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(54) **A UNIT FOR SMOOTHING RAILWAY RAILS**

EINHEIT ZUM GLÄTTEN VON EISENBAHNSCHIENEN

UNITÉ POUR LISSER LES RAILS FERROVIAIRES

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Description

Technical Field

[0001] The present invention relates to a unit for performing mechanical smoothing operations on railway rails. The field of the invention is the sector of machines for the construction and maintenance of railway equipment, and it finds particular application within the domain of smoothing and shaping railway rails.

Background Art

[0002] In the railway field, it is well known that, for reasons of different nature, phenomena of superficial wear on the rail head (or simply "head") are triggered which tend to modify its geometry, making the shape of the rail head deviate from an optimal theoretical profile. Additionally, along the track an undulatory wear (known as "rail corrugation") of the surface of one or both rails can be generated, which wear tends to be amplified over time without stopping spontaneously. Consequently, to prevent the emergence of high levels of vibrations and noise as a result of the transit of trains, a periodic grinding of the rail head becomes necessary.

[0003] It is well known that the rail head is ground by means of appropriate grinding machines which are generally housed on railway cars or on railway vehicles specifically dedicated to restoring the geometry of the track. Such grinding machines are equipped with a plurality of abrasive grinding wheels, e.g. diamond disks, which are placed in contact with respective portions of the rail head to achieve a mechanical machining operation by removal of material. In particular, diamond disks act along a longitudinal direction with respect to the track, generally with a speed of advance given by the advance of the trolley on which the grinding machine is mounted.

[0004] However, such grinding machines do not achieve an optimal re-profiling of the rail head, because the individual diamond disks of the machines act on respective longitudinal bands of the rail independently, and

[0005] this causes an irregular final profile that, in section, is defined by a succession of segments that are not perfectly blended together. This effect is called in technical terms "polygonizing" of the rail head. Moreover, diamond disks are subject to the risk of sudden breakage in operation, with evident risks for the safety of operators assigned to employ them or control their operation.

[0006] It should also be added that the adoption of diamond disks, as tools for the surface machining of the rail, often does not allow a sufficient reduction in the level of surface roughness of the rail itself. This roughness, therefore, causes the triggering, immediately or after a short time, of noise levels that often do not comply with current noise pollution standards.

Disclosure of Invention

[0007] A technical task of the present invention, therefore, is to propose a unit for smoothing railway rails that is free from the aforementioned problems.

[0008] In particular, a specific object of the present invention is to propose a unit for smoothing railway rails that achieves a correct profile of the rail.

[0009] Another object of the present invention is to propose a unit for smoothing railway rails that enables to minimise the surface roughness of the rail.

[0010] An important object of the present invention is to make available a unit for smoothing railway rails that reduces or eliminates the risks of injury for operators assigned to use the machine itself.

[0011] These objects and others beside, which shall become more readily apparent in the course of the description that follows, are substantially achieved by a unit for smoothing railway rails having the characteristics set out in claim 1 and/or in the claims dependent thereon. Further characteristics and advantages shall become more readily apparent from the detailed description of a preferred, but not exclusive, embodiment, of a unit for smoothing railway rails in accordance with the present invention.

[0012] It is also known from EP849397 a grinding machine which uses, as an abrasive tool, a closed abrasive belt which is driven in a continuous manner around a closed path and which has a bottom portion held in contact with the head of the rail.

[0013] EP-A-648895 shows a unit for smoothing railway rails according to the preamble of claim 1.

Description of the Drawings

[0014] The description will be set out below with reference to the accompanying figures, provided purely by way of non-limiting indication, in which:

- figure 1 shows a first perspective view of a unit for smoothing railway rails in accordance with the present invention;
- figure 2 shows a second perspective view of the unit of figure 1;
- figure 3 shows a lateral view of a portion of the unit of figure 1 in a first operative position;
- figure 4 shows a lateral view of the portion of figure 3 in a second operative position;
- figure 5 shows a lateral view of the portion of figure 3 in a third operative position;
- figure 6 shows a first perspective view of a detail of the unit of figure 1 with some parts removed the better to highlight others;
- figure 7 shows a front view of the detail of figure 6;
- figure 8 shows a second perspective view of the detail of figure 6 with some parts removed the better to highlight others.

Description of the Illustrative Embodiment

[0015] In the accompanying figures, the reference 1 indicates in its entirety a unit for smoothing railway rails. Said unit 1 can be stably associated to railway cars or trolleys, and it can be included in the fitting out of railway vehicles dedicated to the maintenance or to the construction of railway equipment.

[0016] It is further specified that in the description that follows reference shall be made, with the term "rail", to the single metallic profile on an upper surface whereof rolls one of the two wheels of each axle of a train, whilst the term "track" shall mean a pair of parallel rails stably connected, by means of sleepers, to define a generic railway route. The unit 1 according to the invention is particularly conceived for smoothing rails that are already installed. In this circumstance it is necessary to have available machines able to move along the track, at a predetermined speed, to carry out a smoothing operation on a single rail or on both rails at the same time.

[0017] In accordance with what is shown in figure 1, the unit according to the invention comprises a pair of support arms 2, able to be rigidly coupled to a "T" portion of a railway trolley or car, or to a portion of a railway vehicle in accordance with what has been described previously. The support arms 2 support, at an external end 2a thereof, an adjustment body 3 which can be made to oscillate about an axis of adjustment "X" by means of known actuators, not shown in the accompanying figures. Preferably, the axis of adjustment "X" is positioned longitudinally to the rail "R", i.e. parallel to a prevalent direction of development of the rail "R" to be smoothed.

[0018] The adjustment body 3 comprises an upper portion 3a and a lower portion 3b, stably fastened together at least according to rotation movements. In other words, the upper portion 3a and the lower portion 3b of the adjustment body 3 are mutually fastened in such a way that they cannot perform rotation movements with respect to one another.

[0019] Preferably, the support arms 2 are rotatably connected to the upper portion 3a of the adjustment body 3. The lower portion 3b of the adjustment body 3 rotatably supports a shaft 4 to an external end whereof is stably fastened, for example by means of threaded connections, an advancement member 5 of an abrasive element which, within the present invention, advantageously a sand belt 6. In detail, as shown in figures 6 and 8, the advancement member 5 comprises a drum 7, which develops according to a circular profile and therefore having toroidal shape. The drum 7 is laterally closed by means of an outer circular plate 8 and an inner circular plate 9, parallel to each other and connected to the drum 7 by means of removable connecting elements, e.g. threaded connections. The inner plate 9 is directly connected, preferably in coaxial manner, to the aforesaid outer end of the shaft 4. Alternatively, the drum 7 can be obtained in a single piece with the inner plate 9, and it may be provided an outer closing plate 8 which can be fastened

removable to the drum 7.

[0020] The drum 7 is rotatable, in connection with the shaft 4 and coaxially thereto, about a respective axis of rotation "Y" preferably perpendicular to the axis of adjustment "X". Consequently, the adjustment body 3 advantageously defines means for orienting the advancement member 5 and, consequently, the sand belt 6.

[0021] In figure 2, it is clearly visible that the shaft 4, at the opposite side relative to the means 5 for supporting the sand belt 6, is connected to a first motor "M1" by means of a universal joint "C", preferably telescopic, which transmits to the shaft 4 a motive power to set the drum 7 in rotation.

[0022] The drum 7 defines, with its own peripheral outer portion, a support surface "S" of the aforementioned sand belt 6. Said sand belt 6 adheres to the support surface "S", preferably under the action of a tensioning force, assuming configuration complementarily shaped to the support surface "S". According to the embodiment illustrated in figure 4, the support medium "S" presents a concave shape according to a section view along a plane passing through the axis of rotation "Y" of the drum 7. In other words, the support surface "S" of the drum 7, the head rail "R" assumes, once the smoothing operation is completed, a surface shaped complementarily to a corresponding portion of the support surface "S".

[0023] Therefore, it is preferable that the support surface "S" has a profile, measured according to a plane passing through the axis of rotation "Y" of the drum 7, complementarily shaped with respect to a corresponding final, or theoretical, profile of the portion of rail "R" to be smoothed. This condition enables to generate a correct profile of the rail "R" with a single smoothing operation with no need to perform several passes to cover an entire development of the head of the rail "R".

[0024] According to the above description, the drum 7, and in particular the guiding surface "S" defined thereby, constitute means for advancing the sand belt 6 whose function is the generation of an advancing motion of the sand belt 6 relative to the rail "R", in order to achieve of velocity of sliding of the sand belt 6 relative to the rail "R", in particular longitudinally to the rail "R" itself, and hence to generate a removal of material therefrom.

[0025] As shown in figure 6, the drum 7, in co-operation with the aforesaid pair of plates 8, 9, defines a closed manoeuvring space 10 whose function shall be illustrated below. Advantageously, within the manoeuvring space 10 are housed means 11 for renewing the sand belt 6.

