being supported to rotate relative to the vertical axis of the post 51 to position its discharge end at any desired point. During transit, the transfer conveyor is carried as illustrated in Fig. 3 in longitudinal alignment with the trailer car. The transfer conveyor is also pivotable, relative

to the post 51, about a horizontal transverse axis, so that the rearward end of the conveyor may be elevated as desired; and this is accomplished by means of a hydraulic lift cylinder 52. The transfer conveyor is preferably provided with hydraulically powered means (not shown) for rotating the conveyor relative to the axis of the post 51. In this manner the discharge end of the transfer conveyor can be positioned where desired, to discharge the material from the train conveyor 40 into other transport vehicles, onto another conveyor, onto piles adjacent to the track or onto the track behind the trailer car.

The trailer car 15 may also carry power generating apparatus for operating the conveyor system described. The train conveyor 40 and the transfer conveyor 50 are preferably drive by suitable electric motors; and the power for these motors may be generated by a suitable electric generator 55 driven by a suitable internal combustion engine 56 such as a diesel engine. The generator 55 may also provide power for auxiliary apparatus such as a portable stacking conveyor to be described.

The clam shell gates 32 for the hoppers will be quite long and heavy, and each gate of a pair of gates would be preferably operated by a pair of double acting hydraulic cylinders. The four cylinders would preferably be controlled simultaneously by a single hydraulic valve which may be a manual valve, or may be a solenoid actuated valve for example. High pressure hydraulic fluid for the operation of these gates 32 would be supplied from the trailer car 15 which would include a suitable electric motor driven hydraulic pump. The electric motor would receive its energy from the above mentioned generator 55. The controls for the hopper gates should be preferably located at the side of the hopper car in order to be conveniently actuated by a crew member. The

controls so located would be either manually operable hydraulic valves or electric switch controls for operating the solenoid actuated valves.

Preferably, the hoppers will be emptied in sequence beginning with the hopper nearest the trailer car. It is desirable that the hopper gates be operated under the manual and visual control of a crew member to assure that one hopper is completely empty before the gates of the succeeding hopper are opened. Where the load is being dumped in a windrow, this operator may also assist in controlling the speed of the train by signaling the locomotive engineer to assure the efficient stacking of the windrow.

The trailer car 15 may also include a suitable control panel or station for the operation and control of the several above described components including the generator 55, the generator driving engine 56, the motors for the train conveyor 40 and the transfer conveyor 50, the hydraulic mechanisms for both rotating and changing the height of the transfer conveyor, and possibly the mechanism for

controlling the tension on the train conveyor 40.

For the operation of the train conveyor 40, the train must be on a straight section of track, since the conveyor belt cannot accommodate any curves during use. During such use the conveyor must be appropriately tensioned; and this may be accomplished by a suitable hydraulically controlled system which is associated with the lift portion 45 of the conveyor carried on the trailer car 15. This belt tensioning system may be conventional and need not be described further here. During the transit of the train, some slack must be imparted to the train conveyor to allow the belt to flex at the coupling points and enable the train to negotiate curves without damage to the belt. The control for that belt tensioning system may also preferably be included in the above mentioned control panel carried on the trailer car.

Fig. 4 of the drawing is a diagrammatic end view of the trailer car, omitting certain structures of the trailer car but illustrating the transfer conveyor 50 in position to deposit the bulk material into a windrow along side the track. The windrow might have a height of ten feet (3 meters) for example and the apex must be sufficiently removed from the track to prevent the material from running onto the track. For this operation, also illustrated in Fig. 1, the material may be deposited in the windrow while the train is moving; and therefore the stretch of straight track must be sufficiently long to allow the train to move a sufficient distance to unload the entire load. For this operation, the hopper gates might be operated in sequence starting from the rear of the train to unload the entire train. It is believed that for this operation, the train would have an unloading rate of 1000 tons per hour (907.2 M.T.

per hour) so that an entire 800 ton (726 M.T.) train load can be deposited in a windrow alongside the track in approximately forty-five minutes.

