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(72) Inventor: **Domenighetti, Domenico**
6900 Lugano (CH)

(74) Representative: **Zavattoni Gusmeroli, Maria**
Chiara et al
Racheli & C. s.r.l.,
Viale San Michele del Carso, 4
20144 Milano (IT)

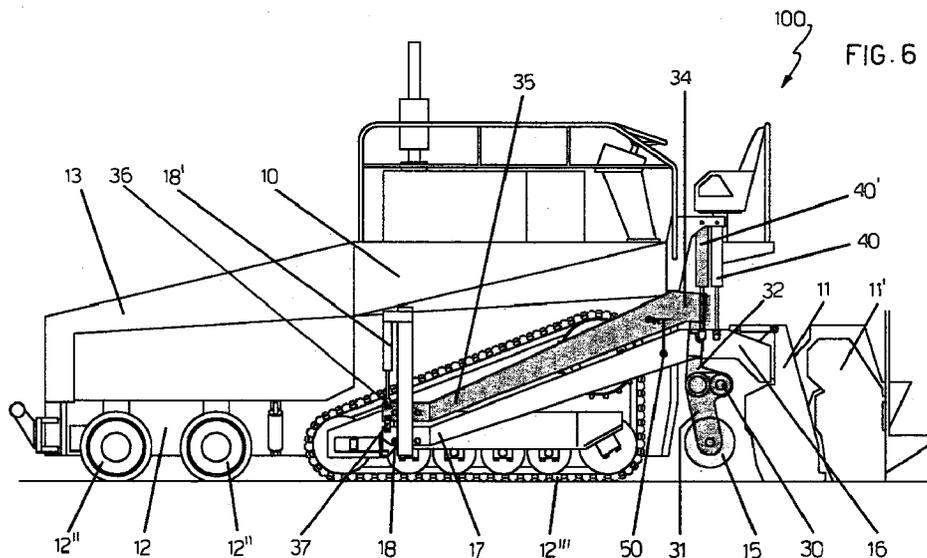
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(71) Applicant: **NIARB S.A.**
CH-6852 Genestrerio (TI) (CH)

(54) Road paver-finisher with automatic control of the height of the transverse augers with respect to the screed

(57) A road paver-finisher having a screed unit of the semi-floating type in front of which operates a system of augers for transverse distribution of the mixture to be laid, has the auger(s) (15) mounted on a sub-frame (32) equipped with arms (34) that remain approximately parallel to the arms (16) of the screed (11), the front ends (35) of the arms (34) of the sub-frame (32) being mounted on the tractor (10) at their centers of rotation (36), the latter always being situated very close

to the centers of rotation and traction (18) of the front end (17) of the arms (16) of the screed (11), the upward and downward movement of the augers taking place as a motion of rotation around the centers (36) by means of actuators, for example hydraulic pistons (40') mounted on the tractor (10) that engage on the sub-frame (32) or on the arms (34).



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Description

A self-propelling machine used to lay down materials for paving roads, airports, cycle tracks, courtyards, car-parks, etc. is commonly called a "road-paver-finisher".

The materials to be laid down (generally mineral aggregates mixed with bitumen, asphalt, or other hydrocarbon binders, or cement or other hydraulic binders) must be spread so as to form a levelled, compact layer.

To obtain this result the paver-finisher in general is essentially composed of a tractor unit to impart the forward motion and a screed or leveling unit, often provided with beating or vibrating tamping members, to form the finished "carpet".

In a road paver-finisher the function of densifying, leveling and smoothing the material laid down to form an even layer is of great importance.

The road paver-finisher member responsible for performing this function is commonly called the "screed" or "leveling plate" or "leveling beam"; from now on we will simply call it a "screed".

Depending on the principle by which the screed performs its function of smoothing out pre-existing undulations, the screeds of known type can be divided into two classes, namely "semi-floating" screeds and "full-floating" screeds.

Semi-floating screeds are virtually the only ones used so far in medium and small-to-medium sized road paver-finishers.

Full-floating screeds have so far been used, with rare exceptions, on large paver-finishers of the slip-form type generally used for laying down concrete.

Full-floating screeds can in turn be divided into two classes: those mounted rigidly on the tractor unit (and which use the tractor itself as the reference member) and those towed by the tractor which use their own reference members to set the thickness of the carpet to be laid down.

As we have seen, a road paver-finisher of the most common type operating on the semi-floating principle is formed by the combination of two main units: the tractor unit and the semi-floating screed unit.

According to the semi-floating principle, the screed consists of a more or less complicated transverse member that is pulled by the tractor unit by means of two long longitudinal arms pivotally mounted about halfway along the tractor unit.

The above mentioned transverse member engages with the material to be laid on the old road surface, smoothing and leveling it to form an even carpet.

The tractor unit forming the main body of the paver also comprises many members that are not directly connected with the function of imparting forward motion to the machine and pulling the screed.

Other important functions performed by the tractor unit are: receiving the material from dump trucks and storing it; organizing the longitudinal and transverse flow of said material in order to feed it, evenly distrib-

uted, in front of the screed.