[0026] Said means of advancement have the function of making the sand belt 6 advance relative to the support surface "S", so that the portion of sand belt 6 engaged on the support surface "S" is periodically, preferably continuously, renewed. For this purpose, the means 11 for renewing the sand belt 6 comprise a first and a second support, preferably comprising a first pivot pin 12 and a second pivot pin 13, whereon are stably supportable respectively a feeding reel 14 and a return reel 15 of the sand belt 6. In the embodiment illustrated in figure 6, the

two pivot pins 12, 13 extend from the inner plate 9 in the direction of the outer plate 8, and they are positioned symmetrically relative to a generic diametrical segment of said plates 8, 9.

[0027] The drum 7 also has an opening 16, at the aforementioned support surface "S", preferably having elongated shape. Said opening 16 has the function of putting operatively in connection the reels 14, 15 with the support surface "S", in such a way that the reels 14, 15 in co-operation with the support surface "S" determine a path "P" of advance of the sand belt 6. Said sand belt 6, unwinding from the feeding reel 14 in the form of a non-worn belt 6a, traverses the opening 16 and, winding the support surface "S", reaches the opening 16 again, re-traversing it and rewinding on the return reel 15 under conditions of worn belt 6b. The path "P" of advance of the sand belt 6 therefore is an open path.

[0028] Preferably, the opening 16 extends, along a direction perpendicular to the aforesaid plates 8, 9, for an amplitude approximating by excess the width of the sand belt 6.

[0029] Additionally, it is preferable for the opening 16 to have a transverse dimensions, measured along a circumferential development of the drum 7, which approximates by excess twice the thickness of the sand belt 6. In this configuration, the opening 16 can be barely traversed by a first portion of the sand belt 6 exiting the feeding reel 14 and a second portion of the sand belt 6 approaching the return reel 15 without the aforesaid two portions of the sand belt 6 interfering with each other, e.g. because of mutual rubbing.

[0030] As a result of this, the reduced transverse dimension of the opening 16 maximises the portion of the support surface "S" whereon the sand belt 6 engages. In particular, in this configuration the support surface "S" is substantially, if not at the limit totally, engaged by the sand belt 6, as shown in figure 7. As a result of the rotation of the drum 7, therefore, there are no perceptible discontinuity in the abrasion action on the head of the rail "R" by the sand belt 6. Preferably, the drum 7 has, at the opening 16, rounded edges 17 to favour a sliding of the sand belt 6 in transit between the support surface "S" and the two reels 14, 15.

[0031] The aforesaid two pivot pins 12, 13 are housed rotatably within respective seats, not shown in the accompanying figures, which are obtained within the inner plate 9. Moreover, at least one of the aforesaid pivot pins 12, 13, preferably both, is connected to motor means 18 which provide a motive force necessary to set in rotation of at least one of the aforementioned reels 14, 15, and in particular at least the return reel 15. The pivot pins 12, 13 are, additionally, preferably positioned perpendicularly relative to the inner plate 9, to rotate about respective axes parallel to the axis of rotation "Y" of the drum 7. Advantageously, the motorisation of both pivot pins 12, 13 allows a reversible operation of the unit 1, because it allows an unwinding of the sand belt 6 in both direction, i.e. it is possible to reverse the functions of the feeding

reel 14 and of the return reel 15. In the embodiment shown in figure 8, the motor means 18 comprise a pair of second electric motors "M2", positioned at the housing seats of the pivot pins 12, 13 and each associated to one of the aforesaid pivot pins 12, 13. Advantageously the second motors "M2" can be hydraulic.

[0032] The motor means 18 are rigidly connected to the inner plate 9 on an outer surface of the plate 9, opposite relative to the aforesaid manoeuvring space 10. As shown in figure 8, moreover, each of the two second motors "M2" is positioned to rotate about an axis that is perpendicular to the pivot pin 12, 13 where to it is associated, and it is connected to the aforesaid respective pivot pin 12, 13 by means of a reducer 19 with orthogonal axes. In this way, the second motors "M2" are approached to the inner plate 9, because they extend parallel to the inner plate 9 itself, and a reduction of the total size of the unit 1 is thereby achieved. It should also be considered that, in operating conditions, the drum 7 rotates about its own axis of rotation "Y" and therefore an orientation of the second motors "M2" along a radial direction of the inner plate 9 could allow a reduction of the total moment of inertia of the rotating masses, understood as an aggregate comprising the drum 7, the second motors "M2", the reels 14, 15, the plates 8, 9 and any auxiliary components.

[0033] Because of the rotation of the drum 7, whereon are mounted the second motors "M2", said motors are connected electrically to a source of electrical power, not shown, by means of sliding contacts.

[0034] The presence of the motor means 18 is made necessary by the fact that the sand belt 6 engages by rubbing on the support surface "S", and in operation it is compressed between the support surface "S" and the rail "R" to be smoothed, so in order for the sand belt 6 to slide on the support surface "S" it is necessary to exert a driving force on the belt 6, which force is, in fact, provided by the motor means 18.

[0035] As shown in figures 3 through 5, the adjustment body 3 further comprises a linear actuator 20, preferably a hydraulic or pneumatic piston, which acts along a direction of approach "W" to actuate the drum 7 along said direction "W", in other words in a direction towards and/or away from the rail "R", between a non-operative position shown in figure 3, in which the drum 7 is raised relative to the rail "R", and an operative position shown in figure 4, in which the drum 7 abuts against the head of the rail "R", and vice versa.

[0036] More in detail, the linear actuator 20 is associated to the upper portion 3a of the adjustment body 3a, and it is active on the lower portion 3b of the adjustment body 3 to actuate the aforesaid second part 3b towards and away from the first part 3a along the aforesaid direction of approach "W". Therefore, acting directly on a portion of the adjustment body 3 able to support the shaft 4, the linear actuator 20 is able to actuate the drum 7 towards and away from the rail "R" to be smoothed. In this way, the linear actuator 20 defines means for actuating

the aforesaid advancement member 5, in order to bring and maintain a portion thereof, and hence of the sand belt 6, in contact with a portion of the rail "R" to be smoothed.

[0037] The direction of approach "W" is transverse, preferably perpendicular, with respect to the axis of adjustment "X" and, preferably, perpendicular also relative to the axis of rotation "Y" of the drum. This is obtained by mounting the linear actuator 20 in stable fashion on the upper surface 3a of the adjustment body 3, and connecting an active portion of the linear actuator 20 directly to the lower portion 3b of the adjustment body 3, in such a way that between the linear actuator 20 and the aforesaid lower portion 3b is allowed exclusively a translation movement along the aforesaid direction of approach "W".

[0038] In the embodiment shown in figures 3 through 5, the linear actuator 20 comprises a cylinder 20a, rigidly coupled, for example by means of threaded connections, to the upper portion 3a of the adjustment body 3 at the opposite side from the lower portion 3b thereof. To the cylinder 20a is connected a piston, not shown, operatively associated to the cylinder 20a and actuated thereby. The piston traverses a through seat of the upper portion 3a, which extends along the aforesaid direction of approach "W" between the cylinder 20a and the lower portion 3b of the adjustment body, and connected directly to the lower portion 3b to actuate it towards and away from the rail "R" to be smoothed.

[0039] In this configuration, shown in the accompanying figures, the axis of adjustment "X", the axis of rotation "Y" of the drum 7 and the direction of approach "W", that in the illustrated embodiment are not all incident in a same point, so they are mutually and stably perpendicular to each other. Use of the aforesaid universal joint "C" as connecting member between the first motor "M1" and the shaft 4 enables to absorb adjusting movements of the advancement member 5 of the sand belt 6, both along the aforesaid direction of approach "W" and as a result of oscillation about the axis of adjustment "X", maintaining a flow of power from the first motor "M1" to the shaft 4 and, consequently, to the drum 7. These movements are necessary to place in contact the sand belt 6 with the rail "R" and to disengage them from each other when the work process is complete. The advancement member 5 of the sand belt 6 is maintained raised relative to the head of the rail "R", known as "rail level", during conditions of interruption of the operation of the unit 1 or during transfer movements thereof. To arrange respective operating configuration, the advancement member 5 is lowered towards the rail "R" along the aforesaid direction of approach "W", to place in contact a portion of the sand belt 6 with a portion of profile of the rail "R" to be smoothed.

[0040] As mentioned previously, the adjustment body 3 can be made to oscillate about the aforesaid axis of adjustment "X", which is oriented parallel to a prevalent direction of development of the rail "R". Consequently, the drum 7 can be positioned on a plurality of planes, inclined differently with respect to a vertical plane, de-

pending on the size of the oscillation imparted to the adjustment body 3 around the axis of rotation "X". Figures 3 and 4 show the adjustment body 3 while it is in vertical position, corresponding to a horizontal alignment of the axis of rotation "Y" of the drum 7, while figure 5 shows the adjustment body in a generic position rotated about the axis of adjustment "X".

