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

(11) EP 0 804 978 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
02.10.2002 Bulletin 2002/40

(51) Int Cl.[7]: **B21F 3/04**, B21F 35/00

(21) Application number: **97830199.2**

(22) Date of filing: **30.04.1997**

(54) **Twisting or bending machine for making either mono or double winding coil springs**

Maschine zum Wickeln von Schraubenfedern mit Einfach- oder Doppelwindungen

Machine d'enroulement de ressorts hélicoidaux à enroulement simple ou double

(84) Designated Contracting States:
DE FR GB

(30) Priority: **02.05.1996 IT MI960856**

(43) Date of publication of application:
05.11.1997 Bulletin 1997/45

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- **PATENT ABSTRACTS OF JAPAN vol. 009, no. 014 (M-352), 22 January 1985 & JP 59 163044 A (CHIYUUOU HATSUJIYOU KK), 14 September 1984,**

EP 0 804 978 B1

Description

[0001] The present invention relates to a twisting or bending machine, which has been specifically designed for making either mono or double winding coil springs.

[0002] As is known, for making coil springs are at present used suitable coil spring winding machines, the so called twisters or benders, by which the wire material to be used for making the coil spring is pressed against a suitable winding tool, causing the wire material to be progressively deformed so as to form the spring with its conventional coil or helical configuration.

[0003] The pressing force on the wire as the spring is formed, is supplied by a wire carrying or transport unit, substantially comprising a roller assembly including a plurality of rollers entraining the wire material along a wire material feeding direction and causing said wire material to pass through a wire guiding element facing the winding tool.

[0004] The wire material transport unit, in particular, is generally stationary with respect to the spindle supporting the winding tool or it can be displaced along a direction parallel to the wire feeding direction.

[0005] Thus, prior coil spring winding machine have an operating flexibility which is comparatively low.

SUMMARY OF THE INVENTION

[0006] Accordingly, the aim of the present invention is to overcome the above mentioned problem, by providing a twisting or bending machine which has been specifically designed for making coil springs, which allows to change, depending on requirements, the contact point of the wire material and the winding tool.

[0007] Within the scope of the above mentioned aim, a main object of the present invention is to provide such a machine which is provided with a very high operating flexibility characteristic.

[0008] Another object of the present invention is to provide such a machine which is specifically adapted to make different shape coil springs, without requiring the coil spring winding tool to be replaced.

[0009] Yet another object of the present invention is to provide such a machine which is very reliable and safe in operation.

[0010] According to one aspect of the present invention, the above mentioned aim and objects, and yet other objects, which will become more apparent hereinafter, are achieved by a twisting or bending machine, specifically designed for making coil springs, according to claim 1.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Further characteristics and advantages of the twisting and bending machine according to the present invention will become more apparent hereinafter from the following detailed disclosure of some preferred embodiments of said machine which are illustrated, by way of a merely indicative, but not limitative example, in the figures of the accompanying drawings, where:

Figure 1 is a schematic side elevation view illustrating a first embodiment of the twisting and bending machine according to the present invention;

Figures 2 and 3 are schematic views illustrating the first embodiment of the twisting and bending machine according to the present invention, in a top plan view, the wire transport unit being shown in two different operating positions with respect to the wire winding tool;

Figure 4 is a further schematic side elevation and partially cross-sectioned view illustrating a second embodiment of the twisting and bending machine according to the present invention;

Figures 5 and 6 are respective top plan views illustrating the second embodiment of the subject machine, the wire transport unit being shown in two different operating positions with respect to the winding tool;

Figure 7 is a further schematic side elevation and partially sectioned view illustrating a further modified embodiment of the twisting and bending machine according to the present invention; and

Figure 8 is a front partially cross-sectioned view illustrating the twisting and bending machine shown in figure 7.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0012] With reference to figures 1 to 3, the twisting and bending machine according a first embodiment of the present invention comprises a base 1, supporting a feeding unit 2 for feeding a wire material 3 to be processed by deformation in order to make coil springs.

[0013] More specifically, the transport or carrying unit 2 comprises an assembly of rollers 4, said rollers 4 being rotatively driven about respective rotary axes and cooperating with one another in order to cause the wire 3 to be driven along a wire driving or feeding direction.