Fig. 5 of the drawing illustrates another method for unloading the train of the invention, which may be accomplished while the train is stationary. This method involves the use of a portable stacking conveyor 60 of a type which is commonly in use. This conveyor 60 is an elongated endless belt conveyor having a support frame 61 including support wheels 62 intermediate its ends, and having a receiving box 63 at its receiving end. This conveyor may be powered by a suitable electric motor; and may be connected to the above described generating system of the trailer car 15. Conceivably, such portable stacking conveyor could be carried with the self-unloading train of the invention; but more practically it would be transported to the unloading site by truck for example. Such portable stacking conveyor may be positioned relative to the trailer car to enable the stacking of an entire train load for example into a pile thirty feet (9 meters) high and forty feet (12 meters) away from the track. For a larger train load, adjacent piles may be made by moving the portable stacking conveyor, for example.

What has been described are improved equipment and methods for the transport of bulk materials by rail, and for the rapid and efficient unloading of those bulk materials when the train arrives at its destination. A particular feature and advantage of the invention is that the equipment and method are functionally independent of any particular kind of unloading facility and independent of unloading time. The train can be unloaded by the train crew without the necessity for any unloading facilities or equipment or personnel at the unloading site.

Where aggregates are to be delivered to a highway construction site for example, advantage may be taken of the fact that railroads frequently parallel highways; and the aggregates may be unloaded either on railroad right of way or highway right of way adjacent to the railroad and very close to the point of use of the aggregates. Additionally such aggregates may be delivered to that site weeks or even months ahead of the time that the aggregates will be used by the highway contractor.

A unit train as above described may be relatively small in terms of the number of hopper cars and overall train load; and this may be desirable to enable the train to be pulled by a relatively low powered locomotive. Where a large quantity of aggregates or materials are to be delivered to a particular destination, two or more such unit trains may be coupled together and either pulled by a larger locomotive or by multiple locomotives, one located at the front of the train and one located at the rear.

An important advantage of the invention is that such unit trains may be utilized to their maximum capacity, since there is no need for the train to remain on a siding for several days or longer waiting to be unloaded. An ancillary

advantage to the receiver of the materials is that he has much more flexibility in arranging for the transfer of the materials from the rail siding to his storage or use location. He can schedule the use of his equipment much more efficiently, and need not be concerned about the cost of idle hopper cars sitting on a siding.

Another feature and advantage of the invention is that several different kinds or grades of material can be shipped on the same train. Since the hoppers are unloaded sequentially, a first kind of material may be loaded onto the front portion of the train, a second kind of material may be loaded onto a middle portion of the train, and a third kind of material may be loaded onto the rear portion of the train. If the train is unloaded in a windrow, the three different kinds of materials will be located in indentifiable sections of the windrow. If the material is unloaded in piles by a portable stacking conveyor, by moving the conveyor or the train or both, the different kinds of material may be stacked in separate piles.

An important advantage of the invention is that it takes advantage of the efficiencies of rail transportation. It allows for twenty-four hour operation of the rail facilities and equipment while requiring no specialized unloading facility.

An overall feature and advantage of the invention is that it provides for maximum economy in the business of transporting bulk materials since it utilizes the rail transportation to maximum advantage, utilizes the equipment to the fullest extent by eliminating idle time, and utilizes the crew more efficiently.

While the preferred embodiments of the invention have been illustrated and described, it will be understood by those skilled in the art that changes and modifications may be resorted to without departing from the spirit and scope of the invention.

CLAIMS:

1. A self-unloading train for the transportation of bulk materials characterized by:

a plurality of hopper cars (11,12,13) coupled together, each having a center sill (22); each hopper car (11,12,13) including at least one hopper (21) having all walls (26) inclined at least 65° from horizontal, and forming an elongated bottom discharge opening (31) having a width at least half the distance between the hopper car wheels (24);

a train conveyor (40) comprising an endless belt (41,43) underlying said hopper discharge openings (31) to receive material discharged therefrom, running the length of said plurality of hopper cars (11,12,13); the return run (43) of said belt being supported by split return idlers (44) alongside said car center sills (22); the supply run (41) of said belt being supported by catenary troughing rollers (42) disposed immediately above said return run;

each of said hoppers (21) having gate means (32) for its discharge opening; said gate means (32) being operable selectively to discharge material from said hoppers (21) onto said train conveyor (40).

