(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 348 364 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **89630285.6**

(51) Int. Cl.4: **E 01 C 23/03**

(22) Date of filing: **20.06.89**

(30) Priority: **22.06.88 IT 351688**

(43) Date of publication of application:
27.12.89 Bulletin 89/52

(84) Designated Contracting States:
AT BE CH DE ES FR GB GR LI LU NL SE

(71) Applicant: **DERBIT- DERIVATI BITUMINOSI ED AFFINI-S.p.A.**
Via Romitino, 5
I-40055 Castenaso (Bologna) (IT)

(72) Inventor: **Vacchi, Giorgio**
Via Romitino, 10
I-40055 Castenaso (Bologna) (IT)

(74) Representative: **Lanzoni, Luciano**
c/o BUGNION S.p.A. Via Farini, 37
I-40124 Bologna (IT)

(54) A self-propelled machine for laying membranes of waterproof or insulating sheet material supplied in rolls.

(57) The machine lays weatherproof sheet supplied in rolls (1), and consists in a self-propelled bearing structure (3) the front end of which affords a cradle (4) for the support of at least one such roll disposed with its axis horizontal and lying transverse to the machine's direction of movement; also, at least one cylindrical roller (5) lying parallel with the roll and adjustable for height at least down to a lowered position in which it presses the sheet material down onto the surface being treated, and torches (13) that soften the sheet as it passes over the roller (5).

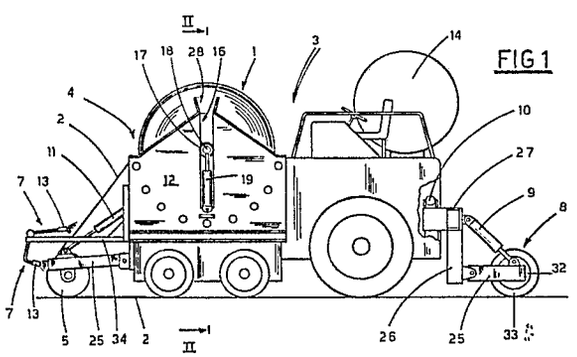


FIG 1

EP 0 348 364 A1

Description

A self-propelled machine for laying membranes of waterproof or insulating sheet material supplied in rolls

The invention relates to a self-propelled machine for laying membranes of waterproof or insulating sheet material, for example over surfaces exposed to weathering agents liable to affect constructions such as roads, bridges, flyovers and airports.

One serious problem besetting reinforced concrete constructions continually exposed to the elements, is that of ensuring a weatherproof top surface. This operation is of fundamental importance as regards the life of the construction, given that cracks are produced in the concrete by vibration from traffic and through natural settlement, which ultimately reach the embedded metal reinforcement. The subsequent penetration of rain, snow and other precipitations into the cracks thus begins to attack the reinforcement and cause its oxidation. Oxidation eventually corrodes the reinforcement, and occasions a reduction in the cross section of its constituent members. As these members provide the only means capable of withstanding the tensile and bending stresses to which reinforced concrete is subject, a reduced cross section per unit of the prescribed ultimate tensile stress also signifies a reduction in the maximum load that can be supported by the structure as a whole without its giving way.

This much established, it will be clear enough that the importance of finding a solution to the problem of infiltration is fundamental if the long term integrity of reinforced concrete is to be ensured; damage occasioned to metal reinforcements by the penetration of weathering agents is in fact an irreversible process which eventually will dictate demolition and rebuilding of the entire structure, in the interests of safety.

Accordingly, the only expedient available is that of adopting a technique designed to prevent such infiltration occurring.

Conventionally, this expedient consists in laying a waterproof or insulating membrane over the concrete structure, utilizing sheet material of bituminous composition. The sheet material in question is laid manually, however, and therefore at a certain cost in terms both of the speed of the operation and of the expense involved in hiring numerous hands. Moreover, the fact of the operation being manual signifies that the dimensions of the sheet material must necessarily be limited, to enable lifting and manoeuvring by hand, resulting in unduly numerous overlapped joints that bring drawbacks in terms of the quantity of material utilized and the uniform finish of the surface.