The longitudinal and transverse flow of the material is organized by one or more conveyor belts and augers that provide a suitable flow of material and convey it toward the screed. In both semi-floating and full-floating screeds the augers' main function is to distribute the material evenly crosswise in front of the screed. The ideal would be if these augers could always be positioned vertically according to the actual height of the bottom of the screed. For this purpose the augers can easily be mounted on the screed; in this way, however, all the reaction forces that the augers undergo because of their interaction with the material are transmitted to the screed on which they are integrally mounted. In the case of paver-finishers equipped with a full-floating screed, placement of the augers on the screed is often possible thanks to the somewhat heavy structure of the screed and the positive steering by its vertical reference members. Integral mounting of the augers on the screed is virtually impossible, however, in the case of semi-floating screeds, since the reaction forces they would transmit to the screed would be such as to have an unacceptable effect on its vertical position and consequently its leveling action. Despite the resulting drawbacks, all known road-paver-finishers with semi-floating screeds have the augers mounted integrally on the tractor unit and not on the screed.

An aim of the present invention is to overcome the drawbacks of the prior art, and in particular to provide a semi-floating-screed paver-finisher in which the auger or augers can follow the screed position vertically without transmitting forces to said screed that might affect its action.

The aims have been achieved with the road paver-finisher as stated in claim 1. Further new and desirable characteristics are stated in the dependent claims.

In particular, the invention relates to a road paver-finisher equipped with a screed or screed unit of the semi-floating type in front of which operates a system of augers for transverse distribution of the mix to be laid down, characterized in that the augers driven by geared motors and drives are mounted on a subframe equipped with arms that remain approximately parallel to the arms of the screed, the front ends of the under-frame arms being mounted on the tractor at their centers of rotation, these latter always being situated in a position very close to the centers of rotation and traction of the screed arm front ends, the up and down movement of the augers taking place as a movement of rotation around the centers by means of actuators, for example hydraulic pistons, mounted on the tractor, that engage on the sub-frame or on the arms.

The invention makes it possible to achieve the above mentioned aims, and particularly to regulate the position of the augers vertically without affecting the action of the screed.

The invention will now be described in detail, with reference to the appended drawings wherein:

FIG. 1 is a perspective view from above of a known road paver-finisher with semi-floating screed, the tractor unit of which is mounted on tired wheels;

FIG. 1a is a perspective view from above of a typical known paver-finisher, with a semi-floating screed, the tractor unit of which is crawler-mounted;

FIG. 2 is a side view of the paver-finisher in FIG. 1;

FIG. 3 shows the paver-finisher in FIG. 2 with the screed detached; the two towing arms have been removed from the pivots situated at the center of the tractor unit and the whole screed has been displaced backwards to allow a complete view of tractor unit;

FIG. 4 is a schematic vertical section of a road surface on which a paver-finisher equipped with a semi-floating screed is laying down a carpet of material;

FIG. 5 is a schematic perspective view of a slip-form paver-finisher mounted on three means of locomotion;

FIG. 6 is a schematic side view of a paver-finisher according to the present invention;

FIG. 7 is a perspective view of the screed unit and the auger assembly in an embodiment according to the present invention, imagining the whole tractor group displaced forwards;

FIG. 8 is a perspective view similar to FIG. 7 in which the auger actuation and transmission units are in a central position.

A known paver-finisher, as illustrated in FIG. 1, 2 and 3, comprises a tractor unit 10 and a screed unit 11.

The tractor unit 10 comprises a main frame 12, a hopper 13 intended to receive the material from dump trucks, one or more conveyor belts 14 and augers 15 that produce a suitable flow of material and convey it towards screed 11.

The main frame 12 of the tractor unit 10 is provided with traction wheels 12' and steering wheels 12" (or crawlers 12''') that cause the translation of the whole machine.

The screed 11 is provided with traction or towing arms 16 pivotally mounted at their end 17 on the main frame 12 of the tractor unit 10.

The geometrical position of connecting points 18 of end 17 of the screed arms on the main frame 12 of the tractor unit 10 is of great importance to obtain the best possible leveling action with the screed 11.

During forward movement of the paver-finisher, the wheels 12' and 12" of the traction unit 10 actually follow the pre-existing undulations of the ground and thus

impart an undulating and jerking movement to the tractor unit which, as far as possible, should not be transmitted to the screed 11.

In order to at least partially to reduce the vertical jolts of the tractor unit 10 when the steering wheels 12" encounter an undulation or obstacle, the two wheels 12" that lie approximately on the same vertical-longitudinal plane, are mounted on a floating arm 12bis called a "cantilever arm" mounted pivotally on the pivot 12ter integral with the main frame 12.

(Crawler-mounted paver-finishers behave in the same way, if not worse, when they encounter an undulation or an obstacle on the pre-existing surface, imparting to the tractor unit a swinging motion with a very long wave-length).

In order to reduce to a minimum the transmission of up and down movements to the screed 11, the position of the pivot 18 is usually chosen about half-way along the wheel-base of the tractor unit 10.

FIG. 4 shows a schematic vertical section of a road surface on which a paver-finisher provided with the semi-floating screed is laying down a carpet of material.

For simplicity's sake, only the section of the screed 11 that is towed with its arms 16 by the tractor unit, not illustrated in FIG. 4, is indicated.

The pre-existing road surface 20 has undulations that are to be eliminated or at least smoothed by laying on top a carpet 21 of a suitably variable thickness so that where there is a bump 22 a thinner carpet layer is laid.

