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(54) A process and an apparatus for producing a concrete floor.

(57) A process for producing a concrete floor, which comprises pouring a concrete mixture over a prepared surface. According to the invention the concrete mixture supplied is transferred into at least one reservoir (2) of a distributing vehicle (1) and the distributing vehicle (1) is traveled over the prepared surface. The concrete mixture is then discharged from the reservoir (2) and poured, in the direction of travel, behind the reservoir (2) and distributed in a transverse direction (11). The invention also provides a distributing vehicle (1) for carrying out the process defined, said vehicle (1) being provided with a reservoir (2), a shoot communicating therewith at the back part via an opening (4) for transversely distributing the concrete mixture, and at least three wheels (5) with low pressure tyres.

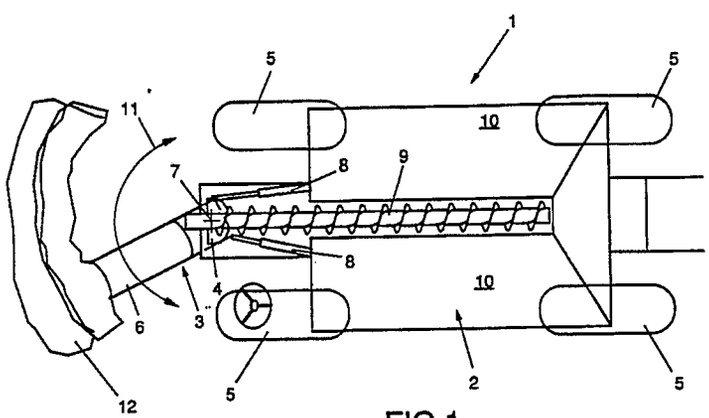

FIG.1

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This invention relates to a process for producing a concrete floor, which comprises pouring a concrete mixture over a prepared surface.

In the manufacture of a concrete floor over a prepared surface, such as a equalized sand surface, it is known to install a storage tank with a concrete pump beside that surface, to lay down along that surface a pipeline communicating with the concrete pump, said pipeline being composed of lengths of pipe interconnected with quick-acting couplings, and to couple a flexible tube to the end of that pipeline. Following these preparations, the concrete mixture prepared in another place is transferred to the storage tank and pumped through the pipeline and the flexible tube by means of the concrete pump. When the concrete mixture is pumped over the prepared surface, the end of the flexible tube connected to the end of the pipeline is moved to evenly distribute the concrete mixture over that surface. Once the part of the surface that can be reached from the end of the pipeline with the flexible tube has been covered with concrete mixture, the pipeline is shortened by removing one or more lengths of pipe, and a following part of the prepared surface is covered with concrete mixture.

By means of this process the concrete mixture can be mechanically poured over the prepared surface.

This known process has some drawbacks. The assembly of the pipeline from lengths of pipe and the disassembly of the pipeline are time-consuming activities. The manipulation of the tube is laborious and arduous and imposes restrictions on the amount to be pumped. The tube and the lengths of pipe must be cleaned after pouring, which is again time-consuming. Moreover, the distribution of the concrete mixture over the floor surface highly depends on the skill of those in charge of moving the discharge end. An uneven distribution results in a longer finishing time required by the redistribution for equalizing purposes, because the concrete mixture must be further distributed manually, which is conventionally done by means of shovels.

The object of this invention is to provide a process by which the above drawbacks are removed or at least restricted.

According to the invention this object is achieved by transferring the concrete mixture supplied into at least one reservoir of a distributing vehicle, traversing the distributing vehicle over the prepared surface while discharging the concrete mixture from the reservoir and pouring it behind the reservoir in the direction of travel and in transverse distribution.

Since the supply of concrete mixture is carried along in the vehicle during distribution, the steps of laying down a pipeline along the prepared surface and manipulating the flexible tube are no longer necessary. The pattern of distribution of the concrete is determined by the route completed by the distributing vehicle and the movements of that vehicle, while a uniform strip is laid out behind the vehicle. The completion of a route evenly distributed over the prepared surface with controlled movements is very easy with a distributing vehicle. Furthermore, the rate of handling can be higher, because a flow of concrete mixture can be handled at a flow rate higher than is possible with the manipulation of a discharge end of a tube. Cleaning the distributing vehicle is considerably less time-consuming than cleaning a concrete pump, loose lengths of pipe and a tube. Moreover, the distributing vehicle can be easily moved to a place suitable for cleaning.