Accordingly, the object of the present invention is to provide a self-propelled machine capable of laying sheet material of the type in question, and thus of overcoming the drawbacks mentioned above. The stated object is achieved with a self-propelled machine as characterized in the claims appended, which is designed to lay a weatherproof membrane utilizing sheet material supplied in rolls.

One of the advantages afforded by the invention is that it ensures enhanced weatherproof properties of the laid material by virtue of the reduction in the number of overlapped joints; more exactly, the fact that the wound sheet material is supported by the bearing structure of the machine means that the rolls can be manufactured in a length such as to cover even the entire width of the construction, thus elimining transverse joins entirely. What is more, the width of the rolls can also be increased, and the number of longitudinal overlapped joints correspondingly reduced.

A further advantage of the machine is that of the considerably increased speed of laying it provides, attributable principally to the very fact of its using a larger size of sheet and thus being capable of an increased quota of work per roll.

The invention will now be described in detail, by way of example, with the aid of the accompanying drawings, in which:

fig 1 is a side elevation of the self-propelled machine according to the present invention;

fig 2 is the section through II-II in fig 1, viewed with certain parts omitted better to reveal others;

fig 3 is the side elevation of an alternative embodiment of the machine in fig 1.

With reference to fig 1, the self-propelled machine according to the present invention is designed to lay waterproof or insulating membranes consisting in sheet material of bituminous composition wound onto rolls, denoted 1; such a machine consists in a self-propelled bearing structure, denoted 3 in its entirety, provided at the forward end, considered in relation to its path of forward motion, with transversely disposed means 4 for the support of the roll, a cylindrical roller 5 disposed parallel to the roll 1, and heating means denoted 7.

The means of support 4 consist in a plurality of cylindrical rollers 40 disposed parallel to the axis of the roll 1, the opposite ends of which are carried by a pair of fixed parallel side walls 12. The rollers 40 are disposed at right angles to the side walls 12, and associated therewith in such a way that their axes coincide substantially with an arc to a circle of diameter approximately equal to the maximum diameter of the roll 1.

Suspended thus between the parallel side walls 12, the rollers 40 are freely rotatable and driven in rotation from a motor 6 rigidly attached to the structure 3, for example by way of chains 23. In a preferred embodiment of the machine, transmission means 15 will be provided between the motor 6 and the first roller 40, having a quick-release clutch mechanism, for example a dog coupling operated from an actuator by way of drive means 24 (fig 2).

The cylindrical roller 5 is disposed parallel to the roll 1, suspended and freely rotatable between the opposite ends of a U-frame 25 articulated to the bearing structure 3 about an axis parallel to that of the roller 5. The frame 25 is shifted by a fluid power cylinder 11 between at least two limit positions, one

raised and at rest, and the other lowered and substantially operative, whereby the roller 5 is able to press the membrane 2 dispensed from the roll 1 onto the exposed surface of the construction.

The heating means 7 are supported by a respective frame 34 fastened to the bearing structure 3, and consist in a plurality of blow torches 13 located alongside and preceding the roller 5, considered in relation to the path of the uncoiling membrane 2; the torches 13 burn a combustible material, such as propane gas, stored in a relative tank 14.

The machine according to the invention (see figs 1 and 3) also comprises a second cylindrical roller 8 disposed parallel with and to the rear of the first roller 5, considered in relation to the path of motion of the bearing structure 3. The roller 8 in question is supported adjustably by the bearing structure 3 in such a way that it can be positioned for height and traversed along its own longitudinal axis (offset); more exactly, the roller 8 is freely rotatable, and supported thus at either end by the projecting ends of a pair of parallel arms 25 the remaining ends of which are hinged to the ends of an upturned-U frame 26. Two fluid power cylinders 9 are anchored by their opposite ends to the arms 25 and to the U-frame 26, in such a way that extension and retraction causes the arms 25 to move downwards and upwards, lowering and raising the roller 8.

