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

(11) EP 0 947 256 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
06.10.1999 Bulletin 1999/40

(51) Int. Cl.[6]: **B21D 3/05**, B21F 1/02

(21) Application number: **99105027.9**

(22) Date of filing: **22.03.1999**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **30.03.1998 IT BO980207**

(71) Applicant: **Schnell S.p.A.**
61032 Fano (Pesaro) (IT)

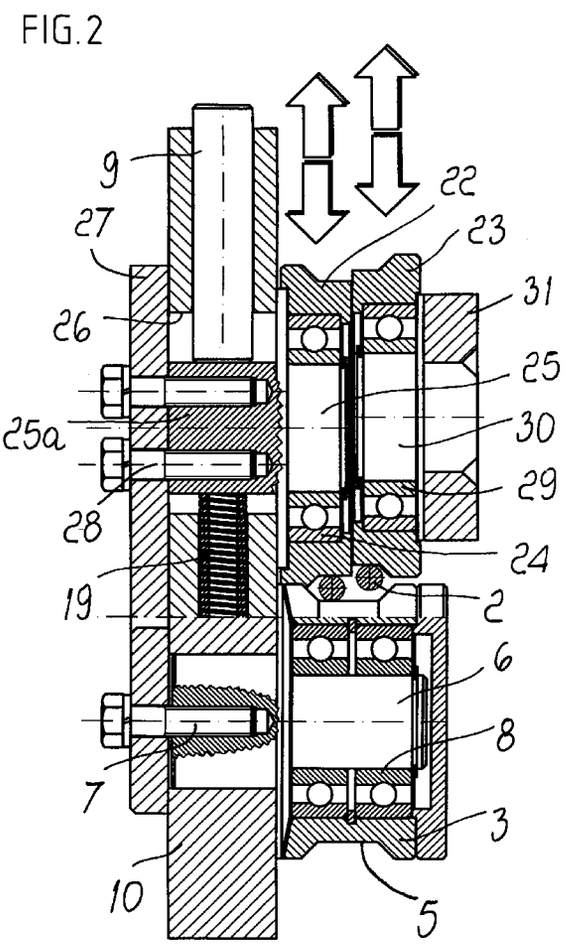
(72) Inventor: **Rupoli, Simone**
61032 Pesaro (IT)

(74) Representative:
Modiano, Guido, Dr.-Ing. et al
Modiano & Associati SpA
Via Meravigli, 16
20123 Milano (IT)

(54) Method and apparatus for straightening metal profiled elements and the like

(57) An apparatus for straightening metal profiled elements, particularly iron rods, comprising pairs of wheels (3,4) arranged in series, with parallel axes, on opposite sides with respect to a plane along which one or more side-by-side rods (2) to be straightened are fed. At an output region, the apparatus has a first split wheel (20) and a second split wheel (21), which are arranged in series and are adapted to cooperate with respective contrarotating wheels (3,4). Each one of the split wheels is constituted by at least a pair of wheels (22,23) arranged side by side which are adapted to be engaged respectively by the side-by-side rods (2) and are provided with an independent adjustment of the position of the axis in a direction which is perpendicular to the feed plane of the rods.

FIG.2



EP 0 947 256 A2

Description

[0001] The present invention relates to a method and an apparatus for straightening metal profiled elements and the like, particularly iron rods used to produce reinforced-concrete frames.

[0002] It is known, in the field being considered, to use coiled metallic material, particularly iron rods for reinforced concrete, which is continuously fed from a coil supported by a reel. The coiled material that unwinds from the reel passes through straightening elements which correct the curvature of the rod before said material reaches the cutting elements.

[0003] The straightening elements generally provide for one or more straightening units, each of which is provided with pairs of contrarotating wheels arranged in series with parallel axes and between which the rods to be straightened are passed. It is known, for example, to use a first straightening unit and a second straightening unit arranged in series and meant to correct a corresponding component of the curvature of the coiled material, particularly on perpendicular planes, essentially a horizontal one and a vertical one.

[0004] The contrarotating wheels gradually correct the curvature of the rods, as shown schematically in Figure 4, in which the numerals 3 and 4 designate the wheels which act on opposite sides with respect to the plane whereon the rods 2 being processed are fed.

[0005] The wheels that lie on a same side with respect to the rod feed plane usually have an axis which can be adjusted in a direction which lies at right angles to said rod feed plane, so as to allow the contrarotating wheels to move mutually closer or further apart depending on the diameter of the rods to be straightened and on the flexing to be applied.

[0006] Usually, the adjustment of each horizontal or vertical straightening unit is handled separately, visually checking the results of the straightening process. Generally speaking, the method consists in applying a greater flexing by means of the first wheels, moving the movable wheels closer to the fixed wheels, and gradually reducing said correction until the adjustment corresponds to an essentially straight condition.

[0007] From a theoretical point of view, an attempt is made to make the rod assume the profile of a sort of damped sinusoid which leads to an essentially straight situation in the final part.

[0008] In this way, in the first part of the straightening unit a slight relieving is applied to the material, allowing the straightening applied in the final part of the straightening unit to be permanent.

[0009] In practice, the two straightening units are adjusted separately in the same manner; the last two wheels of each straightening unit are used to perform the small corrections that become necessary after inspecting the result. In order to do this, the simple logic of leveling is applied, as shown in Figures 5 and 6, which consider only the last three wheels of the straightening unit, i.e., the two movable wheels 4a and 4b and the underlying fixed wheel 3.