The invention is based on the insight that it is possible to traverse a reservoir containing concrete and provided with its own driving and distributing means over a prepared surface, such as a sand surface, optionally covered with a film having a low bearing capacity per surface unit, without excessive deformation of that surface.

Preferably, after discharging from the reservoir and before pouring the concrete mixture is passed through a shoot and the transverse distribution is carried out by moving the shoot in a to-and-fro displacement.

According to an advantageous embodiment of the invention, poured concrete mixture is distributed, during traversing the distributing vehicle and simultaneously with the pouring operation, by rotating at least two distributing worms coiled in opposite directions and transversely suspended at the back part of the distributing vehicle in a substantially horizontal and tandem arrangement, said worms being rotated in a sense of rotation in which the bottom moves in the direction of travel.

The first worm forces poured concrete mixture extending above a specific level in a first transverse direction, while concrete mixture which after passing the first worm still extends above a specific level is distributed in the opposite transverse direction by the next worm. Thus, the concrete mixture can be distributed so evenly that a finishing treatment is hardly, if at all, necessary.

In this distribution method a short shoot can be used which, if required, can be maintained in a fixed position. This admits of a large manoeuvrability of the vehicle, because the length of the vehicle is reduced to a minimum.

In a further elaboration on the invention the concrete mixture distributed by the worms is simultaneously finished during traversing the distributing vehicle. This may be done, e.g., by scraping the surface of the poured and distributed concrete mixture by means of a vibration beam which in the

direction of travel is suspended behind and parallel to the distributing worms. When using concrete reinforced with co-poured loose fibres, the scraping of the surface by means of a vibration beam has the advantage that the fibres will sink as a result of the vibration and their relatively high specific mass to the extent that after passing the vibration beam these fibres are at some distance below the resulting surface of the concrete mixture.

It is a further object of the invention to provide a distributing vehicle for carrying out the process according to the invention.

To achieve this object, the distributing vehicle according to the invention is provided with a reservoir, a shoot for transversely distributing the concrete mixture communicating with the reservoir at the back part via an opening, and at least three wheels with low pressure tyres.

Since the vehicle according to the invention is provided with low pressure tyres, it can convey a large amount of concrete mixture over the prepared surface with a low bearing capacity per surface unit without deforming this surface to the extent that the quality of the floor to be produced is negatively affected.

In order to evenly distribute the concrete mixture, the shoot for transversely distributing the concrete mixture may be a swinging shoot. This has the advantage that the concrete mixture can be poured as a continuous flow and that the flow need not be spread out.

Preferably, the swinging capacity of the shoot is such that the end of the shoot is displaceable over a range extending transversely to about at least the largest track of the distributing vehicle. Thus, a strip of concrete mixture having a breadth at least equal to the track of the distributing vehicle can be poured behind the vehicle.

To obtain a finer distribution of the poured concrete mixture, the distributing vehicle may be provided with at least two distributing worms which in the operating position are suspended transversely behind the shoot in a horizontal and substantially tandem arrangement, at least one of which worms has a substantially left-hand screw and at least one has a substantially right-hand screw. With these worms it is possible to carry along concrete mixture extending above a specific level and to force it in a direction transverse to the direction of travel. Thus, so fine a distribution can be obtained that after passage of the vehicle a finishing treatment will be hardly, if at all, necessary.

In a further elaboration on the invention, a vibration beam is suspended substantially behind the worms and parallel thereto, the bottom edge of which beam is below the lowest generatrix of the outer circumference of the back worm. By means of this vibration beam the surface of the concrete mixture distributed by the worms can be scraped so as to form a surface so equalized as to require no finishing treatment.

The invention will hereinafter be illustrated by some practical examples and with reference to the accompanying drawings, in which:

Fig. 1 is a diagrammatic top plan view of a distributing vehicle according to the invention;

Fig. 2 is a diagrammatic cross-sectional side view of the distributing vehicle as shown in Fig.1;

Fig. 3 is a side view as shown in Fig. 1 of an alternative embodiment of the distributing vehicle according to the invention; and

Fig. 4 is a side view as shown in Fig. 2 of the distributing vehicle as shown in Fig. 3.