[0041] The adjustment of the plane of lay of the drum 7, in accordance with the above description, is fundamentally important because it is well known that rails in many Countries, including Italy, are laid with an inclination of 1/20 relative to a horizontal plane, corresponding to an angle of a little less than 3 degrees, wherein in other Countries this inclination is 1/40, corresponding to about 1.5 degrees. Additionally, in some circumstances said angle of lay of the rail "R" is not provided during the installation phase, e.g. for reasons of simplicity of construction. Therefore, although railway vehicles travelling on the track are positioned horizontally, the work on the head of the rail "R" has to take place in a plane inclined by such an angle relative to a horizontal plane. Therefore, it is extremely advantageous to have said effect of adjustment of the lay of the drum 7, which allows a correct setting of the smoothing of the rail "R" regardless of the angle of lay of the rail "R" itself. Advantageously, the unit 1 according to the invention comprises a control system, which provides for regulating the operating parameters, e.g. the speed of the sand belt 6 or the inclination of the drum 7 about the axis of adjustment "X", by actuating respective command members. In particular, the control system acts on the second motors "M2", on the linear actuator 20 and on the actuators provided for the oscillation of the adjustment body 3, as well as on the first motor "M1". The action of the control system preferably takes in place in co-operation with operations for measuring parameters such as the presence of long and/or short undulations and roughness in the longitudinal profile of the rail, to determine operating parameters such as the thickness of material to be removed from the head of the rail "R" the speed of advance of the railway vehicle or the speed of advance of the sand belt 6.

[0042] Said measurements are performed by a diagnostic apparatus, which is connected to the aforesaid control system and can also comprise cameras applied to the railway car or vehicle to monitor one or more diagnostic parameters.

[0043] In a preferred embodiment, not shown in the accompanying figures, the unit 1 according to the invention can be provided, fitted on railway cars or vehicles, coupled to one or more other units identical thereto.

[0044] Said railway car or vehicle therefore comprises two or more units 1, each of which having the characteristics listed in the previous detailed description. In particular, the unit 1 is able to work on a respective rail "R" of the track, and it is associated to a floating support common to at least two of the aforesaid units 1 for smoothing the rail "R". Said floating support is self-aligning, i.e. it is balanced gravitationally in such a way as to

be constantly positioned on a horizontal plane. In this way, the simultaneous smoothing of the two rails "R" of the track allows to eliminate flaws of surface irregularity or wear of the head of the rail "R" which alter its profile relative to a theoretical, optimal one.

[0045] The present invention achieves the proposed objects, overcoming the drawbacks of the prior art.

[0046] Use of a sand belt coupled to a drum having a surface for supporting the sand belt that is shaped complementarily to the head of the rail enables to perform smoothing operations on the entire surface of the head of the rail, eliminating problems of the emergence of polygonising effects on the final surface of the rail.

[0047] Moreover, the adoption of this system allows a considerable precision in the superficial machining of the rail, which has, at the end of the machining, a much lower surface roughness than the level normally present as a result of currently known work processes. This advantageously entails a marked reduction in the level of vibration and noise emitted as a result of the transit of trains, as well as a slower onset of subsequent wear stages.

[0048] Additionally, use of a sand belt instead of an abrasive disk, as is instead adopted in the prior art, allows to eliminate the risks of sudden breakage, typical of abrasive disks, with the consequent elimination of health and safety hazards for any operators acting in proximity to the sand belt.

[0049] The present invention also achieves other important advantages.

[0050] It should be considered that the presence of the drum for the definition of the support surface of the sand belt enables to carry out smoothing operations on the rail even at low speeds of the railway car or vehicle supporting the smoothing unit, because it is sufficient to adjust the speed of rotation of the drum to adjust the removal of material in the smoothing phase.

[0051] Additionally, the presence of the feed and return reels enables to provide an advancing motion of the sand belt relative to the drum, in order to provide for a gradual renewal of the sand belt, which is progressively unwound from the feeding reel in the form of a non-worn belt, whilst the worn belt is wound on the return reel.

[0052] The support of the reels and of the second motors on the drum and integrally therewith, moreover, enables to maintain a low speed of the sand belt relative to the drum, linked to the action of renewal of the belt itself, whilst maintaining a sufficient relative speed between belt and rail thanks to the rotation of the drum. Therefore, the quantity of sand belt required is maintained at low levels, and high dissipation of energy is avoided thanks to the aforementioned possibility of keeping low the speed of sliding of the belt relative to the drum, linked to the speed of renewal of the belt.

Claims

1. A unit for smoothing railway rails, comprising:

- a sand belt (6) to achieve a superficial removal of material from at least one portion of a railway rail (R);

- an advancement member (5) for advancing; the sand belt (6), active on the sand belt (6) to set it in motion relative to said portion of rail (R), said advancement member (5) comprising a support surface (S) at least partially covered with said sand belt (6) and said surface (S) having a cross section with substantially complementary shape to a profile of the portion of rail (R) to be obtained,

- means for actuating the sand belt (6), active on the sand belt (6) to set a portion thereof in contact with said portion of rail (R),

- means (11) for renewing said sand belt (6), acting on said belt (6) to replace portions of worn sand belt (6b) with corresponding portions of non worn sand belt (6a), said renewal means (11) comprising a first support and a second support, stably associated respectively to a feed reel (14) and to a return reel (15) of the sand belt (6), to enable a renewal of the sand belt (6) itself by winding the portions of worn sand belt (6b) on the return reel (15) and by unwinding the portions of non worn sand belt (6a) from the feed reel (14);

characterized in that:

- said advancement member (5) comprises a drum (7), rotatable about its own axis of rotation (Y) and having a surface with circular development defining said support surface (S),

- said first and second support are mounted internally to the drum (7) in integral position thereto, said drum (7) having at least one opening (16) to allow said sand belt (6), partially wound on said reels (14, 15), to traverse said opening (16) and at least partially to cover said support surface (S).

2. A unit as claimed in claim 1, **characterised in that** said means for advancing the sand belt (6) advance said portion of the sand belt (6) in a direction that is longitudinal to the rail (R) itself.

3. A unit as claimed in any of the previous claims, **characterised in that** said actuating means act on said advancement member (5) to place said portion of the sand belt (6) in contact with said portion of rail (R).

4. A unit as claimed in claim 1, **characterised in that** said renewal means act on the sand belt (6) during operation of the advancement means in use.

5. A unit as claimed in any of the previous claims, **characterised in that** it comprises means for orienting

said advancement member (5), acting on the advancement member (5) to orient it, under the action of respective actuators, by a predetermined angle at least with respect to a vertical plane.

6. A unit as claimed in any of the previous claims, **characterised in that** said drum (7) is connected to a respective motor (M1).
7. A unit as claimed in claim 3, **characterised in that** said actuating means act on the advancing member (5) to actuate it along a direction towards and/or away from said portion of rail (R) to be smoothed.
8. A unit as claimed in claim 7, **characterised in that** said actuating means comprise a linear actuator (20) active along a direction of approach (W) of the advancement member relative to the rail (R).
9. Unit as claimed in claim 8, **characterised in that** the direction of advance (W) is perpendicular to a prevalent direction of development of the rail (R).
10. A unit as claimed in claims 6 to 8, **characterised in that** said axis of rotation (Y) of the drum (7) and said direction of approach (W) are perpendicular to each other.
11. A unit as claimed in any of the previous claims, **characterised in that**, in operative configuration, the sand belt (6) encompasses substantially the entire support surface (S).
12. A unit as claimed in any of the previous claims, **characterised in that** said support are rotatable about respective axes of rotation parallel to the axis of rotation of the drum (7).
13. A unit as claimed in claim 1 or 12, **characterised in that** said drum (7) has at least one closing plate (8, 9), lying in a plane that is perpendicular to the axis of rotation (X) of the drum (7), said supports comprising a first pivot pin (12) and a second pivot pin (13) projecting from said closing plate (7) to rotatably support said reels (14, 15).
14. A unit as claimed in claim 1, **characterised in that** said supports are connected to respective motor means (M2) to set in rotation at least said return reel (14).
15. A unit as claimed in claims 6 and 14, **characterised in that** the motor (M1) associated to the drum (7) is operatively independent from the motor means (M2) associated to said supports.
16. A unit as claimed in claim 5, **characterised in that** said orienting means act on the advancement mem-

ber (5) to make it oscillate about an axis of adjustment (X).

17. A unit as claimed in claim 16, **characterised in that** said axis of adjustment (X) is substantially parallel to the rail (R) to be smoothed.
18. A unit as claimed in claim 17, **characterised in that** said axis of rotation (Y) of the drum (7) is maintained perpendicular to said axis of adjustment (X).
19. A unit as claimed in claims 8 and 18, **characterised in that** said direction of approach (W), said axis of adjustment (X) and said axis of rotation (Y) of the drum (7) are mutually perpendicular.
20. A unit as claimed in claim 8 and 16, **characterised in that** said orienting means comprise an adjustment body (3) having an upper portion (3a) and a lower portion (3b), said upper portion (3a) being rotatably engaged to a portion of a chassis (T) of a vehicle to oscillate about said axis of adjustment (X) and being also associated to said linear actuator (20), said lower portion (3b) supporting said advancement member (5) and being slidably engaged with said upper portion (3b) along said direction of approach (W) under the action of said linear actuator (20).
21. A unit as claimed in claim 6, **characterised in that** said drum (7) is connected to the respective motor means (M1) by a universal joint (C), to absorb relative movements between the drum (7) and the respective motor means (M1).
22. A unit as claimed in claim 1, **characterised in that** the sand belt (6) engages said support surface (S) by sliding.