[0010] More particularly, when a bar which curves upward is obtained (Figure 5), the operator performs the correction by lowering the wheel 4b until the intended result is achieved.

[0011] When a bar which curves downward is obtained (Figure 6), the operator performs the correction by lowering the wheel 4a until the intended result is achieved.

[0012] Twin straightening elements are also known which allow to simultaneously straighten two rods fed side by side. The above-described correction step becomes more complicated for these straightening units.

[0013] At the output of the straightening unit, the two rods in fact probably have a different degree of residual curvature, as shown in Figure 7, in which the numerals 2a and 2b designate the two side-by-side rods for the sake of greater clarity. In order to correct the curvature of the side-by-side rods, the twin straightening elements have, at the output, a split wheel which is substantially constituted by two side-by-side wheels 40a and 40b which are adapted to act individually on a corresponding rod 2a and 2b. The correction of the residual curvature of the rods 2a, 2b is actuated by the operator by adjusting the axial position of said wheels 40a and 40b independently of each other.

[0014] However, when one of the rods to be straightened has a residual curvature whose center of curvature is on the opposite side with respect to the wheels 4a and 4b relative to said rod feed plane, or one of the rods is straight as shown in Figure 8, the correction can be achieved only by acting in combination on said split wheel 40a and 40b and on the wheel 4 arranged ahead of it. This correction in fact entails acting first on the upstream wheel 4, in order to return the rod 2b to the correct position; since the wheel 4 is a single wheel, said correction however entails an unwanted displacement of the other rod 2a, which was initially straight and must in turn be corrected subsequently by acting on the corresponding split wheel 40a.

[0015] This operation is obviously complicated and not very intuitive and requires time as well as experience, consequently entailing a significant increase in production times.

[0016] The aim of the present invention is to solve the above problem, providing an apparatus of the twin type which allows to correct the residual curvature of the side-by-side rods simply and rapidly.

[0017] Within the scope of this aim, an object of the present invention is to provide a rod straightening apparatus which is simple in concept, safely reliable in operation and versatile in use.

[0018] This aim, this object and others are achieved, according to the invention, by the present apparatus for straightening iron rods and the like, of the type comprising pairs of wheels arranged in series, with parallel

axes, on opposite sides with respect to a plane along which two side-by-side rods to be straightened are fed, characterized in that it comprises, at a region where said rods exit therefrom, a first split wheel and a second split wheel, said wheels being arranged in series and being suitable to cooperate with respective contrarotating wheels, each one of said split wheels being constituted at least by a pair of wheels arranged side by side which are adapted to be engaged respectively by said side-by-side rods and are provided with an independent adjustment of the position of the axis in a direction which is perpendicular to said feed plane of said rods.

[0019] The details of the invention will become apparent from the following detailed description of a preferred embodiment of the apparatus for straightening iron rods, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a side view of the apparatus for straightening iron rods according to the invention;
Figures 2 and 3 are respective transverse sectional views of said apparatus, taken along the planes II-II and III-III of Figure 1;
Figure 4 is a schematic side view of the straightening of the iron rods performed by said contrarotating wheels;
Figures 5 and 6 are schematic side views of the correction of the residual curvature of an iron rod with conventional types of device;
Figures 7 and 8 are similar schematic side views of the correction of the residual curvature of a pair of iron rods with conventional devices.

[0020] With particular reference to the above figures, the reference numeral 1 generally designates the apparatus for straightening the iron rods 2, for example of the type of rods used to manufacture frames for reinforced-concrete components.

[0021] The apparatus 1 has, in a substantially known manner, pairs of contrarotating free wheels 3 and 4 between which the rods 2 to be straightened are passed in a longitudinal feed direction A. The wheels 3 and 4 have parallel axes and are staggered along the line formed by the feed direction A.

[0022] The wheels 3 and 4 are usually provided peripherally with a groove 5 which engages the rods 2 to be straightened; in particular, the width of the groove 5 allows it to receive two rods 2 arranged side by side to be straightened simultaneously (see Figure 2).

[0023] The first wheels 3, which lie on a same side with respect to the feed plane of the rods 2, in the direction A, have a fixed axis with respect to a plate 10 which constitutes the fixed structure of the apparatus. Said axis is formed by a corresponding pivot 6 which is rigidly coupled to the plate 10 by means of a screw element 7 and which rotatably supports the wheel by means of a rolling element 8.

[0024] The second wheels 4, arranged on the opposite side with respect to said feed plane of the rods 2, instead have an axis which can be adjusted at right angles to said feed plane of the rods 2, so as to allow the mutual approach or spacing of said wheels 3, 4.

[0025] This adjustment is provided in a known manner, for example by means of an element 11 provided with a cylinder 12 which is arranged so that its axis is parallel to the feed direction A (Figure 1). The cylinder 12 is rotatably supported, at end tangs 13, by two supports 14 which are fixed to the plate 10. The tangs 13 of the cylinder 12 are locked in the intended working position by means of screw elements 15 which are associated with the supports 14 and are contrasted by corresponding elastic elements 16 arranged in corresponding seats formed in said supports 14.

