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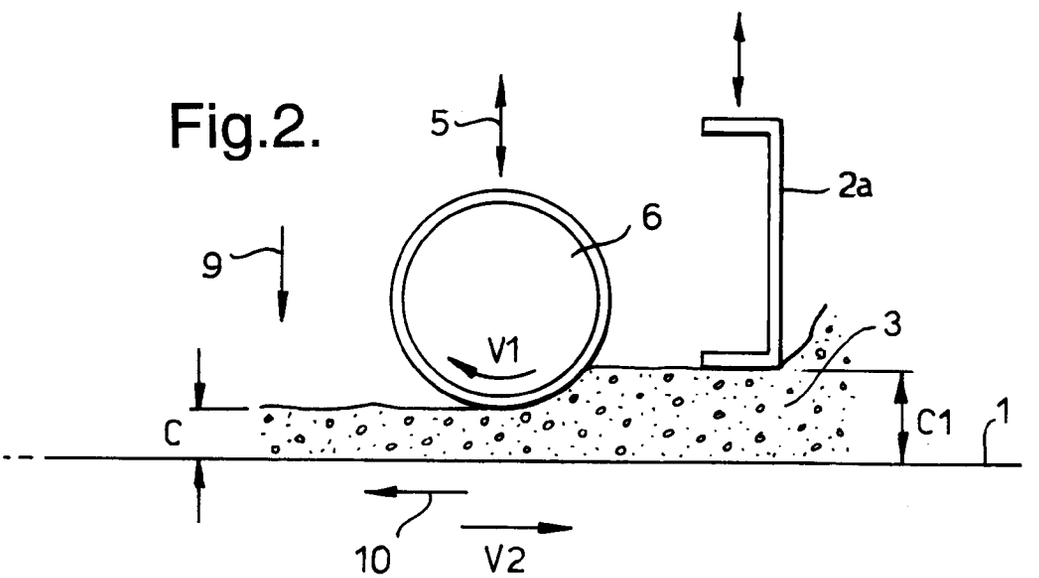
(54) Surfacing apparatus and method

(57) A road-surfacing vehicle comprises means for applying a surfacing composition to the road as the vehicle moves, and a screed (2) that essentially defines the contour of the surface, wherein the screed (2) is movable relative to the vehicle and opposite to the vehicle's direction of movement during application.

Fig.2.



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Description

Field of the Invention

This invention relates to apparatus, in particular a road-surfacing vehicle, and to a method for surfacing substrates such as roads.

Background of the Invention

The application of road-surfacing overlays with good negative texture, using a cold application technique, with the material mixed at the point of application, has many advantages compared with conventional hot-applied products supplied to site in a hot premixed form. However, in order to provide an economically and environmentally-acceptable trafficking time, the cold material needs to react quickly and "set".

It has been found that, when conventional mixed asphalt screeds, or screeds of a similar design to those used to apply hot materials, are used for cold-surfacing, two problems arise.

Firstly, the screeds cause the cold products to drag, as shown in Figure 1 of the accompanying drawings. This effect opens up the surface and, in severe cases, causes holes through to the substrate. The resultant "open" surface, after compaction, has insufficient integrity; fretting results, under traffic.

Secondly, the screeding contact surfaces are difficult to maintain in a clean condition. The practice of heating them, which is conventionally used for hot materials, would be counter-productive and likely to increase the problem. It has been found that any non-uniform build-up causes the new surface to be gouged longitudinally, and causes transverse unevenness.

Summary of the Invention

The present invention is based on an appreciation of the problems described above, and on the realisation that the dragging effect is caused by the forces generated in the materials resulting from the different relative velocities of the substrate and the screed plate with respect to the material sandwiched in between, for a given compaction coefficient. The novel solution is to provide a screed that, while continuing to define the contour of the surface (flat or curved), is movable relative to the vehicle/applicator, and opposite to the direction of travel of the applicator. Preferably, the screed moves at the same or similar velocity as the substrate (road) and in the same relative direction. An additional preference is that the material contact zone of the screed should be maintained free of any material build-up; for example, the screed may be lubricated or scraped in such a way that either the surfacing material does not attach to it, or is periodically removed.