[0014] The wire transport unit 2 comprises, moreover, a wire guiding element 5 provided with a wire passage, extending parallel to the wire feeding direction, and facing a wire winding tool 6 comprising, in the embodiment shown in figures 1 to 3, a winding spindle or shaft, having a substantially vertical axis, which is rotatively driven about its axis so as to cause the wire 3 to be progressively wound about said shaft or mandrel.

[0015] Between the wire guiding element 5 and the wire winding tool 6 a cutting blade 7 is arranged, specifically provided for cutting the wire 3 at the end of a spring making operation.

[0016] As shown, the wire transport unit 2 is supported by the machine base 1 by means of two pairs of cross-guiding element 8, each of which comprises a bot-

tom guiding element 9 extending perpendicular to the wire 3 feeding direction, a middle guiding element 10 and a top guiding element 11 arranged parallel to the wire 3 feeding direction, thereby the wire 3 transport unit can be driven either in a direction parallel to the wire 3 feeding direction or in a direction perpendicular to said wire 3 feeding direction, in a substantially horizontal plane.

[0017] The driving of the wire transport unit 2 along the guiding elements 8 is obtained, in a direction parallel to the wire 3 feeding direction, for example by a servomotor 12 which, through suitable transmission means, comprising, for example, a belt 13 and a screw-screw nut assembly, drive the transport unit 2.

[0018] The displacement or driving of the wire transport unit 2 in a direction perpendicular to the wire 3 feeding direction can be obtained, in a like manner, by known driving means which, for simplicity, have not been specifically shown.

[0019] According to the modified embodiment shown in figures 4 to 6, the wire transport unit 2, instead of being supported by the machine base 1 through cross guiding elements, is pivoted to said machine base by a pivot pin 20, to a vertical axis 20a, i.e. perpendicular to the wire 3 feeding direction in the wire transport unit 2.

[0020] In this modified embodiment, the driving of the transport unit 2, i.e. the swinging thereof about the axis 20a, with respect to the machine base 1, can be obtained by a servomotor, with a screw or screw-nut transmission, generally indicated by the reference number 21, operating on the transport unit 2 so as to cause the latter to partially turn about the rotary axis 20a.

[0021] Thus, by the above possible displacements of the wire transport unit 2, with respect to the wire winding tool 6, both in a parallel direction and in a perpendicular direction to the wire 3 feeding direction, it is possible to change the contact point of the wire with the winding tool 6, thereby, by a single winding tool, it will be possible to make several different coil springs, depending on requirements.

[0022] Figures 2 and 3, as well as figures 5 and 6, clearly illustrates this multiple displacement or driving of the wire transport unit 2 with respect to the wire winding tool, in order to make two springs having opposite winding directions.

[0023] In the inventive embodiment shown in figures 7 and 8, it is provided to drive the winding tool 31 supporting mandrel or spindle 30, in a direction which is transversal of the wire 3 feeding direction 33, said wire 3 being supplied by the wire guiding element 5 of the wire transport unit 2.

[0024] As shown in the above mentioned figures, the mandrel or spindle 30 has the axis 30a extending in a vertical direction and is supported both rotatably about said axis 30a and parallel to said axis 30a, by supporting framework 34.

[0025] Inside the supporting framework 34 a threaded shaft 35 is arranged, also having a vertical axis, and engaging with a nut screw 36 rigid with a movable block 37 supporting rotatably the spindle 30 so as to allow said spindle to rotate about its rotation axis 30a.

[0026] As shown, the threaded shaft 35 can be driven by an electric motor 38 so as to cause the block 37 and, accordingly, the spindle 30, to rotate about the rotation axis 30a.

[0027] In particular, the spindle 30 can be rotatively driven about its rotation axis 30a by a gear wheel 41 and 42 transmission assembly, the gear wheels 41 and 42 of which are housed inside the supporting framework 34.

[0028] The latter is slidably mounted on two guides 43a and 43b which are horizontally arranged and extend perpendicular to the wire 3 feeding direction 33.

[0029] The driving of the supporting framework 34 and, accordingly, of the spindle or mandrel 30 in a horizontal direction, or the driving of said guide elements 43a and 43b is obtained, in a like manner to that disclosed thereinabove, by means of a threaded shaft 44 engaging in a screw nut rigid with the supporting framework 34.

