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(71) Applicant: **Mecno S.R.L.**
30036 Santa Maria di Sala (IT)

(72) Inventor: **Mason, Tiziano**
30038 - Spinea (IT)

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(74) Representative: **Piovesana, Paolo**
Corso del Popolo, 70
30172 Venezia-Mestre (IT)

(54) **Tangential grinding machine**

(57) A tangential grinding machine slidable on rails to be ground and comprising at least one support frame (9) for at least two tangential grinding wheels (42) for grinding a rail (6), wherein the two grinding wheels can traverse axially on opposite sides of the centre line of the rail to be ground and be inclined inwards with reference to the direction of advancement along the rail, each grinding wheel having its axis of rotation non-parallel with the rail rolling surface, said frame being substantially rockable about a transverse axis extending between the grinding wheel axes.

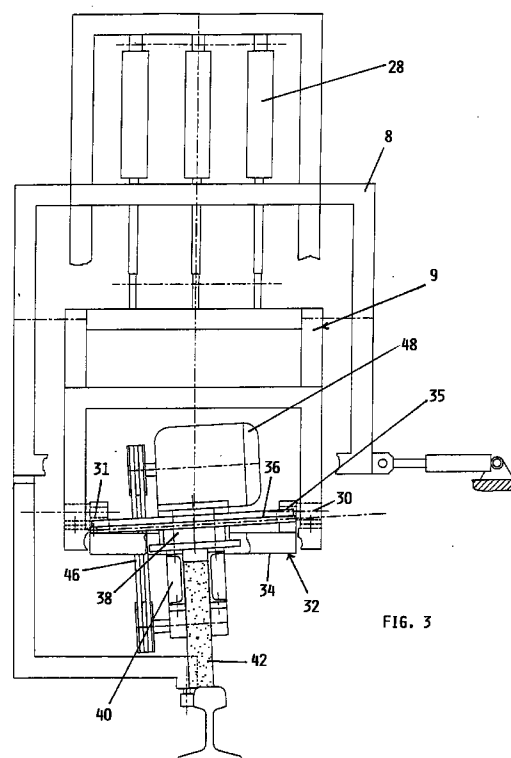


FIG. 3

EP 0 843 043 A1

Description

This invention relates to a tangential grinding machine.

Tangential grinding machines are known comprising a grinding device consisting essentially of a grinding wheel of abrasive material which when rotated removes by abrasion a part of the material with which it comes into contact.

These known machines, ie the assembly comprising the grinding device with its abrasive tools, the rotational drive members, its adjustment and replacement systems, and all the accessories which ensure their correct operation, currently possess a series of limits and drawbacks which it is the purpose of the present invention to eliminate.

One of these drawbacks derives from the fact that each grinding device consists generally of a disc of abrasive material, or grinding wheel, built to operate with its circumferential edge.

As this abrasive disc wears with time, and hence its working circumference decreases, its axis of rotation has to be shifted in relation to the workpiece to be ground, in order to ensure mutual contact. In all cases a complex adjustment and control system is required and which in any event does not eliminate all the problems related to vibration and oscillation of the grinding wheel.

A further drawback of a tangential grinding wheel is the fact that to reprofile a rail a system with a negative contour is required, such a system being of high cost.

In the case of grinding machines used specifically to restore the profile of railway, tramway and/or subway rails, another drawback is that known grinding machines for rails generally use "cup" grinding wheels, which operate on a narrow longitudinal band of the rail to be ground. The result is that many such grinding wheels are required, and as they are mounted on trucks a large number of these must be available to operate on adjacent bands totally covering the entire profile of the rail. An excessive and often unacceptable overall size is involved, together with imperfect execution of the work because of the inevitable faceting presented by the rails on termination of the work. In addition, those cup wheels which operate on the rail lateral surface are hindered by the presence of natural obstacles such as points, guide and containing blades at the points and, in the particular case of tram-rails, the cement and asphalt plus the actual rail counterblade.

A further drawback is that cup-type grinding wheels generally have to work on both rails simultaneously for mass balancing reasons. This makes it more difficult to carry out grinding work on a single rail, such as the central earth rail or the outer live lateral rail for subway trains.