Brief Description of the Drawings

Fig. 1 shows the dragging effect associated with the prior art. This invention will be described by way of example only with respect to the other drawings, in which no complete road-surfacing vehicle is shown (since only those parts which are essential to the invention need illustration):

Figs. 2 and 3 are sectional side views of part of different embodiments of apparatus for use in this invention;

Fig. 4 is another sectional side view, showing more detail of an attachment for a road-surfacing vehicle according to this invention;

Figs. 5A and 5B are respectively cut-away top and side views of an asphalt laying box for use in this invention; and

Fig. 6 is a front view of a roller for use in the invention.

Description of the Invention

In accordance with this invention, a convenient and preferred loss motion solution to both given problems of the prior art is to make the screed in the form of a roller. For the purpose of illustration only, the invention may be described below with reference to rollers. However, other loss motion principles, although perhaps more complicated, may also perform the same task, such as an endless belt or an oscillating mechanism. It is recognised that, as there is a frictional force at the interface between the screed and the material, some form of horizontal compaction could result if the relative velocity of the screed was greater than that of the substrate.

Simple scrapers may be applied to rollers, to prevent material pick-up. Water jets may be provided, in order to lubricate the surface of the screed, to either augment or replace the scraper system.

The roller is preferably provided in an arrangement that accommodates a road camber. This is preferably achieved by dividing its length into two or more sections such that it can be deformed along its length, without creating marks in the road surface. If, for example, the laying box is more than 3 m wide, three coaxial roller sections may be used. The respective parts of the roller are preferably connected by means of a hinge support bearing, e.g. with constant velocity drive coupling. If desired, the respective parts may be driven independently, e.g. in order to facilitate the surfacing of road corners.

The speed of roller rotation may be controlled and maintained so that it is be governed by the forward speed of the applicator. This may be either by mechanical means or by a fluid motor controlled by an electro-hydraulic servo control system with or without feedback.

The thickness of the applied surfacing may be varied

by raising or lowering the rollers. In order to prevent a roller from climbing up a reservoir of material positioned behind it, the quantity of material supplied to the roller may be controlled, e.g. by means of a conventional strike plate set at a height which will limit the upward climbing force on the roller. This force will be less than that required to lift the thickness-controlling skids off the substrate, and may be controlled by adjusting the compaction coefficient C/C1.

Means may also be provided, in order to vibrate the roller. This enhances consolidation of the material.

Fig. 1 (illustrating the prior art) shows a substrate 1 and that part of a conventional applicator comprising a fixed screed 2 and associated strike plate 2a, travelling at a velocity V2 relative to the substrate. The compaction coefficient is given by C/C1. A surfacing composition 3 is deposited between the substrate 1 and the screed 2 by trailing application. The arrows 4 indicate the horizontal forces generated in the material due to the moving screed, and the arrows 5 indicate allowable vertical movement of the screed 2.

Figs. 2 and 3 are provided for direct comparison with Fig. 1. Instead of the screed 2, there is a roller 6 or an endless belt 7 mounted on rollers 8, respectively, driven at a velocity V1. The arrows 9 and 10 respectively indicate vertical and horizontal compaction. In both of the cases illustrated in Figs. 2 and 3, V1 and V2 are approximately the same.

Fig. 4, like Fig. 2, shows a substrate 1, a strike plate 2a and a roller 6. A roller drive motor 11 is shown in this case, and is connected to the roller 6 by means of a belt 11a. For the purposes of cleaning the roller from surfacing composition 3 that is picked up, there are a scraper 12 and a water sprayer 13. Fig. 4 also shows a laying box illustrated generally at 13, including paddles 14 and an auger 15.

