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(54) Apparatus for straightening iron rods with final correction unit

(57) The final correction unit (1) is applied in apparatuses for straightening iron rods and the like, comprising a plurality of contrarotating straightening rollers (3, 4) between which the rods (2) to be straightened are inserted, so that they advance along a longitudinal direction (A). The unit (1) comprises at least one first auxiliary roller (11) and one second auxiliary roller (12), whose axes are parallel to the axes of the straightening rollers (3, 4) and are arranged in series on the same plane as the straightening rollers. An abutment roller (13) is adapted to cooperate with the auxiliary rollers (11, 12) in order to clamp the rods (2) on a mutual tangency plane that is substantially longitudinal to the advancement direction (A). The auxiliary rollers (11, 12) can rotate about supporting means (10) that oscillate about an axis that is perpendicular to the plane of the auxiliary rollers (11, 12). Means (31, 32) for adjusting the angular position of the supporting means (10) are adapted to tilt appropriately the plane of tangency formed by the auxiliary rollers (11, 12) with respect to the advancement direction (A) in order to correct the residual curvature of the rods (2).

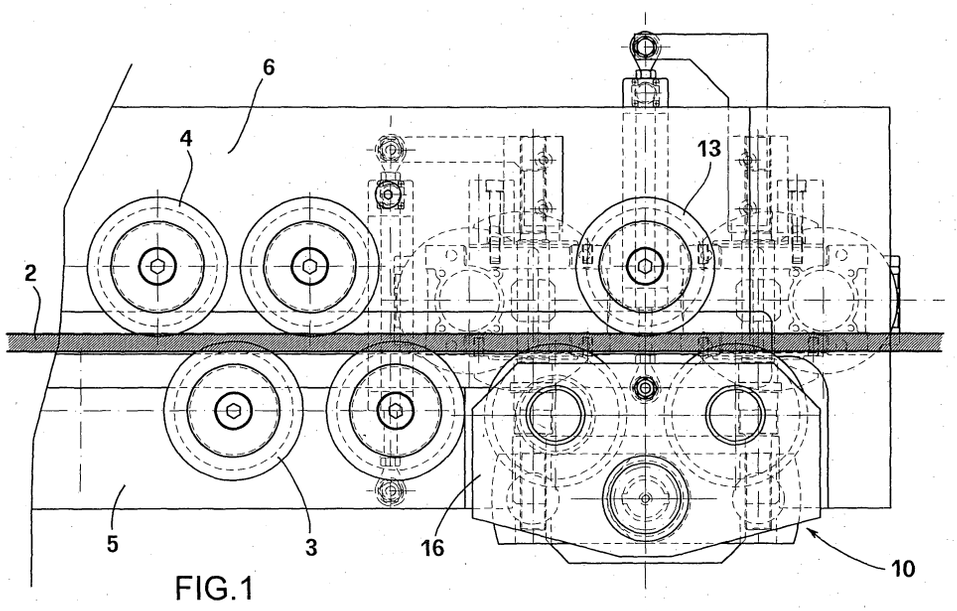

FIG.1

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Description

[0001] The present invention relates to a final correction unit intended to be applied in apparatuses for straightening iron rods and the like originating from coils.

[0002] It is known that iron rods, used for example to produce frames for reinforced concrete, are generally fed to machines provided with adapted straightening apparatuses. These straightening apparatuses are usually provided with a plurality of straightening elements, constituted by pairs of contrarotating rollers that are grooved appropriately. The rod that arrives from a coil is inserted between such contrarotating rollers along a preset direction of longitudinal advancement.

[0003] In particular, machines are known which allow to treat simultaneously two rods arranged longitudinally side by side. The straightening apparatuses used in these machines are provided with twin straightening rollers adapted to be engaged by said pair of rods. A straightening apparatus of this kind is disclosed for example in EPA 0947256, by the same Applicant.

[0004] The straightening operation is often performed by means of multiple series of straightening elements, which act on different planes, for example on two perpendicular planes, in order to correct corresponding components of the curvature. However, the rods that exit the straightening elements can sometimes have a residual curvature of more or less significant extent that is orientated unpredictably. This of course compromises the optimum production of the articles by means of the iron rods.

[0005] The use of devices for final correction of the straightening of rods, adapted to be applied at the output region of such apparatuses to correct the residual curvature of the rods, has therefore been proposed. Known final correction devices, however, are awkward to use and require skilled operators, requiring for example coordinated intervention on several straightening rollers. This drawback is particularly significant, of course, in the case of straightening apparatuses adapted to work on a pair of rods arranged side by side.

[0006] The aim of the present invention is to solve the cited problem, by providing a final correction unit that can be applied in apparatuses for straightening iron rods and the like that allows to correct the residual curvature of the rods rapidly and precisely.

[0007] Within this aim, an object of the present invention is to provide a unit for final correction of straightening that is capable of operating independently on two rods arranged side by side.

[0008] Another object of the present invention is to provide a unit for final correction of straightening that is simple in concept, safely reliable in operation, and versatile in use.

[0009] This aim and these and other objects are achieved, according to the present invention, by the present unit for final correction in apparatuses for straightening iron rods and the like, comprising a plurality of contrarotating straightening rollers between which the rods to be straightened are inserted, so that they advance along a longitudinal direction, characterized in that it comprises, at the output of said straightening rollers, at least one first auxiliary straightening roller and one second auxiliary straightening roller whose axes are parallel to the axes of said straightening rollers and are arranged in series on the same plane as said straightening rollers; an abutment roller, which is adapted to cooperate with said auxiliary rollers in order to clamp said rods on a mutual tangency plane that is substantially longitudinal to said advancement direction; means for supporting said auxiliary rollers, which oscillate about an axis that is perpendicular to the plane of said auxiliary rollers; means for adjusting the angular position of said supporting means, which are adapted to tilt appropriately the plane of tangency formed by said auxiliary rollers with respect to said advancement direction in order to correct the residual curvature of said rods.

[0010] The features of the invention will become better apparent from the detailed description of a preferred embodiment of the final correction unit applied in an apparatus for straightening iron rods, illustrated by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a front side view of the final correction unit according to the present invention;
Figures 2 and 3 are identical front side views of the final correction unit in different operating configurations;
Figure 4 is a rear side view of said final correction unit;
Figure 5 is a corresponding plan view thereof;
Figures 6 and 7 are respectively sectional views, taken along a vertical central plane, of the final correction unit according to the invention, at a sectional plane that is transverse to the rod advancement direction and from opposite viewpoints;
Figure 8 is a front side view of a different embodiment of the final correction unit according to the invention;
Figures 9 and 10 are front side views of a further embodiment of the final correction unit according to the invention in various steps of operation.

[0011] With reference to the figures, the reference numeral 1 generally designates the final correction unit adapted to be applied in an apparatus for straightening iron rods 2 originating from a coil.

[0012] The final correction unit 1 is arranged at the output region of the straightening apparatus, which comprises in a known manner pairs of contrarotating straightening rollers 3 and 4, which lie for example on a vertical plane and are appropriately grooved in order to form a seat for guiding the rods 2. The lower rollers 3 are supported by a fixed frame 5, which is elongated in the direction A in which the rods 2 advance; the upper

rollers 4 are instead supported by a plate 6, which is associated with the fixed frame 5 and can move at right angles to the advancement direction A, in order to allow to adjust the mutual distance of said rollers 3 and 4 according to the dimensions of the rods 2 and to the deformation to be imparted to the rod being processed.

[0013] In the case shown, the straightening apparatus acts on two rods 2a and 2b arranged side by side. The correction unit 1 can be applied in any case at the output of any known type of straightening apparatus.