[0026] The cylinder 12 supports a plurality of adjustment screws 17 which are angularly distributed in radial directions; said screws have a rounded head and are locked in the intended position by means of corresponding nuts 18. The adjustment screws 17 are adapted to act axially on respective stems 9 which are mounted so that they can slide along their own axis in corresponding holes formed in the plate 10 and are adapted to act on the pivot of the adjustable wheels 4 in contrast with respective elastic elements.

[0027] In practice, by producing the angular rotation of the cylinder 12 into the intended adjustment position, it is possible to place one row of adjustment screws 17 or the other, adjusted to different extensions in a diametrical direction with respect to said cylinder 12, into abutment against the stems 9, so as to vary the axial position of said stems 9 and accordingly the position of each one of the adjustable wheels 4. In this manner, the cylinder 12 constitutes a sort of "mechanical memory" which is adapted to store the adjustments determined for each rod diameter.

[0028] At an output region 1a of the apparatus there is a first split wheel 20 and a second split wheel 21 which are arranged in series with respect to the adjustable wheels 4 and are adapted to cooperate with respective contrarotating wheels 3 which are staggered on the opposite side with respect to said feed plane of the rods 2.

[0029] Each one of the split wheels 20 and 21 is constituted by two wheels 22 and 23 arranged side by side, which are adapted to be respectively engaged by the rods 2 arranged side by side and are provided with independent adjustment of the position of the axis, in a direction which is perpendicular to said feed plane of the rods 2 (Figure 2).

[0030] The side-by-side wheels 22 and 23 have a width which essentially corresponds to half of the wheels 3 and 4 and form in particular one half of the groove 5 of said wheels, in order to receive respective rods 2.

[0031] More specifically, the split wheels 20 and 21 have an internal wheel 22, which is adjacent to the plate 10, and a wheel 23, which is external to the preceding

one. The internal wheel 22 is supported so that it can rotate, by means of a rolling element 24, by a pivot 25 in which the position of the axis is adjustable, at a slot 26 formed in the plate 10, in which a head 25a of the pivot 25 is slidingly guided; the pivot 25 is retained by a plate 27 which is locked by screw elements 28 on the head 25a (Figure 2).

[0032] A corresponding stem 9 is adapted to act, in said direction at right angles to the feed plane of the rods 2, on the head 25a of the pivot 25; said stem is actuated, in contrast with an elastic element 19, by a corresponding adjustment screw 17 of the element 11, as described above for the wheels 4.

[0033] The outer wheel 23 is in turn rotatably supported, by means of a rolling element 29, by a pivot 30 which is supported by an arm 31 whose axial position can be adjusted at a slot 32 formed on the plate 10 in which a head 31a of the arm 31 is slidingly guided; the arm 31 is retained by a plate 33 which is locked by screw elements 34 (Figure 3).

[0034] A corresponding stem 9 is adapted to act on the head 31a of the arm 31 in said direction at right angles to the feed plane of the rods 2, and is actuated, in contrast with an elastic element 19, by a corresponding adjustment screw 17 of the element 11, as already described.

[0035] The operation of the apparatus is easily understandable from the above description.

[0036] The rods 2 to be straightened are fed, in the direction A, between the contrarotating wheels 3 and 4, which perform a gradual correction of the curvature of said rods 2.

[0037] If residual curvature of the rods 2 occurs at the output of the apparatus, the operator performs the corresponding correction by acting independently on the two wheels 22 and 23 of each split wheel 20, 21 arranged in series in the output region 1a of the apparatus.

[0038] In particular, the first split wheel 20 allows to correct the residual curvature of the rods 2 if it is an upward curvature, i.e., if its center of curvature is on the opposite side with respect to the wheels 4, 20 and 21 relative to the feed plane of said rods 2, as shown in Figure 8.

[0039] The second split wheel 21 instead allows to perform the correction if the residual curvature of the rods 2 has its center of curvature on the same side as the wheels 4, 20 and 21 with respect to the feed plane of the rods, as shown above in Figure 7.

[0040] The two wheels 22 and 23 of course allow to act independently on the two side-by-side rods 2.

[0041] The above-described straightening apparatus accordingly achieves the aim of simply and rapidly correcting the residual curvature of the side-by-side rods in twin machines. This correction can in fact be performed by the operator with a single adjustment manoeuvre, acting independently on the split wheels 20 and 21 depending on the residual curvature to be corrected.

[0042] This correction is also performed and stored by acting simply on the corresponding adjustment screws 17 associated with the pivots 25, 30 of said split wheels 20 and 21, as usually occurs for the adjustable wheels 4 of the apparatus.

[0043] It is of course possible to provide, for the adjustment of the split wheels 20 and 21 (and optionally of the adjustable wheels 4), actuators which act on the respective stems 9 instead of the adjustment screws 17.

[0044] The apparatus might of course straighten even more than two side-by-side rods. In this case, the final wheels 20, 21 for correcting the residual curvature of the rods are divided into as many parts as there are rods being processed.

[0045] In the practical execution of the invention, the materials employed, as well as the shapes and the dimensions, may be any according to requirements.

[0046] The disclosures in Italian Patent Application No. BO98A000207 from which this application claims priority are incorporated herein by reference.