Figs. 1 and 2 show a distributing vehicle 1, which at the back part is provided with a reservoir 2 and a shoot 3. The shoot communicates with the reservoir 2 via an opening 4. The vehicle is provided with low pressure tyres 5. The shoot 3 is provided with a detachable extension 6 and is rotatable about an axis 7 by means of hydraulic cylinders 8. The reservoir includes a worm 9 disposed along the bottom edges of opposed walls 10 inclined downwards.

When pouring concrete mixture, it is forced through the opening 4 by its own weight and by the worm 4 and then passed through the shoot 3. The shoot 3 is moved in a to-and-fro displacement as indicated by the arrow 11, while the distributing vehicle 1 is moved forward, optionally stepwise Thus, a strip of concrete mixture 12 is poured behind the distributing vehicle, with the length of the shoot 3 including the extension 4 and the swinging capacity of the shoot ensuring that the poured strip of concrete mixture is preferably broad enough in at least one direction to pour an abutting following strip without the necessity of traveling with the tyres 5 over the strip already poured.

When filling the reservoir 2, the worm 9 can be rotated to distribute the concrete mixture over the reservoir 2. It is not necessary during filling to move the reservoir beneath the discharge opening of, e.g., the concrete mixer.

When the capacity of the reservoir 2 is such that two reservoirs correspond to one load of concrete mixture conveyed by a truck equipped with a concrete mixer, a compromise favourable to the utility construction is obtained between the quantity of concrete mixture to be loaded in one time and the manoeuvrability of the distributing vehicle. The capacity of the reservoir is 4.5 m3.

In the embodiment shown the opening 4 can be closed with a cover plate 13 to be moved horizontally and operable by means of a hydraulic cylinder 14.

In the embodiment shown in Figs. 3 and 4, the extension 6 of the shoot 3 has been removed and a

pair of distributing worms 15 and 16 is transversely suspended behind the distributing vehicle 1. The screws of the worms 15 and 16 are coiled in opposite directions. Suspended behind the worm 16 and parallel thereto is a vibration beam 17. Each of the worms 15 and 16 is provided at one end with a part 18 having a screw coiled oppositely to the screw of the other parts of that worm. The worms are suspended between end plates 19 extending to below the lowest part of the outer circumference of the back worm 16.

The distributing vehicle according to the practical example shown in Figs. 3 and 4 operates as follows: a concrete mixture is poured from the shoot 3 and is distributed in a slightly transverse direction by swinging the shoot 3 as indicated by the arrow 20. Concrete mixture extending above the level A is forced to the left by the front worm 15 and is spread. Concrete mixture which still extends above the level B after passage of the first worm is forced to the right by the back worm 16 and is spread. By means of the parts 18 having a screw coiled oppositely to the screw of the other parts of the worms and the end plates 19, concrete mixture is prevented from being forced beyond the end of the worms 15 and 16. The vibration beam distributes the concrete mixture equalized to level B to a further equalized surface having level C.

Instead of the vibration beam 17, there may also be provided means for applying a structure in the surface having level B. Furthermore, by selecting an appropriate course of the diameter of the worms 15 and 16 and using a vibration beam 17 inclined downwards to the ends or means for applying a structure, there can be poured a strip of concrete mixture having a level sloping downwards to the edges. This is particularly advantageous in the production of floors requiring a proper water discharge, such as bicycle paths.

The worms 15 and 16 are suspended in a frame (not shown) which can be swung up by means of a hydraulic piston 21 only shown in Fig. 4. The frame is fastened at one side to a vertical supporting beam 22, which, turn, is suspended to substantially parallel supporting arms 23 and 24, the supporting arm 23 being formed by a hydraulic piston for adjustment of the inclination of the worms 15 and 16. The worms are vertically adjustable by means of a further hydraulic cylinder (not shown).

Columns 25 with scanners 26 are fastened to the end plates 19. The scanners 26 are arranged to detect a rotary laser beam defining a plane in relation to which the height of the worms 15 and 16 and the vibration beam 17 must be maintained. By feeding back deviations from the height of the scanners relative to the laser beam, the adjustment of the height of the worms 15 and 16, and the vibration beam 17 can be controlled.