[0014] The correction unit 1 has at least one first auxiliary straightening roller 11 and one second auxiliary straightening roller 12, which are arranged practically downstream of, and in series to said rollers 3 and, if appropriate, are likewise grooved; the auxiliary straightening rollers 11 and 12 are adapted to cooperate with a contrast roller 13, which in turn is arranged in series to said rollers 4 of the straightening apparatus and is supported so that it can rotate freely by the movable frame 6. The auxiliary rollers 11 and 12 and the abutment roller 13 have axes that are parallel to the axes of the straightening rollers 3 and 4.

[0015] The auxiliary rollers 11 and 12 are supported, so that they can rotate freely, by a supporting element 10 that oscillates about an axis that is parallel to the axis of said rollers 11 and 12 and is determined by a pivot 14 that passes through the frame 5.

[0016] Actually, when working on a pair of rods 2a and 2b arranged side by side, twin auxiliary rollers are used, i.e., rollers constituted by pairs of mutually independent side-by-side rollers 11a, 11b and 12a, 12b, while the abutment roller can be constituted by' a single roller 13 that is common to the two rods being worked.

[0017] The oscillating supporting means 10 are constituted by a first internal support 15 and by a second external support 16, which substantially form a sort of shell that constitutes the support and receptacle of said pairs of side-by-side rollers 11a, 11b and 12a, 12b. The first support 15 bears the inner auxiliary rollers 11a and 12a, which are mounted so that they can rotate freely, by way of adapted rolling means 17, on corresponding pivots 18a, 19a; the second support 16 bears the outer auxiliary rollers 11 band 12b, which are mounted so that they can rotate freely, by way of corresponding rolling means 17, about corresponding pivots 18b, 19b (see Figure 5).

[0018] The first support 15 protrudes from a sleeve 20, which is mounted on the pivot 14 so that mutual rotation can occur.

[0019] Conveniently, the rotation axes of the supports 15 and 16 and the axis of the abutment roller 13 are arranged on a same plane at right angles to the advancement direction of the rods 2 being worked. The supports 15 and 16, moreover, can be arranged on either side with respect to the line that connects the two rotation centers of the auxiliary rollers 11 and 12.

[0020] The supports 15 and 16 of the supporting means 10 are adapted to be actuated so as to perform an angular rotation by means of respective rocker elements 21 and 22, which can oscillate about the axis of the pivot 14. More specifically, the first rocker 21 is rigidly coupled to the sleeve 20 that constitutes the axis of the first support 15, while the second rocker 22 is rigidly coupled to the pivot 14 of the second support 16.

[0021] The angular position of the rockers 21 and 22 can be adjusted by way of respective adjustment means 31 and 32, which are actuated by corresponding gearmotors 33 and 34 supported by a bracket 30 that protrudes from the fixed frame 5. The adjustment means 31 and 32 are constituted respectively by a shaft 35 and 36, which is supported so that it can rotate about a vertical axis, by way of suitable rolling means 37, at the bracket 30.

[0022] The shaft 35 and 36 has threaded portions 35a, 36a and 35b, 36b at its opposite ends. At the lower end of the shaft 35 and 36, the threaded portion 35a, 36a is coupled to a female thread 38, 39, which is formed in a cylindrical body. Said cylindrical body of the female thread 38 and 39 is inserted, so that it can rotate, in a correspondingly cylindrical seat formed in the rocker 21 and 22.

[0023] At the upper end of the shaft 35 and 36, the threaded portion 35b, 36b is in turn coupled to a corresponding female thread formed in a slider 41, 42, which can slide along a guide 43, 44. The slider 41, 42 has a protruding arm 45, 46, to which a linear position transducer 47, 48 of a per se known type is articulated. The position transducer 47 of the first rocker 21 is rigidly coupled in a fixed position to a coupling 49 that protrudes from the frame 5, while the position transducer 48 of the second rocker 22 is rigidly coupled in a fixed position to a coupling 40 provided on the bracket 30.

[0024] The operation of the final correction unit entails advancing the iron rods 2a and 2b that exit from the contrarotating straightening rollers 3 and 4 of the straightening apparatus between the auxiliary rollers 11a, 11b and 12a, 12b and the abutment roller 13. If the rods 2a, 2b have no residual curvature and therefore no corrective intervention is needed, the auxiliary rollers 11a, 11b and 12a, 12b are kept in alignment with the straightening rollers 3, i.e., tangent to the advancement direction A of the rods (Figure 1).

[0025] If instead a residual curvature is detected, the oscillating supporting means 10 are made to perform an angular rotation in one direction or the other, so as to incline appropriately the plane of tangency formed by said auxiliary rollers 11a, 11b and 12a, 12b with respect to the advancement direction A (see Figures 2 and 3).

[0026] In particular, the adjustment means 31, 32 actuated by the corresponding gearmotors 33, 34 allow to act independently on the rockers 21 and 22, which are rigidly coupled to the supports 15 and 16 that support respectively the inner auxiliary rollers 11a, 12a and the outer auxiliary rollers 11b, 12b, correcting the residual curvature of the rod 2a or of the rod 2b independently of each other.

[0027] In practice, by acting on each one of the gearmotors 33 and 34, the rotation of the shaft 35 and 36 is actuated; said rotation causes, with the threaded portion 35a, 36a, the axial movement of the female thread 38 and 39 and accordingly the angular rotation of the rocker 21 and 22 that is coupled thereto. It should be noted that this rotation is allowed by the rotary coupling between the rocker 21 and 22 and the cylindrical body in which the female thread 38 and 39 is formed.

[0028] Naturally, in a simplified embodiment the shafts 35 and 36 can be actuated manually, for example by means of suitable crank means or the like.

[0029] The rotation of the shaft 35 and 36 also produces, by means of the threaded portion 35b, 36b, the axial movement of the female thread produced by the slider 41 and 42, which can slide along the guide 43 and 44, and accordingly produces the actuation of the linear position transducer 47 and 48, which allows to measure the extent of the correction imparted and to send this information to electronic means for controlling the machine.

[0030] The final correction unit according to the invention therefore achieves the aim of correcting rapidly and precisely the residual curvature of iron rods and the like that exit from straightening elements, particularly by acting independently on a pair of rods arranged side by side. A single actuation in fact adjusts the auxiliary rollers 11 and 12 (in the case of a pair of rods, the rollers 11a, 12a and 11b, 12b) appropriately and with perfect synchronization.

[0031] In the solution described above, the auxiliary rollers 11 and 12 are arranged downward with respect to the rods 2 being worked, while the abutment roller 13 is arranged upward; however, the auxiliary rollers 11 and 12 can be arranged upward with respect to the rods 2 being worked and the abutment roller 13 can be arranged downward.

[0032] Figure 8 illustrates a different embodiment of the final correction unit, in which the auxiliary straightening rollers 11 and 12 are mounted, by way of the oscillating supporting means 10, on the movable plate 6 in alignment with the upper straightening rollers 4, while the contrast roller 13 is mounted on the fixed frame 5. The operation of this correction unit is obviously similar to the one described previously.

[0033] Figures 9 and 10 illustrate another embodiment of the final correction unit, in which the means 10 for supporting the auxiliary rollers 11 and 12 are mounted on the plate 6 so that they can slide by means of suitable sliding guides 50 at right angles to the advancement direction of the rods 2 being worked, while the contrast roller 13 is mounted on the fixed frame 5.

