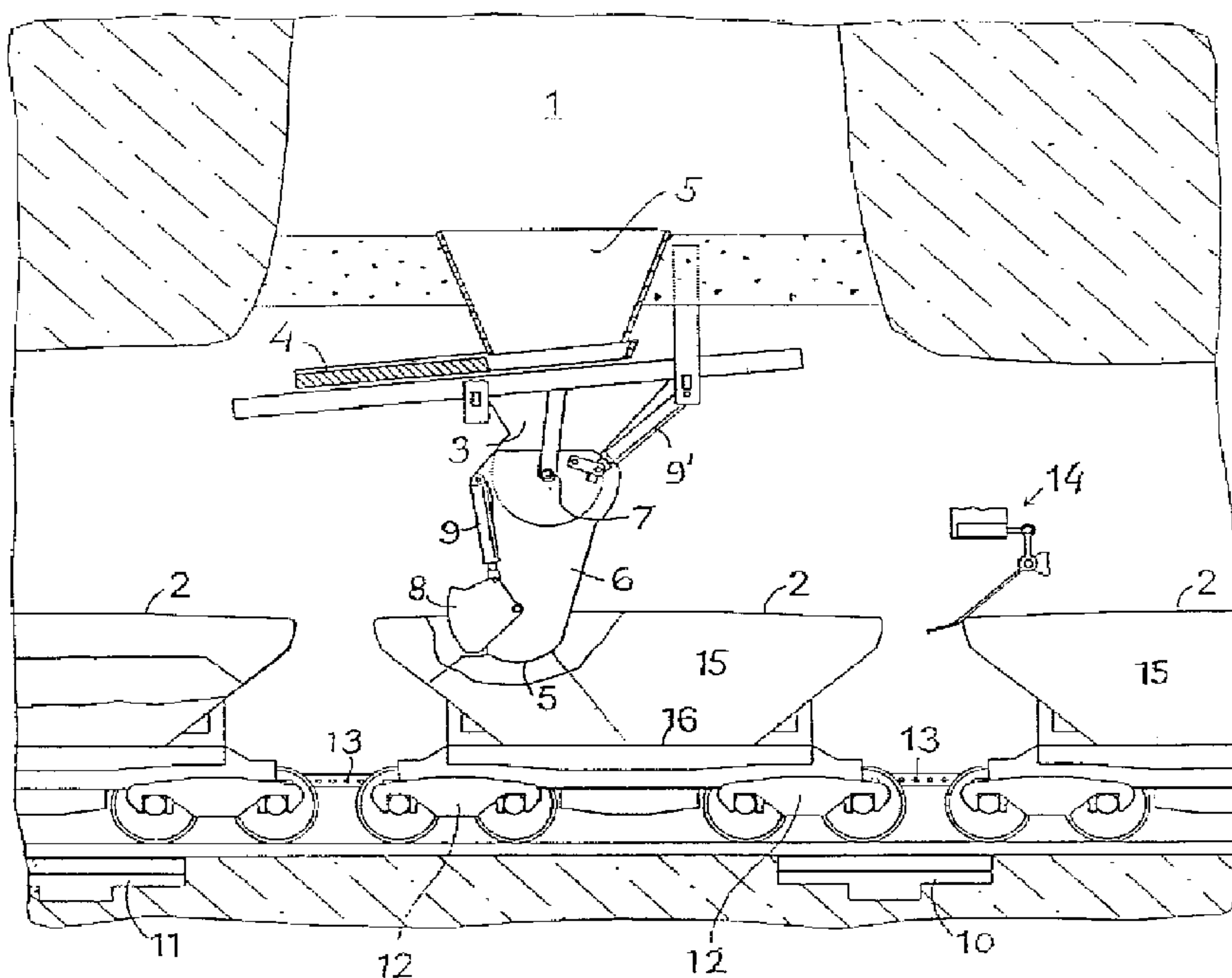




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(54) Titre : PROCEDE POUR UTILISER AU MAXIMUM LA CAPACITE DE CHARGEMENT D'UN WAGON INDIVIDUEL ET D'UN TRAIN DE WAGONS, LORSQU'ON CHARGE AVEC UN MATERIAU EN VRAC
(54) Title: METHOD TO MAXIMALLY UTILIZE THE LOADING CAPACITY OF AN INDIVIDUAL WAGON AND THE TRAIN WHEN LOADING WITH BULK MATERIAL