Patentansprüche

1. Einheit zum Glätten von Eisenbahnschienen, umfassend:
 - ein Sandband (6), um eine oberflächliche Entfernung des Materials von mindestens eines Abschnitts einer Eisenbahnschiene (R) zu erzielen;
 - ein Vorschubelement (5) für den Vorschub des Sandbands (6), wirkend auf das Sandband (6), um dieses relativ zum Schienenabschnitt (R) in Bewegung zu setzen, wobei das Vorschubelement (5) eine Trägeroberfläche (S) umfasst, die mindestens teilweise mit dem Sandband (6) abgedeckt ist, und diese Oberfläche (S) einen Querschnitt mit im Wesentlichen ergänzender Form zu einem Profil des Abschnitts der zu erzielenden Schiene (R) aufweist;

- Mittel zum Betätigen des Sandbands (6), wirkend auf das Sandband (6), um einen Abschnitt davon in Kontakt mit dem Schienenabschnitt (R) zu setzen;
 - Mittel (11) zum Erneuern des Sandbands (6), wirkend auf das Sandband (6), um Abschnitte abgenutzten Sandbands (6b) durch entsprechende Abschnitte nicht abgenutzten Sandbands (6a) zu ersetzen, wobei diese Erneuerungsmittel (11) einen ersten Träger und einen zweiten Träger umfassen, die fest jeweils mit einer Zuführungsspule (14) und einer Rücklaufspule (15) des Sandbands (6) verbunden sind, um die Erneuerung des Sandbands (6) durch Aufwickeln der Abschnitte abgenutzten Sandbands (6b) auf die Rücklaufspule (15) und Abwickeln der Abschnitte nicht abgenutzten Sandbands (6a) von der Zuführungsspule (14) zu ermöglichen,
dadurch gekennzeichnet, dass:
 - das Vorschubelement (5) eine Trommel (7) umfasst, die um ihre eigene Rotationsachse (Y) drehbar ist und eine Oberfläche mit einer kreisförmigen Entwicklung aufweist, die die Trägeroberfläche (S) definiert;
 - der erste und zweite Träger intern in der Trommel (7) in einer fest damit verbundenen Position montiert sind, wobei die Trommel (7) mindestens eine Öffnung (16) aufweist, um dem Sandband (6), das teilweise auf den Spulen (14, 15) aufgewickelt ist, zu erlauben, diese Öffnung (16) zu durchqueren und mindestens teilweise die Trägeroberfläche (S) zu bedecken.
2. Einheit nach Anspruch 1, **dadurch gekennzeichnet, dass** die Mittel für den Vorschub des Sandbands (6) den Abschnitt des Sandbands (6) in eine Richtung vorschieben, die längs zur Schiene (R) verläuft.
 3. Einheit nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Betätigungsmittel auf das Vorschubelement (5) wirken, um den Abschnitt des Sandbands (6) in Kontakt mit dem Schienenabschnitt (R) zu positionieren.
 4. Einheit nach Anspruch 1, **dadurch gekennzeichnet, dass** die Erneuerungsmittel auf das Sandband (6) während des Betriebs der im Einsatz befindlichen Vorschubmittel wirken.
 5. Einheit nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie Mittel zum Ausrichten des Vorschubelements (5) umfasst, die auf das Vorschubelement (5) wirken, um es unter der Wirkung jeweiliger Aktoren mittels eines vorgegebenen Winkels zumindest zu einer vertikalen Ebene auszurichten.
 6. Einheit nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Trommel (7) mit einem jeweiligen Motor (M1) verbunden ist.
 7. Einheit nach Anspruch 3, **dadurch gekennzeichnet, dass** die Betätigungsmittel auf das Vorschubelement (5) wirken, um dieses entlang einer Richtung hinführend zum und/oder wegführend vom zu glättenden Schienenabschnitt (R) betätigen.
 8. Einheit nach Anspruch 7, **dadurch gekennzeichnet, dass** die Betätigungsmittel einen Linearaktor (20) umfassen, der entlang einer Annäherungsrichtung (W) des Vorschubelements relativ zur Schiene (R) wirkt.
 9. Einheit nach Anspruch 8, **dadurch gekennzeichnet, dass** die Vorschubrichtung (W) lotrecht zu einer vorwiegenden Entwicklungsrichtung der Schiene (R) verläuft.
 10. Einheit nach Anspruch 6 bis 8, **dadurch gekennzeichnet, dass** die Rotationsachse (Y) der Trommel (7) und die Annäherungsrichtung (W) lotrecht zueinander verlaufen.
 11. Einheit nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Sandband (6) in einer betriebswirksamen Konfiguration im Wesentlichen die gesamte Trägeroberfläche (S) umgreift.
 12. Einheit nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** dieser Träger um jeweilige Rotationsachsen parallel zur Rotationsachse der Trommel (7) drehbar ist.
 13. Einheit nach Anspruch 1 oder 12, **dadurch gekennzeichnet, dass** die Trommel (7) mindestens eine Verschleißplatte (8, 9) aufweist, die auf einer Ebene liegt, die lotrecht zur Rotationsachse (X) der Trommel (7) verläuft, wobei die Träger einen ersten Drehzapfen (12) und einen zweiten Drehzapfen (13) umfassen, die aus der Verschleißplatte (7) herausragen, um die Spulen (14, 15) drehbar zu tragen.
 14. Einheit nach Anspruch 1, **dadurch gekennzeichnet, dass** die Träger mit jeweiligen Motormitteln (M2) verbunden sind, um mindestens die Rücklaufspule (14) in Drehung zu versetzen.
 15. Einheit nach Anspruch 6 und 14, **dadurch gekennzeichnet, dass** der Motor (M1), verbunden mit der Trommel (7) betriebswirksam unabhängig von den Motormitteln (M2) ist, die mit den Trägern verbunden sind.
 16. Einheit nach Anspruch 5, **dadurch gekennzeichnet,**

net, dass die Ausrichtungsmittel auf das Vorschubelement (5) wirken, um dessen Schwenken um eine Justierachse (X) zu bewirken.

17. Einheit nach Anspruch 16, **dadurch gekennzeichnet, dass** die Justierachse (X) im Wesentlichen parallel zur zu glättenden Schiene (R) verläuft. 5
18. Einheit nach Anspruch 17, **dadurch gekennzeichnet, dass** die Rotationsachse (Y) der Trommel (7) lotrecht zur Justierachse (X) beibehalten wird. 10
19. Einheit nach Anspruch 8 und 18, **dadurch gekennzeichnet, dass** die Annäherungsrichtung (W), die Justierachse (X) und die Rotationsachse (Y) der Trommel (7) zueinander lotrecht verlaufen. 15
20. Einheit nach Anspruch 8 und 16, **dadurch gekennzeichnet, dass** die Ausrichtungsmittel einen Justierkörper (3) umfassen, aufweisend einen oberen Abschnitt (3a) und einen unteren Abschnitt (3b), wobei der obere Abschnitt (3a) drehbar in einen Abschnitt des Fahrgestells (T) eines Fahrzeugs eingreift, um um die Justierachse (X) zu schwenken und ebenso mit dem Linearaktor (20) verbunden ist, wobei der untere Abschnitt (3b) das Vorschubelement (5) trägt und schiebbar in den oberen Abschnitt (3b) entlang der Annäherungsrichtung (W) unter der Wirkung des Linearaktors (20) eingreift. 20
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21. Einheit nach Anspruch 6, **dadurch gekennzeichnet, dass** die Trommel (7) mit jeweiligen Motormitteln (M1) mittels einer Universalverbindung (C) verbunden ist, um entsprechende Bewegungen zwischen der Trommel (7) und den jeweiligen Motormitteln (M1) zu absorbieren. 35
22. Einheit nach Anspruch 1, **dadurch gekennzeichnet, dass** das Sandband (6) in die Trägersoberfläche (S) durch Gleiten eingreift. 40

Revendications

1. Unité pour lisser les rails ferroviaires, comprenant : 45
 - une bande abrasive (6) permettant l'enlèvement superficiel de matière d'au moins une partie d'un rail ferroviaire (R) ;
 - un élément d'avancement (5) permettant de faire avancer la bande abrasive (6), agissant sur la bande abrasive (6) pour la mettre en mouvement par rapport à ladite partie du rail (R), ledit élément d'avancement (5) comprenant une surface de support (S) au moins couverte partiellement par ladite bande abrasive (6) et ladite surface (S) ayant une section transversale avec une forme essentiellement complémentaire au 50
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profil de la partie de rail (R) à obtenir,