Because of its particular geometry the semi-floating screed 11 allows this compensation of thicknesses and consequently "smoothing" of the pre-existing undulations to be achieved without having to resort to complicated automatic leveling systems.

On examining the schematic operation of the semi-floating screed 11 illustrated in FIG. 4, it can be seen that its vertical position also depends on the plasticity of the material laid down. This characteristic is typical of semi-floating screeds and distinguishes them from the full-floating screeds that will be described below.

As we have already mentioned, full-floating screeds have until now been used almost exclusively on paver-finishers of the slip-form type.

FIG. 5 shows a schematic perspective of a slip-form paver-finisher mounted on three means of locomotion 24. In a paver-finisher of this type, the material 25 is contained in a hopper 26 the side walls of which also perform the function of slip forms to "extrude" the final layer of material 27 that is laid down by the paver-finisher.

In the example of a slip-form paver-finisher illustrated in FIG. 5, it is the position of the hopper 26 with respect to the pre-existing road surface that determines the thickness of the layer 27. This position is in turn determined by the relative position of the locomotion means 24 with respect to the whole machine.

The devices 23 schematically represent the mechanical-hydraulic systems that regulate the vertical

position of the means of locomotion relative to the main body of the whole machine and thus determine the height of the hopper 26 moment by moment with respect to the pre-existing road surface and ultimately establish the thickness of the layer 27 of material to be laid moment by moment.

A paver-finisher like that illustrated in FIG. 5 is therefore provided with a full-floating screed mounted integral to the tractor unit of the paver-finisher itself.

As we mentioned earlier, paver-finishers with a full-floating screed towed by the tractor unit have also been placed on the market, though somewhat rarely.

In these cases the full-floating screed determines its own vertical position (and consequently the thickness of the layer to be laid) making use of its own reference members which can be soles, slides, wheels or other means that rest on the pre-existing road surface.

The towed full-floating screed must therefore comprise internal adjustment means that allow the transverse member (on which the thickness of the layer to be laid down depends) to be positioned at a desired pre-set height, in order to determine precisely the thickness of the spread layer.

An example of a paver-finisher provided with a towed full-floating screed is that described in Swiss Patent No. 336858.

The distinction between semi-floating and full-floating screeds has been described because, as will be seen below, the interaction between augers and screed differs substantially in the two types of screed.

The present invention in fact relates to a paver-finisher with a series of devices and arrangements that allows better control of the interaction between the semi-floating screed unit 11 and the auger unit 15, which produces a leveling action like that illustrated in the diagram in FIG. 4.

In both types of screeds, the augers 15 have the main function of evenly spreading the material transversely in front of the screed 11.

Ideally it should always be possible to position these augers 15 vertically depending upon the height of the bottom of the screed 11.

For this purpose it is easy to mount the augers 15 on the screed 11, which means, however, that all the reaction forces that the augers 15 undergo because of their interaction with the material are transmitted to the screed on which they are mounted integrally.

In the case of paver-finishers provided with a full-floating screed, placement of the augers 15 on the screed is often possible, thanks to the very heavy structure of the screed and the positive way in which it is driven by its vertical reference members.

It is virtually impossible, on the other hand, for the augers 15 to be mounted integral with the screed in the case of semi-floating screeds since the reaction forces they would transmit to the screed itself would be such as to have an unacceptable effect on its vertical position and, consequently, on its leveling action.

In fact, despite the resulting drawbacks, all known

paver-finishers provided with a semi-floating screed have the augers 15 mounted integral to the tractor 10 and not on the screed 11.

We will now describe an embodiment of the present invention in light of the paver-finisher shown in FIG. 6, in which the various members that also appear in the preceding FIG. 1, 2 and 3 are also indicated with the same reference numbers.

The paver-finisher 100 shown in FIG. 6, unlike those that appear in the preceding figures is of the "semi-crawler" type where the function of the traction wheels 12' (of FIG. 2 and 3) is performed by a crawler carriage 12"; however, it could also be of the wheeled type.

In FIG. 6 the semi-floating screed 11, which carries behind it its extensible members 11' (it being a modern hydraulically extensible screed) is towed by the tractor 10 by means of the arms 16 the front ends 17 of which are coupled to the tractor 10 at 18.

As suggested by the conventional art known to date, two hydraulic pistons 40 mounted on the tractor 10 (one on each side) engage on the screed 11 (or, as shown in FIG. 6, on the arms 16) to allow the whole screed to be raised at the end of the job, facilitating rapid traverse and/or transportation of the whole machine on a truck.

During work, that is during laying down of the material, the pistons 40 "idle", which means there is no oil pressure inside them, allowing the screed to "float" freely following its own self-leveling movement, that is riding on the spread material following the pull of the tractor 10 exerted by means of the arms 16. The (average) thickness of the layer of material to be laid is set by the operator and/or by automatic leveling systems not described herein, simply by raising or lowering the traction point 18 by means of a hydraulic piston 18'.

It is obvious, therefore, that depending upon the desired average spreading thickness and the pre-existing undulations on the laying surface, the lower surface of the screed 11, during the spreading work, is raised and/or lowered, sometimes markedly, with respect to the position in which the screed 11 is shown in FIG. 6.

In the case of paver-finishers equipped with a semi-floating screed, we have seen that the augers 15 must traditionally be mounted integral to the tractor 10 and therefore cannot follow, as would be desirable, the vertical movements made by the screed 10 during the laying work.