Fig. 5 shows a Micro Asphalt laying box incorporating a rolling strike plate as described above. The laying box is constructed in conventional fashion and is hinged on the centre line 21 to accommodate any road camber. The two sides of the laying box are the same but of opposite hand. Skids 22 maintain the laying box altitude with respect to the substrate, and also reduce the reproduction of substrate imperfection in the newly formed surface. The mixed material is delivered to the laying box on the box centre line 21 and midway between the agitation paddles 23 and a distribution auger 24 whose speed and direction of rotation can be altered via a fluid drive system 25. A screw or fluid power adjustor 26 is used to vary the height of the box structure above the substrate and so vary the thickness of the applied material.

A roller 27 is also hinged, by means of a support bearing with constant velocity drive coupling, on the centre line 21. The roller 27 is provided with its own fluid drive system 28 which enables the roller's rotational speed to be accurately controlled in relation to the forward velocity of the applicator. The roller 27, and its constituent parts 27a and 27b, are shown in more detail in Fig. 6, where the coupling is shown at 30.

The height above the substrate of a strike plate 29 can be independently adjusted, to enable the head of material presented to the strike roller to be varied and so vary the compaction coefficient C/C1. Likewise the height of the strike roller 27 above the substrate can be varied, which controls the thickness of the applied material.

Generally the strike roller height adjustment will also adjust the height of the strike plate 29, as the two are mechanically linked. The head of material presented to the strike roller 27 will thus be maintained for any strike roller setting, so varying the compaction coefficient C/C1. The roller speed can be controlled manually or using a ground speed-related electro-hydraulic system similar to that used on conventional road construction or agricultural equipment.

Experiments have shown that the application of materials of the type previously described is improved using the invention. For example, there is a discernible reduction in the amount of dragging; this has been measured in terms of surface texture depth using the ASTM 2709 Sand Patch Method.

Materials applied with normal strike plates designs exhibit a texture depth of between 3 mm and 5 mm. Those applied with a strike plate roller have texture depths of between 1.73 mm and 2.8 mm.

Both horizontal and vertical compaction were also found to be improved, and post-dead-weight rolling proved to be sufficient to compact the surface. The compaction coefficient C/C1 was found to vary between 0.25 and 0.5, depending on the value of C.

Tests were also conducted using two coaxial rollers, driven independently, with one roller rotating faster than the other. The roller rotating faster produced a surface with a lower surface texture depth of 1.8 mm compared with a surface texture depth of 2.55 mm for the slower roller, indicating that some horizontal, as well as vertical, compaction was taking place at the surface.

It was found that a glazed surface with almost no surface texture can result if the rotation speed of the strike roller is very high compared with the relative ground speed.

Using simple scrapers, the rollers remained clean. However, the scraped residue contaminated the freshly applied surface. It was found that the scrapers had to be positioned close to the applied material or in the zone between the strike plate and roller to reduce the contamination and keep the roller free of material build-up.

Claims

1. A road-surfacing vehicle comprising means for applying a surfacing composition to the road as the vehicle moves, and a screed that essentially defines the contour of the surface, wherein the screed is

movable relative to the vehicle and opposite to the vehicle's direction of movement during application.

2. A vehicle according to claim 1, wherein the screed has a continuous surface.

3. A vehicle according to claim 2, wherein the screed is in the form of a roller.

4. A vehicle according to claim 3, wherein the roller is divided into two or more parts along its length.

5. A vehicle according to any preceding claim, which comprises means for driving the screed relative to the vehicle.

6. A vehicle according to claim 5, wherein the screed is adapted to be driven at a velocity, relative to the composition, greater than that of the road.

7. A vehicle according to any preceding claim, which additionally comprises a strike plate that limits the flow of the composition to the screed, wherein the plate is adjustable or is at a height adapted to limit the upward force on the screed.

8. A method for surfacing a substrate, which comprises the trailing application of a surfacing composition to the substrate via a screed that essentially defines the contour of the surface, and causing or allowing the screed to move in the trailing direction.

9. A method according to claim 8, wherein the screed is as defined in any of claims 2 to 4.

10. A method according to claim 8 or claim 9, which comprises driving the screed relative to the trailing application.

11. A method according to claim 10, wherein the screed is driven at a velocity, relative to the composition, greater than that of the substrate.