[0047] 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 method for straightening iron rods and the like, characterized in that it comprises the steps of: feeding one or more rods arranged side by side between pairs of controrotating wheels arranged in series, with parallel axes, on opposite sides with respect to a plane along which said rods being processed are fed; engaging said rods, at an output region, with a first split wheel and a second split wheel, each one of said split wheels being constituted by a pair of wheels arranged side by side which are adapted to be engaged respectively by said side-by-side rods; and independently adjusting the position of the axis of said pair of side-by-side wheels of each one of said split wheels, in a direction which is perpendicular to said feed plane of said rods.

2. An apparatus for straightening iron rods and the like, of the type comprising pairs of wheels arranged in series, with parallel axes, on opposite sides with respect to a plane along which one or more side-by-side rods to be straightened are fed, characterized in that it comprises, at an output region, a first split wheel and a second split wheel, said wheels being arranged in series and being adapted to cooperate with respective contrarotating wheels, each one of said split wheels being constituted by at least a pair of wheels arranged side by

side which are adapted to be engaged respectively by said side-by-side rods and are provided with an independent adjustment of the position of the axis in a direction which is perpendicular to said feed plane of said rods.

3. The apparatus according to claim 2, characterized in that said split wheels have an internal wheel, arranged adjacent to a fixed structure, and an external wheel, said internal wheel and said external wheel being supported so that they can rotate, by means of rolling elements, by a corresponding pivot which has an adjustable axial position.

4. The apparatus according to claim 3, characterized in that said internal wheel is rotatably supported by said corresponding pivot, the position of the axis of which can be adjusted at a slot formed in said fixed structure, in which a head of said pivot is slidingly guided, a corresponding stem being adapted to act on said head of the pivot in said direction that lies at right angles to the feed plane of said rods, said stem being actuated in contrast with elastic means by a corresponding adjustment screw.

5. The apparatus according to claim 3, characterized in that said external wheel is rotatably supported by said corresponding pivot, which is rigidly coupled to an arm in which the position of the axis can be adjusted at a slot formed in said fixed structure, in which a head of said arm is slidingly guided, a corresponding stem being adapted to act on said head of the arm in said direction that lies at right angles to the feed plane of said rods, said stem being actuated in contrast with elastic means by a corresponding adjustment screw.

6. The apparatus according to claim 2, characterized in that said first and second split wheels respectively comprise multiple wheels constituted by a plurality of wheels arranged side by side which are suitable to be respectively engaged by said side-by-side rods and are provided with independent adjustment of the position of their axis in a direction which is perpendicular to said feed plane of said rods.