In addition, while the screed 11 is suitably raised during traversing and transportation of the paver-finisher on trucks, the augers 15, if mounted integrally on the tractor, often come to be in a very cumbersome position, suffering knocks and damage.

In some more recent embodiments, the augers 15 are mounted on the tractor so that their height can be adjusted, but their movement never parallels that of the screed 11, adjustment is awkward, must generally be done with the machine at a standstill and in any case it is never directly controlled by the movement of the

screed.

According to the present invention, on the other hand, as shown in FIG. 6, the augers 15 driven by a geared motor unit 30 by means of a drive 31 are mounted on a subframe 32 also provided with arms 34, the front ends 35 of which are mounted on the tractor 10 at their centers of rotation 36.

The front ends 35 of the arms 34 are connected with articulated joints to the front ends 17 of the arms 16 of the screed 11, for example making use of link rods 37 so that when their vertical position is changed by the piston 18 the vertical position of the front ends 35 of the arms 34 is changed accordingly.

Rearward, another two hydraulic pistons 40' mounted on the tractor 10 engage on the sub-frame 32 or, as shown in FIG. 6, on the arms 34 so that when they lengthen or shorten, the vertical position of the augers 15 is changed gradually and continuously.

A simple sensor 50 measures the relative vertical position between the screed 11 and the subframe 32 (in the case in FIG. 6, between the arms 16 and the arms 34) and transmits appropriate signals to the hydraulic circuit that controls the pistons 40' in order to ensure that the augers 15 always follow all the changes in height made by the screed 11 during the laying work. The sensor 50 is also provided with adjustment members of a known type that make it possible to pre-set the desired height difference between the augers 15 and the screed 11 that is to be maintained constantly.

FIG. 7 is a perspective view of the screed unit and the auger unit in an embodiment according to the present invention, imagining the whole tractor unit 10 displaced forwards. Only the parts 51 and 52 of the tractor 10 have been left visible as these are the parts through which connection between the tractor 10 and the screed units 11 and augers 15 takes place.

This FIG. 7 is also useful because it provides a view of the supports 33 that support the axle of the augers 15 in an intermediate position when the geared motor units 30 and relative drives 31 are moved outwards to achieve the maximum transverse extension of the augers 15 themselves.

Also in FIG. 7 the same reference numbers as in the preceding figures have been maintained.

Another embodiment of the present invention is shown in FIG. 8, in which the rotary motion is imparted to the two augers by means of a system of two geared motors and two drives virtually fused into a single central unit according to a configuration similar to that applied in more conventional paver-finishers.

Also in the embodiment in FIG. 8, the present invention allows the augers to be given a movement that is always parallel to the screed movement, therefore keeping the auger axle at a constant horizontal distance from the front surface of the screed and allowing its height relative to said screed to be adjusted automatically.

In FIG. 8 all the same numbers as in the preceding figures have been maintained and therefore in the cen-

tral actuation-drive unit, 30 indicates the geared motors and 31 the final drives that impart the rotary motion to the right and left branches of the augers 15.

5 Claims

1. A road paver-finisher provided with a screed or screed unit of the semi-floating type, comprising screed arms that can be mounted on the paver-finisher tractor, and in front of which screed an auger system operates for transverse distribution of the mix to be laid, characterized in that the augers (15) are mounted on a sub-frame (32) provided with arms (34) that are maintained approximately parallel to the arms (16) of the screed (11), the front ends (35) of the arms (34) of the subframe (32) being mounted on the tractor (10) at their centers of rotation (36), the latter always being situated in a position very near to the centers of rotation and traction (18) of the front ends (17) of the arms (16) of the screed (11), the up and down movement of the augers taking place as a rotary movement around their centers of rotation (36) by means of actuators (40') mounted on the tractor (10) that engage on the sub-frame (32) or on the arms (34).
2. A road paver-finisher like that in claim 1 characterized in that the front ends (35) of the arms (34) are connected in an articulated manner to the front ends (17) of the arms (16) of the screed (11), making use of link rods for example (37).
3. A road paver-finisher as in claim 1 characterized in that the arms (34) of the under-frame (32) are practically as long as the arms (16) of the screed (11).
4. A road paver-finisher as in claim 1 characterized in that a sensor (50) measures the relative vertical position between the screed (11) and the augers (15) and transmits signals to an electro-hydraulic circuit that controls the pistons (40) ensuring that the augers (15) follow all the height changes performed by the screed (11) during the laying work.
5. A road paver-finisher as in claim 4 characterized in that the sensor (50) is provided with adjustment members that make it possible to pre-set the height difference that is to be constantly maintained between the augers (15) and the screed (11).
6. A road paver-finisher as in claim 1, characterized in that the actuators (40') are hydraulic cylinders.