According to the invention all these drawbacks are eliminated through a grinding machine as described in claim 1.

The present invention is further clarified with refer-

ence to the accompanying drawings in which:

- Figure 1 is a schematic side view of a grinding machine according to the invention;
- Figure 2 is an enlarged detailed view of the grinding framework;
- Figure 3 is a view thereof on the line III-III of Figure 2;
- Figure 4 is a plan view thereof; and
- Figure 5 is a partial view of the grinding frame with worn grinding wheels.

As can be seen from the figures, the machine according to the invention comprises a base frame 2 mounted on four wheels 4 which run on the rails 6 to be ground. On said base frame there are mounted two grinding units 8 provided with cylindrical rollers 10 slidable along the machines 12 of the base frame 2. The grinding units 8 are movable transversely to the base frame 2 driven by hydraulic systems 14 (only one system is shown on the figures).

Each grinding unit 8 comprises a frame 9 formed from two parallel longitudinal members 16 joined together by cross-members 18, at the junctions between the longitudinal members and cross-members there being provided four uprights 20 for stiffening the frame.

The upper ends of the uprights are connected together by beams 22 provided with two guide arms 24 which engage in the uprights 26 of the grinding unit 8. In the same manner at the middle point of the longitudinal members 16 there is provided a further pair of arms 24' parallel to the aforesaid to enable the frame 9 to be moved vertically in a rigid manner relative to the grinding unit 8.

Said vertical movement is achieved by means of a plurality of pneumatic systems 28 fixed to the grinding unit 8 and having their rods rigid with the frame 9. The force required at any given time for the various operations can be set by a pressure regulator (not shown on the drawings).

In its central portion the frame 9 comprises a pair of bushes 30 in which there engage two pins 31 oppositely projecting from the longitudinal edges of a rocking platform 32. The rocking platform consists of a rectangular frame 34 to which there are hinged, on a longitudinal side, two plates 36 which can be spaced apart at the other longitudinal side by a screw mechanism 35. The plates 36 are hinged to the rectangular frame 34 on different sides.

Each plate 36 is fixed to a corresponding flange 38 provided with brackets 40 for securing an abrasive grinding wheel 42. Each flange 38 can be adjusted by axial rotation relative to the overlying plate 36 and can be locked relative to it by bolts which engage in a plurality of corresponding holes 44. Each grinding wheel 42 can be rotatably driven by a pulley 46 rigid with the shaft of a corresponding electric motor 48 mounted on the

flange 38.

Each flange 38 is also provided with pairs of slotted holes 49 to enable it to be shifted outwards relative to the overlying plate so that the two grinding wheels 42 are not longitudinally aligned with each other, but are positioned on opposite sides of the centre line of the rail 6 to be ground.

Because of the possibility to incline the plates 36 to the frame 34 each grinding wheel 42 has its axis of rotation non-parallel with the rolling surface of the track, and because of the facility for axially rotating the flange 38 relative to the plate 36 the two grinding wheels 42 can be inclined inwards relative to the direction of advancement along the rail.

On varying the inclination of the plate 36 to the frame 32, the angle between the grinding wheel axis and the horizontal plane of the rail (inclination) varies, and on varying the position of the flange 38 to the plate 36, the angle between the grinding wheel axis and the rail axis (convergence) varies.

The machine of the invention also uses a plurality of reference sensors for the rail position, which activate the various controls for effecting the grinding cycle.

To operate the machine, it has firstly to be transferred to the site on which the rail to be ground is located. This transfer is preferably done by a locomotive 50, which can also be provided with an electrical generator unit 52 for remotely powering the grinding machine, especially if the railway line is not electrified or if the power supply has been temporarily switched off for maintenance reasons.

The horizontal cylinder-piston units 14 are then operated to transversely move the units 8 until the sensors sense the position of the rail 6 and halt the travel of the frame 9. At this point the frame is lowered by the pneumatic system 28 such that the grinding wheels 42 make contact with the rail head 53. During this operation the frame descends substantially rigidly as the arms 24, 24' are guided within the uprights 26.