2. A self-unloading train as set forth in claim 1 characterized by:

said gate means (32) comprising clam shell-type gates pivoted about axes parallel to said train conveyor (40); and hydraulic control means for effecting modulated opening of said gates to control the flow of material onto said train conveyor (40).

3. A self-unloading train as set forth in claim 2 characterized by:

each of said clam shell-type gates (32) having a long dimension parallel to said conveyor (40) of at least 80% of the longitudinal top dimension of its respective hopper (21).

4. A self-unloading train as set forth in any preceding claim characterized by:

said train including a trailier car (15); said train conveyor (40) extending to said trailer car (15), and said trailer car (15) supporting a lift portion (45) of said train conveyor at its discharge end sufficiently high to discharge said material to a transfer conveyor (50).

5. A self-unloading train as set forth in claim 4 characterized by:

a prime mover (56) mounted on said trailer car (15) providing power for hydraulic and electric systems for operating said train conveyor (40) and said gate means (32).

6. A self-unloading train as set forth in claim 4 or 5 characterized by:

a transfer conveyor (50) mounted on said trailer car (15) for receiving material from said train conveyor (40) and for discharging said material at selected points surrounding said trailer car (15).

7. A method for transporting bulk material by rail and unloading same which includes the step of loading the material into a plurality of hoppers (21) of a plurality of hopper cars (11,12,13), each having a center sill (22), coupled together to form a train, characterized by:

forming said hoppers (21) with walls (26) inclined at least 65° from horizontal, and an elongated bottom discharge opening (31) having a width at least half the distance between the wheels (24) of said hopper cars (11,12,13);

discharging said material from said hoppers (21) onto a train conveyor (40) which underlies said hoppers (21) and runs the length of said train;

supporting the return run (43) of said train conveyor (40) by split return idlers (44) disposed alongside said car center sills (22);

supporting the supply run (41) of said train conveyor (40) by catenary troughing idlers (42) disposed

immediately above said return run (43); and conveying said material on said train conveyor (40) to one end of said train, for discharge of said material from said train.

8. A method as set forth in claim 7 characterized by:
conveying said material on said train conveyor (40) to an end car (15) coupled to said plurality of hopper cars (11,12,13); elevating said material at said end car by means of a lift portion (45) of said train conveyor (40) mounted thereon; discharging said material from said train conveyor (40) to a transfer conveyor (50) mounted on said end car (15); and discharging said material from said transfer conveyor (50) to selected points surrounding said end car (15).

9. A method as set forth in claim 7 or 8 characterized by:
controlling the flow of said material from said hoppers (21) by means of clam shell-type gates (32) pivoted about axes parallel to said train conveyor (40); and controlling the opening of said gates (32) by hydraulic means for modulating the flow of material onto said train conveyor (40).

10. A method as set forth in claim 7, 8 or 9 characterized by:
forming said hopper discharge openings (31) and said clam shell-type gates (32) to have a long dimension parallel to said conveyor (40) of at least 80% of the longitudinal top dimension of the hopper (21).