[0034] Conveniently, in this case, the last of the lower straightening rollers 3, designated by the reference numeral 3a in Figure 10 for the sake of greater clarity and arranged on the opposite side with respect to the auxiliary rollers 11 and 12 relative to the advancement direction of the rods 2, is moved upward so as to interfere with said rods 2 in order to give them a specific curvature.

[0035] In the practical execution of the invention, the materials used, as well as the shape and the dimensions, may be any according to requirements, all of which are within the scope of the appended claims.

[0036] The disclosures in Italian Patent Application No. B02002A000604 from which this application claims priority are incorporated herein by reference.

[0037] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A unit for final correction in apparatuses for straightening iron rods and the like, comprising contrarotating straightening rollers (3, 4) between which the rods (2) to be straightened are inserted, for advancement along a longitudinal direction (A), **characterized in that** it comprises, arranged downstream of said straightening rollers (3, 4), at least one first auxiliary straightening roller (11) and one second auxiliary straightening roller (12), whose axes are parallel to the axes of said straightening rollers (3, 4) and are arranged in series on the same plane as said straightening rollers (3, 4); an abutment roller (13), which is adapted to cooperate with said auxiliary rollers (11, 12) in order to clamp said rods (2) on a mutual tangency plane that is substantially longitudinal to said advancement direction (A); supporting means (10) for supporting said auxiliary rollers (11, 12), which oscillate about an axis that is perpendicular to the plane of said auxiliary rollers (11, 12); and adjustment means (31, 32) for adjusting the angular position of said supporting means (10), which are adapted to tilt appropriately the plane of tangency formed by said auxiliary rollers (11, 12) with respect to said advancement direction (A) in order to correct the residual curvature of said rods (2).

2. The unit according to claim 1, **characterized in that** said auxiliary rollers (11, 12) are constituted by pairs of rollers arranged side by side (11a, 11b and 12a, 12b) that are mutually independent and are adapted to cooperate with two side-by-side abutment rollers (13a, 13b) in order to clamp a corresponding pair of rods (2a, 2b).

3. The unit according to claims 1 or 2, **characterized in that** said supporting means (10) for supporting said auxiliary rollers (11, 12) are constituted by a

first support (15), which supports said auxiliary rollers (11a, 12a) so that they can rotate freely, and a second support (16), which supports said auxiliary rollers (11b, 12b) arranged side by side with respect to the preceding rollers so that they can rotate freely.

4. The unit according to claim 3, **characterized in that** said supports (15, 16) of said supporting means (10) form a sort of shell that is adapted to form respectively the receptacle of said pairs of side-by-side rollers (11a, 11b and 12a, 12b).

5. The unit according to claim 3, **characterized in that** said supports (15, 16) of said supporting means (10) are rigidly coupled, at respective coaxial pivots (20, 14) to corresponding rocker means (21, 22), which are adapted to be actuated so as to perform an angular rotation independently of each other by said adjustment means (31, 32).

6. The unit according to claims 1 or 5, **characterized in that** said adjustment means (31, 32) respectively have a shaft (35, 36) that is supported so that it can rotate about its own axis and has, at one end, a threaded portion (35a, 36a) that is coupled to a corresponding female thread (38, 39) that is associated with said rocker means (21, 22).

7. The unit according to claim 6, **characterized in that** said female thread (38, 39) is formed in a cylindrical body that is inserted, with a rotary coupling, in a correspondingly cylindrical seat formed in said rocker means (21, 22).

8. The unit according to claim 6, **characterized in that** said shaft (35, 36) of said adjustment means (31, 32) is adapted to be actuated rotationally by a respective gearmotor (33, 34).

9. The unit according to claim 6, **characterized in that** said shaft (35, 36) of said adjustment means (31, 32) has, at a second end, a second threaded portion (35b, 36b), which is coupled to a corresponding female thread (41, 42) that is associated with position transducer means (47, 48) that are adapted to measure the extent of the correction imparted to said rods (2a, 2b).

10. The unit according to claim 1, **characterized in that** said abutment roller (13) is freely rotatably supported by a movable frame (6), so as to allow adjustment of the distance with respect to said auxiliary rollers (11, 12).

11. The unit according to claim 1, **characterized in that** the pivots of said auxiliary rollers (11, 12) are supported so as to rotate freely by a frame (6) that can move on the plane of arrangement of the straightening element and at right angles to the advancement direction of the rods (2) being worked, so as to allow to adjust their mutual distance from said abutment roller (13).

12. The unit according to claim 3, **characterized in that** said supports (15, 16) can be arranged on either side with respect to the line that connects the two centers of rotation of said auxiliary rollers (11, 12).

13. The unit according to claim 3, **characterized in that** the rotation axes of said supports (15, 16) and the axis of said abutment roller (13) are arranged on a same plane that is perpendicular to the advancement direction of the rods (2) being worked.

14. The unit according to claim 1, **characterized in that** said auxiliary rollers (11, 12) are arranged in a downward region with respect to said rods (2) being worked, and said abutment roller (13) is arranged in an upward region.

15. The unit according to claim 1, **characterized in that** said auxiliary rollers (11, 12) are arranged in an upward region with respect to said rods (2) being processed, and said abutment roller (13) is arranged in a downward region.

16. A final correction unit in devices for straightening iron rods and the like, of the type that comprises a series of contrarotating straightening rollers (3, 4), between which the rods (2) to be straightened are arranged for advancement along a longitudinal direction (A), **characterized in that** it comprises, downstream of said straightening rollers (3, 4), at least one first auxiliary straightening roller (11) and one second auxiliary straightening roller (12), whose axes are parallel to the axes of said straightening rollers (3, 4), said auxiliary straightening rollers being arranged in series on the same plane as said straightening rollers (3, 4); an abutment roller (13), which is adapted to cooperate with said auxiliary rollers (11, 12) in order to clamp said rods (2) on a mutual plane of tangency that is substantially longitudinal with respect to said advancement direction (A); supporting means (10) for supporting said auxiliary rollers (11, 12), which are mounted so that they can slide, at sliding guides (50), at right angles to the advancement direction of the rods (2) being worked, so as to correct the residual curvature of said rods (2).

17. The unit according to claim 16, **characterized in that** said auxiliary rollers (11, 12) are supported so that they can rotate freely by an upper frame (6) that can move on the plane of arrangement of the straightening element and at right angles to the ad-

vancement direction of said rods (2) being worked, while said contrast roller (13) is mounted on a lower fixed frame (5).

18. The unit according to claim 16, **characterized in that** the last roller (3a) of said straightening rollers (3), arranged on the opposite side with respect to said auxiliary rollers (11, 12) relative to said advancement direction (A) of the rods (2), is moved toward said rods (2) so as to interfere with said rods (2) in order to give said rods a specific curvature.