FIG. 1

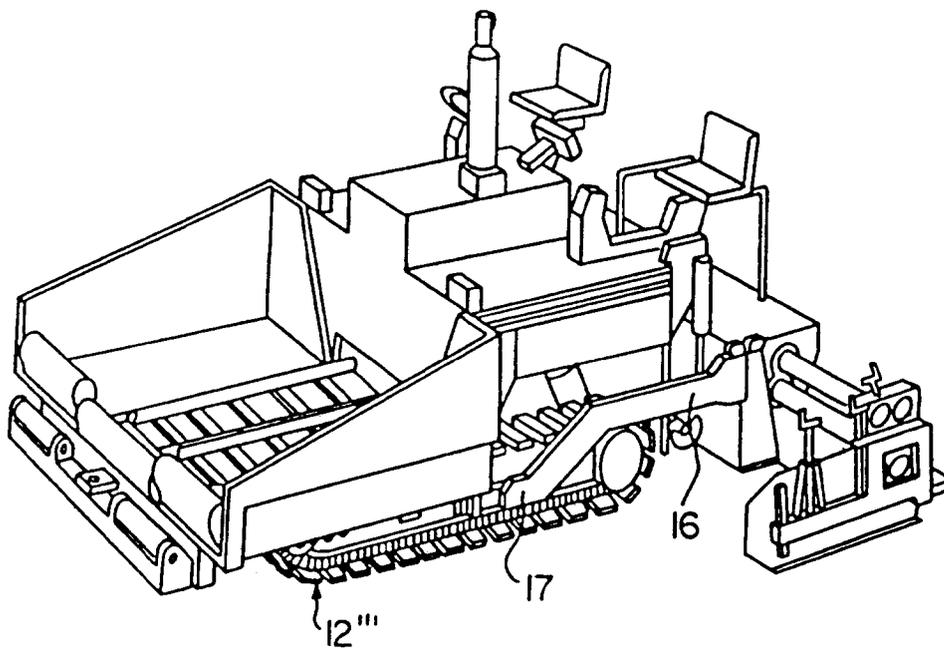
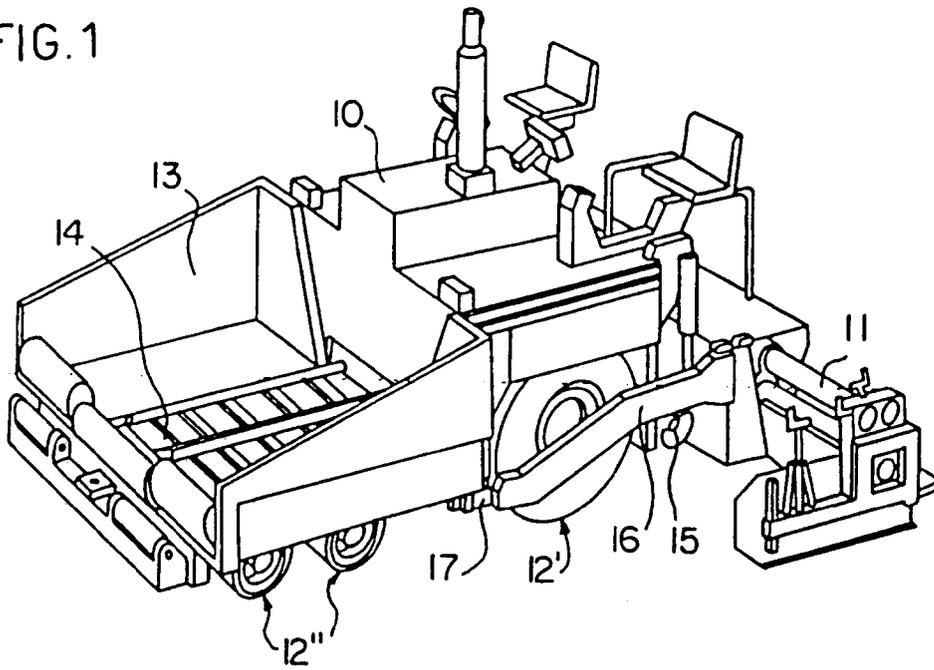