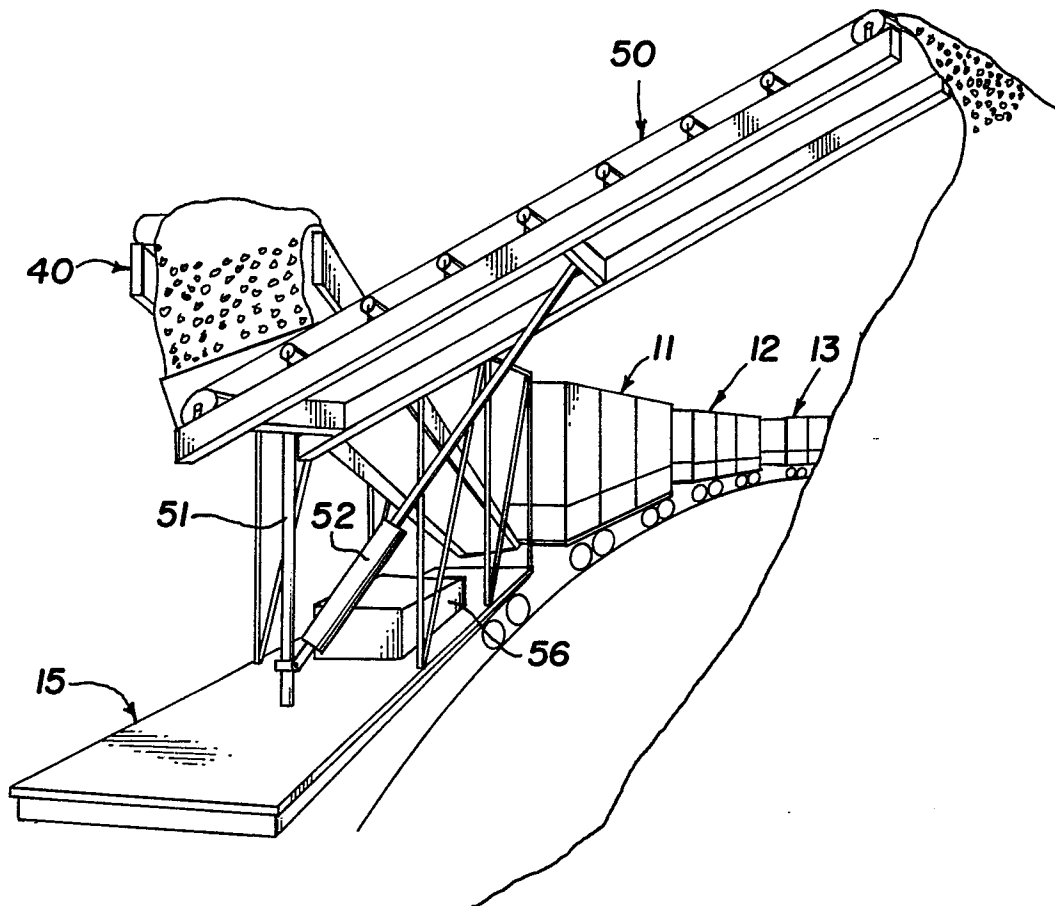


Fig. 1

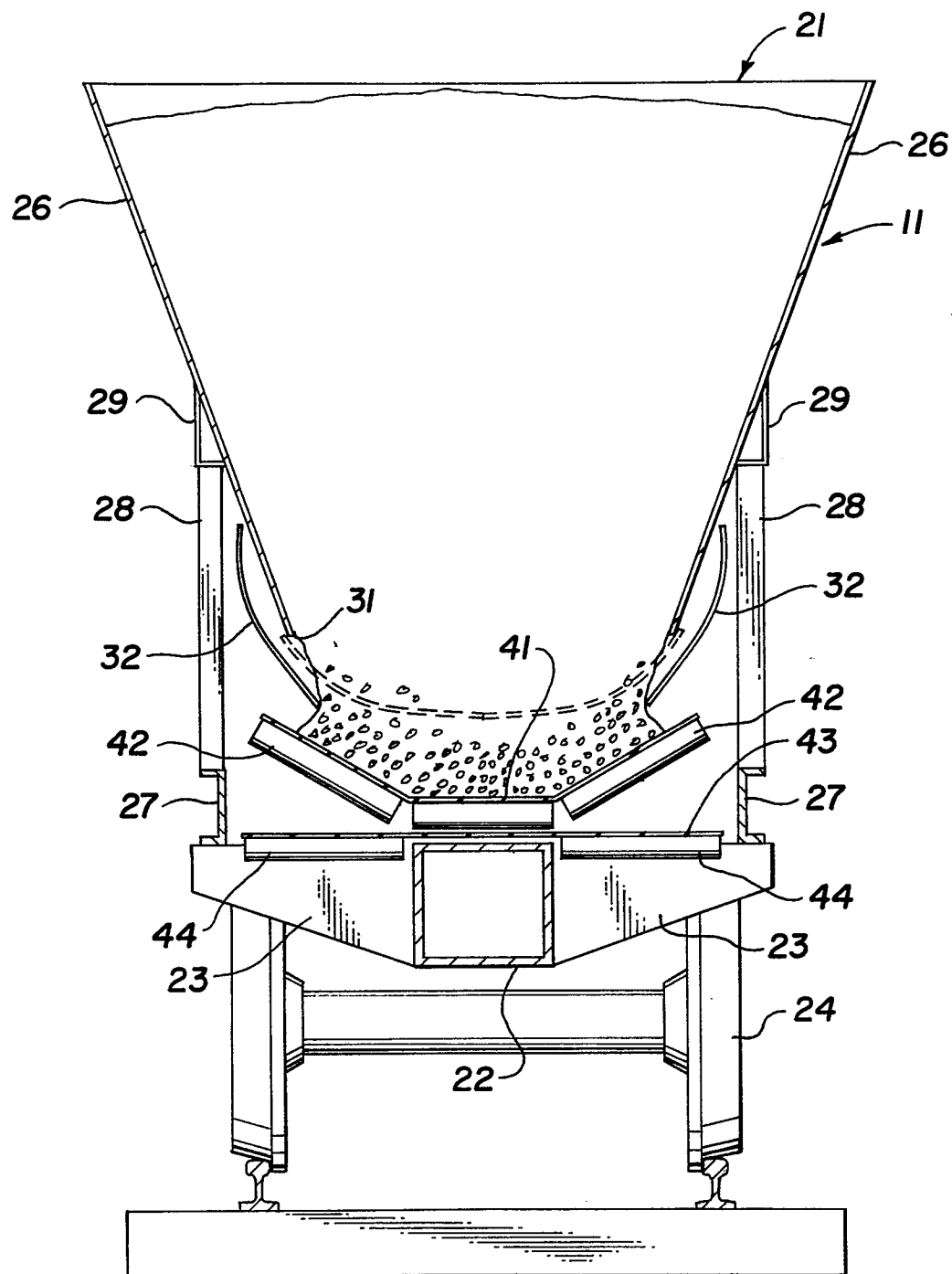


Fig. 2

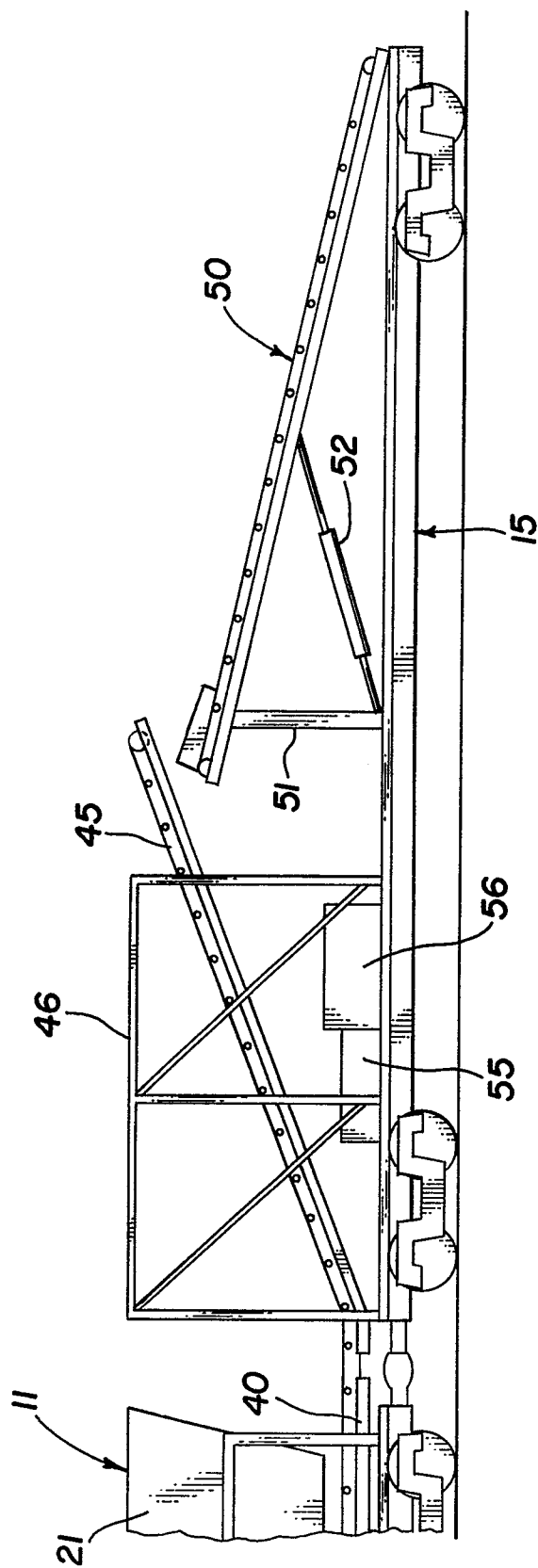


Fig. 3

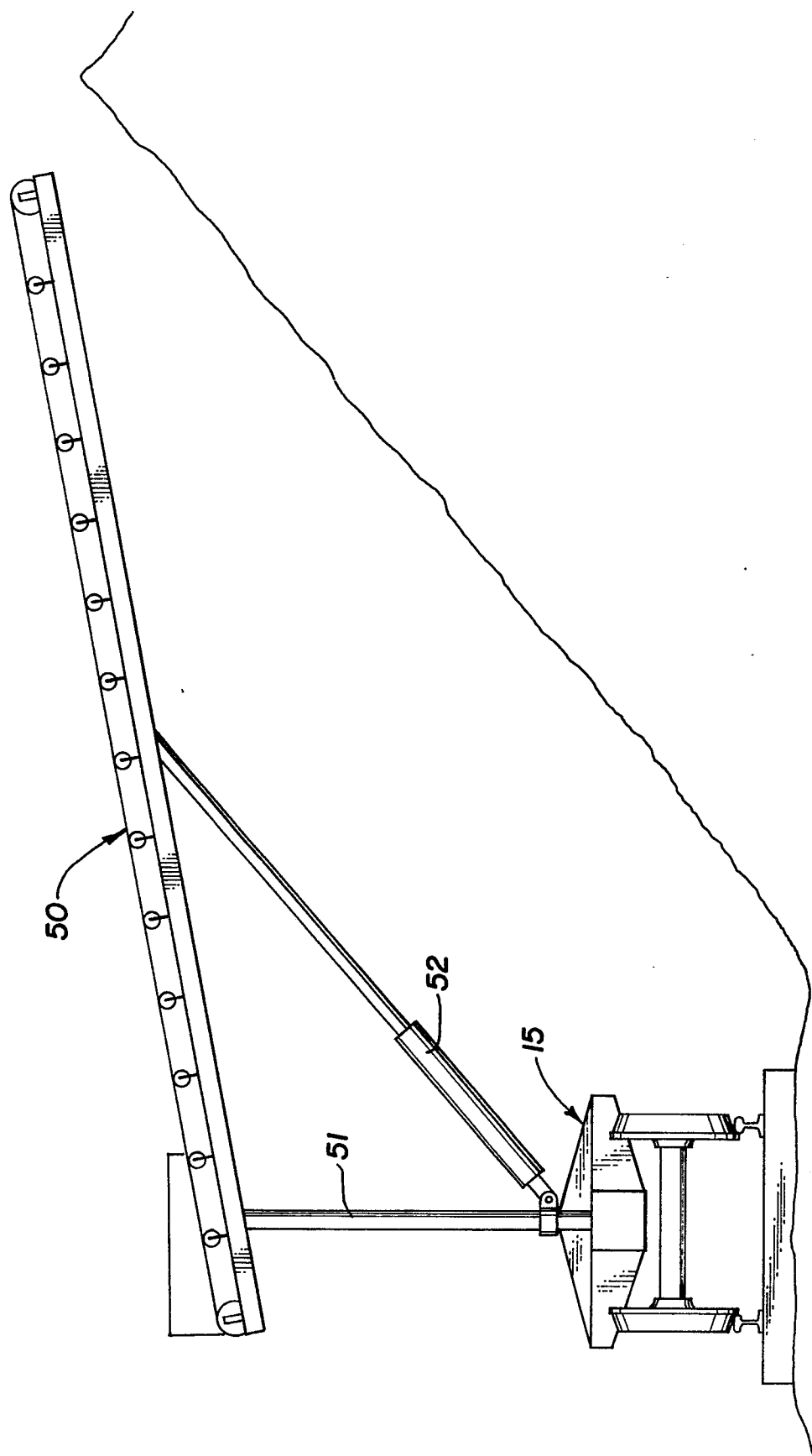


Fig. 4

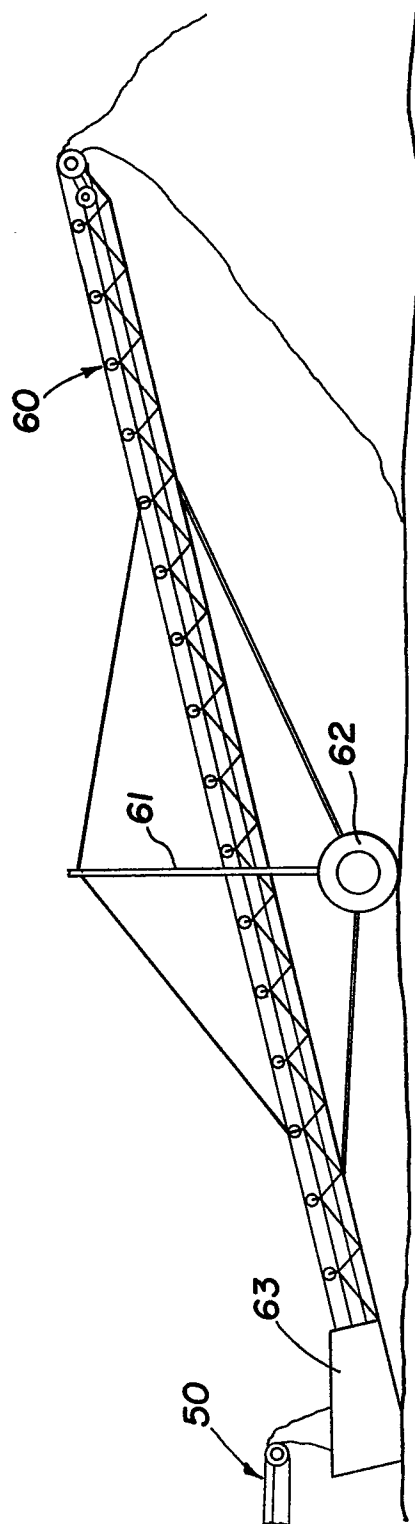


Fig. 5



European Patent
Office

EUROPEAN SEARCH REPORT

0206590

Application number

EP 86 30 4284