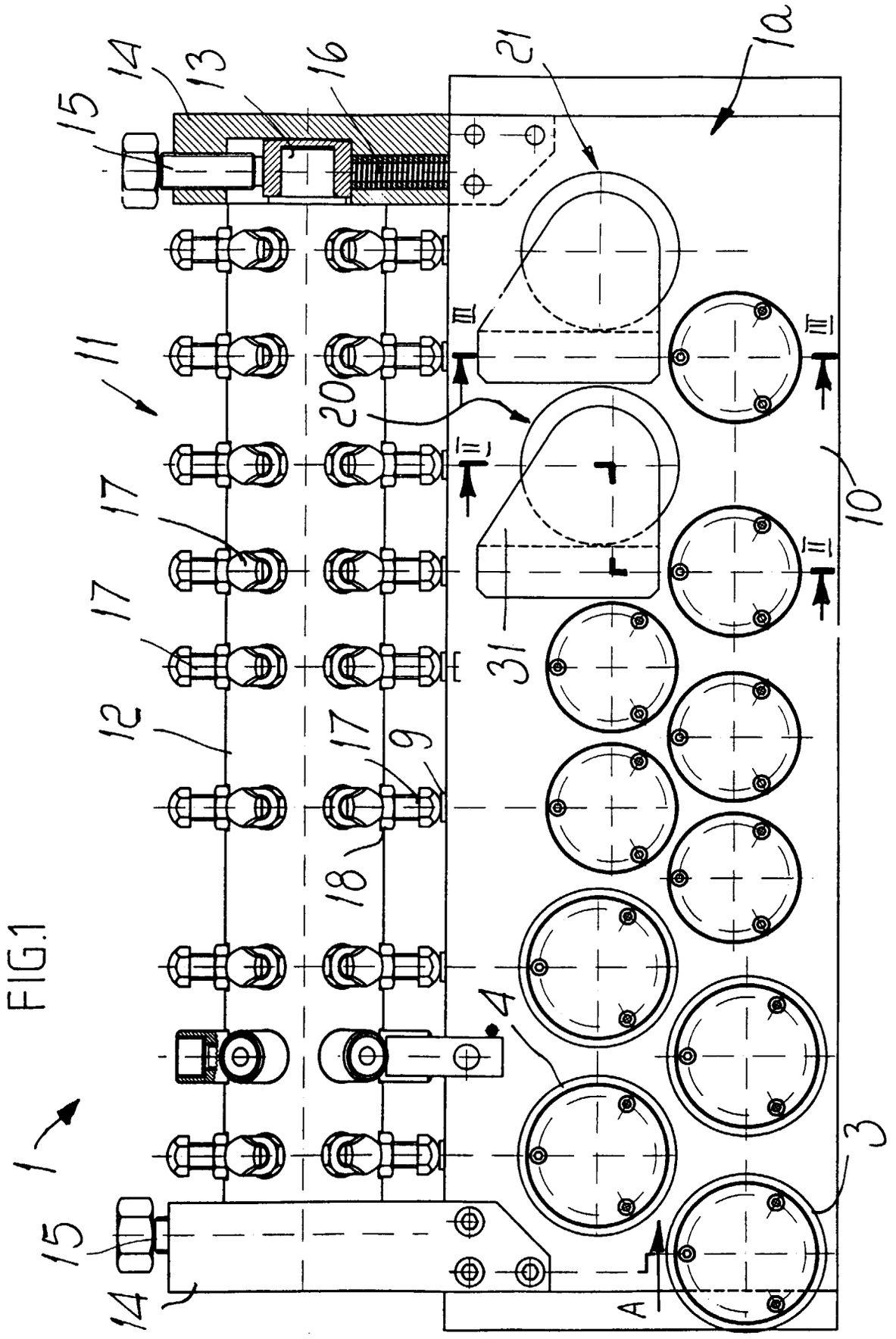


FIG.1

FIG. 2