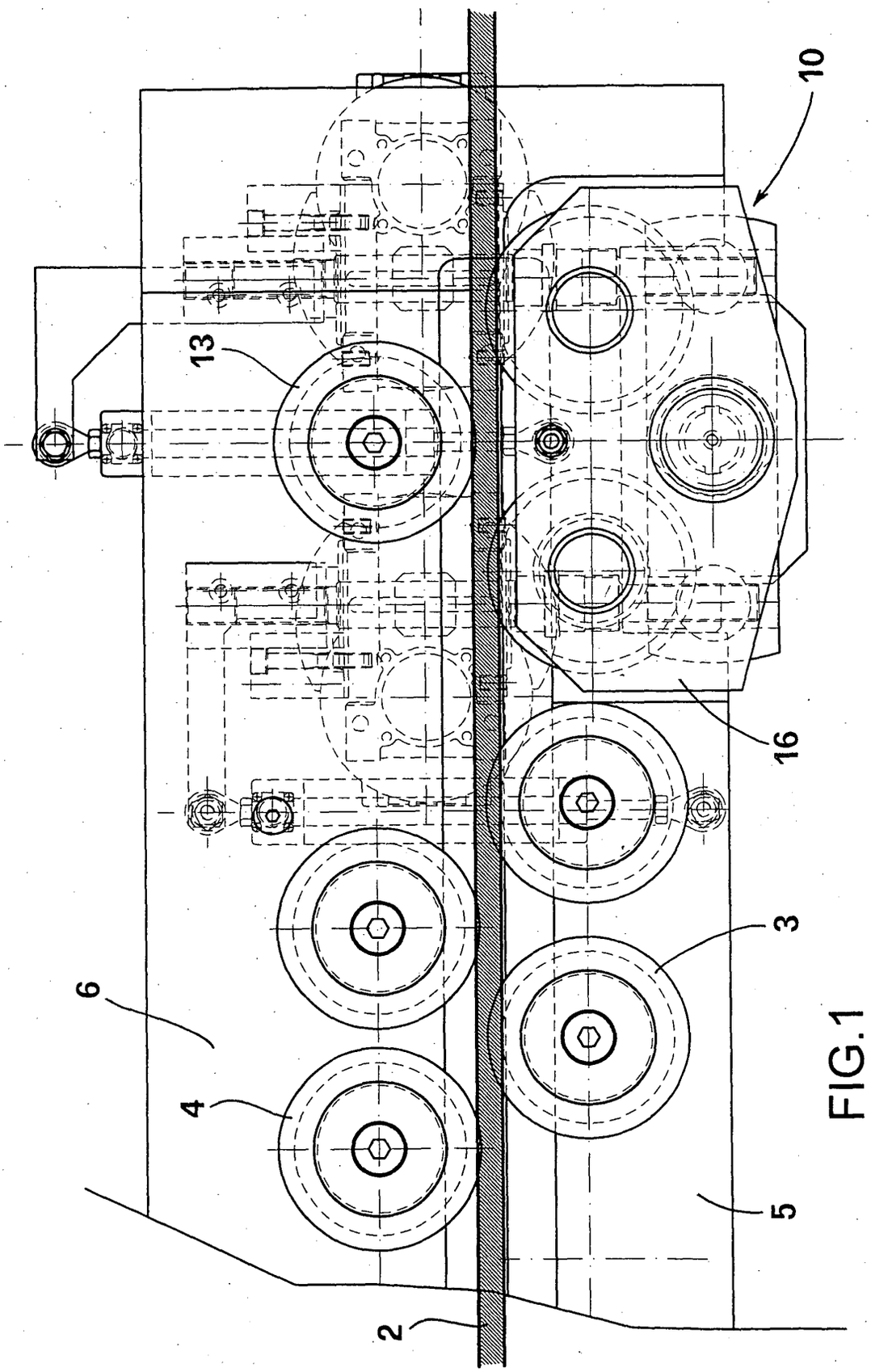

FIG.1

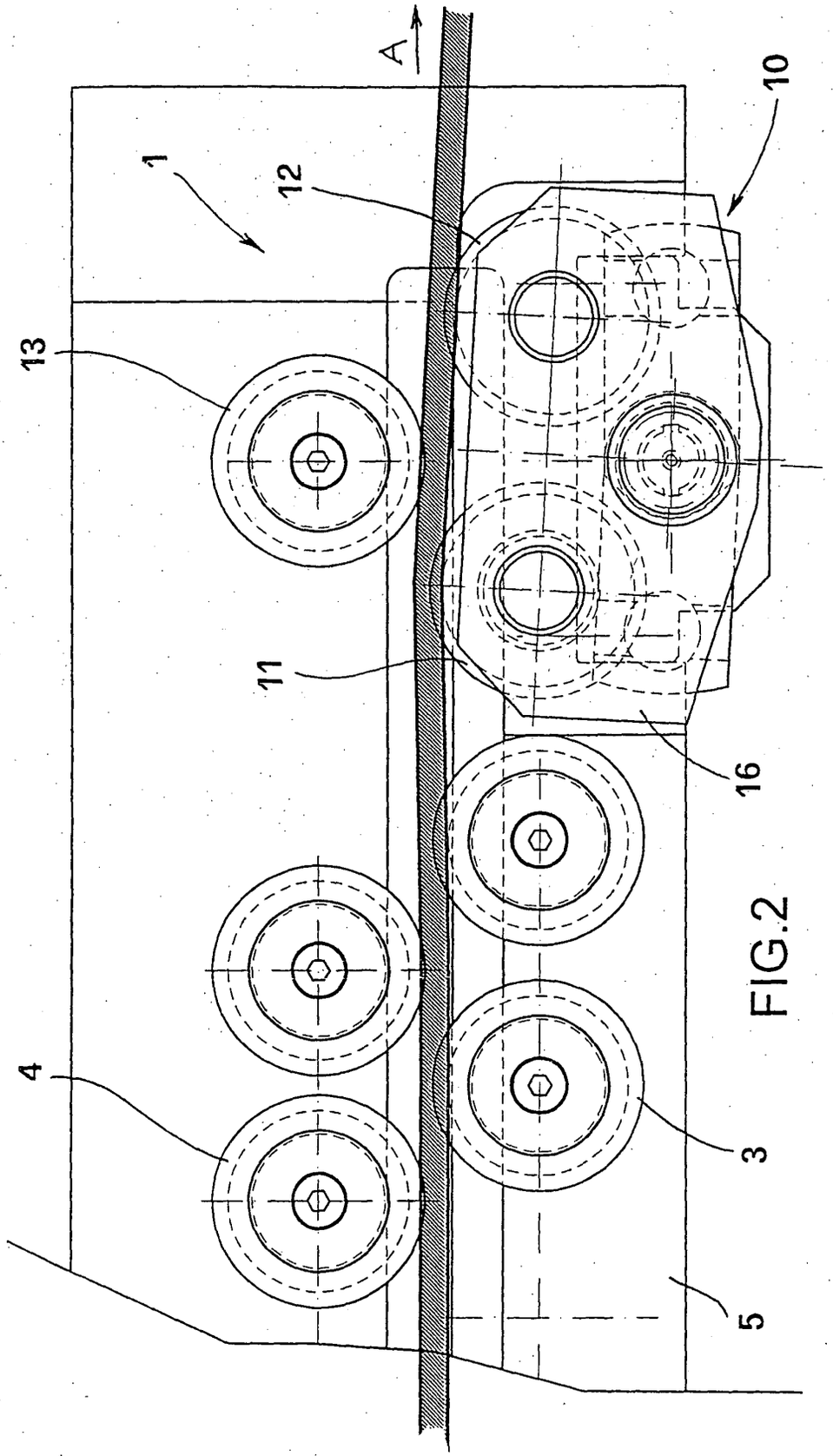

FIG.2