12. A method according to any of claims 8 to 11, wherein the substrate is a road and the composition is a road-surfacing composition.

Fig.1.

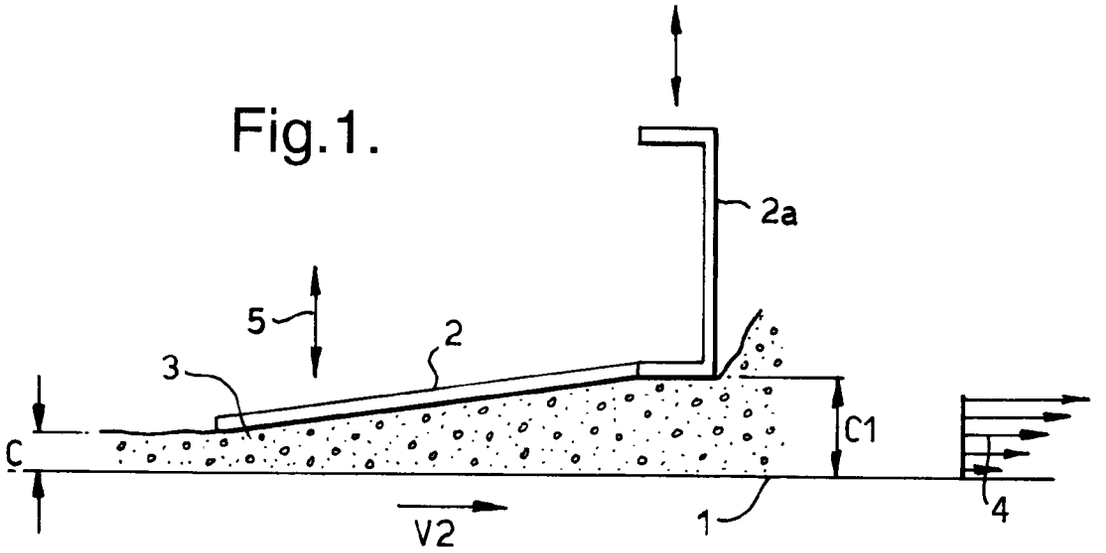


Fig.2.