The motors 48 are then operated to rotate the grinding wheels, which perform their abrasive action with a working pressure suitably regulated by the afore-said pressure reducers. It should be noted that the particular grinding wheel arrangement (inclination, convergence and shift with respect to the rail) means that the grinding wheels wear down in accordance with a certain profile (shown in Figure 5), which is independent of the worn shape of the rail. Consequently by combining several grinding wheel profiles the rail can be restored to its original profile.

This means that having identified the correct profile for the grinding wheel, the rail can be restored by using grinding wheels in which the profile is defined at the grinding wheel preparation stage by setting it at a particular inclination, convergence and shift with respect to the rail.

If the profile still does not correspond exactly to requirements it is sufficient merely to vary the inclination

of the plate 36 to the frame 32 and to vary the angular position of the flanges 38 relative to the plates, in order to correspondingly vary the grinding wheel inclination and convergence with respect to the rail.

The flange 38 can also be shifted relative to the plate 36 to vary the position of the grinding wheel centre line about the rail axis.

Because of the rocking configuration of the frame 32 the grinding wheels are always in contact with the rail head even if its plane is irregular, so effectively eliminating all vibration. To increase system stability two pneumatic units 54 are provided connected between the grinding wheel support frame 32 and the frame 9.

These two units 54 have the function of supporting, in the case of deformation of the horizontal surface of the rail, the grinding wheel which is near this surface.

In the embodiment two pneumatic units have been illustrated but they could be replaced with hydraulic jacks, springs or other supporting means.

From the foregoing it is apparent that the tangential grinding machine according to the invention has numerous advantages, and in particular:

- it allows total and perfect grinding of railway or tramway rail profiles however deformed,
- it combines the merits of a tangential grinding wheel with those of a traditional cup grinding wheel, while overcoming the drawbacks of this latter consisting of the large number of tools and the always faceted form of the ground rail,
- it eliminates irregularity problems by the presence of the rocking frame,
- it also enables points, crossings etc. to be effectively ground by virtue of the control achievable by the lowering of pistons.

Claims

1. A tangential grinding machine slidable on rails to be ground and comprising at least one support frame (9) for at least two tangential grinding wheels (42) for grinding a rail (6), characterised in that the two grinding wheels can traverse axially on opposite sides of the centre line of the rail to be ground and be inclined inwards with reference to the direction of advancement along the rail, each grinding wheel having its axis of rotation non-parallel with the rail rolling surface, said frame being substantially rockable about a transverse axis extending between the grinding wheel axes.
2. A machine as claimed in claim 1, characterised in that the support frame (9) is mounted on a framework (8) movable vertically under the control of a hydraulic or pneumatic system (28) mounted on the machine.
3. A machine as claimed in claim 2, characterised in

that the framework (8) is movable horizontally under the control of a hydraulic system (14) or pneumatic system mounted on the machine.

4. A machine as claimed in claim 1, characterised in that the support frame (9) is provided with a pair of bushes (30) in which pins (30) engage laterally projecting from the longitudinal edges of a rocking platform (32). 5
5. A machine as claimed in claim 4, characterised in that the rocking platform (32) is of substantially rectangular shape and carries, hinged on opposite sides of the axis on which it is hinged to the support frame (9), two plates (36) which at their other end are provided with devices for adjusting their inclination to the support frame. 10
6. A machine as claimed in claim 5, characterised in that the two plates (36) are hinged on opposite sides. 15
7. A machine as claimed in claim 5, characterised in that a flange (38) for supporting the grinding wheel is connected to each plate (36), said flange being axially rotatable relative to the overlying plate (36) and lockable to it. 20
8. A machine as claimed in claim 5, characterised in that the connection between the plate (36) and the corresponding flange (38) is made by inserting bolts through a plurality of holes provided in the plate. 25
9. A machine as claimed in claim 5, characterised in that each flange (38) can be shifted axially relative to the plate (36). 30
10. A machine as claimed in claim 1, characterised in that each grinding wheel is rotated by a corresponding motor (48) mounted on the corresponding plate. 35
11. A machine as claimed in claim 2, characterised in that the framework (9) is provided with guide arms (24, 24') engaged in the machine uprights. 40
12. A machine as claimed in claim 5 characterised in that connecting means are provided between the support frame (9) and the rocking platform (32). 45
13. A machine as claimed in claim 12 characterised in that said connecting means consist of pneumatic units (54). 50