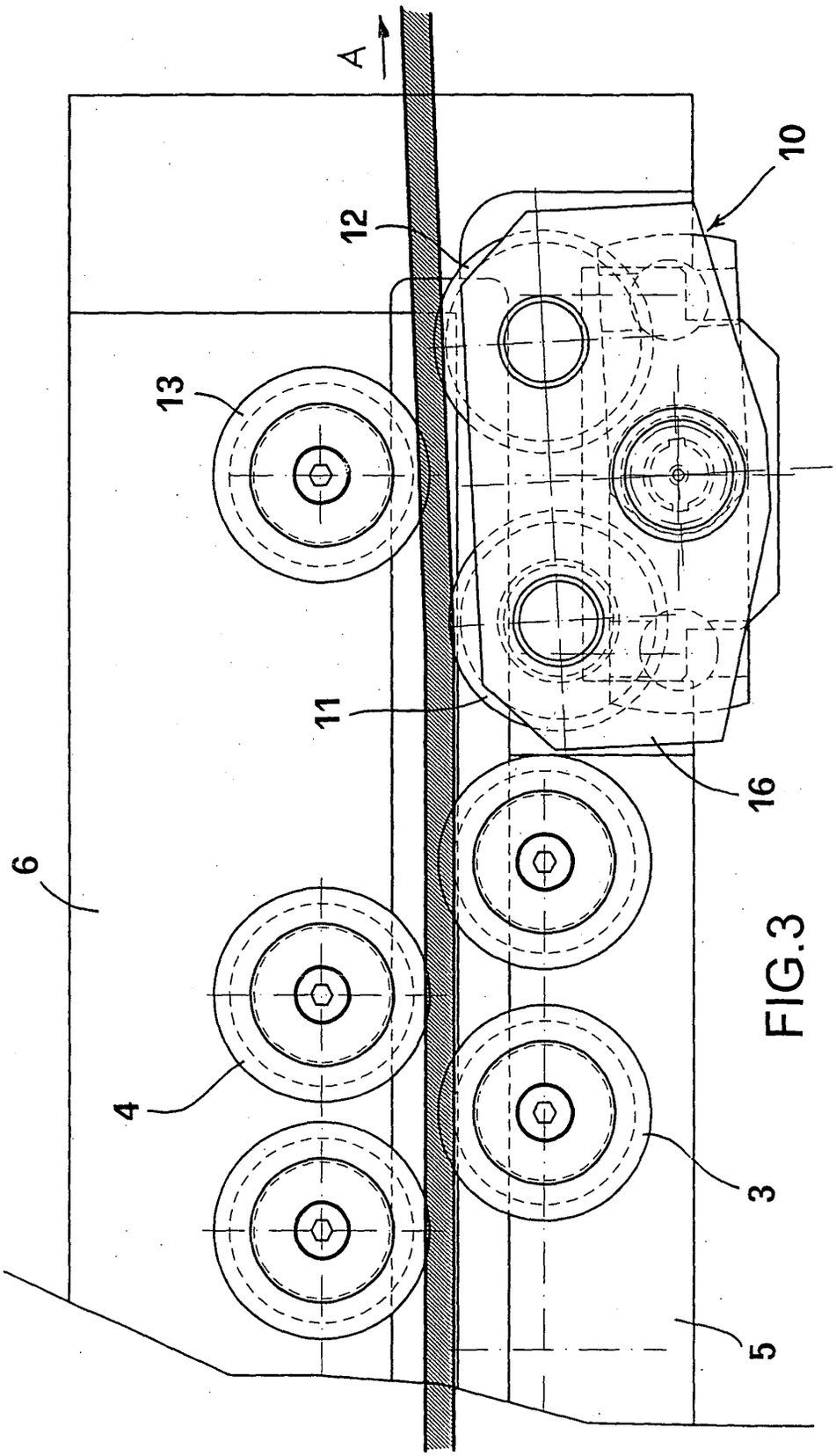

FIG.3

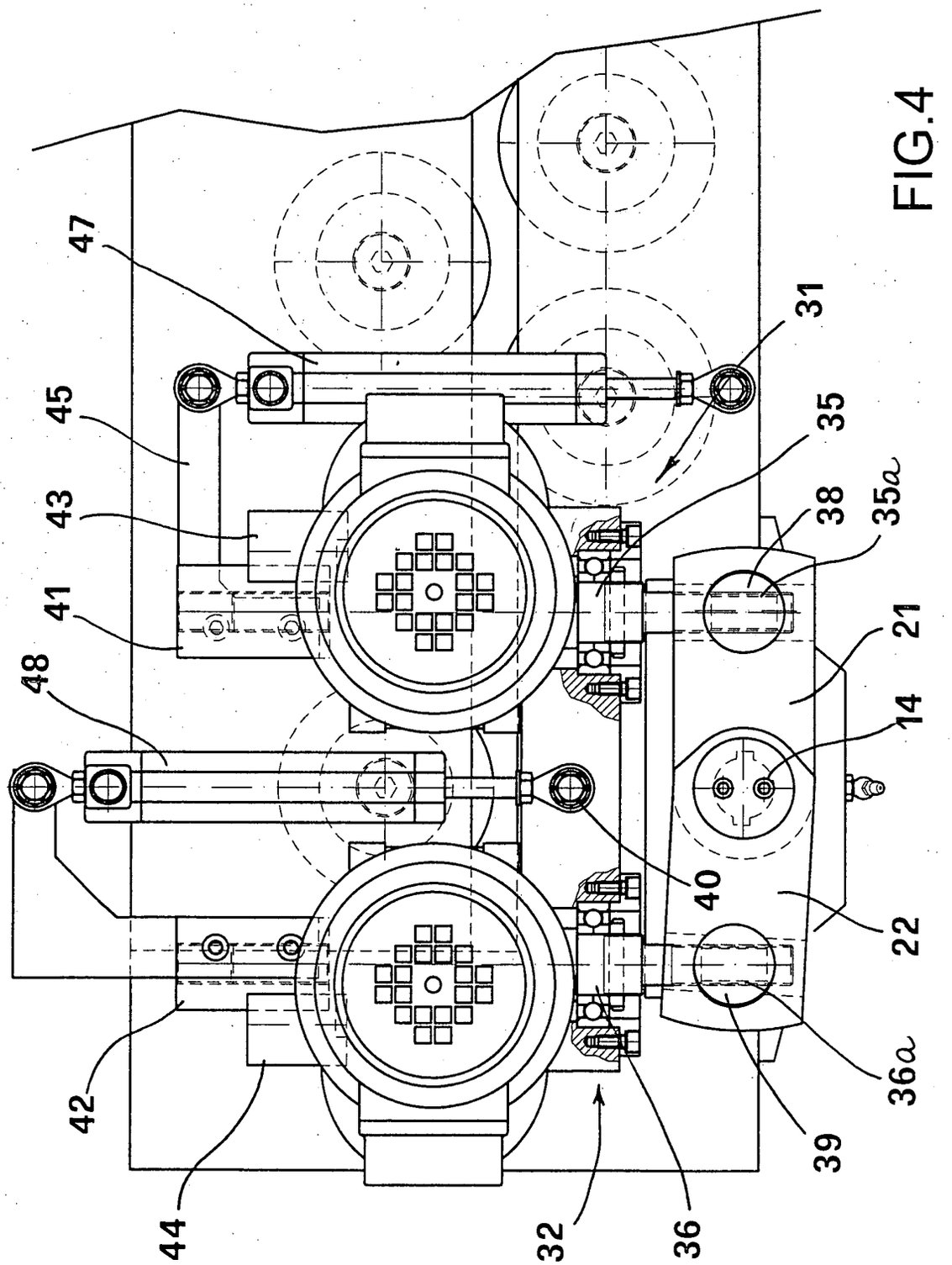

FIG.4