Disposed across the reservoir 2 of the distributing vehicle is a bridge 27 provided with a walkable grid 28. The cleaning of the reservoir, which is preferably carried out by means of a high-pressure gun with rotating worm 9, can take place from this bridge 27 so as to minimize the risk of falling into the reservoir 2 and sustaining injuries caused by the rotating worm.

Preferably, each of the four wheels 5 is steerable so as to obtain an optimum manoeuvrability of the distributing vehicle. The wheels 5 are preferably steerable such that they can each constantly roll in their respective directions of travel. The wheels are thus prevented from moving transversely to the rolling direction, resulting in deformations of the prepared surface.

Claims

1. A process for producing a concrete floor, which comprises pouring a concrete mixture over a prepared surface, characterized in that the concrete mixture supplied is transferred into at least one reservoir of a distributing vehicle and the distributing vehicle is traversed over the prepared surface while discharging the concrete mixture from the reservoir and pouring it behind the reservoir in the direction of travel and in transverse distribution.

2. A process according to claim 1, characterized in that after discharging from the reservoir and before pouring the concrete mixture is passed through a shoot and the transverse distribution is carried out by moving the shoot in a to-and-fro displacement.

3. A process according to claim 2, characterized in that the concrete mixture is passed through the shoot over such a distance and the shoot is moved in a to-and-fro displacement through such an angle that the concrete mixture is distributed over a breadth substantially equal to at least the largest track of the distributing vehicle.

4. A process according to claim 1, characterized in that the concrete mixture is discharged from the reservoir via a closable opening and by driving a worm.

5. A process according to claim 1, wherein the concrete mixture is supplied by means of a truck provided with a concrete mixer, characterized in that during filling of the distributing vehicle the concrete mixture is distributed over the reservoir by means of the worm.

6. A process according to claim 5, characterized in that the vehicle is filled with half a load of concrete mixture supplied by one truck.

7. A process according to claim 1, characterized in that poured concrete mixture is distributed,

during traversing the distributing vehicle and simultaneously with the pouring operation, by rotating at least two distributing worms coiled in opposite directions and transversely suspended at the back part of the distributing vehicle in a substantially horizontal and tandem arrangement, said worms being rotated in a sense of rotation in which the bottom moves in the direction of travel.

8. A process according to claim 7, characterized in that the concrete mixture is simultaneously finished after it has been distributed by the worms.

9. A process according to claim 8, characterized in that the finishing treatment is carried out by scraping the surface of the poured and distributed concrete mixture by means of a beam set and kept vibrating and suspended in the direction of travel behind and parallel to the worms.

10, A process according to claim 8, characterized in that the finishing treatment consists in applying a structure in the surface.

11. A process according to claim 7, characterized in that the height and position of the worms are adjusted by scanning a plane fixed with respect to the prepared surface and defined by a rotary laser beam and, in dependence thereon, controlling the height and position of the worms with respect to the vehicle.

12. A process according to claim 2, characterized in that the steps of rotating the worm for discharging the concrete mixture from the tank, swinging the shoot and traveling the vehicle are controlled in a fixed relation by a central control member.

13. A distributing vehicle for carrying out the process according to any of the preceding claims, characterized by a reservoir (2), a shoot communicating therewith for transversely distributing the concrete mixture at the back part via an opening (4), and at least three wheels with low pressure tyres (5).

14. A vehicle according to claim 13, characterized in that the shoot for transversely distributing the concrete mixture is a swinging shoot (3).

15. A vehicle according to claim 14, characterized in that the swinging capacity of the shoot (3) is such that the end of the shoot (3) is displaceable over a range approximately extending transversely to at least the largest track of the vehicle (1).

16. A vehicle according to claim 13, characterized by at least two worms (15 and 16) suspended in the operating position transversely behind the shoot, in a horizontal and substantially tandem arrangement, at least one of which worms (15 and 16) has a substantially left-hand screw and at least one has a substantially right-hand screw.

17. A vehicle according to claim 13, characterized in that the worms (15 and 16), each at one end, are provided with at least one coil oppositely coiled to the other coils of said worm.

18. A vehicle according to claim 17, characterized in that the worms (15 and 16) are suspended between plates which in the operating position extend downwards beyond the worms (15 and 16) to near the surface on which the vehicle (1) rests.

