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(54) A finishing machine for laying bituminous aggregates equipped with an improved expandable screed

(57) A road surface finishing machine has the screed (1, 2, 1', 2') comprising central screed elements (2, 2'), expandable side elements (1, 1'), supported by guides (6 and 7) mounted slidably on the central screed elements (2 and 2'), an actuator stem (8) that causes transversal sliding of the expandable elements (1 and 1'); each of the expandable side elements comprise a vertical and angular adjustment device that comprises two plates (9 and 13) mounted in a pack-like way by means of screws 10, 11 etc., with a vertical body (12) of the expandable element(1'), the intermediate plate (13) also being mounted rotatably around a pivot (14) having the geometric axis of rotation (14') integral with the body (12), while the inner plate (9) is mounted slidably along guides (15) integral with the intermediate plate (13).

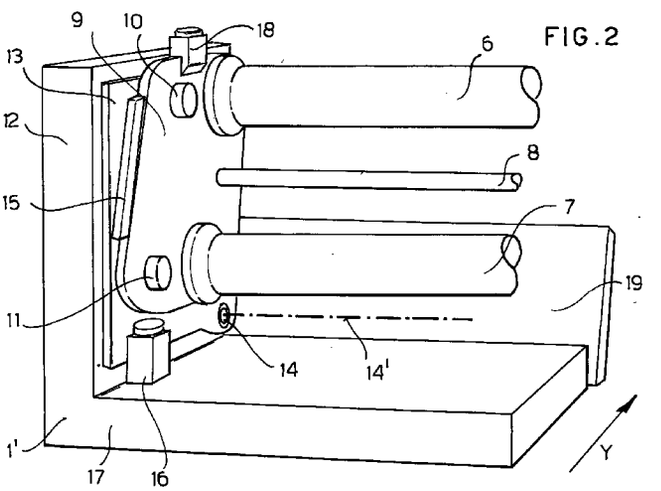

FIG.2

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Description

DESCRIPTION OF PRIOR ART

[0001] In finishing machines for laying bituminous aggregates for modern road making, two important parts are generally distinguished: a pulling part (tractor) and a part that carries out the actual work of laying, levelling, compacting etc. the aggregate on the road surface. The latter assembly, called a "screed", consists of an apparatus which in the years has become very complex and articulated.

[0002] The most recent embodiments provide a screed composed of four distinct elements, two central elements of which being articulated to each other and having systems for adjusting the inclination of one element relative to the other. On each of these central elements a stem element is mounted which is approximately equal in length to the other elements and is horizontally slidable outwards, moved by hydraulic pistons.

[0003] This type of "screed" is generally called an "integrated screed" or "hydraulically expandable screed".

[0004] The advantage inherent to the two expandable outer elements of the integrated screed is that of being able to vary the laying width at will and without interruption. The expandable side or outer elements may be fixed on the central elements in a variety of ways depending upon the models and the types of finishing machines produced. Generally very precise and rugged cylindrical guides are provided, in order to ensure that sliding takes place respecting the geometric design characteristics of the "screed" element as much as possible.

[0005] It is very important to respect said characteristics because the shape of the screed, and especially its lower face, directly affects the resulting surface of bituminous aggregate layed.

[0006] Even if the slide guides are made with high accuracy, there is always a danger that the geometric shape planned for the road in fact suffers alterations due to elastic deformations of the various members making up the "screed" when the expandable side elements themselves are subject to considerable forces (static and dynamic reactions) that occur with rapidly changing values during operation.

[0007] One of the most serious elastic deformations that usually takes place is torsional strain which occurs, and can be detected, on the expandable side elements, which allow rapid changing (at the wish of the road constructor and/or of the finishing machine operator) of the laying width of the bituminous aggregate road coating.

[0008] In fact the expandable side elements with which this modem type of expandable screed is provided must be constructed so as to be as light as possible, though assuming a more or less parallelepiped shape, and therefore, for both these reasons, they are difficult to implement in a sufficiently rigid structure to resist torsional stress.

[0009] On all known finishing machines to date, torsional stress in practice tends to deform the expandable side elements, giving them a helical shape that is also transmitted to the surface facing the roadway that is receiving the new coating of bituminous material. This can have negative consequences on the perfection of the finished road.