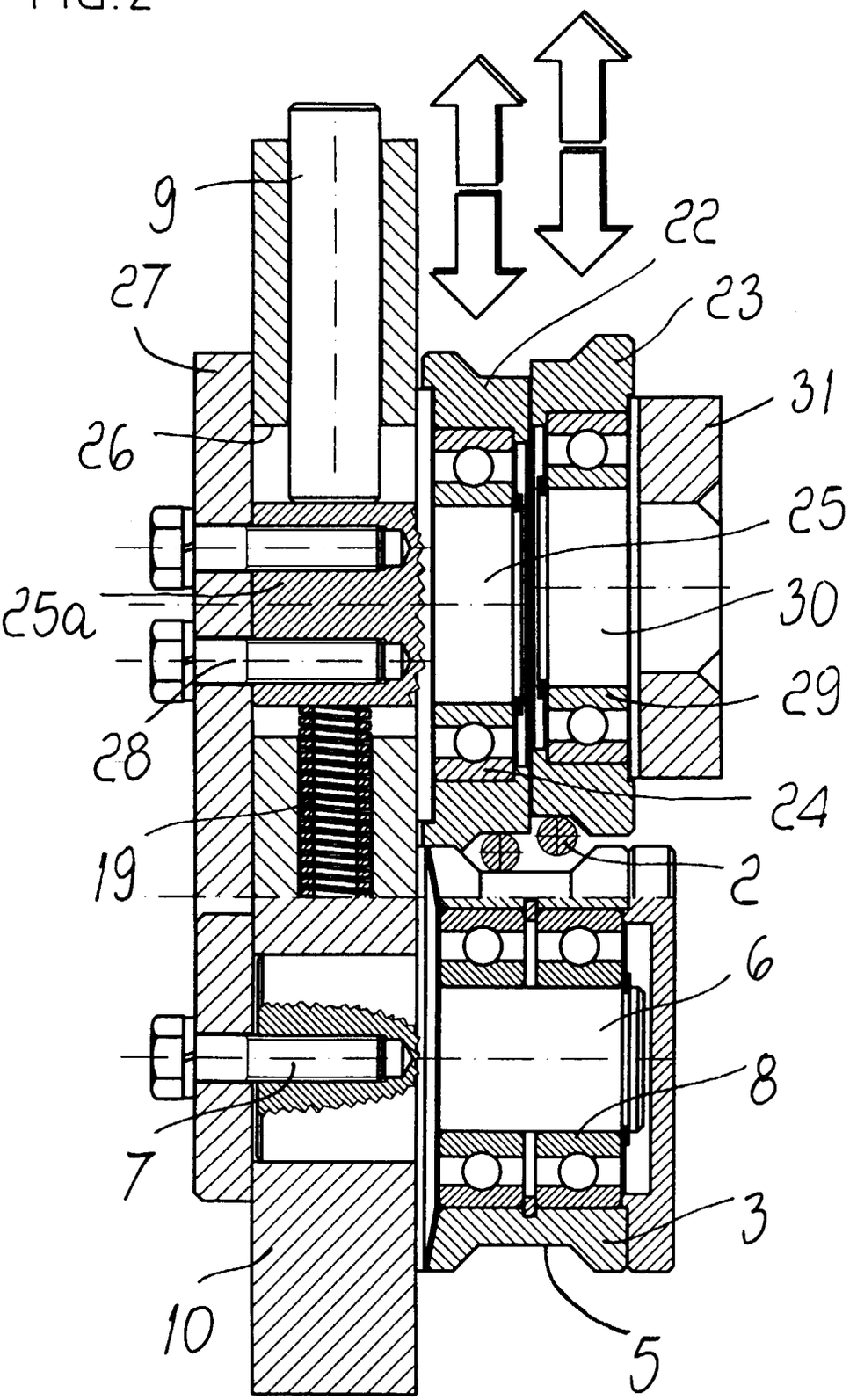
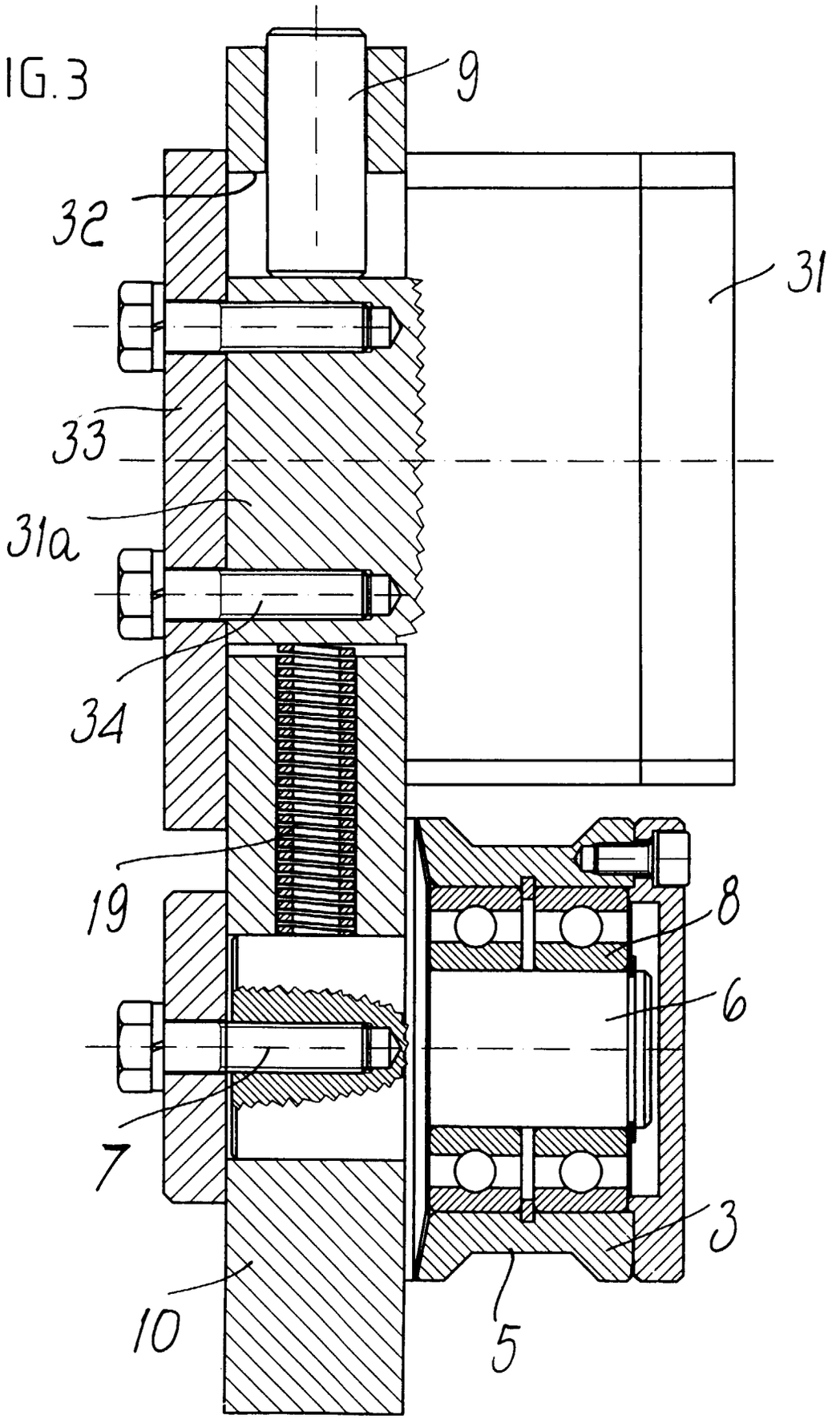