[0030] Thus, the spindle 30 can be driven both vertically, i.e. in a direction parallel to the rotation axis 30a thereof, and accordingly perpendicular to the wire feeding direction 33, preferably a horizontal direction, and in parallel to the guiding elements 43a and 43b, also horizontally extending, but perpendicular to the wire feeding direction 33 so as to change, depending on requirements, the contact point of the wire being supplied by the wire guiding element 5 and the winding tool 31.

[0031] The winding tool 31, in particular, is supported by the spindle or mandrel 30 through a tool holder element 45 which, as shown in figure 7, can be turned, in a per se known manner, about the rotary axis thereof, extending parallel to or even coinciding with the wire feeding direction 33.

[0032] In this connection it should be pointed out that the wire guiding element 5 can be either a fixed type of wire guiding element, or it can turn about its rotation axis, coinciding with the axis of the wire 3 and, moreover, said wire guiding element can also be provided with wire gripping means, for gripping the wire during the rotation thereof, so as to increase the working capabilities of the twisting and bending machine according to the present invention.

[0033] From the above disclosure and from the figures of the accompanying drawings, it should be apparent that the invention fully achieves the intended aim and objects.

[0034] In particular, the fact is to be pointed out that a wire twisting and bending machine has been provided which, owing to the possibility of changing the contact point of the wire material and wire winding tool, has a very flexible type of operation, adapted to meet all of the processing requirements for making coil springs.

[0035] The invention, as disclosed, is susceptible to several variations and modifications, all of which will

come within the scope of the appended claims.

[0036] Moreover, all of the details can be replaced by other technically equivalent elements.

[0037] In practicing the invention, the used materials, as well as the contingent size and shapes, can be any, depending on requirements.

Claims

1. A wire twisting or bending machine, specifically designed for making coil springs, either of a mono or a double winding type, comprising a wire transport unit (2) including an assembly of rollers (4) for entraining the wire (3) along a wire feeding direction, said wire transport unit (2) being arranged in front of a wire winding tool (6) adapted to bend said wire (3), **characterized in that** said wire transport unit (2) can be controllably driven, with respect to said wire winding tool, both in parallel to the wire (3) feeding direction as well as transverse to the wire feeding direction and transverse to the rotation axis of the wire winding tool in order to cause the contact point of the wire and wire winding tool (6) to change.

2. A machine according to Claim 1, **characterized in that** said wire transport unit (2) is mounted on cross slides (8) supported by the base (1) of said machine, driving means being provided for driving said wire transport unit (2) along two legs of said slides (8), said legs being respectively arranged parallel and perpendicular to said wire feeding direction.

3. A machine according to Claim 1, **characterized in that** said wire transport unit (2) is pivoted to said base (1) of said machine about a pivot axis (20a) which is both substantially perpendicular to said wire feeding direction as well as parallel to the rotational axis of the wire winding tool.

4. A machine according to one or more of the preceding claims, **characterized in that** said wire transport unit (2) comprises a wire guiding element in which a passage for said wire (3) is defined, said wire passage extending along the wire feeding direction, and **in that** said wire guiding element (5) can be controllably rotated about the axis of said wire, extending along said wire feeding direction.

5. A machine according to one or more of the preceding claims, **characterized in that** said wire (3) guiding element (5) is provided with wire gripping means.

6. A machine according to one or more of the preceding claims, **characterized in that** said wire winding tool (31) is supported on a tool spindle (30), which can be controllably rotated about a rotation axis perpendicular to said wire feeding direction.

7. A machine according to Claim 6, **characterized in that** said wire winding tool is supported on a controllably rotatable tool holder, which can be controllably turned, with respect to said spindle (30), about an axis parallel to said wire feeding direction.

8. A machine according to Claim 6 or 7, **characterized in that** said spindle (30) can be controllably driven along a first driving direction both transverse to said wire feeding direction as well as transverse to the rotational axis of said spindle.

9. A machine according to Claim 8, **characterized in that** said spindle (30) can be controllably driven along a second driving direction, which is both substantially perpendicular to said wire feeding direction as well as substantially perpendicular to said first driving direction.