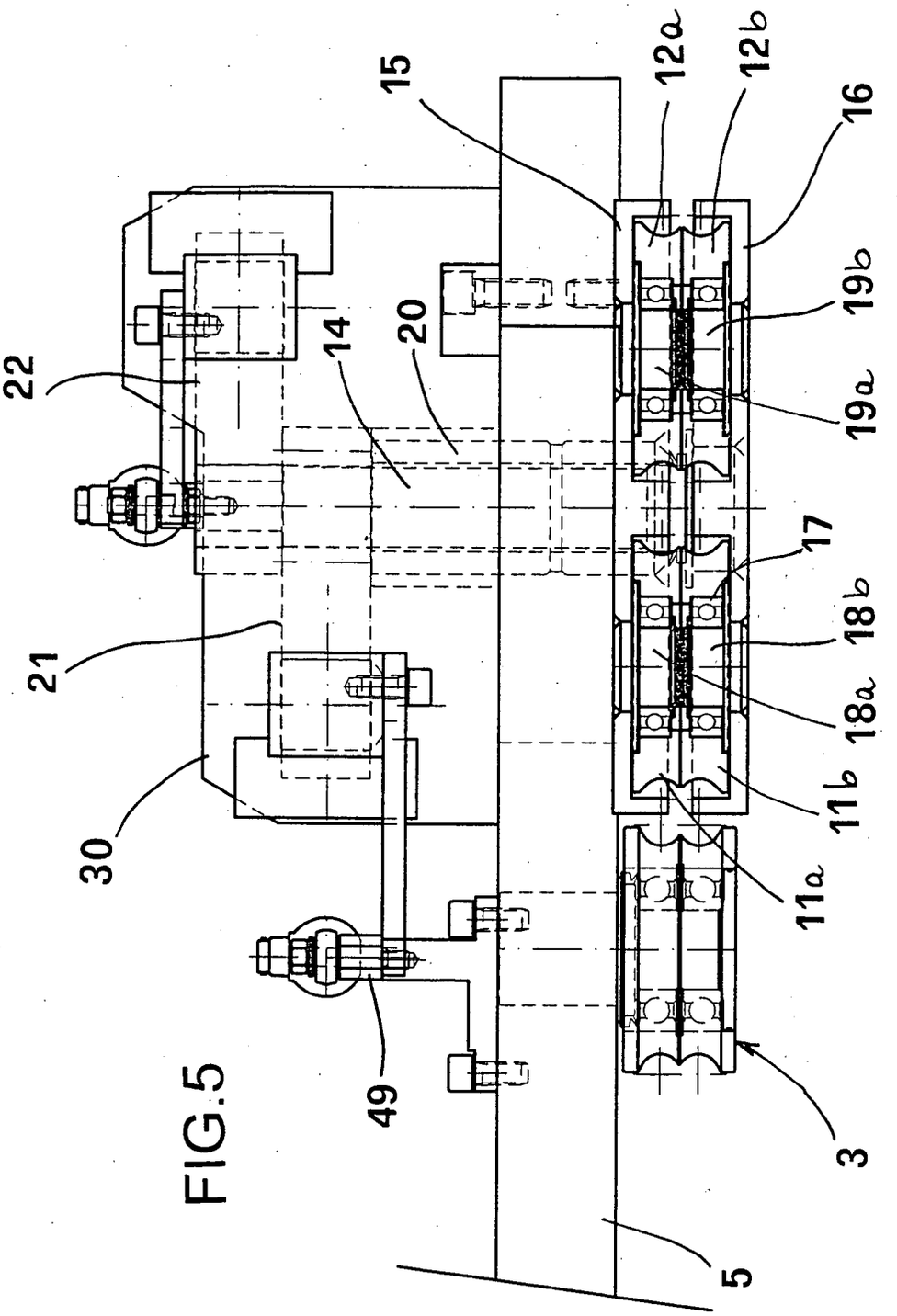

FIG.5

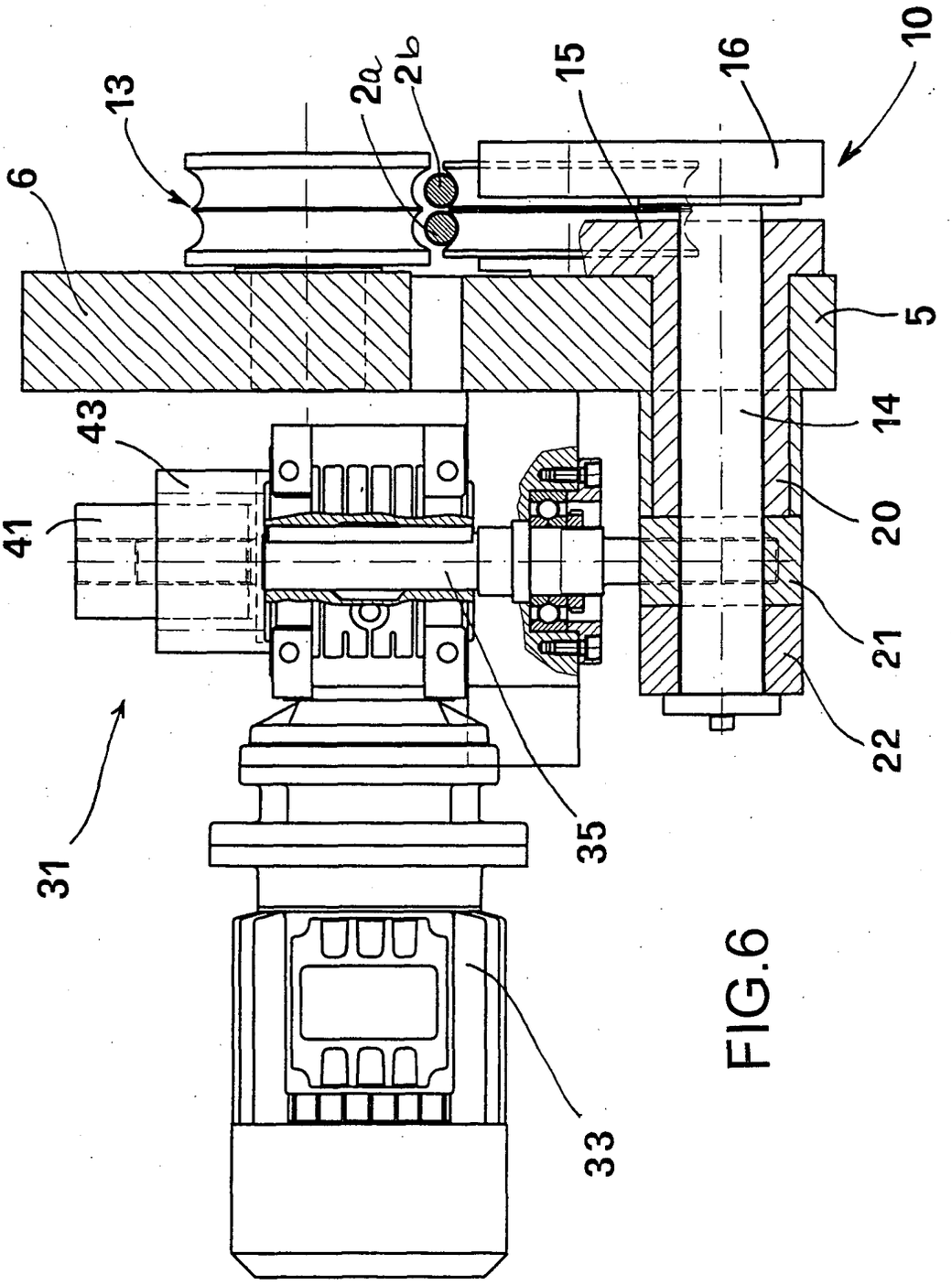

FIG.6