The central horizontal part of the U-frame 26 is carried by a guide 27 rigidly associated with the bearing structure, and slidable therein through a path parallel with the roller 8. A further fluid power cylinder 10, anchored by one of its ends to the U-frame 26 and by the remaining end to the bearing structure 3 or the guide 27, serves to offset the U-frame 26, hence the roller 8, through a plurality of essentially contiguous positions in a direction transverse to the bearing structure 3.

The rear roller 8 may be embodied entirely in metal as per the forward roller 5 (see fig 3), or may be faced in resilient material, for example comprising a hard centre 32 shod with a solid rubber tyre 32 (as in fig 1). Moreover, the roller 8 in question might be position toward the middle of the bearing structure 3 (fig 3) or at the rear end (fig 1). 16 denotes an open-ended slot in each of the side walls 12, disposed in alignment with a vertical plane coinciding substantially with the axis of the roll 1 cradled in the rollers 40, each one of which accommodating a slider 17; the slider 17 in turn freely accommodates a shaft 18 disposed coaxially with the roll 1, and is actuated by means, such as a fluid power cylinder 19 anchored to the wall 12, by which it can be moved along the slot 16 through a plurality of contiguous positions. The top open end of the slot 16 is widened to create a splayed entry 28, as illustrated in fig 1, for a reason that will become apparent in due course.

The machine is worked by two operators, one seated at the driving position responsible for propulsion and supervision of the roll 1, and the other either standing alongside or occupying a seat at one side (not illustrated), responsible for the torches 13, the position of the pressing rollers 5 and 8 and, when necessary, operation of the cradle rollers 40.

With a machine thus embodied, rolls 1 of sheet material are brought to the site by conventional haulage trucks provided with on-board cranage; one such vehicle will then draw alongside the machine in readiness to load a replacement roll 1, at which time the torches 13 will obviously be deactivated. Using a sling arrangement of chains terminating in two pins, each inserted into the relative end of a hollow shaft onto which the material 2 is coiled, the roll 1 is lifted from the truck and lowered onto the cradle rollers 40. During this operation, the sliders 17 remain at the bottom of the slot 16, while the splayed entries 28 ensure ease of access to the pins between which the roll 1 is suspended. Thereafter, the cradle rollers 40 will be rotated in the direction which uncoils the roll 1 and the leading edge of the sheet material 2 drawn over the forward roller 5, whereupon the rollers 40 are stopped and the sliders 17 raised into coaxial alignment with the roll 1. A shaft 18 can now be inserted through the sliders 17 and the roll 1, and the sliders 17 raised a given distance in such a way as to support the entire weight of the roll.

Throughout these preparatory steps, the pressing rollers 5 and 8 remain raised, and will be lowered only when the machine is ready to begin laying the roll of material fitted. With the leading edge of the sheet 2 uncoiled and positioned beneath the forward roller 5, the torches 13 are lit, and the machine is set in motion. As the machine moves forward, the sheet 2 is gradually uncoiled from the roll 1, heated to the melting point of the bitumen component, and laid and pressed onto the surface of the construction. Additional pressure is applied by the rear roller 8, especially along the overlapping joins between adjacent sheets, which bond together more firmly as a result. The operator in charge of the rollers will adjust the height and offset of the rear roller 8 in such a way as to ensure that the overlaps are properly pressed.

It will be seen that one has what is substantially a combined action of the torches 13, which heat the bituminous component in the sheet material until thoroughly melted, and the forward roller 5, which forces the bitumen into the receiving surface while still in the fluid state; accordingly the fluid penetrates down to the cracks and crevices of the surface, even a particularly rough surface, and the membrane 2 thus adheres solidly to the concrete, or where overlaps occur, to the sheet beneath.

The roll 1 can be lowered gradually as the sheet 2 is being laid, without actually coming to rest on the cradle rollers 40; however, in the event that the roll is not used up entirely, it can be lowered onto the rollers 40 and, having cut the material to the length required to finish the job in hand, the remaining length can be rewound by operating the cradle rollers 40 in the reverse direction, thus avoiding damage during subsequent transit.