FIG. 1a

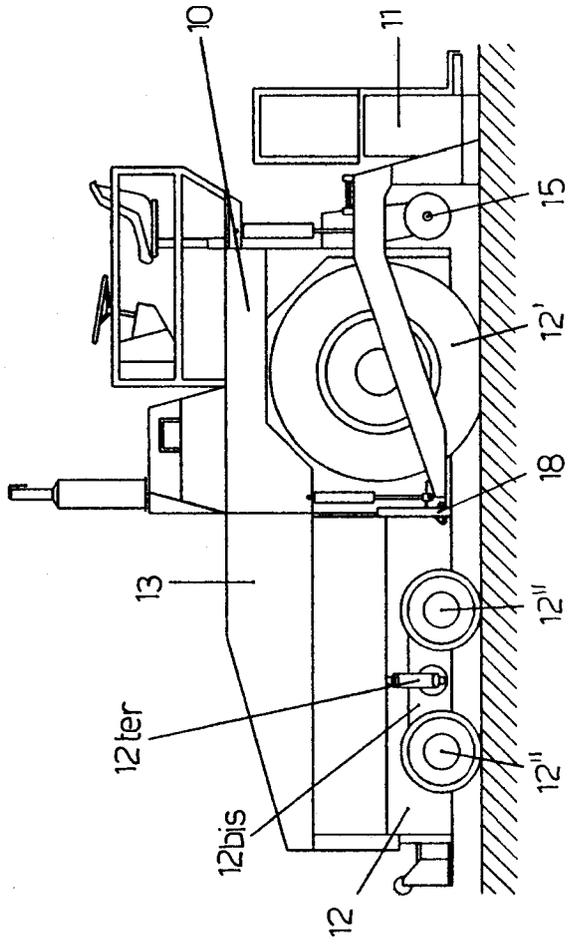


FIG. 2

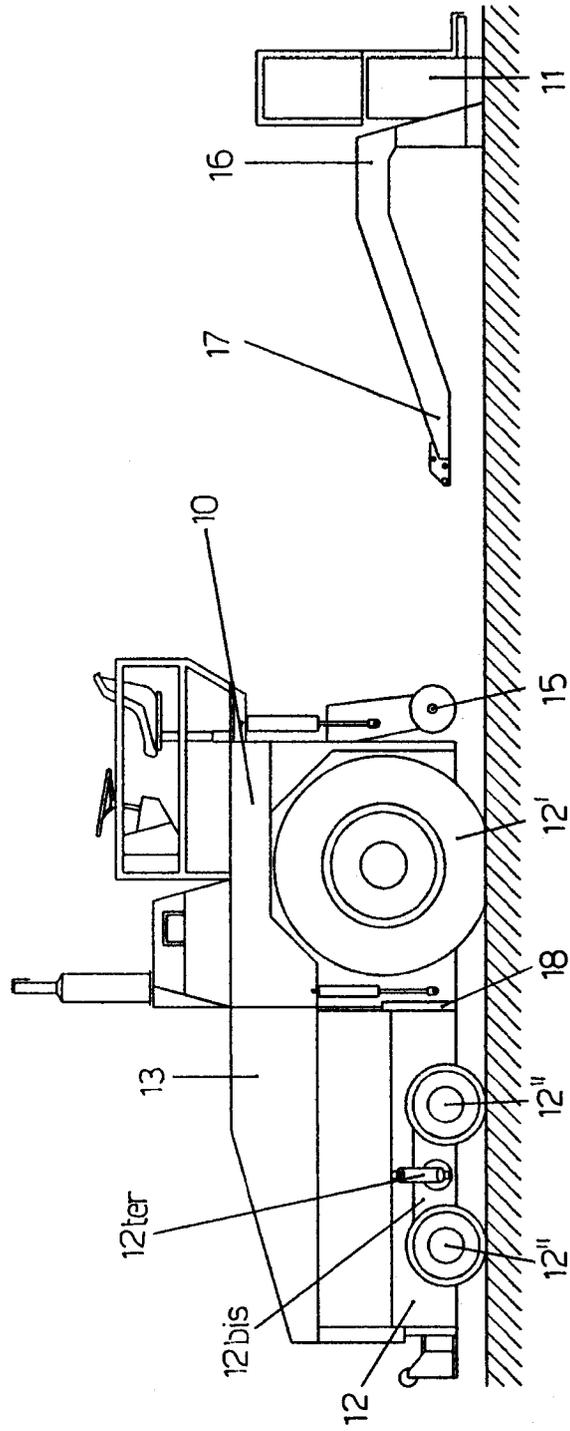