FIG.3



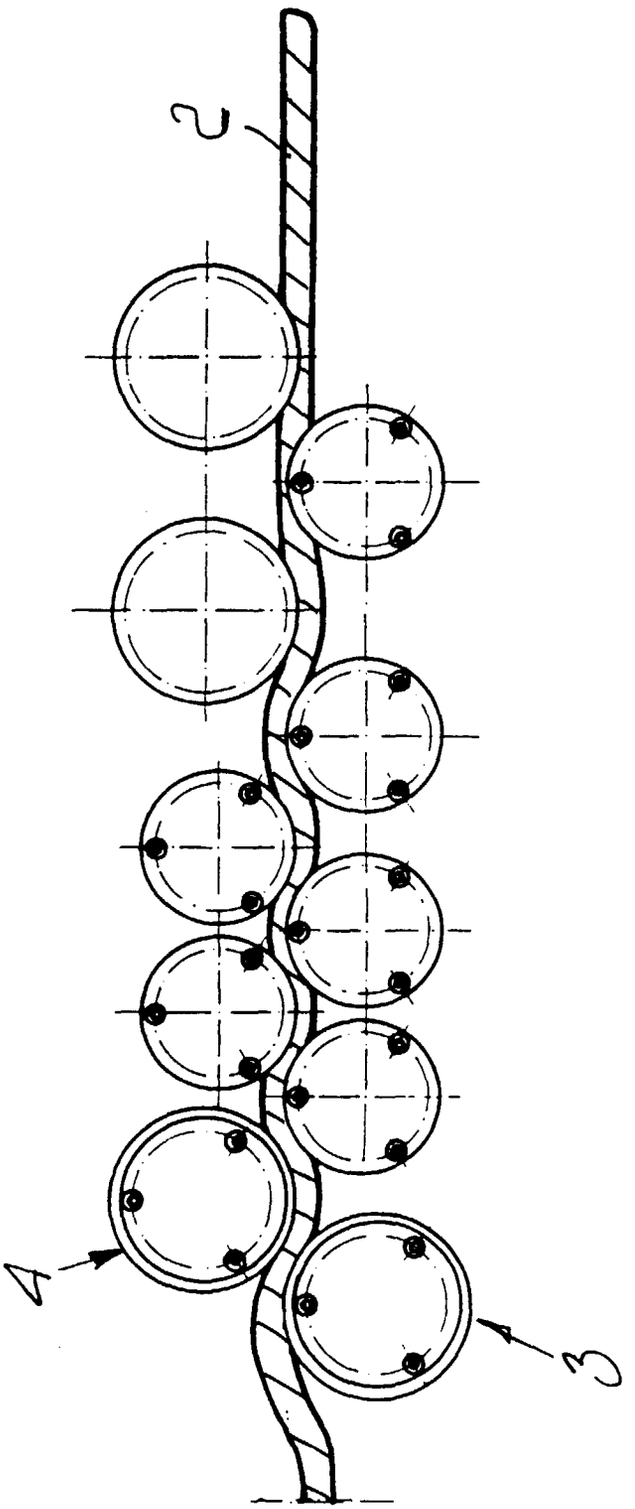
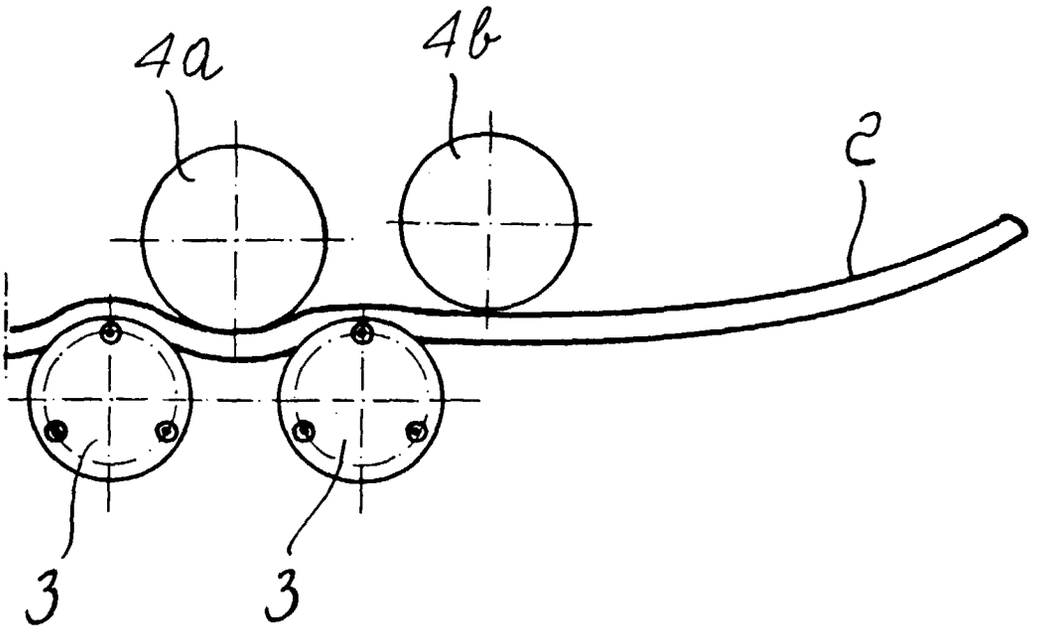