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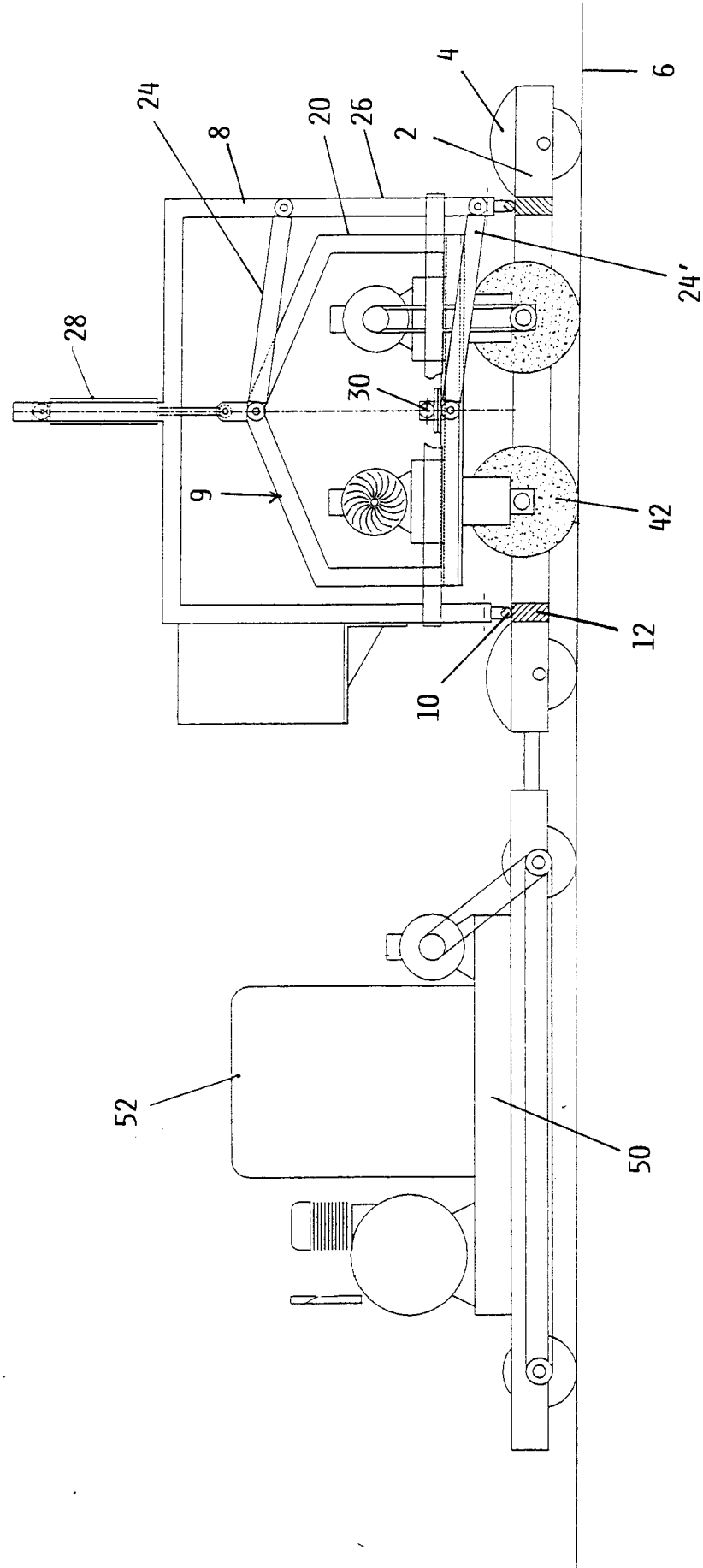
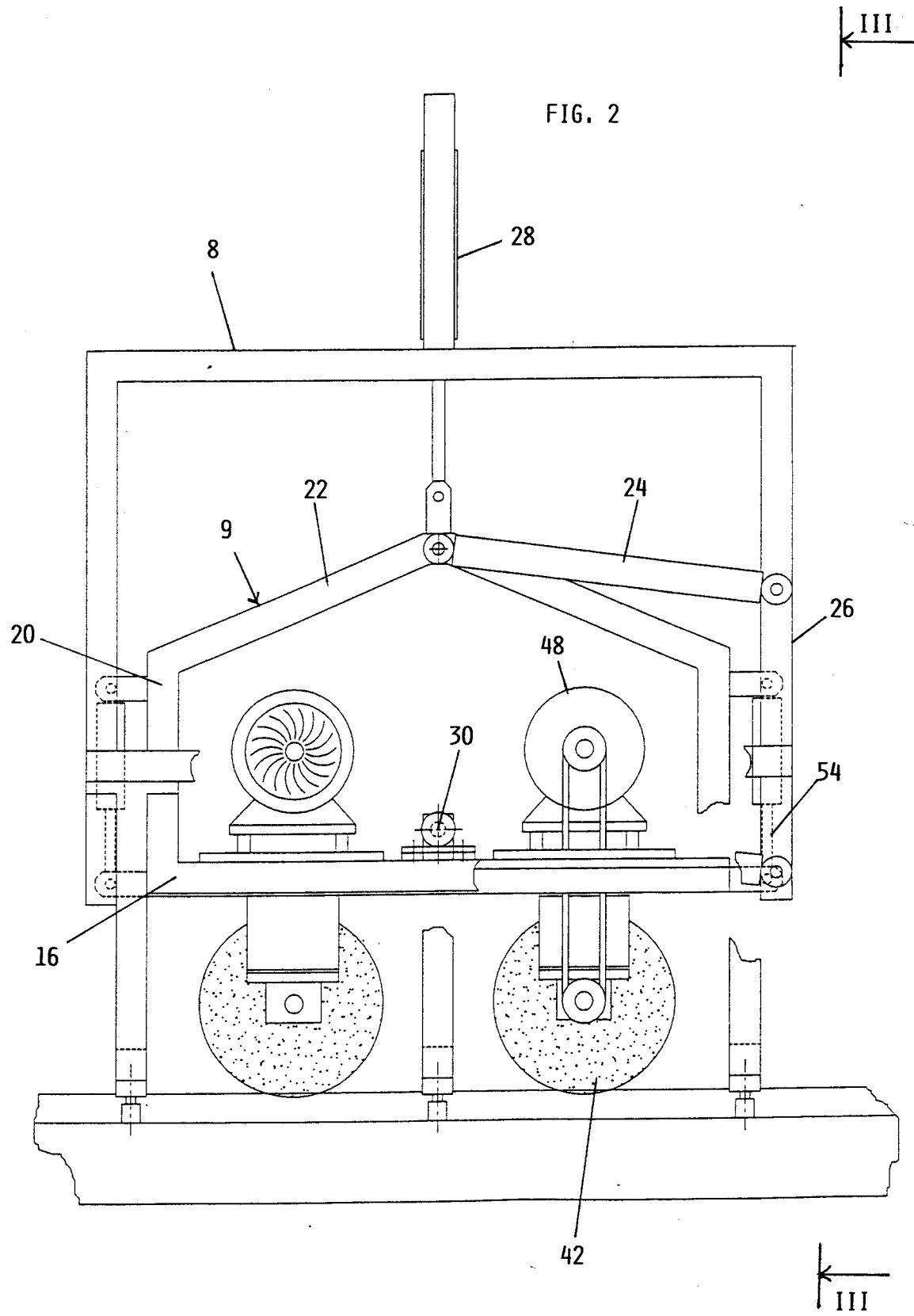