[0010] This helical-shaped deformation is shown on the expandable side elements in a most irregular fashion, depending upon the laying width that has been chosen to perform the work. In other words, if the expandable side elements are pushed outwards as far as possible, that is to the end of the stroke, each expandable element is hit completely by the heap of material to be laid on the new roadway and therefore all reaction forces act on the expandable side elements.

[0011] When an expandable side element has to work only partially pushed outward,on the other hand, part of said expandable side element remains covered by a central element of the screed, and is no longer in contact with the material to be laid; the reaction forces acting on the expandable side elements are thus different or differently distributed.

[0012] It can therefore be stated that, depending upon the laying width to be achieved, an expandable side element is subjected to different or differently distributed reaction forces.

[0013] Consequently, an expandable side element will inevitably vary its own elastic deformation.

[0014] As has been seen above, the elastic deformation of the expandable side elements that is of most concern is that which tends to twist said expandable side element.

[0015] If said expandable side element is considered similar to a parallelepiped with a horizontally and transversally elongated shape, the deformation of most concern is that which tends to cause the two vertical walls lying in the direction of forward travel of the machine during work to rotate relative to each other.

[0016] When this happens, the horizontal surface that rests on the material to be spread is helically deformed, causing considerable disturbance also on the surface of the laid material.

[0017] Due to the inevitable elasticity of the materials with which these expandable side elements can be made, and taking into account that, for intuitive reasons, these expandable elements must be made so as to have their weight reduced as much as possible, in practice it has been observed that, unfortunately, the above mentioned torsional deformations or strains reach significant values however much care has been taken in making these expandable side elements and their slide guides.

DESCRIPTION OF THE PRESENT INVENTION

[0018] A neat but approximate solution to combat and partially avoid these deformations has been illustrated in Swiss patent CH 657 168 filed on 16.11.1982, which describes a finishing machine the screed of which comprises central elements and expandable side elements, and these can be individually preloaded by means of a preloading device.

[0019] Many hundreds of finishing machines have been built and put on the market provided with "expandable screeds" made according to the aforementioned Swiss patent.

[0020] From the road yard experience observed during the work carried out by these machines it could be noted that an even greater laying precision could have been achieved by adopting construction materials and geometric shapes that allowed the torsional deformation to be further reduced (something that modern technology has allowed as the years passed) and at the same time introducing mechanical control means for more precise adjustment of the relative position of the expanding side elements with respect to that of the central elements of the screed.

[0021] Road yard experience has also shown that of three orthogonal directions to be kept under control for adjusting the relative position of the expandable elements (with respect to the position of the central ones), the most important is a polar rotational direction with respect to a horizontal transversal axis that is as near as possible (and in any case parallel) to the horizontal transversal geometric axis that contains the bottom front edge of the central elements.

[0022] An object of the present invention is to allow the angular and vertical positioning of an expandable element to be modified with respect to a corresponding central element to compensate less approximately (than did the invention of the aforementioned Swiss patent) for the elastic deformations caused on the entire screed by the reaction forces that the bituminous aggregate exerts on the active surfaces of the screed during laying.

[0023] This object is reached with a finishing machine as stated in claim 1. Further new and advantageous characteristics are said in the dependent claims.

[0024] The appended drawing schematically shows the main characteristics of the improved finishing machine and precisely:

Figure 1 is a perspective diagrammatic rear view of a finishing machine provided with a diagrammatically shown expandable screed forming the subject matter of the invention, which is able to carry out gradual widening or narrowing of the coating of bituminous aggregate to be laid on the road;

Fig. 2 shows an enlarged, partial and perspective rear view, of the left end of a road surface laying device according to the invention in operating position with an angle adjusting device acting on a left expandable side element; a second similar (specular) angle adjustment device acts on a right expandable side element.

[0025] In the figures, reference F is a road surface finishing machine; M is a coating of bituminous aggregate laid on the road.

[0026] The direction of travel of the finishing machine during the work is indicated by the arrow Y.

[0027] In Fig. 1 a right expandable side element of the screed is indicated by 1 and a central right element by 2 while the same elements on the left side are indicated by 1' and 2'.