19. A vehicle according to claim 13, characterized in that in the operating position the worms (15 and 16) are suspended such that from the front worm (15) the lowest generatrix of the outer circumference of the next worm (16) is always lower than the lowest generatrix of the outer circumference of the preceding worm (15).

20. A vehicle according to claim 16, characterized in that a vibration beam (17), the lower edge of which is lower than the lowest generatrix of the outer circumference of the back worm (16), is suspended substantially behind the worms (15 and 16) and parallel thereto

21. A vehicle according to claim 16, characterized in that means for providing a structure in the surface of the poured and distributed concrete mixture are suspended substantially behind the worms (15 and 16).

22. A vehicle according to claim 16, characterized in that it is provided with a main frame, the worms (15 and 16) are suspended in the operating position in a frame elongated in a direction longitudinal to said worms (15 and 16), said frame being suspended at one end to a substantially vertical sup porting beam (22) which is suspended to the main frame by means of at least two substantially parallel supporting arms (23 and 24), one of which supporting arms is longitudinally adjustable, and a height adjusting arm which is longitudinally adjustable and extends between the main frame and the substantially vertical supporting beam (22) in a more vertical direction than the supporting arms.

23. A vehicle according to claim 16, characterized in that the worms (15 and 16) have a diameter gradually increasing from the middle to the ends.

24. A vehicle according to claim 13, characterized by four steerable wheels (5), which are steerable relatively to each other in such a manner that each of the four wheels (5) can continuously roll down in its direction of travel.