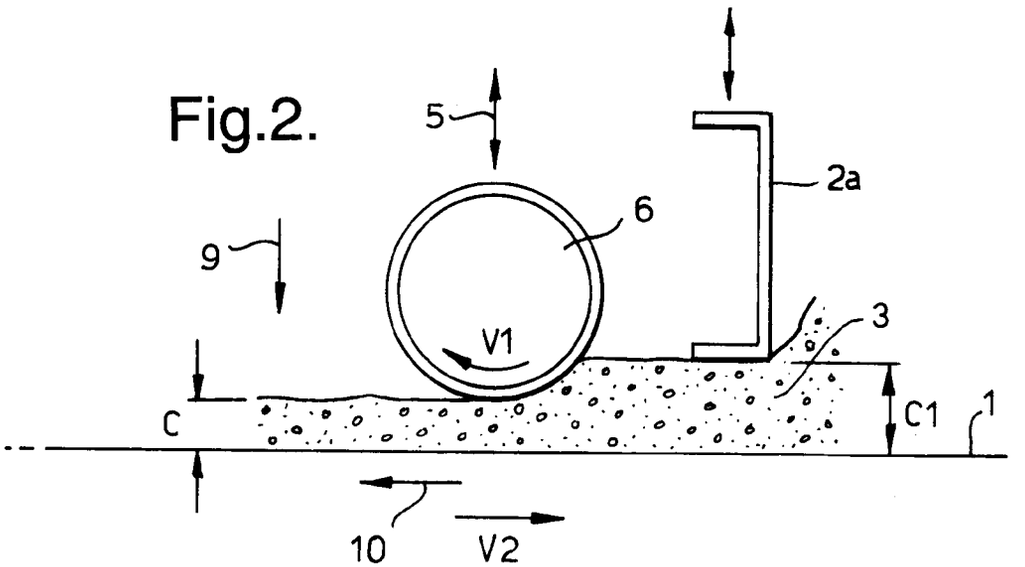
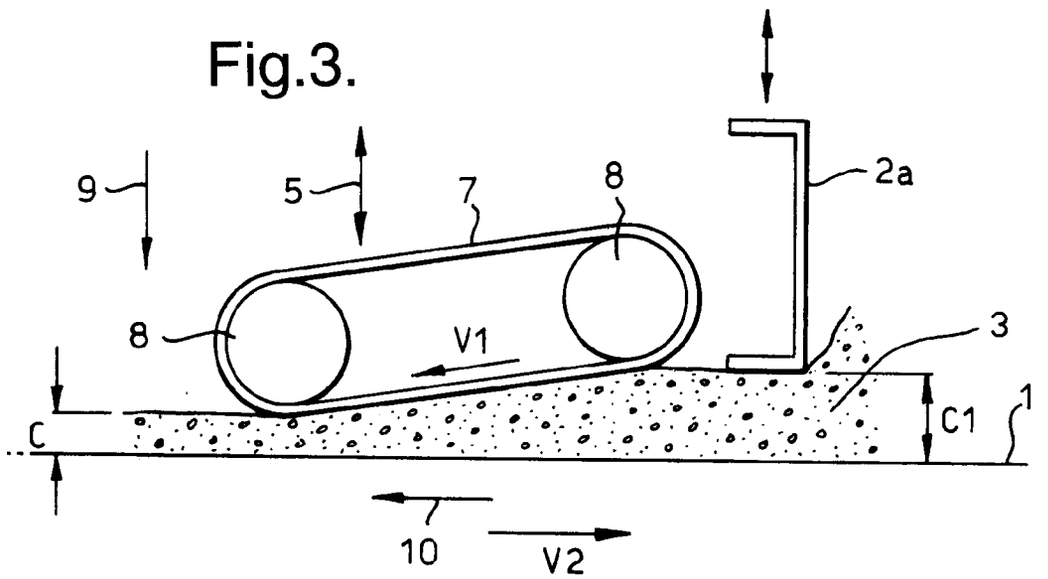


Fig.3.



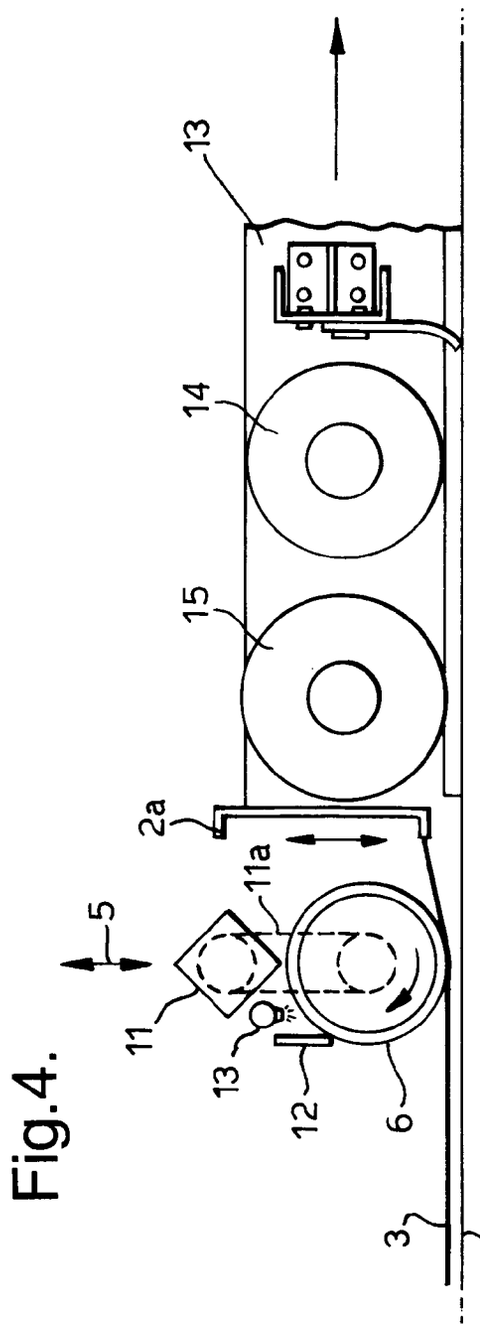


Fig.4.