- des moyens permettant d'actionner la bande abrasive (6), agissant sur la bande abrasive (6) pour mettre une partie de celle-ci en contact avec ladite partie de rail (R),
- des moyens (11) permettant le renouvellement de ladite bande abrasive (6), agissant sur ladite bande (6) afin de remplacer les parties de la bande abrasive usée (6b) avec des parties correspondantes de la bande abrasive non usée (6a), lesdits moyens de renouvellement (11) comprenant un premier et un second support, respectivement associés stablement à une bobine d'alimentation (14) et à une bobine de reprise (15) de la bande abrasive (6), pour permettre le renouvellement de la bande abrasive (6) elle-même par l'enroulement des parties de bande abrasive usée (6b) sur la bobine de reprise (15) et par le déroulement des parties de bande abrasive non usée (6a) à partir de la bobine d'alimentation (14),

caractérisée en ce que :

- ledit élément d'avancement (5) comprend un tambour (7), pouvant tourner autour de son propre axe de rotation (Y) et ayant une surface à développement circulaire définissant ladite surface de support (S),
 - lesdits premier et second supports sont montés à l'intérieur du tambour (7) dans une position solidaire avec celui-ci, ledit tambour (7) comportant au moins une ouverture (16) pour permettre à ladite bande abrasive (6), enroulée partiellement sur lesdites bobines (14, 15), de traverser ladite ouverture (16) et de couvrir au moins partiellement ladite surface de support (S).
2. Unité selon la revendication 1, **caractérisée en ce que** lesdits moyens permettant de faire avancer la bande abrasive (6) font avancer ladite partie de bande abrasive (6) dans une direction longitudinale au rail (R) lui-même.
 3. Unité selon l'une quelconque des revendications précédentes, **caractérisée en ce que** lesdits moyens d'activation agissent sur ledit élément d'avancement (5) afin de mettre en contact ladite partie de la bande abrasive (6) avec ladite partie de rail (R).
 4. Unité selon la revendication 1, **caractérisée en ce que** lesdits moyens de renouvellement agissent sur la bande abrasive (6) lors du fonctionnement des moyens d'avancement en marche.
 5. Unité selon l'une quelconque des revendications précédentes, **caractérisée en ce qu'elle** comprend

- des moyens pour orienter ledit élément d'avancement (5), agissant sur l'élément d'avancement (5) pour l'orienter, sous l'action d'actionneurs respectifs, selon un angle préétabli au moins par rapport à un plan vertical.
6. Unité selon l'une quelconque des revendications précédentes, **caractérisée en ce que** ledit tambour (7) est relié à un moteur correspondant (M1).
7. Unité selon la revendication 3, **caractérisée en ce que** lesdits moyens d'activation agissent sur l'élément d'avancement (5) pour l'activer le long d'une direction d'approche ou de recul par rapport à ladite partie de rail (R) à être lissée.
8. Unité selon la revendication 7, **caractérisée en ce que** lesdits moyens d'activation comprennent un actionneur linéaire (20) agissant le long d'une direction d'approche (W) de l'élément d'avancement par rapport au rail (R).
9. Unité selon la revendication 8, **caractérisée en ce que** la direction d'avancement (W) est perpendiculaire à une direction principale de développement du rail (R).
10. Unité selon les revendications 6 à 8, **caractérisée en ce que** ledit axe de rotation (Y) du tambour (7) et ladite direction d'approche (W) sont perpendiculaires l'un à l'autre.
11. Unité selon l'une quelconque des revendications précédentes, **caractérisée en ce que** dans une configuration de fonctionnement, la bande abrasive (6) encercle substantiellement toute la surface de support (S).
12. Unité selon l'une quelconque des revendications précédentes, **caractérisée en ce que** lesdits supports peuvent tourner autour d'axes de rotation respectifs de manière parallèle à l'axe de rotation du tambour (7).
13. Unité selon les revendications 1 ou 12, **caractérisée en ce que** ledit tambour (7) comporte au moins une plaque de fermeture (8, 9), située dans un plan perpendiculaire à l'axe de rotation (X) du tambour (7), lesdits supports comprenant un premier tourillon (12) et un second tourillon (13) en saillie de ladite plaque de fermeture (7) afin de supporter de manière rotative lesdites bobines (14, 15).
14. Unité selon la revendication 1, **caractérisée en ce que** lesdits supports sont reliés à des moyens moteur respectifs (M2) pour entraîner en rotation au moins ladite bobine de reprise (14).
15. Unité selon les revendications 6 et 14, **caractérisée en ce que** le moteur (M1) associé au tambour (7) est opérationnellement indépendant des moyens moteur (M2) associés aux dits supports.
16. Unité selon la revendication 5, **caractérisée en ce que** lesdits moyens d'orientation agissent sur l'élément d'avancement (5) pour le faire osciller autour d'un axe d'ajustement (X).
17. Unité selon la revendication 16, **caractérisée en ce que** ledit axe d'ajustement (X) est substantiellement parallèle au rail (R) à être lissée.
18. Unité selon la revendication 17, **caractérisée en ce que** ledit axe de rotation (Y) du tambour (7) est maintenu perpendiculaire au dit axe d'ajustement (X).
19. Unité selon les revendications 8 et 18, **caractérisée en ce que** ladite direction d'approche (W), ledit axe d'ajustement (X) et ledit axe de rotation (Y) du tambour (7) sont mutuellement perpendiculaires.
20. Unité selon les revendications 8 et 16, **caractérisée en ce que** lesdits moyens d'orientation comprennent un corps d'ajustement (3) comportant une partie supérieure (3a) et une partie inférieure (3b), ladite partie supérieure (3a) étant engagée de manière pivotante dans une partie d'un châssis (T) d'un véhicule afin d'osciller autour dudit axe d'ajustement (X) et étant aussi associée au dit actionneur linéaire (20), ladite partie inférieure (3b) supportant ledit élément d'avancement (5) et étant engagée de façon coulissante avec ladite partie supérieure (3b) le long de ladite direction d'approche (W) sous l'action dudit actionneur linéaire (20).
21. Unité selon la revendication 6, **caractérisée en ce que** ledit tambour (7) est relié aux moyens moteur respectifs (M1) par un joint cardan (C), afin d'absorber les mouvements relatifs entre le tambour (7) et les moyens moteur respectifs (M1).
22. Unité selon la revendication 1, **caractérisée en ce que** la bande abrasive (6) s'engage dans ladite surface de support (S) par coulissement.