FIG. 1



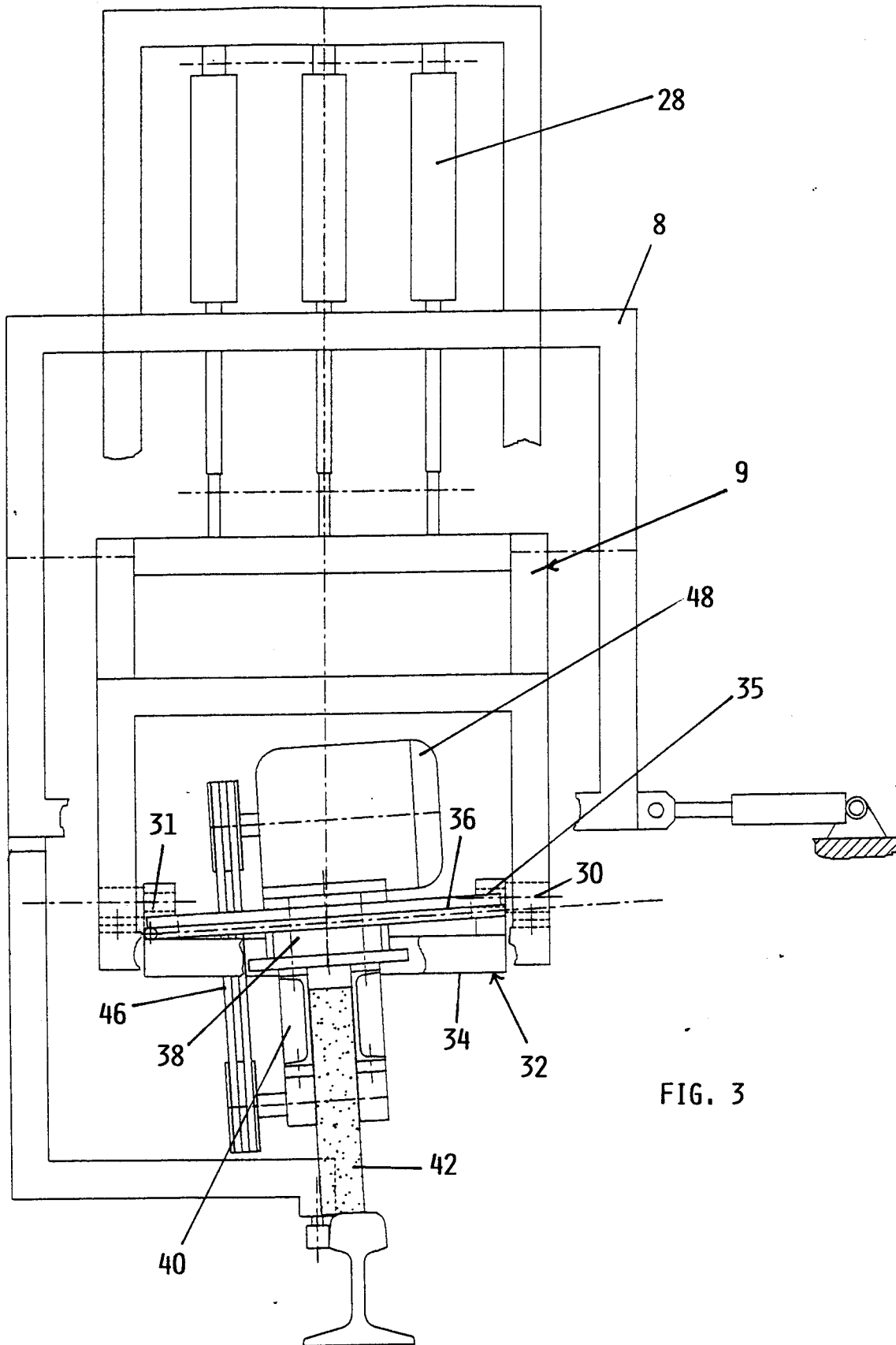