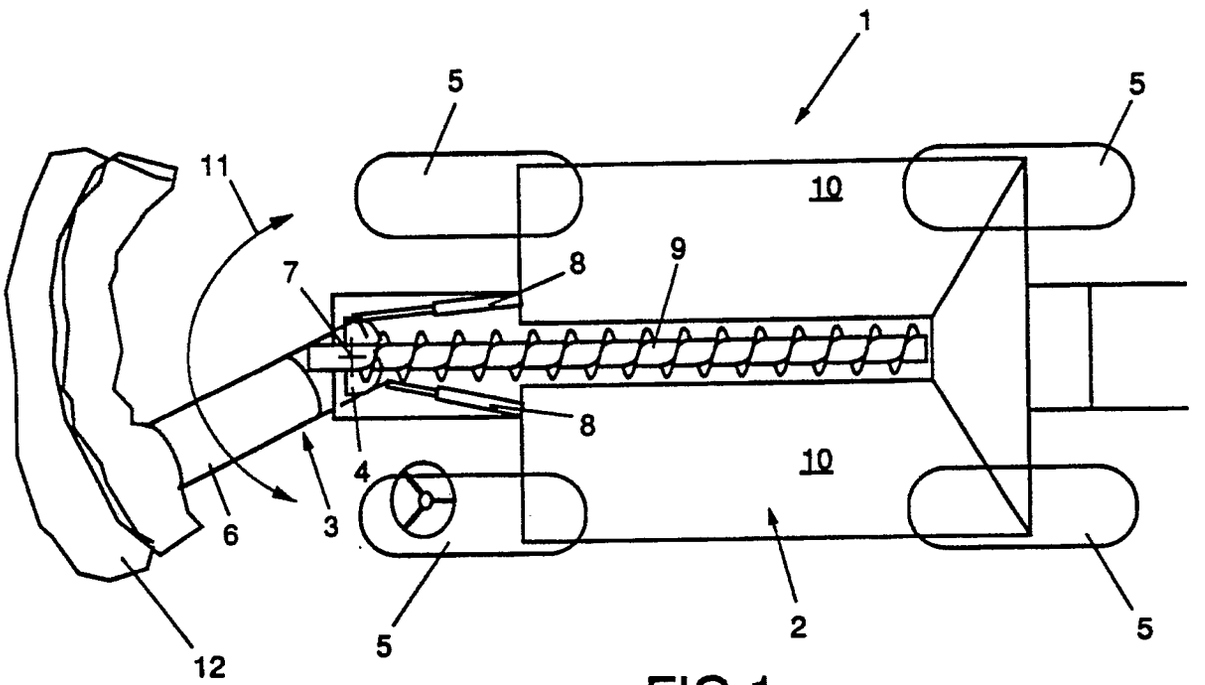

FIG.1

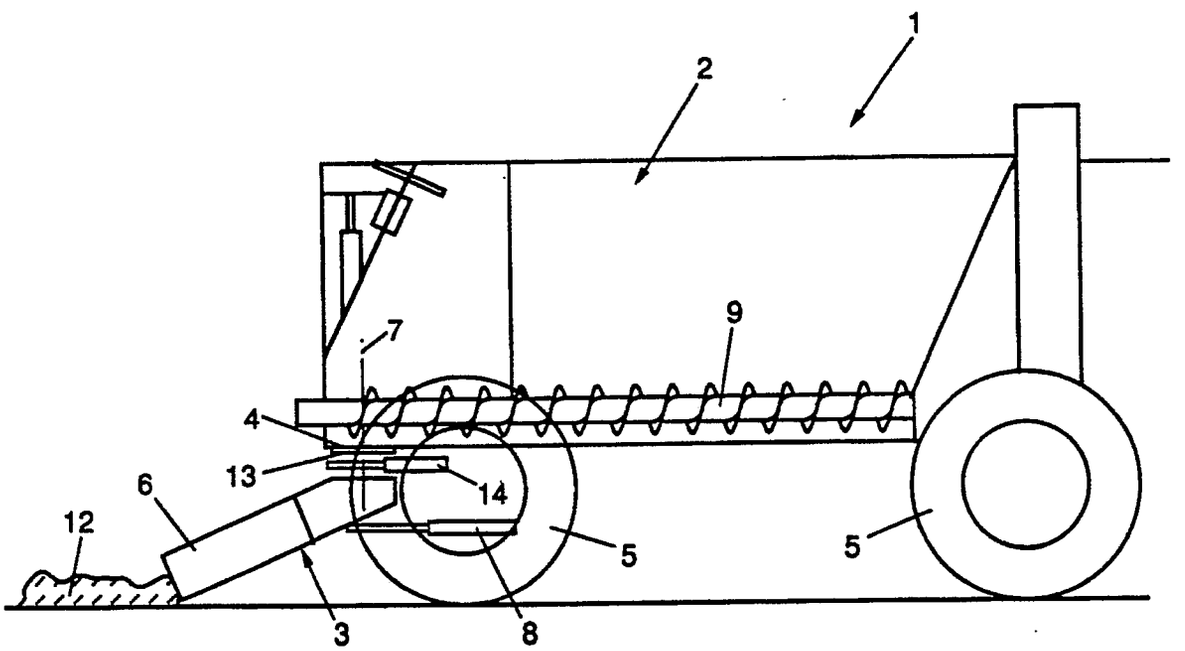

FIG.2

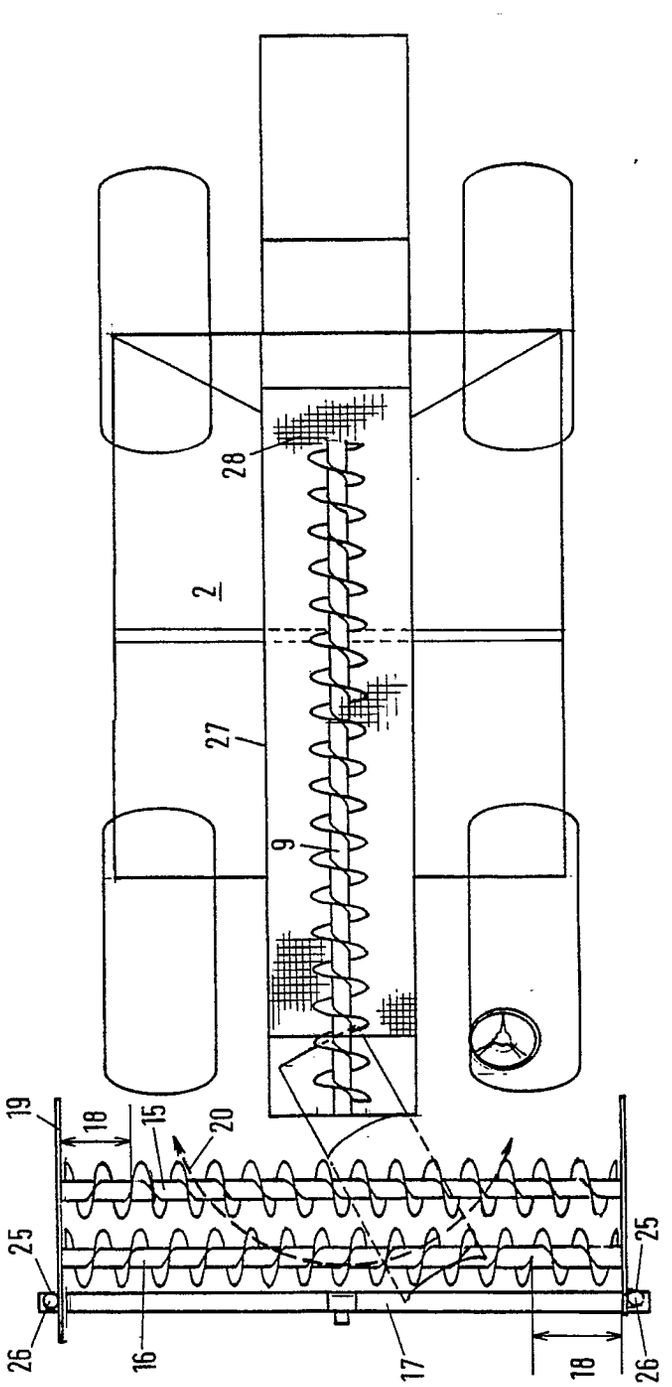