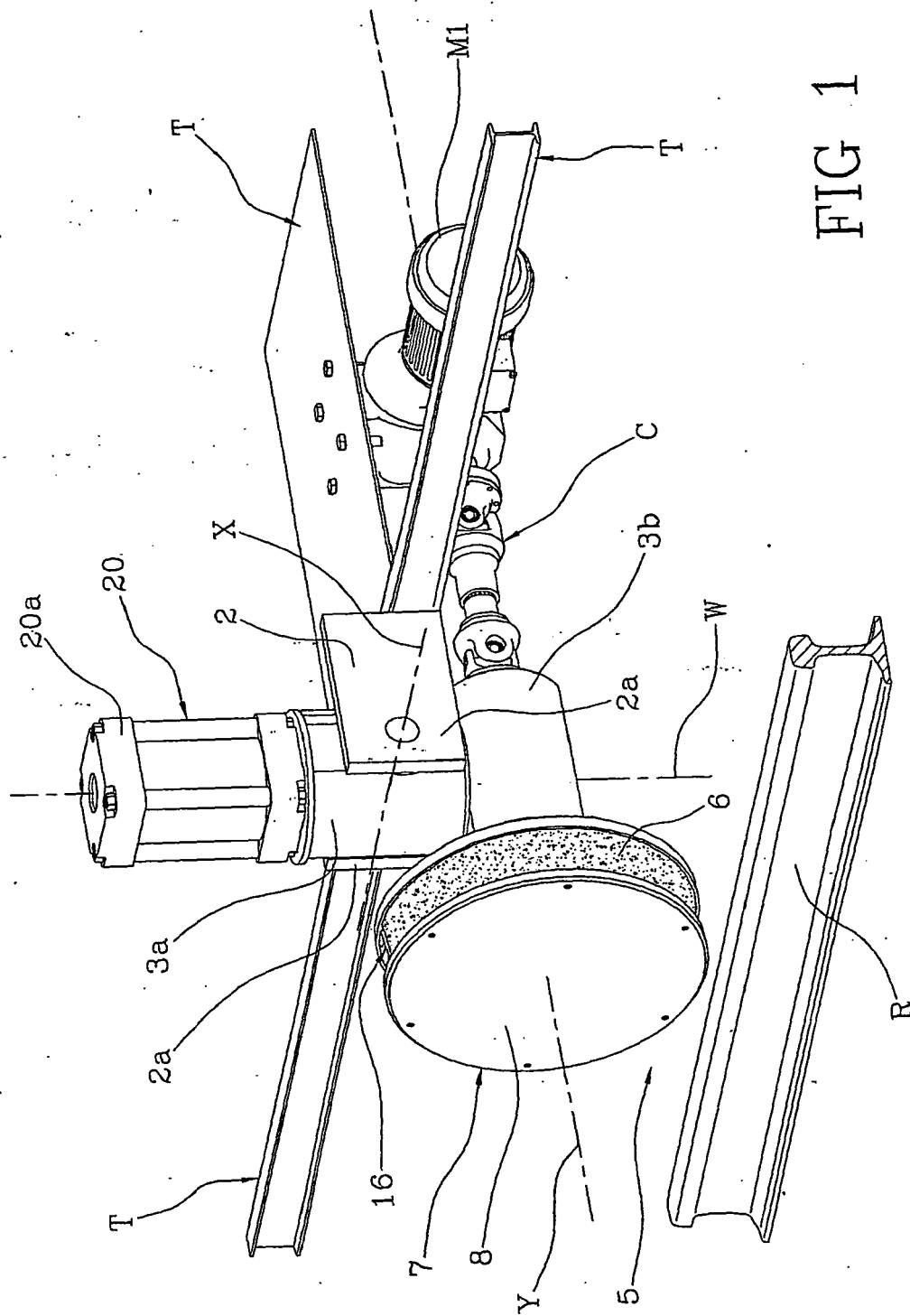


FIG 1

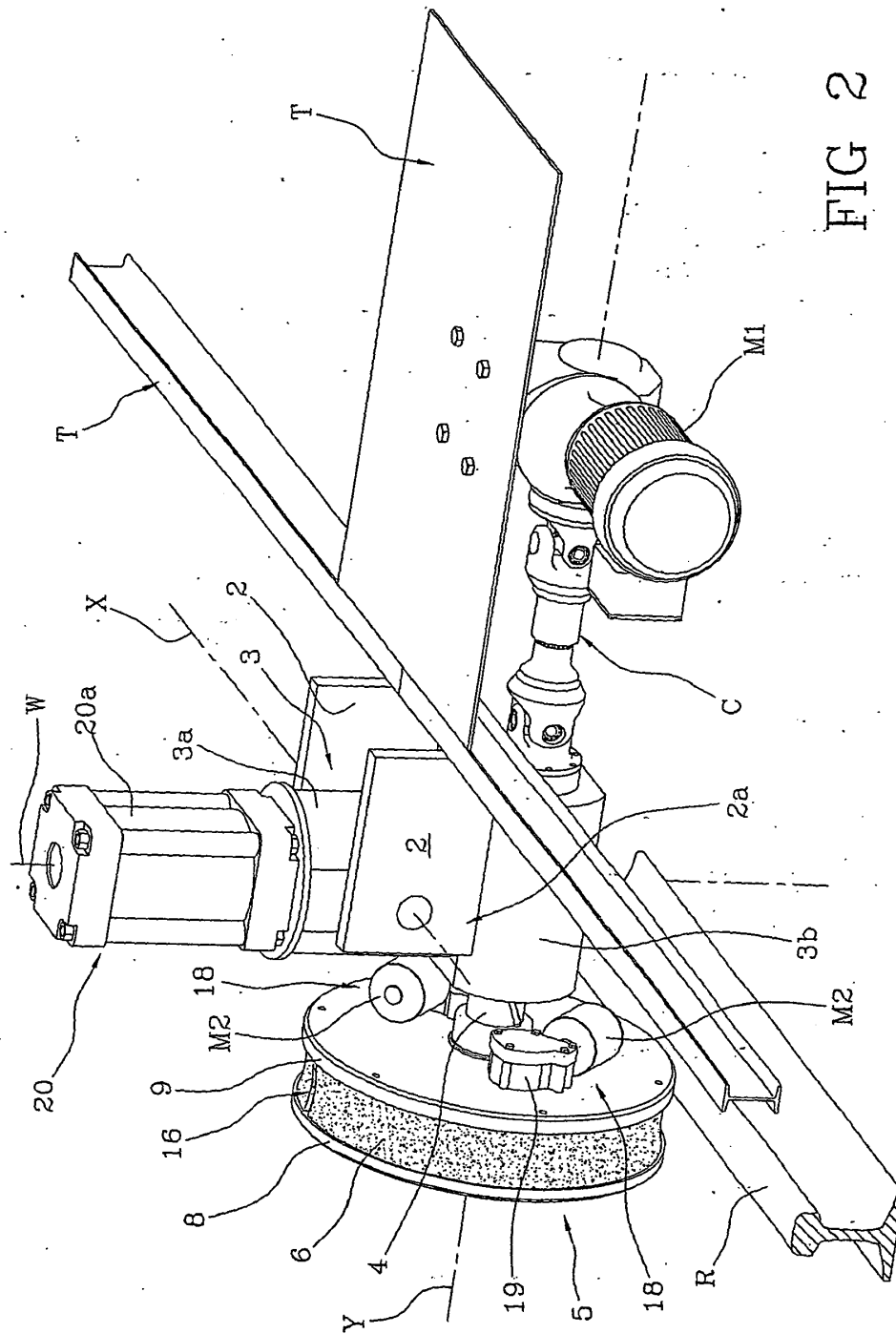


FIG 2

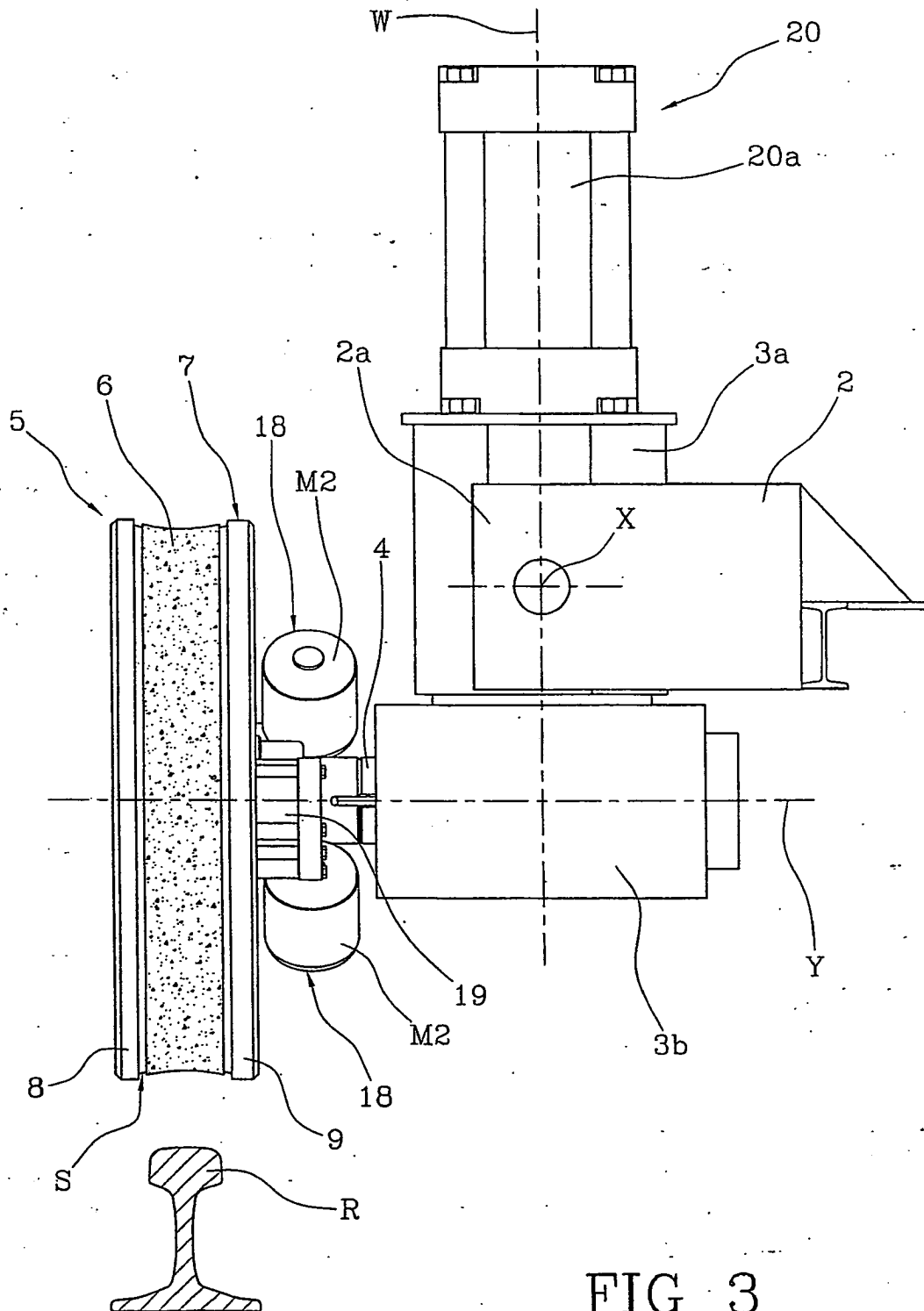