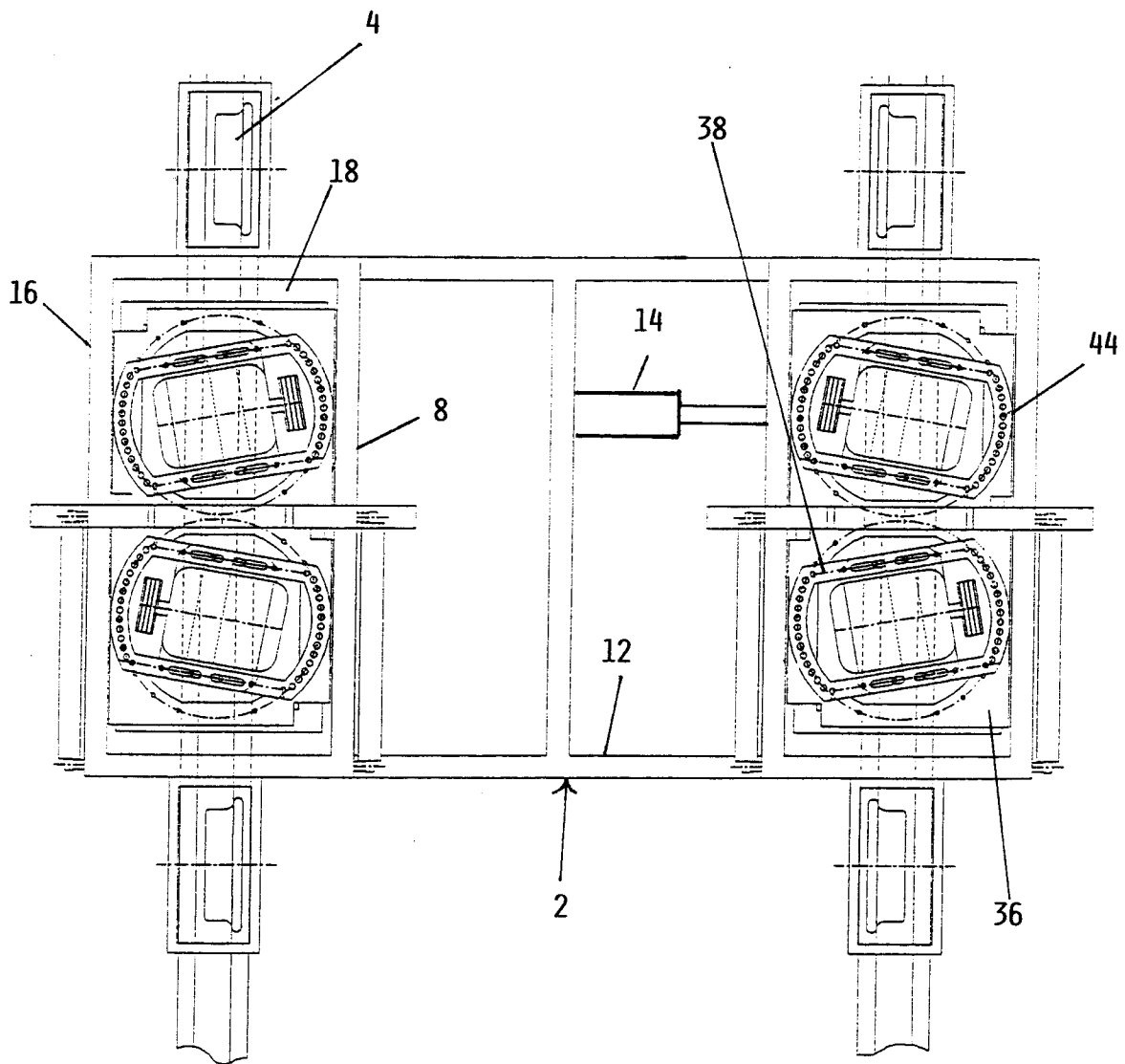