[0028] In Figure 2 the element 1' has been illustrated partly broken off to improve understanding of the inner structure.

[0029] Cylindrical guides 6 and 7, and also a stem 8 of an hydraulic actuator that transversally slides expandable element 1', are mounted in a traditional manner (not shown) on the corresponding central element (2') of the screed.

[0030] The guides 6 and 7 are mounted integral with the inner surface of an inner plate 9. Mounted on the same surface is an end of the stem 8 of the hydraulic actuator that slides the expandable side element 1' with respect to the fixed central element 2'.

[0031] The plate 9 is mounted in a pack-like way by means of four through screws schematically shown by 10 and 11 (two of these screws cannot be seen because they are coaxial with the guides 6 and 7) with vertical body 12 of the expandable element 1'.

[0032] According to the present invention, between the vertical body 12 and the plate 9 is interposed an intermediate plate 13 (provided with large through holes - not visible - to allow screws 10 and 11 to pass through) which is pivoted on body 12 by means of a pivot 14, having a geometric axis of rotation indicated by straight line 14'.

[0033] The pivot 14 has a horizontal transversal geometric axis (with respect to the entire finishing machine) disposed very near (and parallel) to the horizontal transversal bottom front edge of the expandable element 1'.

[0034] The plate 13 carries two slide guides 15 (of which one is not visible in Figure 2 because it is hidden by the plate 9).

[0035] A screw-type or hydraulic adjustment device 16 of a known type engages on one side plate 13 and on the other side a horizontal body 17 of the expandable element 1', allowing angular adjustment of the plate 13 with respect to the element 1', causing rotation around the pivot 14 and then, due to shape and orientation of the geometric axis 14' of the pivot 14, around a horizontal transversal axis very near to the geometric axis that contains the horizontal transversal bottom front edge of the expandable element 1'.

[0036] Another screw-type or hydraulic adjustment device 18 of a known type engages on one side on the

plate 13 and on the other on the plate 9 to cause relative adjustment thereof by sliding one plate with respect to the other in the direction imposed by the guides 15.

[0037] All these adjustment movements obtained by acting on adjustment devices 16 and 18 are carried out when the four screws 10, 11 etc. are slightly loosened and the "pack" formed by body 12, plate 13 and plate 9 has sufficiently low internal friction to allow said adjustment movements.

[0038] During work, depending on the intensity of the stresses to which the expandable element 1' is subjected, the four screws 10, 11 etc. can be more or less tightly screwed so as to ensure that the mutual positions which have been fixed acting on the two adjustment devices 16 and 18 remain unchanged, until the changed working conditions induce the operator to change said adjustments.

[0039] The expandable element 1' acts on the bituminous aggregate mix to be laid by means of the bottom surface of its body 17 and the front surface of the plate 19 integral with the bodies 12 and 17.

[0040] According to the present invention, by acting on the adjustment devices 16 and 18, relative sub vertical and angular movements of the bodies 12 and 17 and of the related active surfaces thereof are caused, with respect to the plate 9, consequently with respect to the guides 6 and 7 and therefore with respect to the central element of the screed 2'.

[0041] The object is thus achieved of modifying the angular and vertical positioning of the expandable element 1' with respect to the corresponding central element 2' to compensate, in a less approximate manner than was done with the invention of the aforementioned Swiss patent, for the elastic deformations caused on the entire screed by the reaction forces that the bituminous aggregate exerts on the active surfaces of the screed during laying.

Claims

1. A road surface finishing machine with a screed (1, 2, 1', 2') comprising central elements (2, 2') of the screed, expandable side elements (1, 1') supported by guides (6 and 7) slidably mounted on the central elements (2 and 2') of the screed, an actuator stem (8) that causes transversal sliding of the expandable elements (1 and 1'), characterized in that each of the expandable side elements comprises a vertical and angular adjustment device that comprises two plates (9 and 13) mounted in a pack-like way by means of screws (10, 11, etc.) with a vertical body (12) of the expandable element (1'), the intermediate plate (13) also being mounted rotatably around a pivot (14) having its geometric rotational axis (14') integral with the body (12), whilst the inner plate (9) is mounted slidably along guides (15) integral with the intermediate plate (13).