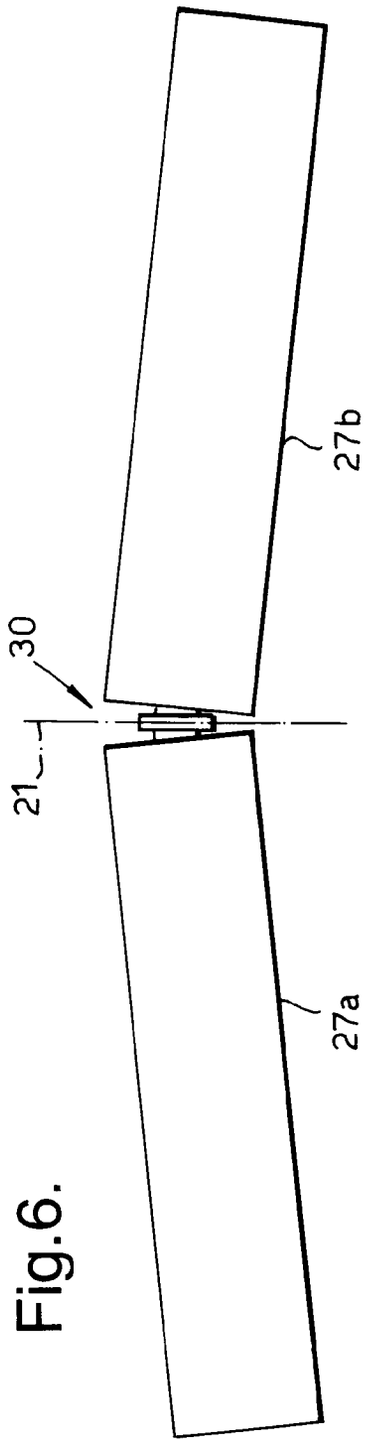


Fig.6.