(57) **Abrégé/Abstract:**

A method of utilizing the loading capacity of a wagon and a wagon train to a maximum when loading with pourable material, particularly bulk material, from a silo (1) with the aid of a raisable and lowerable delivery chute (6) having an outlet opening, down into a wagon (2) moving beneath the chute (6). The by-passing wagon (2) to be filled is weighed (10) and its empty weight registered. The method is characterized by registering the type of by-passing wagon (2) to be filled and by feeding to a computer registered data representing the weight of an empty wagon and the type of wagon concerned. This data, in the form of signals, is fed into the computer and the computer functions to move the outlet opening of the chute (6) to a height above the bottom (16) of the wagon in accord with the type of wagon (2) concerned on the basis of said data and the density of the bulk material through the medium of manoeuvring devices (9, 9'), wherein the height at which the chute outlet opening is located above the bottom (6) determines the volume of bulk material that corresponds to the maximum permitted total weight of this individual wagon.

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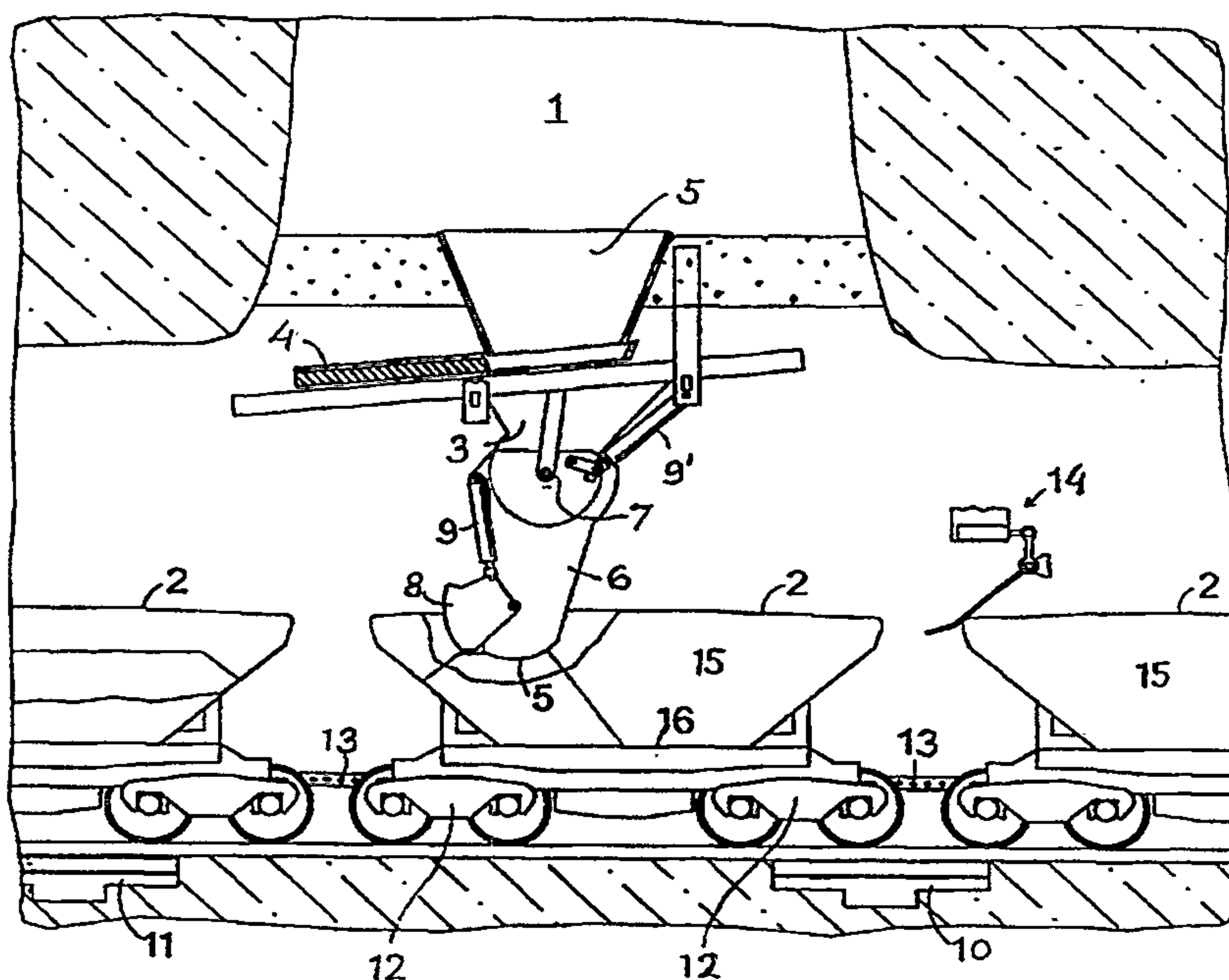
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(57) Abstract