2. A finishing machine as in claim 1 characterized in that it comprises screw-type adjustment devices (16, 18) that engage respectively one (16) between the intermediate plate (13) and the body (12) to cause an angular movement around the axis of the pivot (14) and the other (18) between the intermediate plate (13) and the inner plate (9) to cause a vertical rectilinear movement between the inner plate (9) and the intermediate plate (13).

3. A finishing machine according to claim 2, characterized in that the adjustment device is mounted on each of the expandable side elements (1 and 1') of the screed of the finishing machine.

4. A finishing machine according to claim 1 characterized in that the geometric axis of the pivot (14) is horizontal, transversal and substantially parallel to the bottom front horizontal transversal edge of the expandable element (1').

5. A finishing machine according to claim 1, characterized in that the geometric axis of the pivot (14) is very near to the bottom horizontal transversal edge of the expandable element (1').

6. A finishing machine according to claim 5, characterized in that the axis (14') of the pivot is parallel to the bottom front horizontal transversal edge of the expandable element (1').

7. A finishing machine according to any one of the preceding claims characterized in that the rotation of the plates (9 and 13) relative to each other around the geometric axis (14') is obtained by making one plate slide with respect to the other along rectilinear or curved guides the contact surfaces of which determine an instantaneous rotation axis coinciding with the geometric axis (14').