FIG.4

FIG.5



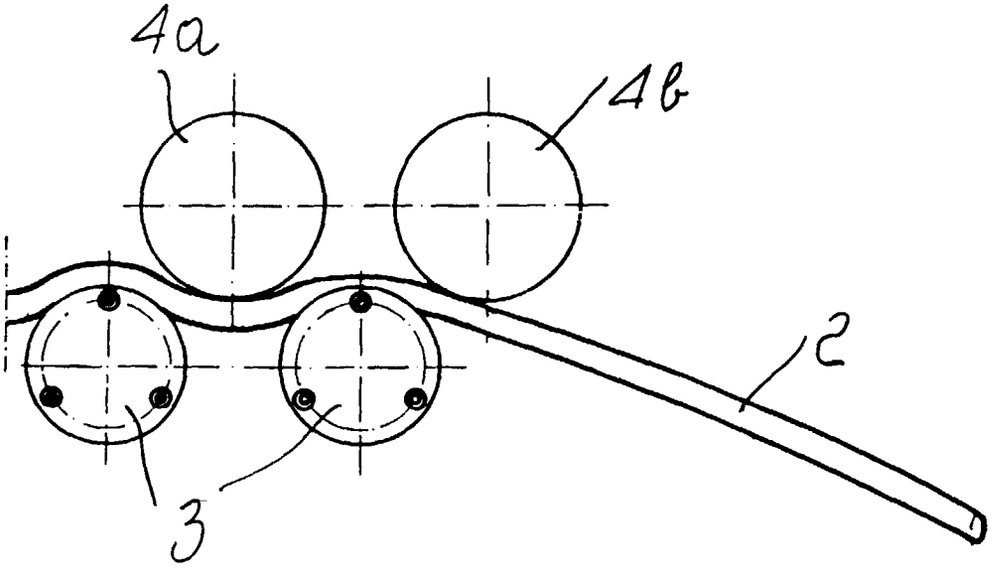
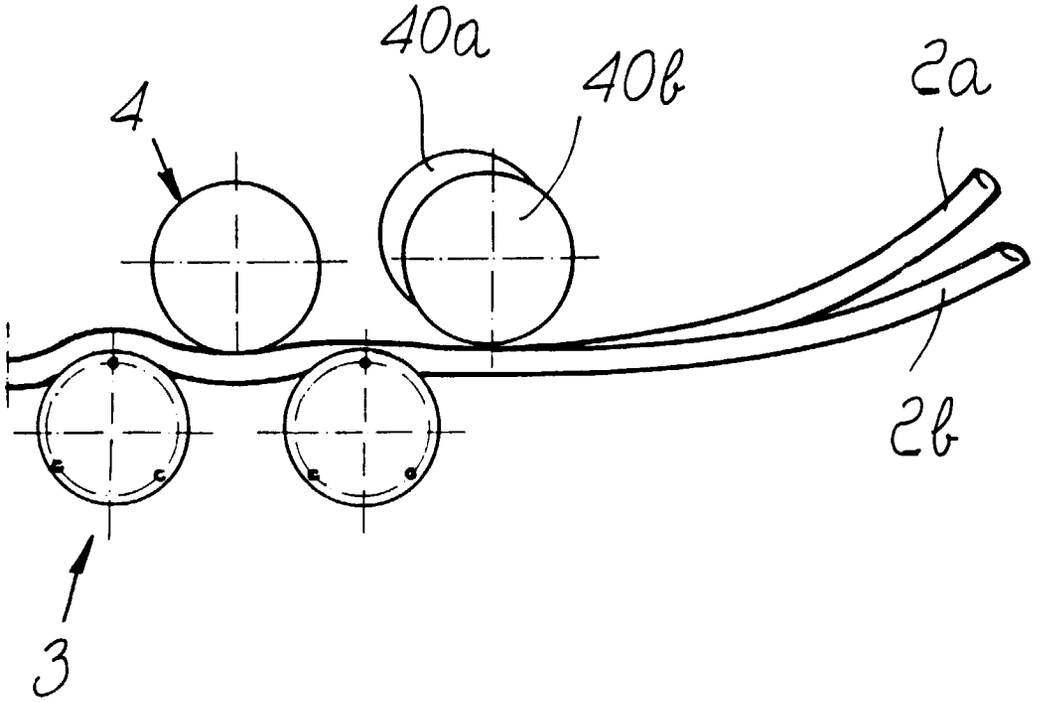


FIG.6

FIG.7



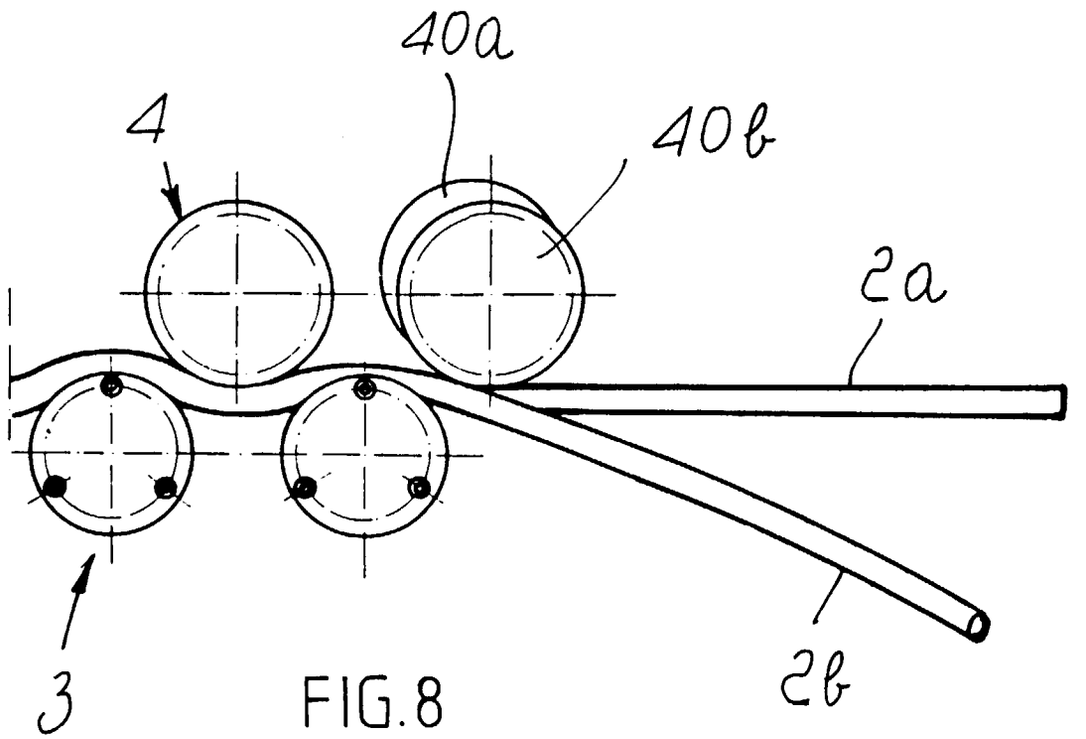


FIG.8