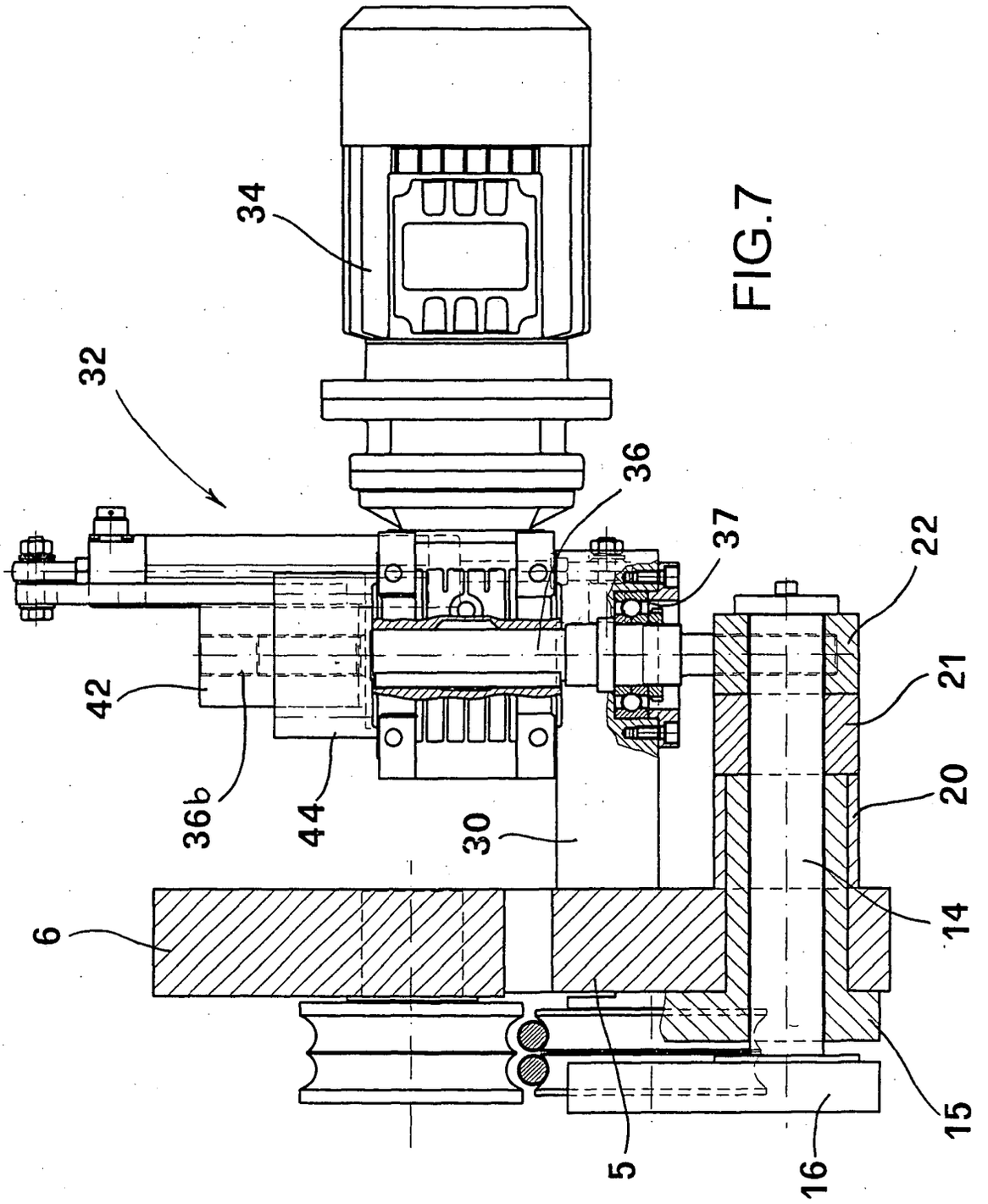

FIG.7

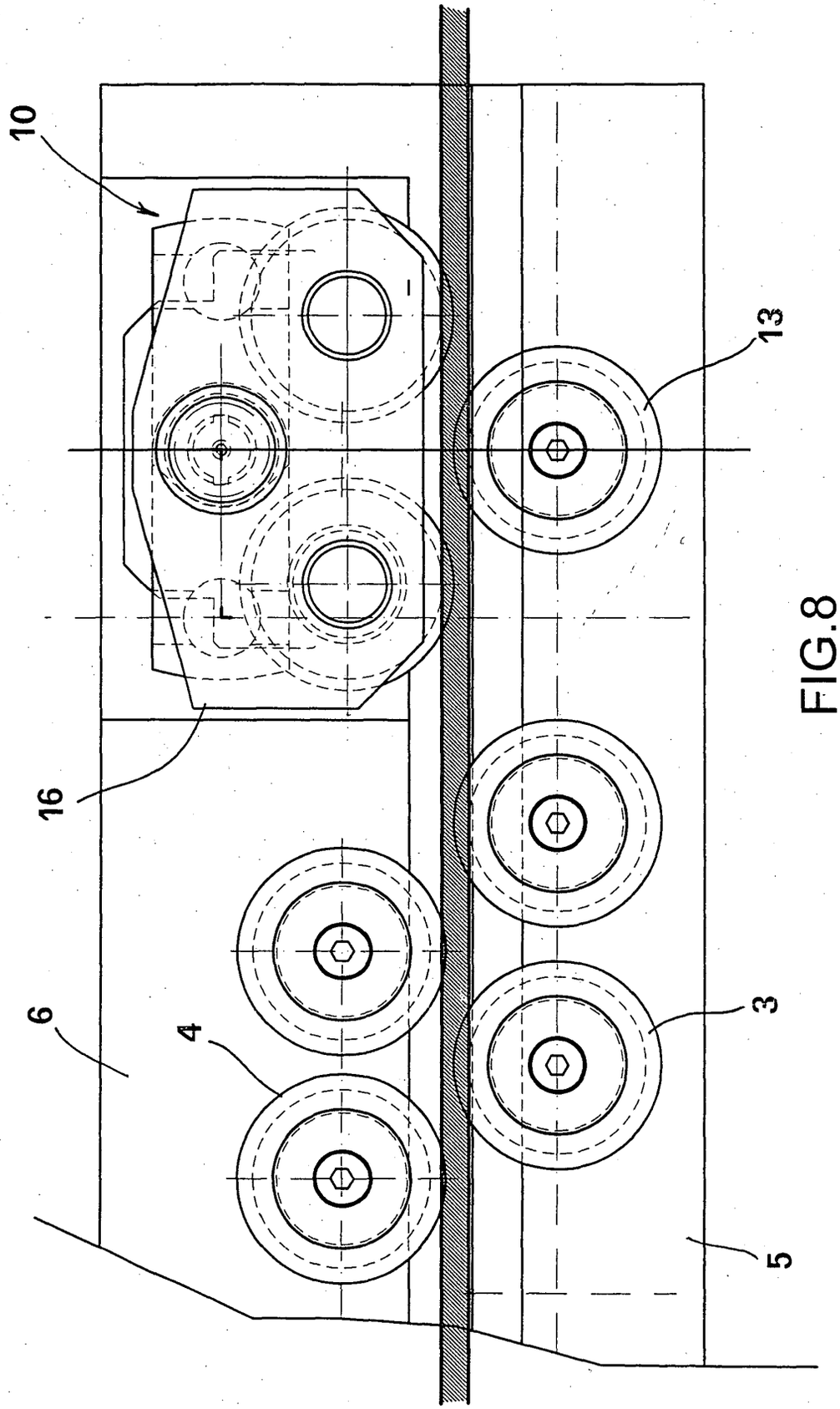

FIG.8