FIG. 3

FIG. 4

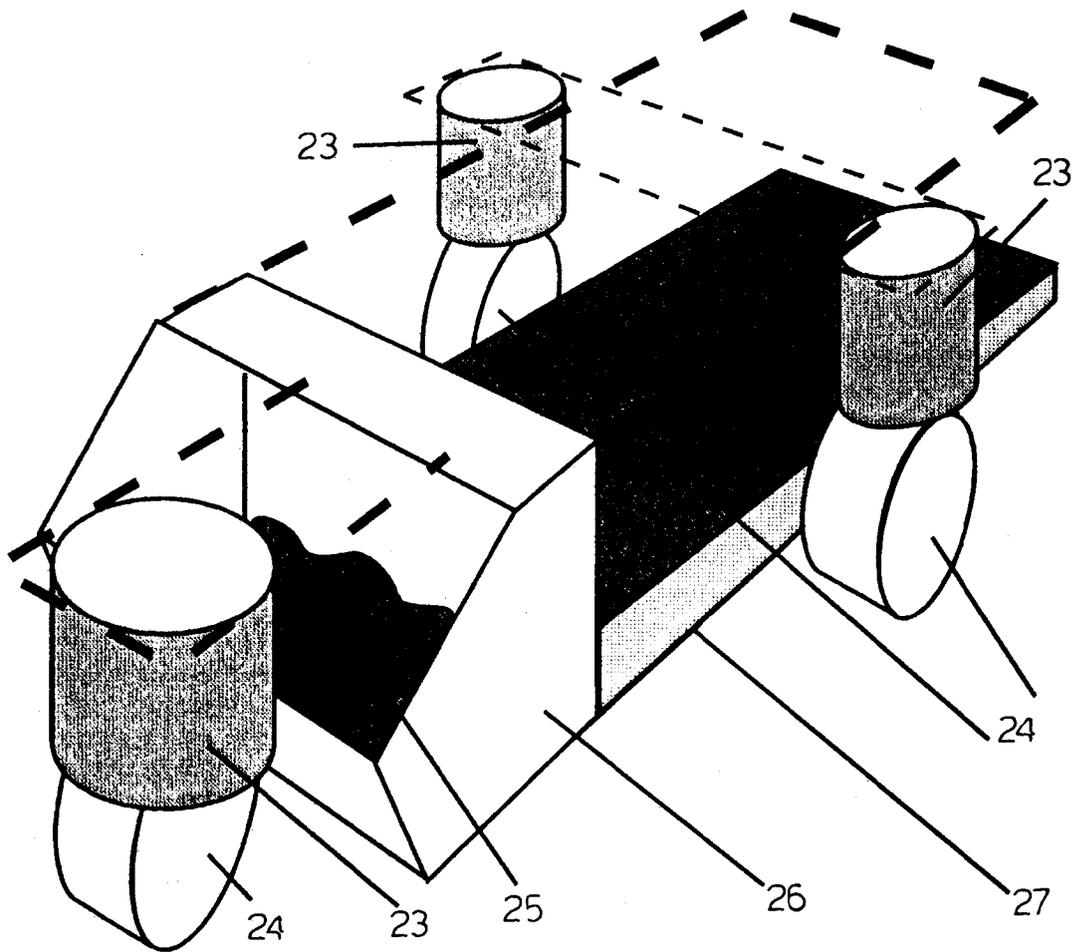
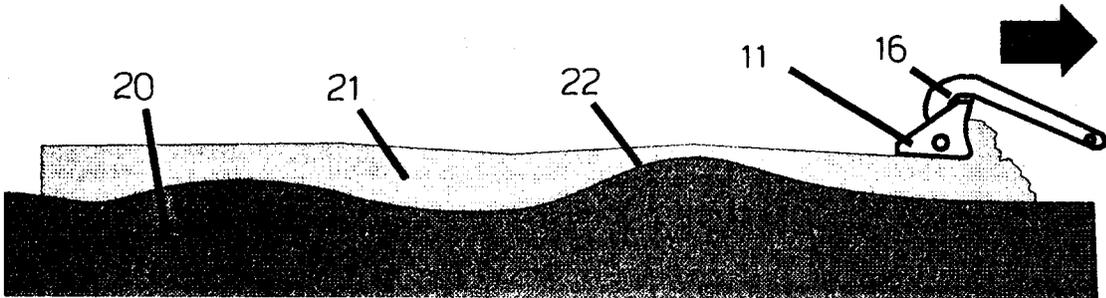