A method of utilizing the loading capacity of a wagon and a wagon train to a maximum when loading with pourable material, particularly bulk material, from a silo (1) with the aid of a raisable and lowerable delivery chute (6) having an outlet opening, down into a wagon (2) moving beneath the chute (6). The by-passing wagon (2) to be filled is weighed (10) and its empty weight registered. The method is characterized by registering the type of by-passing wagon (2) to be filled and by feeding to a computer registered data representing the weight of an empty wagon and the type of wagon concerned. This data, in the form of signals, is fed into the computer and the computer functions to move the outlet opening of the chute (6) to a height above the bottom (16) of the wagon in accord with the type of wagon (2) concerned on the basis of said data and the density of the bulk material through the medium of manoeuvring devices (9, 9'), wherein the height at which the chute outlet opening is located above the bottom (6) determines the volume of bulk material that corresponds to the maximum permitted total weight of this individual wagon.



**METHOD TO MAXIMALLY UTILIZE THE LOADING CAPACITY OF AN
INDIVIDUAL WAGON AND THE TRAIN WHEN LOADING WITH BULK
MATERIAL**

5 Field of the Invention

The present invention relates to load management of a wagon,
and more particularly to a method of utilizing to a maximum
the load-carrying capacity of a wagon and a wagon train when
10 filling a wagon with pourable bulk material from a silo.

Background of the Invention

Bulk materials are normally loaded onto railway freight cars
15 or wagons, by passing a number of mutually hitched wagons
through a loading zone above which there is arranged a
storage unit or silo in which bulk materials, such as ore
concentrates or pellets, are stored. The material is
discharged from the silo down into an underlying wagon
20 through the medium of a chute provided with an outlet
opening, referred to here as a material delivery chute.
Loading of the wagons takes place automatically and the
outlet end of the delivery chute is provided with a flap
whose width is sufficient to cause the material pouring from
25 the chute to be distributed uniformly in the wagon.

Australian Publication B 55576/86 teaches one such type of
loading arrangement where the intention is to distribute the
weight of the material equally at both ends of the wagon
30 while, at the same time, maintaining an essentially constant
height or level of the material in the wagon, therewith to
utilize the capacity of the wagon effectively. To this end,
the wagon is weighed and its height is determined and also
its passage through specific points. On the basis of this

information, the material delivery chute is controlled to deliver a specific volume or weight of material to the wagon and to distribute the material uniformly in the wagon while levelling the material therein at the same time.