In the alternative embodiment of the machine shown in fig 3, which utilizes a roll 1 of material having a projecting coaxial shaft 31, means 4 are provided for the support of the roll that consist in a frame 20 of substantially U shape. The frame in question is hinged at bottom to the bearing structure 3, and associated with actuator means consisting in

two fluid power cylinders 21 anchored to the bearing structure 3, by which it is rotated between a raised position, and a lowered position in which the roll 1 is set on the ground, or at all events, on the surface to be covered. The frame 20 affords seatings 29 for the support of the roll shaft, and radial means 22 and axial means 30 which clamp the two shaft ends in position while allowing them freedom to rotate about their own axis.

Operation of this embodiment differs only as far as regards the method of loading the roll 1, which is effected by the machine itself, thus: the frame 20 is first lowered to permit of lodging the shaft ends in their respective seatings 29; this done, the clamp means 22, 30 are applied and the frame 20 raised, whereupon the machine can begin laying the new roll of material 2.

Claims

1) A self-propelled machine for laying membranes of waterproof or insulating sheet material supplied in rolls (1),
characterized
in that it comprises a self-propelled bearing structure (3) and, carried by the forward end of such a structure:
-means (4) for supporting at least one roll (1) of material disposed with axis horizontal and normal to the path of motion of the bearing structure (3);
-at least one cylindrical roller (5) disposed with its axis parallel to that of the roll (1), located forward of the roll and adjustable for height by the operation of relative means (11) at least between a raised, at-rest position, and a lowered operating position in which it presses the membrane sheet material (2) uncoiled from the roll (1) onto the surface to be waterproof ed or insulated;
-means (7) for investing the membrane (2) with heat at least when near to the cylindrical roller (5).

2) A machine as in claim 1, further comprising a second cylindrical roller (8) supported by the bearing structure (3), disposed with its axis parallel to that of the forward cylindrical roller (5), located to the rear of the forward roller in relation to the path of motion of the bearing structure (3), and when actuated by respective means (9, 10), capable of movement between a raised at-rest position and a lowered operating position in which it presses the membrane sheet material (2) onto the surface to be waterproofed or insulated, and, in a direction normal to the path of motion of the bearing structure (3), between two limit positions encompassing a plurality of intermediate positions that correspond to the overlapped joins between adjacent sheets of the membrane (2).

3) A machine as in claim 2, wherein the cylindrical roller (8) is positioned at an intermediate point between front and rear of the machine.

4) A machine as in claim 2, wherein the cylindrical roller (8) is positioned at rear of the machine.

5) A machine as in claim 2, wherein the cylindrical roller (8) consists in a hard centre (23) faced with resilient material (33).

6) A machine as in claim 1, further comprising drive means (6) by which to rotate the roll (1) in one direction or the other.

7) A machine as in claim 1, wherein heating means (7) consist in a plurality of blow torches (13) fuelled from a relative tank (14) of combustible material.

8) A machine as in claim 1, wherein means (4) of supporting the roll (1) consist in a plurality of rollers (40) disposed with axes parallel to the axis of the roll and describing an arc to a circle of diameter substantially identical to the maximum diameter of the roll, which are freely rotatable and suspended by their respective opposite ends between a pair of vertical side walls (12) disposed normal to the parallel axes and rigidly associated with the bearing structure (3).

9) A machine as in claim 1, wherein means (4) of supporting the roll (1) consist in a plurality of rollers (40) disposed with axes parallel to the axis of the roll and describing an arc to a circle of diameter substantially identical to the maximum diameter of the roll, which are freely rotatable and suspended by their respective opposite ends between a pair of vertical side walls (12) disposed normal to the parallel axes and rigidly associated with the bearing structure (3); and wherein the rollers (40) are connected mechanically with drive means (6) by way of engageably and disengageably coupled transmission means (15)

10) A machine as in claim 8 or 9, wherein the vertical side walls (12) exhibit respective slots (16) disposed in alignment with a vertical plane passing through the axis of a roll (1) supported by the rollers (40), and accommodating respective sliders (17) serving to support a shaft (18) inserted through and coaxial with the roll (1), each one of which is actuated by means (19) producing its movement along the relative slot (16) through a plurality of positions including and encompassed by a lowered limit position, in which the roll (1) comes to rest on the rollers (40), and a raised limit position in which the roll (1) remains clear of the rollers (40).