FIG. 5

FIG. 7

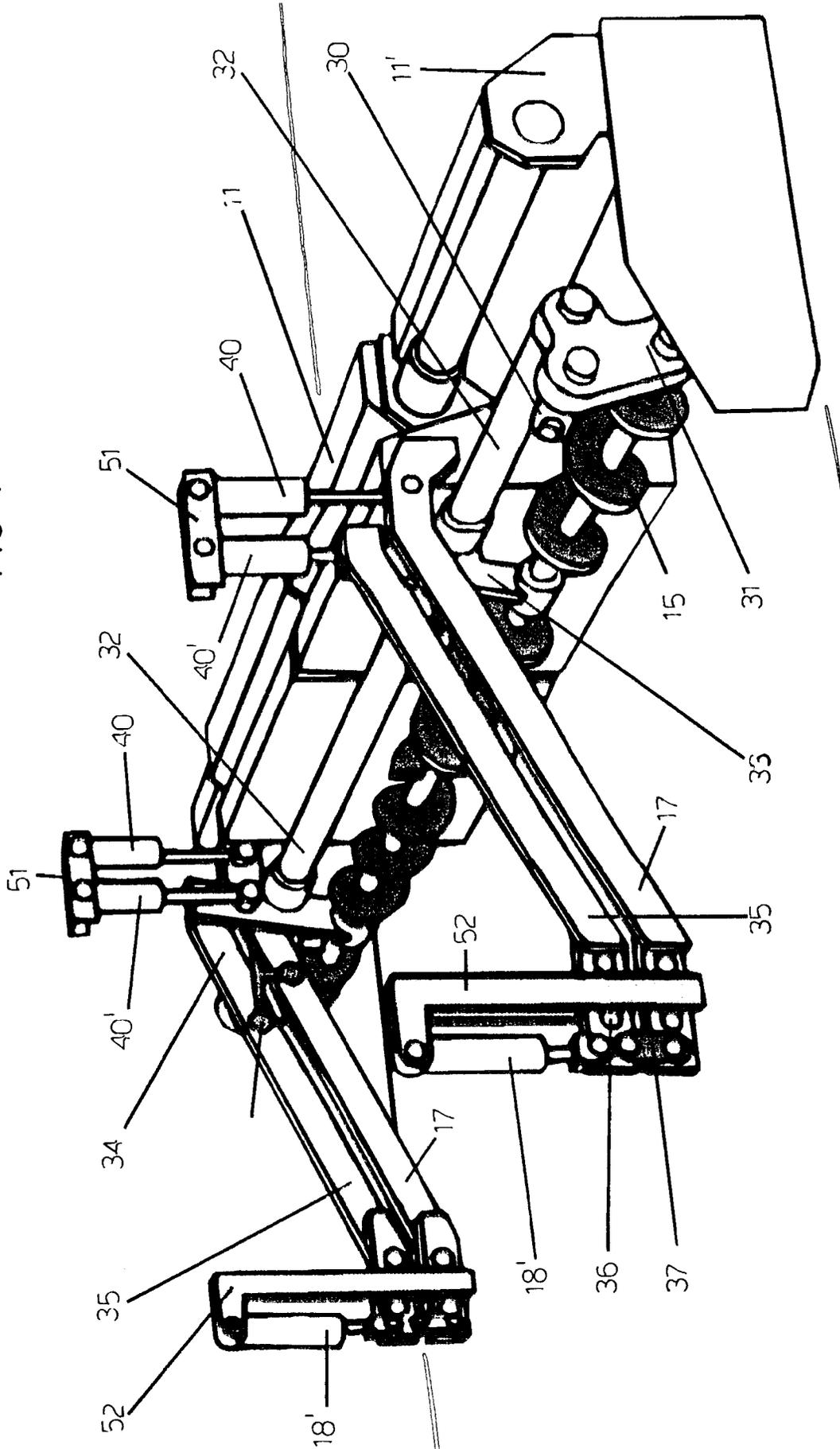
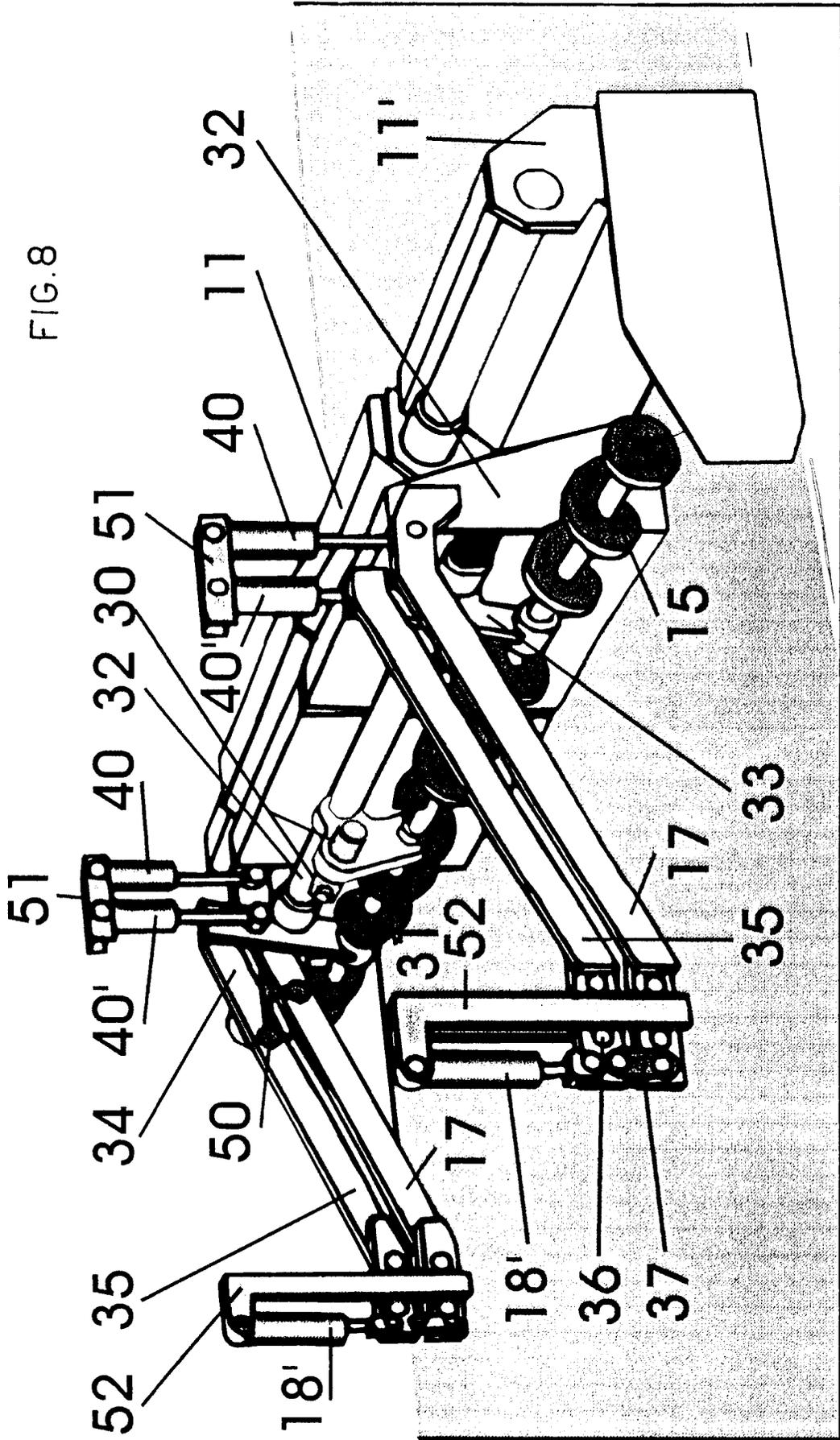


FIG.8





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EUROPEAN SEARCH REPORT

Application Number
EP 96 11 8184

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.6)
A	DE 42 29 465 A (ULM GMBH MASCHBAU) 10 March 1994 * the whole document * ---	1	E01C19/40
A	EP 0 240 477 A (WHITE CONSOLIDATED IND INC) 7 October 1987 * abstract; figures * ---	1	
A	DE 295 10 058 U (VOEGELE AG J) 2 November 1995 * figures * ---	1	
A	DE 21 09 833 A (DEMAG BAUMASCHINEN) 14 September 1972 -----		
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			E01C
Place of search	Date of completion of the search	Examiner	
THE HAGUE	26 February 1997	Dijkstra, G	
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