5

When seen against the background of the number of wagons that annually transport bulk materials of the aforesaid kind, such as ore, ore concentrates or pellets, it is a natural aim to utilize the load capacity of each wagon and each wagon train
10 to a maximum. Wagon wheels and wagon baskets become worn and in time a wagon may become one or two tonnes lighter in weight. Its loading capacity has not diminished, however. The endeavour to constantly utilize the full load capacity of individual wagons or freight cars is readily understandable.

15

SUMMARY OF THE INVENTION

The present invention relates to a method which enables this to be achieved in accordance with the characterizing features
20 set forth in the following claims.

According to an aspect of the present invention, there is provided a method of utilizing to a maximum the load-carrying capacity of a wagon and a wagon train when filling a wagon
25 with pourable bulk material from a silo with the aid of a raisable and lowerable delivery chute which includes an outlet opening and which functions to discharge the material into a wagon moving beneath the chute, wherein the wagon to be loaded is weighed and its empty weight registered, which
30 comprises: registering the type of the wagon to be filled; feeding, to the computer, registered data representative of the empty weight of the wagon and the type of the wagon concerned; at the computer, on the basis of the registered data, a maximum permitted total weight for the wagon and the

density of the bulk material, determining a maximum permitted volume of the bulk material; and causing the outlet opening of the chute to be positioned at a height above the wagon bottom which is in accord with the type of the wagon
5 concerned, through the medium of manoeuvring devices, the height determining a volume of the bulk material loaded to the wagon and being adjusted such that the volume of the bulk material is within the maximum permitted volume of the bulk material.

10

According to a further aspect of the present invention, the method further includes the step of weighing the loaded wagon and registering its total weight and comparing the registered weight with the maximum permitted total weight of the wagon
15 concerned, wherein the difference between the registered total weight and the maximum permitted total weight is fed as data to the computer, wherein on the basis of this data the outlet opening of the delivery chute is guided to a height above the bottom of a following carriage such that the wagon
20 will be loaded with correspondingly less bulk material when the difference is positive and correspondingly more bulk material when the difference is negative.

BRIEF DESCRIPTION OF THE DRAWING

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Figure 1 is a diagram showing a side view of an arrangement of an apparatus for carrying out the method in accordance with the embodiment of the present invention.

30

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention will now be described in more detail with reference to an exemplifying embodiment thereof and also with reference to the accompanying drawing which illustrates

schematically and in side view an arrangement of apparatus for carrying out the inventive method.

The drawing illustrates a silo 1 for storing bulk materials such as ore concentrates or pellets. The silo is located in a high rock elevation above a loading zone through which a plurality of railway wagons or freight cars 2 continuously move during a loading operation. Extending from the silo 1 is a metering means which functions to meter material into respective wagons 2 and to uniformly distribute the load therein. The metering means has a conical upper part 3 which is located adjacent to or connects with a closure flap 4 provided at the silo outlet 5. A material delivery chute 6 is pivotally mounted on a shaft 7 beneath the outlet 5, the upper part 3 of the metering means and the closure flap 4. The lower part of the delivery chute 6 is provided with a closure flap 8 whose position relative to the chute opening is controlled by a piston-cylinder maneuvering device 9. Pivotal movement of the delivery chute in relation to said conical part 3, or downfeed funnel 3, is also effected with the aid of a piston-cylinder maneuvering device referenced 9' in the drawing. The delivery chute 6 can be swung clockwise from its illustrated discharging position to a generally horizontal rest position in which it enables wagons 2 to pass freely therebeneath.

The illustrated arrangement also includes a conventional weighing machine 10 over which the bogies 12 of respective wagons 2 are intended to pass, so that their weights and tare weights can be established.