11) A machine as in claim 1, wherein means (4) of supporting the roll (1) consist in a frame (20) substantially of U shape articulated with the bearing structure (3) and capable, when actuated by relative means (21), of rotation about an axis parallel to the axis of the roll (1) between a raised operating position and a lowered position in which the roll (1) is loaded and unloaded; and further comprising separable means (22), associated with the frame (20), by means of which a shaft (31) passing coaxially through the roll (1) can be made fast to the frame (20).

FIG 1

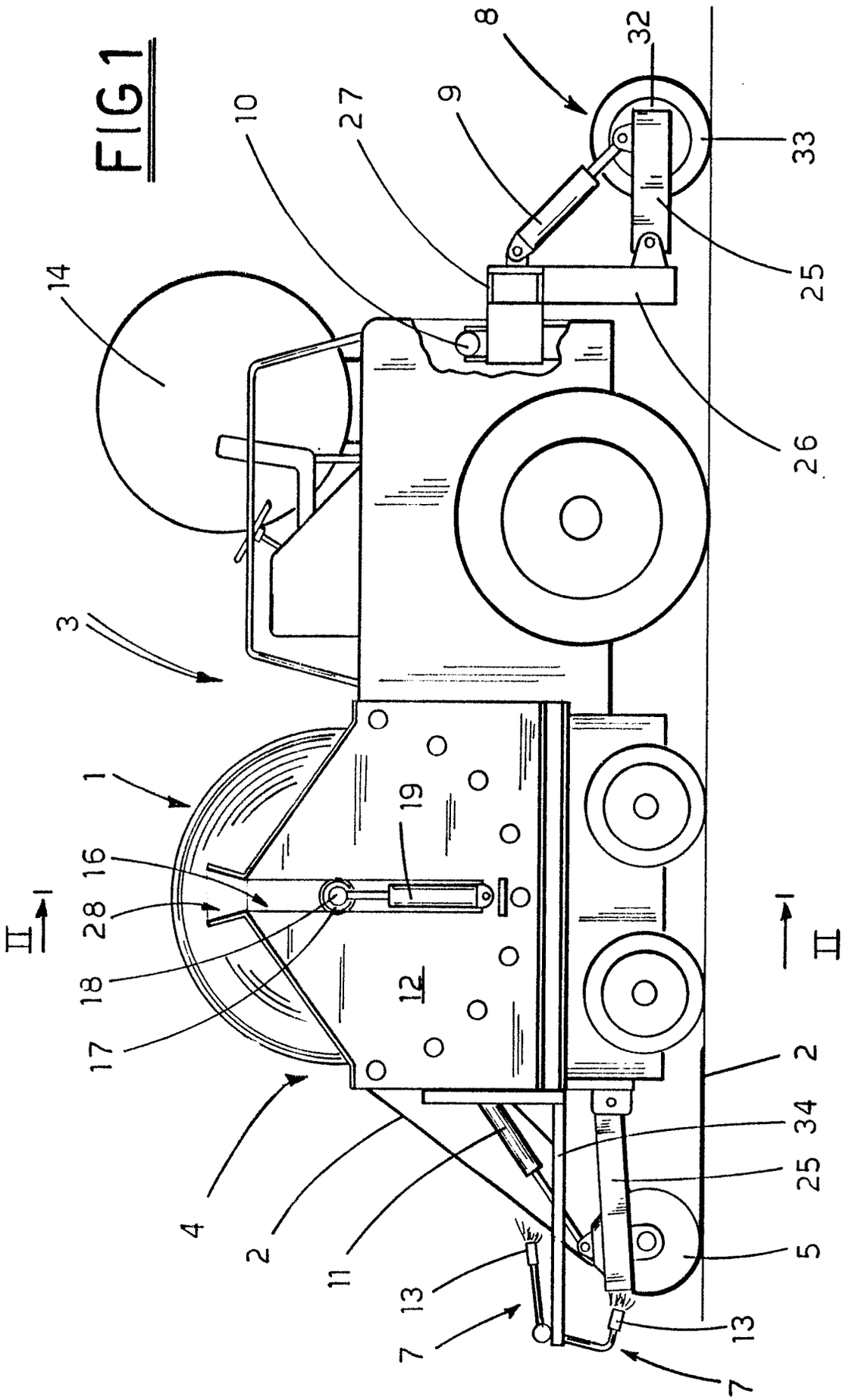

8
32
33
10
27
9
25
14
26
3
1
19
16
28
18
17
12
II
I
I
II
2
34
25
4
2
11
5
13
13
7
7

FIG2

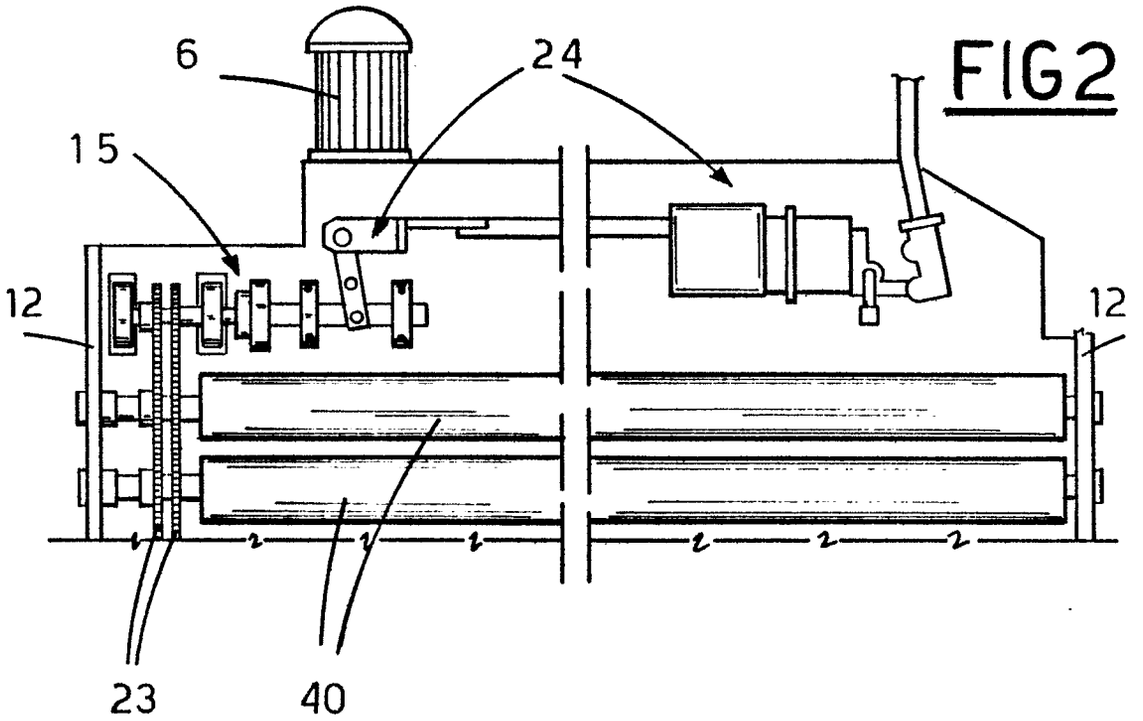
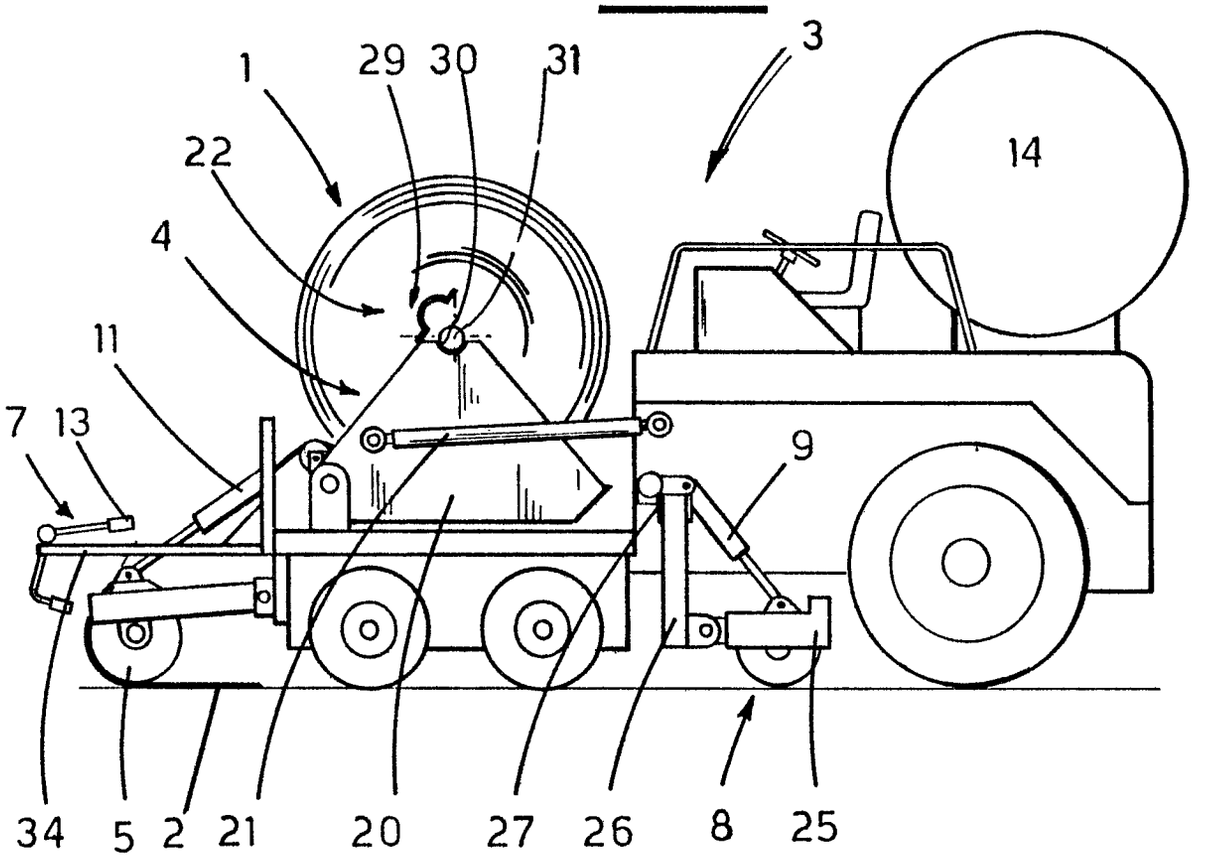


FIG3



European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 89 83 0285

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.4)
Y	DE-A-2 602 947 (EIGENMANN) * Page 19, lines 4-9; figures 6,7 *	1,7	E 01 C 23/03
Y	DE-U-8 533 154 (STEINBRECHER) * Whole document *	1,7	
A	DE-A-2 348 339 (SCHLEGEL ENGINEERING) * Whole document *	1,6,8,9	
A	DE-B-1 194 437 (EIGENMANN) * Figure 7 *	1,5	
A	FR-A-1 500 107 (VIASPHALTE) * Page 2, left-hand column, lines 15-31; figure 2 *	2	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

E 01 C
E 04 D
E 02 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21-09-1989	DIJKSTRA G.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P0401)