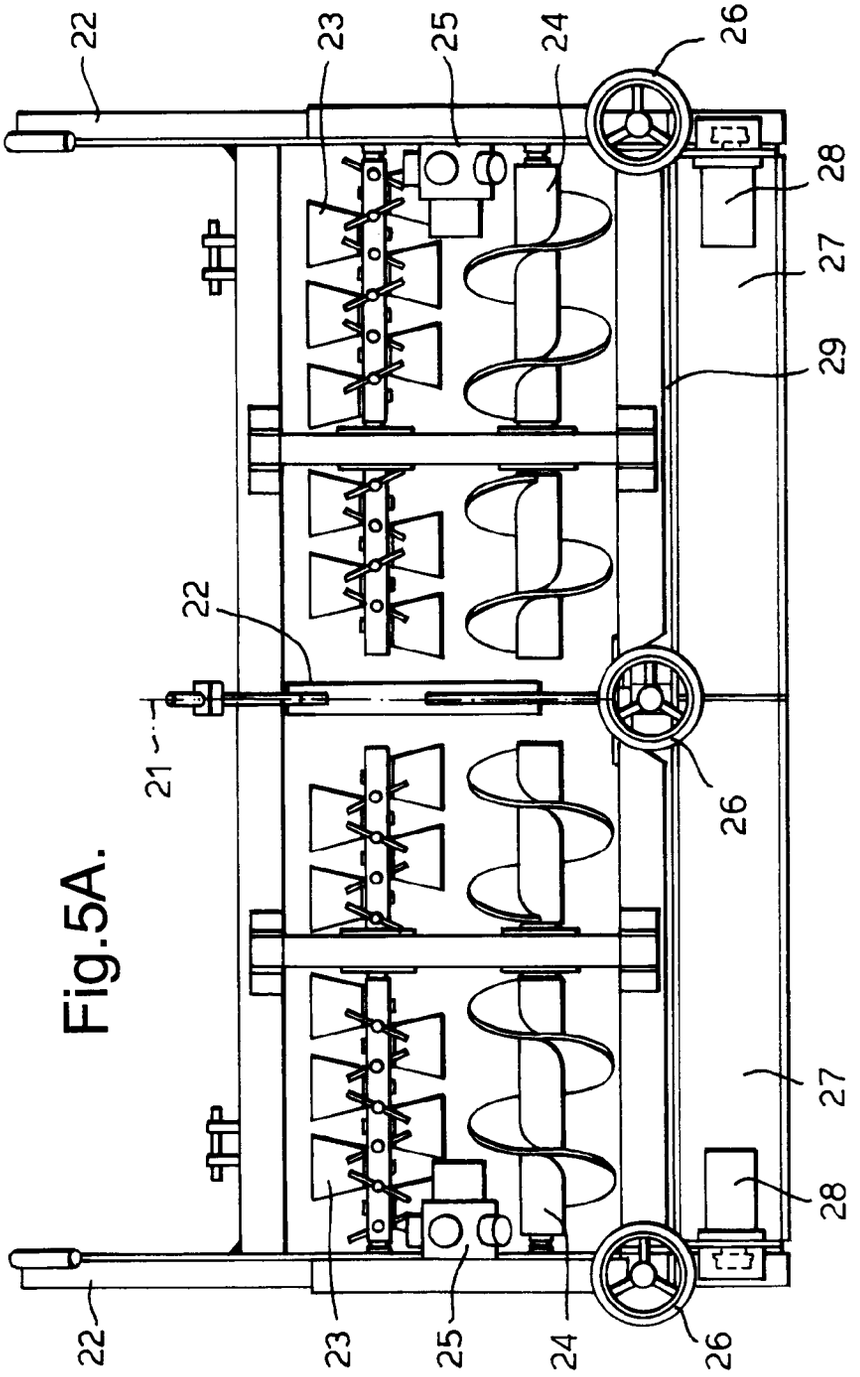


Fig.5A.

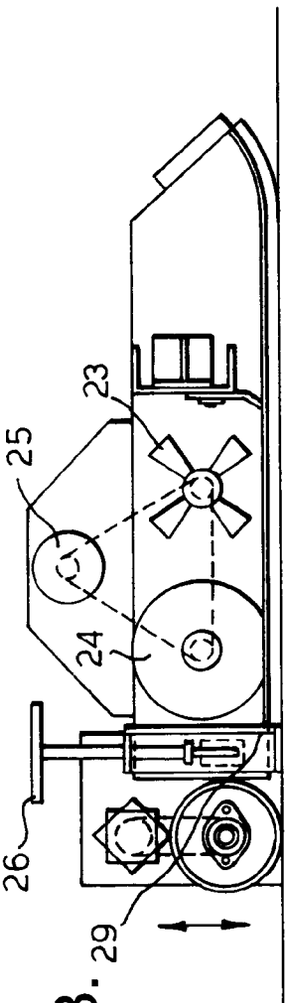


Fig.5B.

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EUROPEAN SEARCH REPORT

Application Number
EP 95 30 4826

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)
X	US-A-3 801 211 (PERKINS G) 2 April 1974	1-5, 7-10,12	E01C19/48
A	* the whole document *	6,11	
X	DE-C-843 856 (STRABAG BAU)	1-3,7-9, 12	
	* the whole document *		
X	WO-A-87 07921 (CIRAUD PIERRE) 30 December 1987	1-3,5, 8-10,12	
A	* the whole document *	6,11	
A	FR-A-2 559 802 (SCREG ROUTES & TRAVAUX) 23 August 1985		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

E01C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	2 November 1995	Dijkstra, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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