Arranged along the rail track in the loading zone is a sensor 13 which functions to establish the instantaneous positions of a wagon to be filled as the wagon moves through the

loading zone beneath the silo 1. Also provided is an angle indicator 14 which detects and registers the height of an arriving wagon above the rail track. The angle indicator 14 has a slip arm which gives an angle indication immediately the end wall of a wagon begins to lift the arm while registering the first or leading end of the wagon at the same time, in a manner that will be readily understood. The same applies when the arm leaves the passing wagon. The length of the wagon is registered by the horizontal sensor 13 and the empty weight or tare weight of the wagon is registered by the weighing machine 10.

This registered data is fed into a computer which determines the type of wagon to be loaded on the basis of the values obtained with the aid of sensors 13 and 14. The height of the bottom 16 of the wagon above the rail track is therewith determined by this information or data. The computer is able to determine the height of the outfeed end of the delivery chute above the bottom 16 of the wagon basket 15 on the basis of these values and with knowledge of the density of the bulk material and the permitted total weight of the wagon. As the wagon moves beneath the silo, the wagon is filled continuously with bulk material from the silo via the delivery chute 6, the adjusted height of which corresponds to the maximum load of the type of wagon concerned. The height adjustment to the delivery chute 6 is effected with the aid of the piston-cylinder device 9' and movement of the closure flap 8 is controlled with the aid of the piston-cylinder device 9.

30

The total weight of the now filled carriage 2 is then registered with the aid of the weighing machine 11, it being established whether or not the weight of the wagon exceeds its maximum permitted total weight or whether the weight of

the wagon is below this weight. For instance, if it is found that the wagon that has just been loaded weighs less than the maximum permitted total weight, the next wagon in line can be loaded to a correspondingly greater extent than the preceding wagon, whereas if it is found that the wagon that has just been loaded weighs more than the maximum permitted total weight, the next wagon in line can be loaded to a correspondingly lesser extent. This enables the total weight of the wagon train to be adjusted constantly to an optimum. It will be understood that any excess weight will be comparatively small and will lie within the safety margins of the wagons.

The difference between the registered total weight and the maximum permitted total weight may be fed as data to the computer. On the basis of this data, the outlet opening of the delivery chute 6 is guided to a height above the bottom of a following carriage such that the wagon will be loaded with correspondingly less bulk material when the difference is positive and correspondingly more bulk material when the difference is negative.

It will also be understood that the sensors 13 and 14 for instance may be of another kind which, for instance, will enable the type of wagon concerned to be identified by given markings on the sides of the wagon which can be read-off and therewith disclose the type of wagon concerned. It will also be understood that the height-measuring angle indicator may alternatively have the form of a vertical ramp of photocells.

CLAIMS

1. A method of utilizing to a maximum the load-carrying capacity of a wagon and a wagon train when filling a wagon with pourable bulk material from a silo (1) with the aid of a raisable and lowerable delivery chute (6) which includes an outlet opening and which functions to discharge said material into a wagon (2) moving beneath the chute (6), wherein the wagon (2) to be loaded is weighed (10) and its empty weight registered, which comprises:

registering the type of the wagon (2) to be filled;

feeding, to the computer, registered data representative of said empty weight of the wagon and the type of the wagon concerned;