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	DE-A-2, 447 635 (MOKSEL) * Page 1, lines 4-12; page 2, lines 1-19; page 2, line 24 - page 3, line 14; claims 1,3; figures 1,2,4 *	1,7	E 01 B 27/02
Y		2,9	
A		5,6,8	
Y	US-A-2 989 930 (FLOWERS) * Column 2, line 65 - column 3, line 35; column 5, lines 18-37; figures 1,3-5,12 *	2,9	
A	US-A-1 455 602 (CURLLEE) * Page 1, line 101 - page 2, line 36; figures 1-5 *	1,3,7,10	TECHNICAL FIELDS SEARCHED (Int. Cl.4) E 01 B B 61 D
A	GB-A-2 097 846 (FRANZ PLASSER) * Page 2, lines 77-87; figure 1 *	4-6,8	
A	FR-A-2 508 950 (BOUVOT) * Page 1, line 26 - page 2, line 35; page 3, line 22 - page 4, line 10; figures 1-4 *	1,5-9	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 29-09-1986	Examiner KERGUENO J.P.D.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			



DOCUMENTS CONSIDERED TO BE RELEVANT			Page 2
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	GB-A- 142 569 (SHUTT) * Page 2, lines 12-33; figures 2,3 * -----	5,6,8	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 29-09-1986	Examiner KERGUENO J.P.D.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	