FIG 3

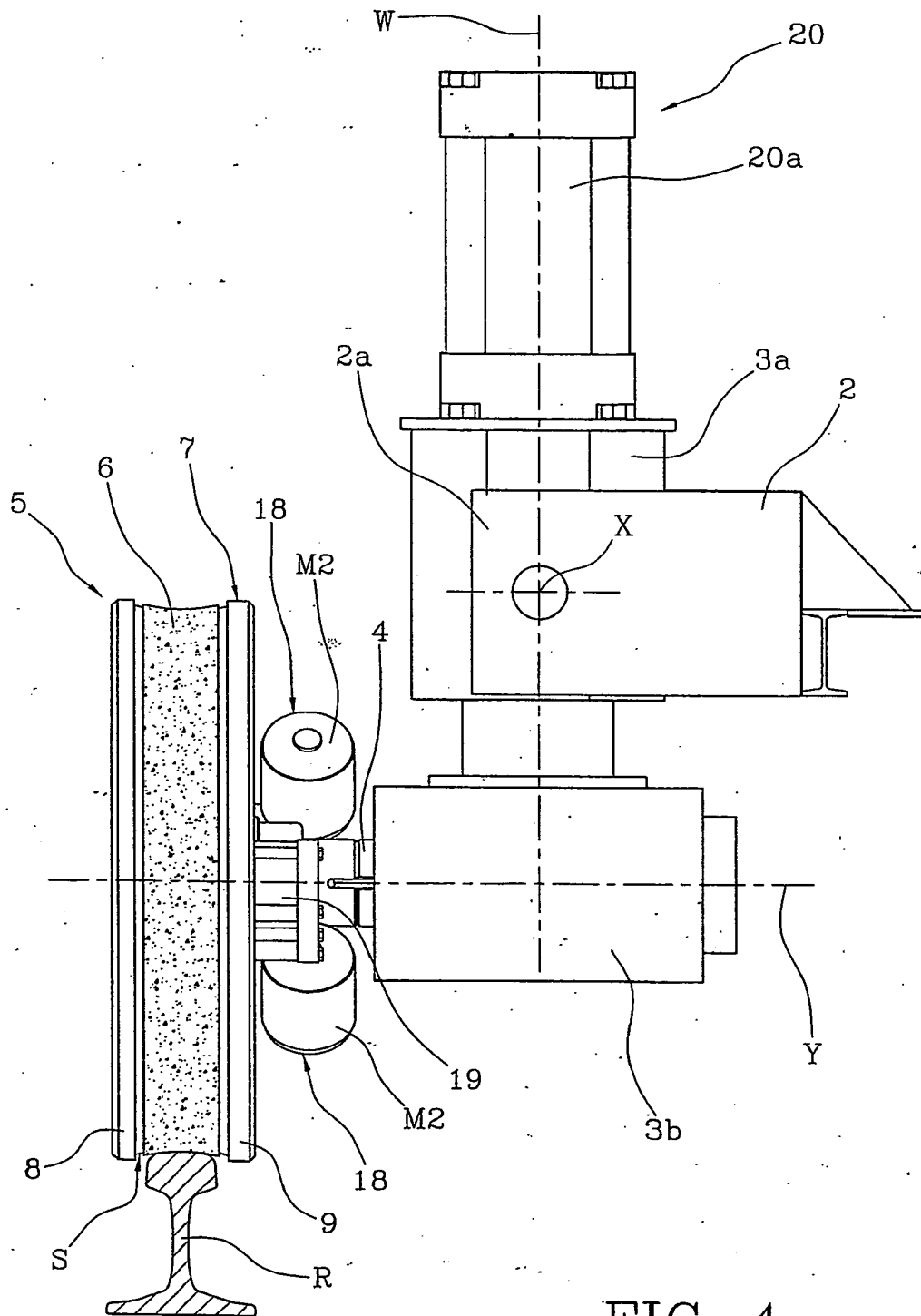


FIG. 4

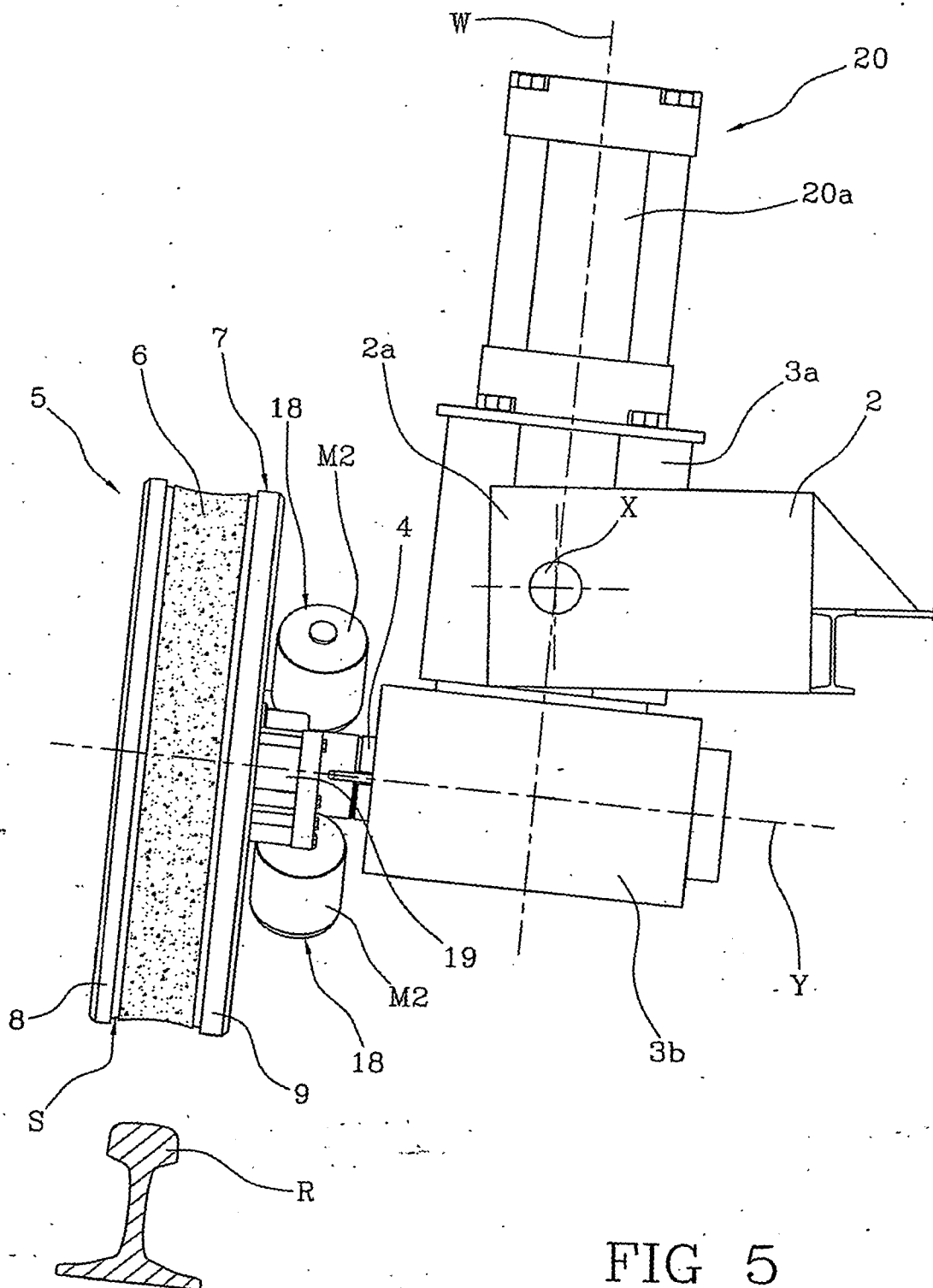
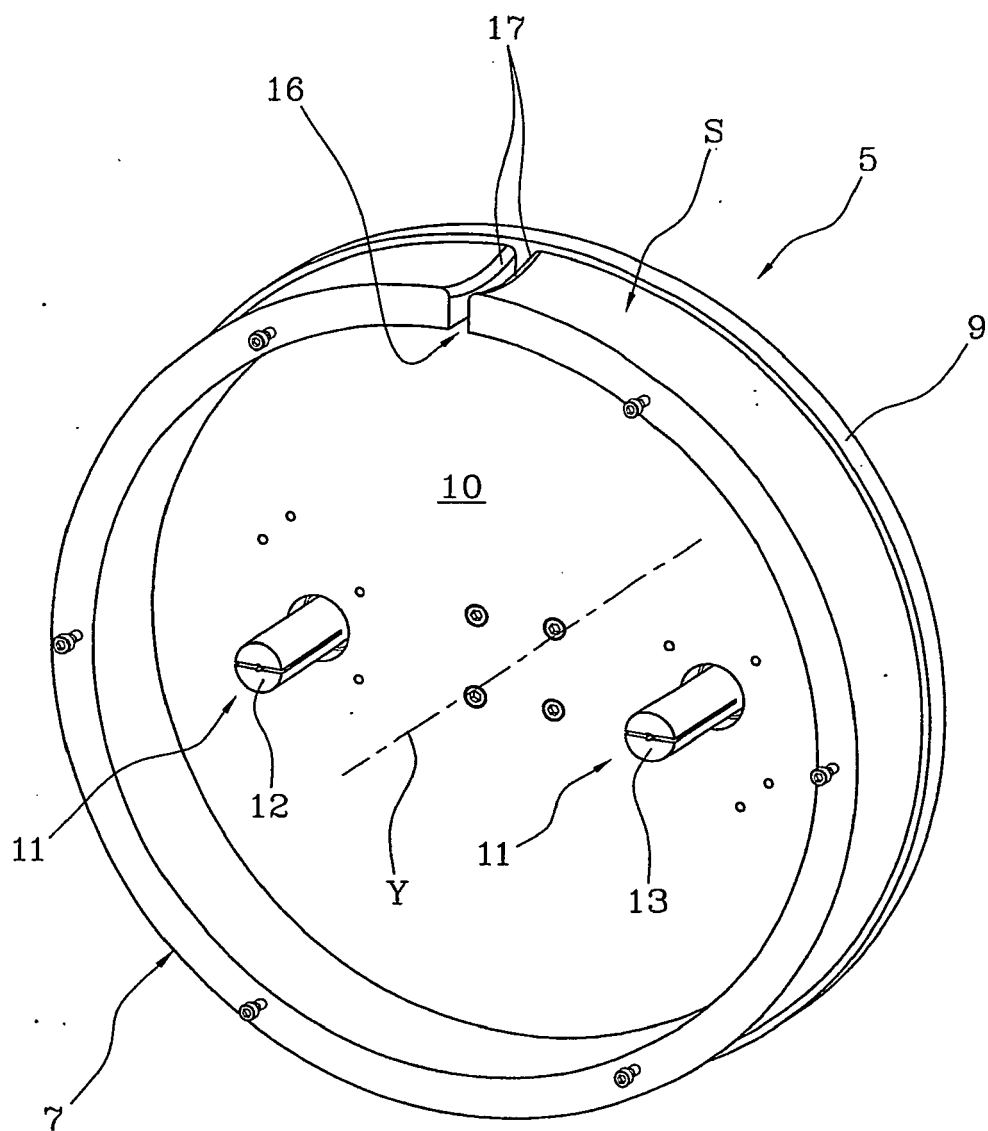