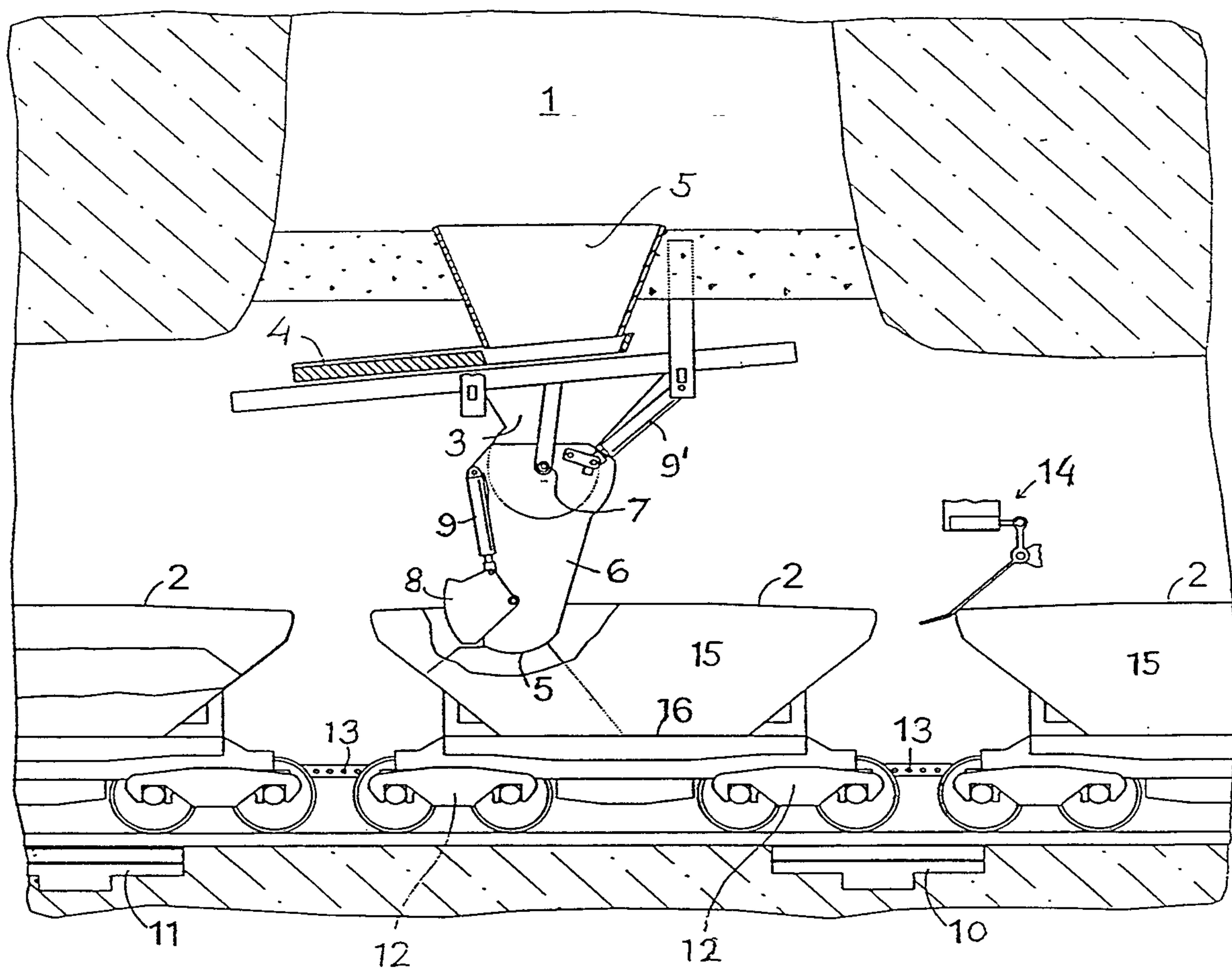
at the computer, on the basis of the registered data, a maximum permitted total weight for the wagon and the density of the bulk material, determining a maximum permitted volume of the bulk material; and

causing the outlet opening of the chute (6) to be positioned at a height above the wagon bottom (16) which is in accord with the type of the wagon (2) concerned, through the medium of manoeuvring devices (9, 9'), said height determining a volume of the bulk material loaded to the wagon and being adjusted such that the volume of the bulk material is within the maximum permitted volume of the bulk material.

2. A method according to Claim 1, further comprising weighing the loaded wagon and registering its total weight and comparing the registered weight with the maximum permitted total weight of the wagon concerned, wherein the difference between the registered total weight and the maximum permitted total weight is fed as data to the computer, wherein on the basis of this data the outlet opening of the delivery chute (6) is guided to a height above

the bottom (16) of a following carriage (2) such that the wagon will be loaded with correspondingly less bulk material when said difference is positive and correspondingly more bulk material when said difference is negative.

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