FIG. 4



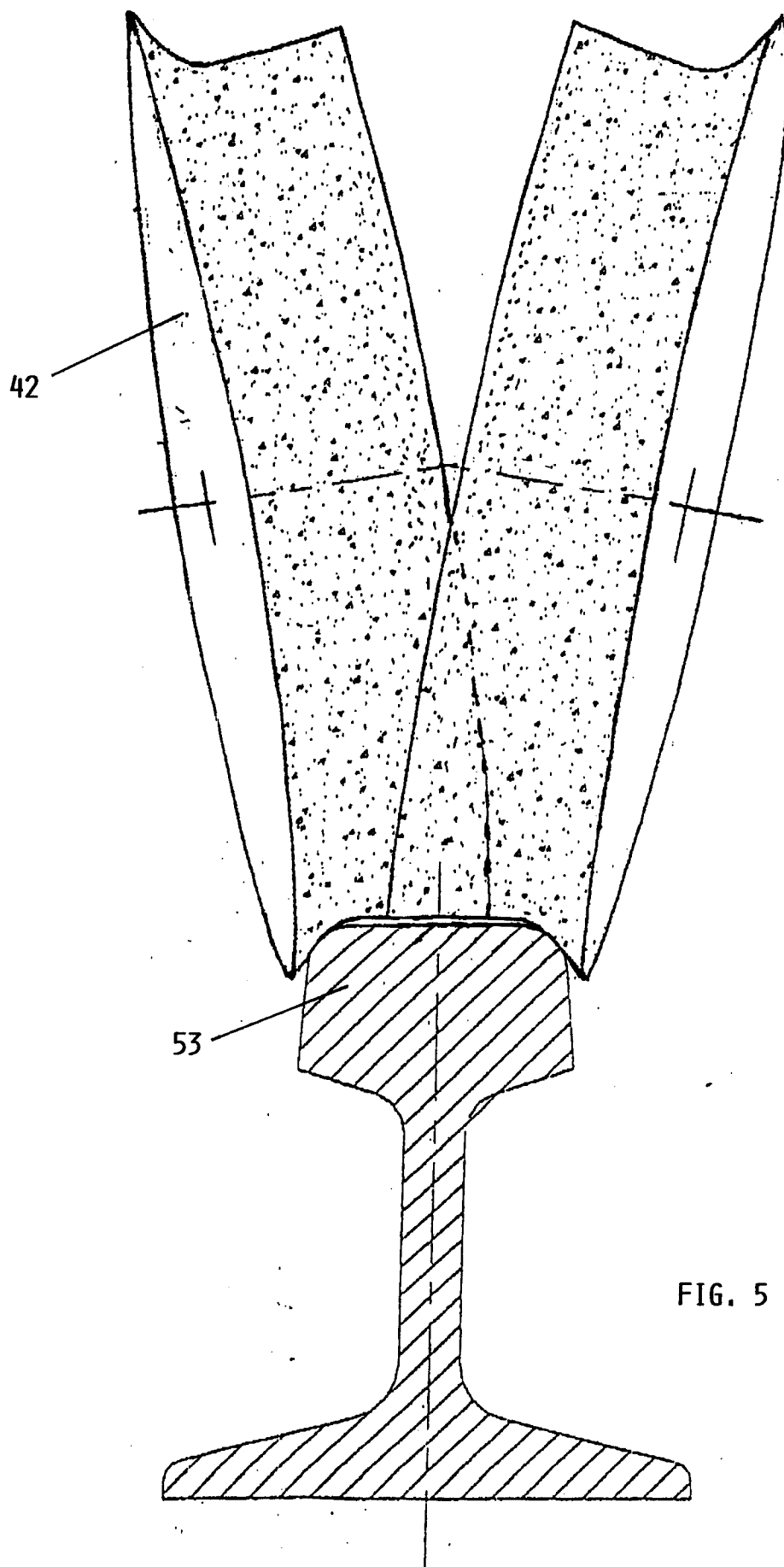


FIG. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 97 11 9385

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	FR 2 703 084 A (GEISMAR ANC ETS L) * page 2, line 21 - page 8, line 35; figures 1-12 *	1-3,10, 11	E01B31/17
X	DE 26 12 174 A (PLASSER BAHNBAUMASCH FRANZ)	1,2,10, 11	
A	* page 14, line 32 - page 23, line 32; figures 1-5 *	5,6,12	
A	CH 444 208 A (SPENO) * column 4, line 3 - column 10, line 14; figures 1-6 *	1,5	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			E01B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 16 February 1998	Examiner Tellefsen, J
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