FIG 5

FIG 6



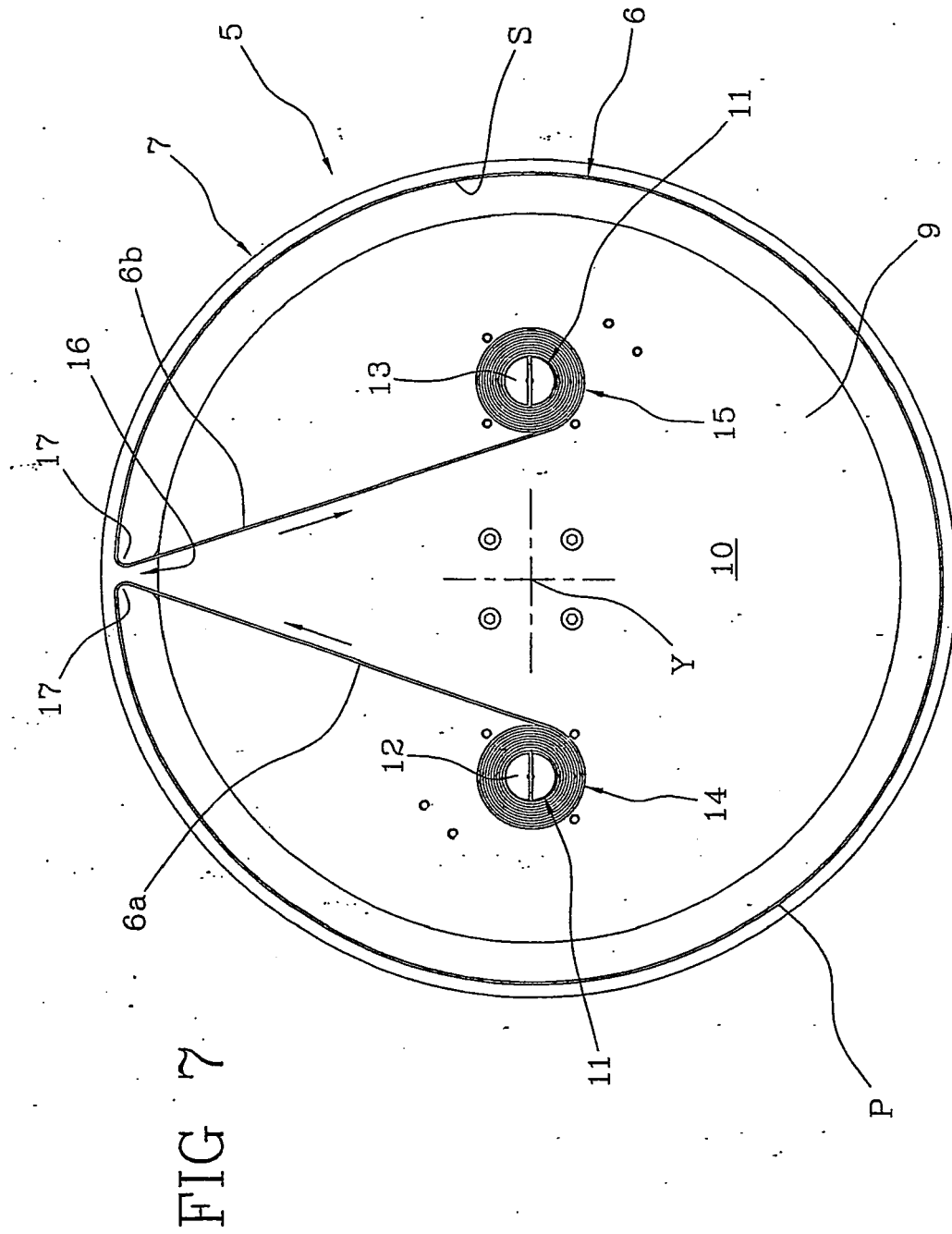
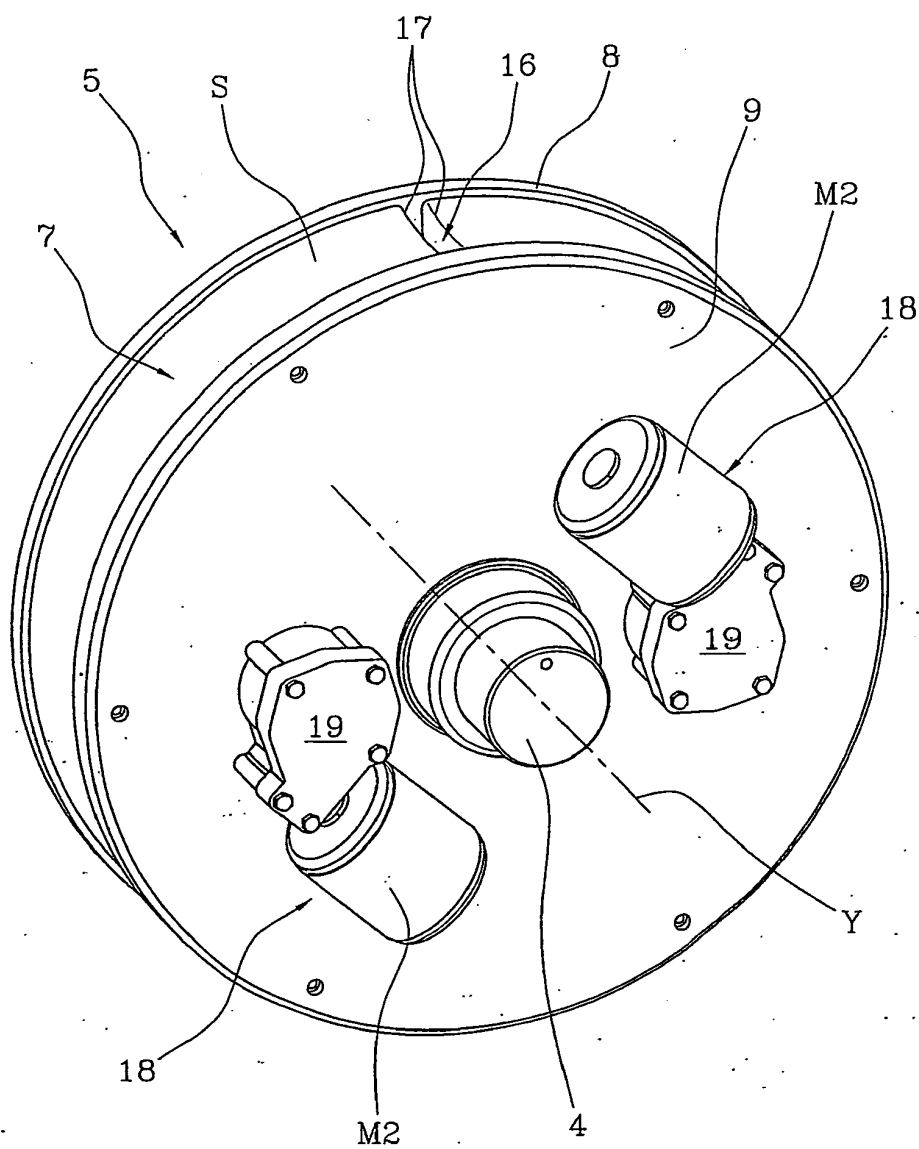


FIG 8



REFERENCES CITED IN THE DESCRIPTION

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