FIG.1

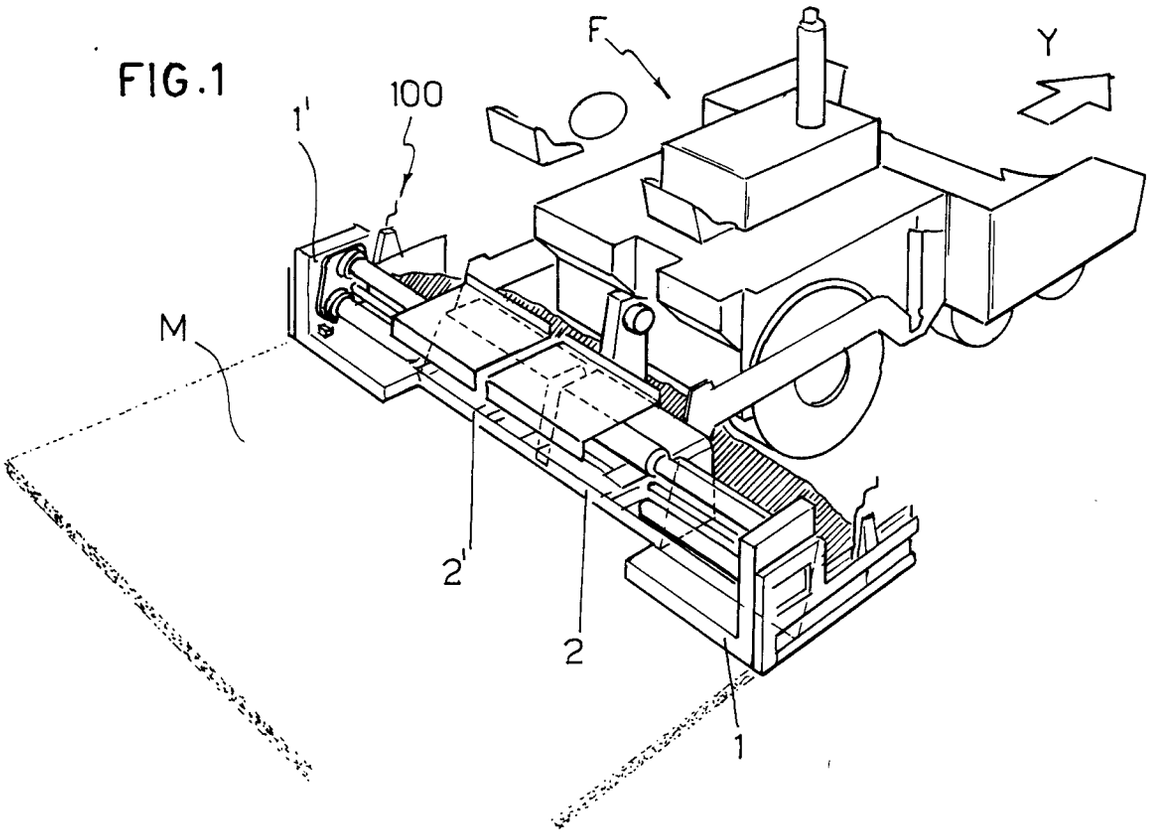
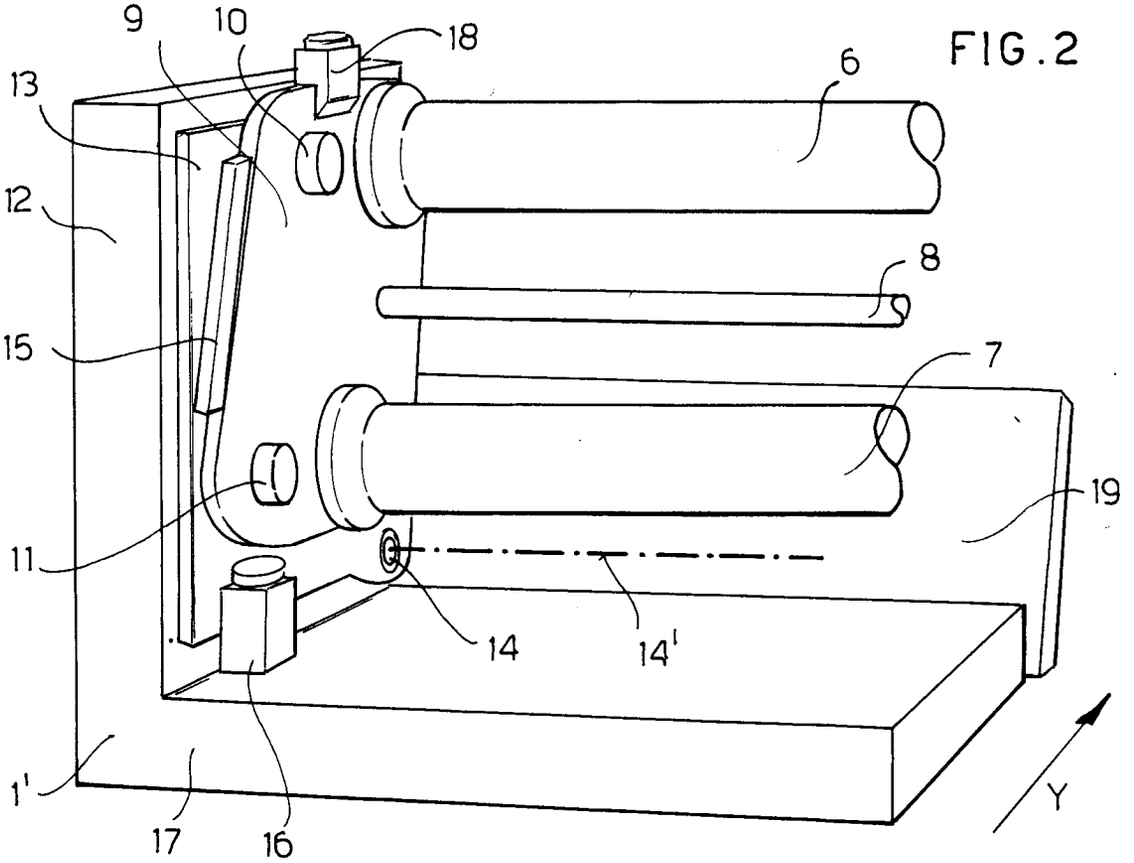


FIG.2



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EUROPEAN SEARCH REPORT

Application Number
EP 98 11 8776

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)
D,A	EP 0 109 639 A (DOMENIGHETTI DOMENICO) 30 May 1984 * the whole document *	1	E01C19/42
A	DE 295 05 382 U (DYNAPAC GMBH) 13 July 1995 * page 4, line 6 - page 8, line 17; figures *	1	
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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	11 January 1999	Dijkstra, G

CATEGORY OF CITED DOCUMENTS

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