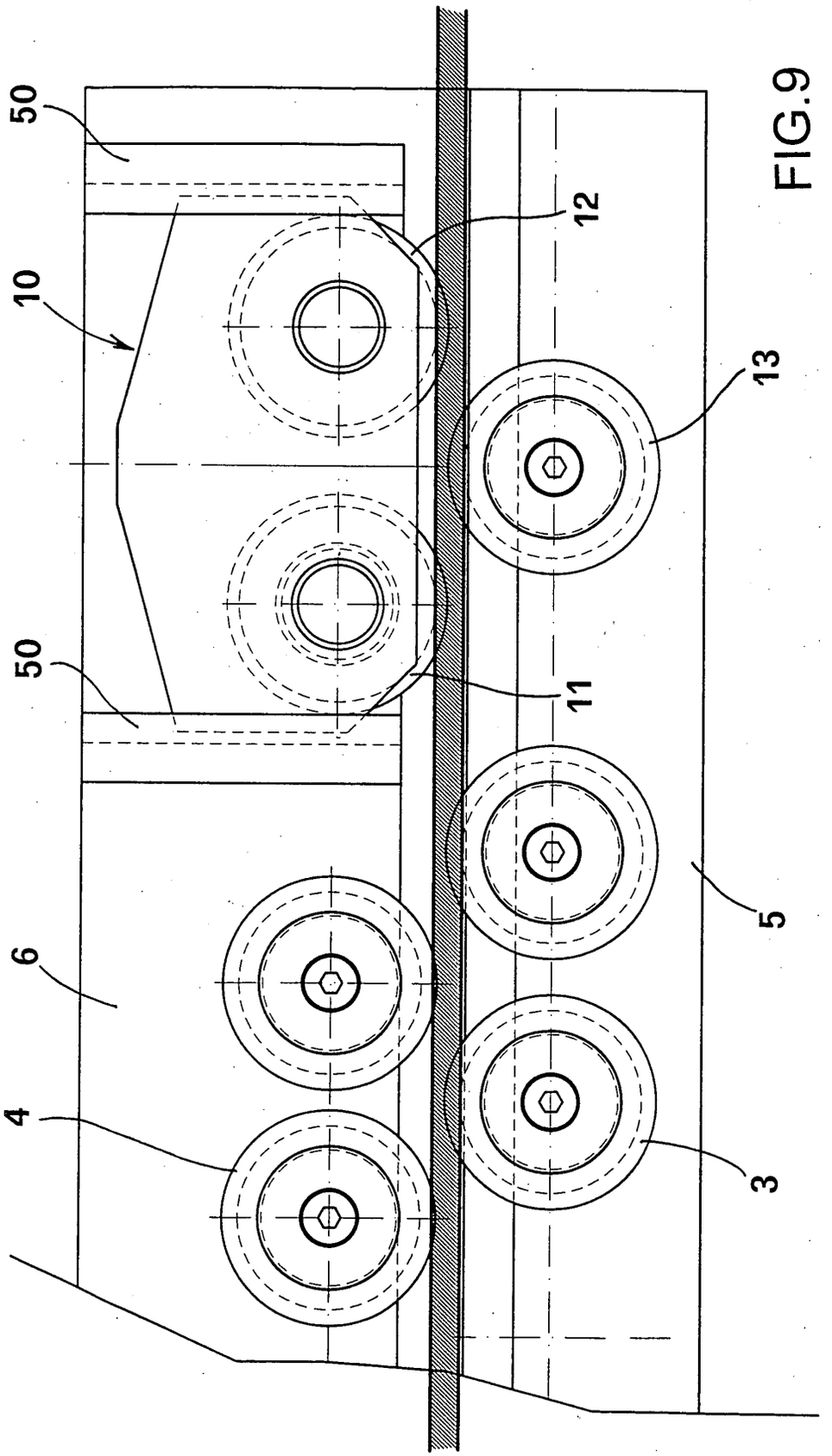

FIG.9

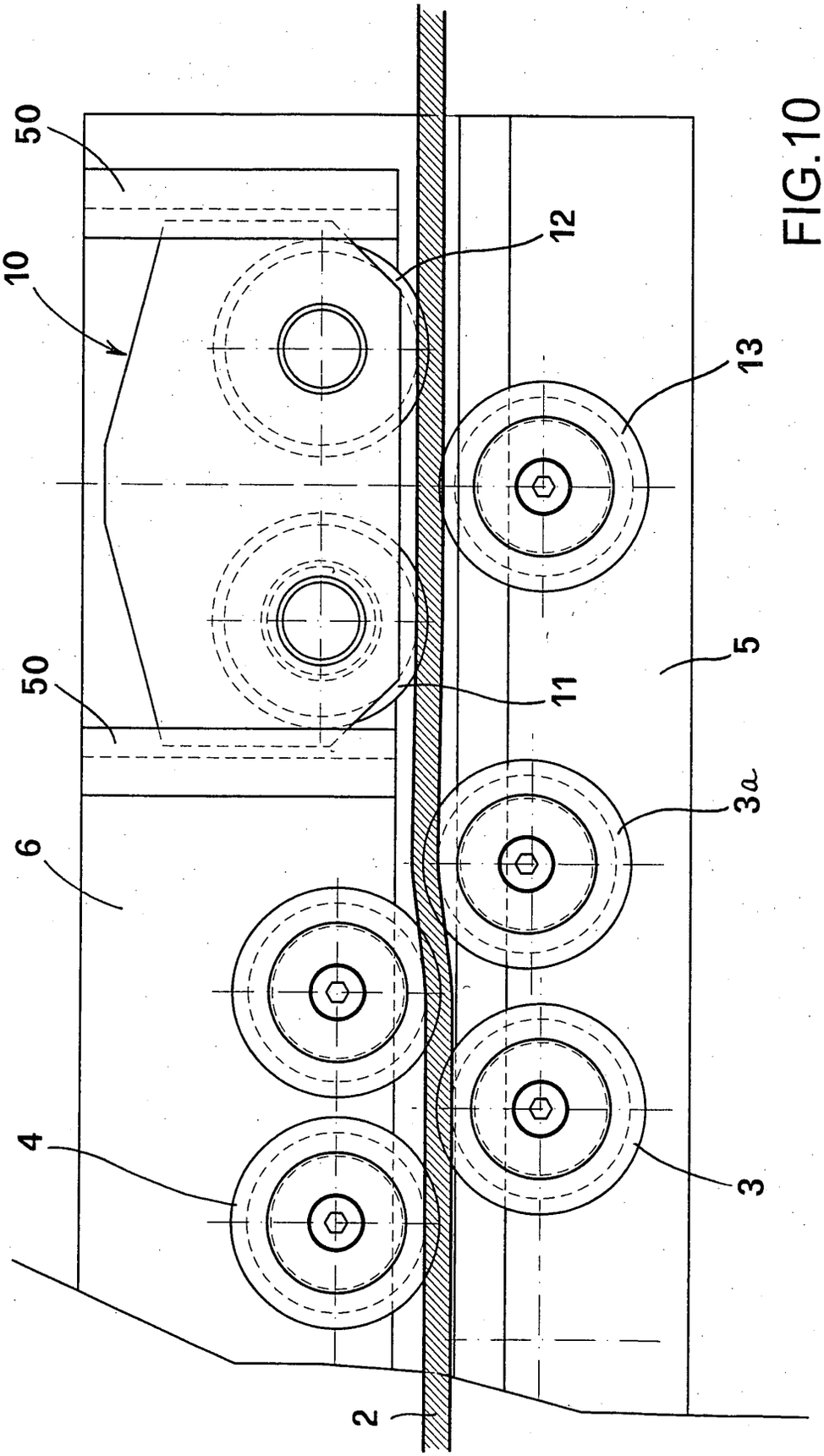

FIG.10