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FIG.3

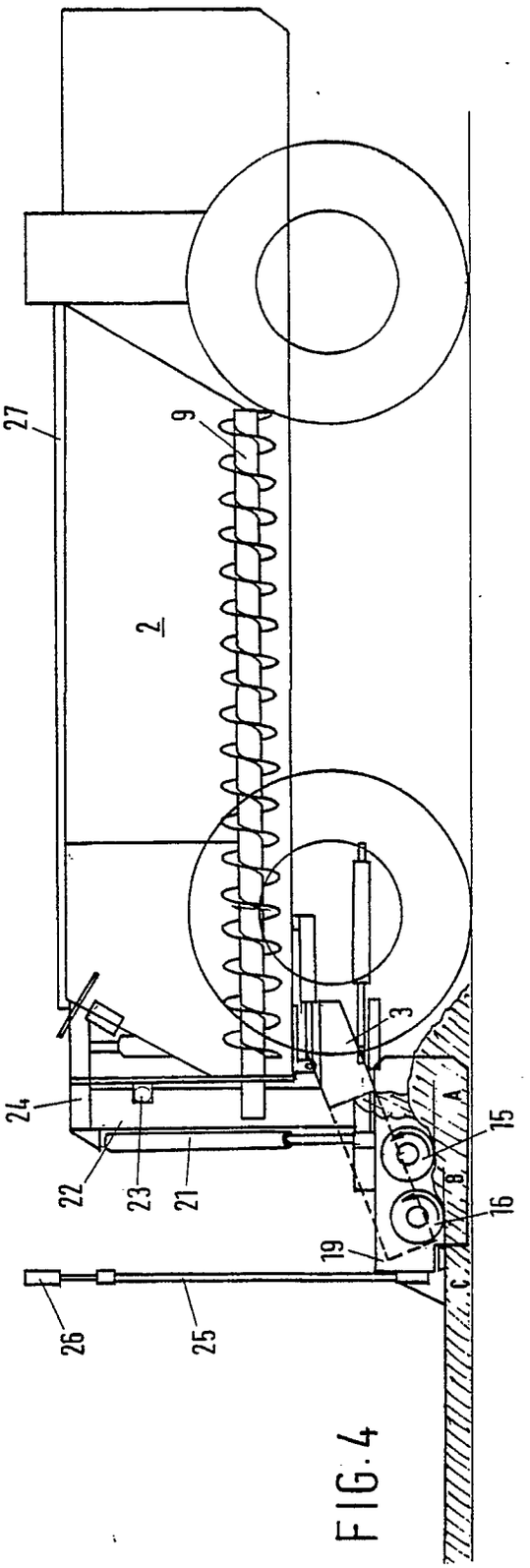
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FIG.4