Patentansprüche

1. Drahtdreh- oder Biegemaschine, insbesondere zur Herstellung von Spiralfedern mit einfacher oder doppelter Windung, mit einer Drahttransporteinheit (2) mit einer Rollenbaugruppe (4) zum Antrieb des Drahtes (3) entlang einer Drahtzufuhrrichtung, wobei die Drahttransporteinheit (2) vor einem zum Biegen des Drahtes (3) angepaßten Drahtwickelwerkzeug (6) angeordnet ist,
dadurch gekennzeichnet, daß
die Drahttransporteinheit (2) im Verhältnis zu dem Drahtwickelwerkzeug sowohl parallel zu der Zufuhrrichtung des Drahtes (3) als auch quer zu der Drahtzufuhrrichtung als auch quer zu der Drehachse des Drahtwickelwerkzeuges steuerbar antreibbar ist, um den Berührungspunkt des Drahtes und des Drahtwickelwerkzeuges (6) zu verändern.

2. Maschine nach Anspruch 1,
dadurch gekennzeichnet, daß
die Drahttransporteinheit (2) auf in der Basis (1) der Maschine gelagerten Querschlitten (8) angebracht ist, wobei ein Antriebsmittel zum Antreiben der Drahttransporteinheit (2) entlang zweier Schenkel der Schlitten (8) vorgesehen ist und die Schenkel jeweils parallel und senkrecht zu der Drahtzufuhrrichtung angeordnet sind.

3. Maschine nach Anspruch 1,
dadurch gekennzeichnet, daß
die Drahttransporteinheit (2) an der Basis (1) der Maschine um eine Drehachse (20a) drehbar gelagert ist, die sowohl im wesentlichen senkrecht zu der Drahtzufuhrrichtung als auch parallel zu der Drehachse des Drahtwickelwerkzeuges verläuft.

4. Maschine nach einem oder mehreren der vorangegangenen Ansprüche,
dadurch gekennzeichnet, daß
die Drahttransporteinheit (2) ein Drahtführungselement aufweist, in dem ein Durchgang für den Draht (3) definiert ist, wobei sich der Drahtdurchgang entlang der Drahtzufuhrrichtung erstreckt und das Drahtführungselement (5) steuerbar um die Achse des Drahtes drehbar ist und sich entlang der Drahtzufuhrrichtung erstreckt.

5. Maschine nach einem oder mehreren der vorangegangenen Ansprüche,
dadurch gekennzeichnet, daß
das Element (5) zum Führen des Drahtes (3) mit Drahtgreifermitteln versehen ist.

6. Maschine nach einem oder mehreren der vorangegangenen Ansprüche,
dadurch gekennzeichnet, daß
das Drahtwickelwerkzeug (31) auf einer steuerbar um eine senkrecht zu der Drahtzufuhrrichtung verlaufende Drehachse drehbaren Werkzeugspindel (30) gelagert ist.

7. Maschine nach Anspruch 6,
dadurch gekennzeichnet, daß
das Drahtwickelwerkzeug auf einem im Verhältnis zu der Spindel (30) um eine parallel zu der Drahtzufuhrrichtung verlaufende Achse steuerbar drehbaren Werkzeughalter gelagert ist.

8. Maschine nach Anspruch 6 oder 7,
dadurch gekennzeichnet, daß
die Spindel (30) entlang einer ersten Antriebsrichtung sowohl quer zu der Drahtzufuhrrichtung als auch quer zu der Drehachse der Spindel steuerbar antreibbar ist.

9. Maschine nach Anspruch 8,
dadurch gekennzeichnet, daß
die Spindel (30) entlang einer zweiten Antriebsrichtung, die sowohl im wesentlichen senkrecht zu der Drahtzufuhrrichtung, als auch im wesentlichen senkrecht zu der ersten Antriebsrichtung verläuft, steuerbar antreibbar ist.

Revendications

1. Machine de torsion ou de pliage de fil métallique, spécialement étudiée pour fabriquer des ressorts hélicoïdaux, aussi bien d'un type à enroulement simple ou double, comprenant une unité de transport de fil métallique (2) incluant un assemblage de cylindres (4) pour entraîner le fil métallique (3) le long d'une direction d'alimentation de fil métallique, ladite unité de transport de fil métallique (2) étant disposée en face d'un outil d'enroulement de fil métallique (6) adapté pour plier ledit fil métallique (3), **caractérisée en ce que** ladite unité de transport de fil métallique (2) peut être actionnée de manière contrôlée, par rapport audit outil d'enroulement de fil métallique, aussi bien parallèlement à la direction d'alimentation du fil métallique (3) que transversalement à la direction d'alimentation du fil métallique (3) et perpendiculairement à l'axe de rotation de l'outil d'enroulement de fil métallique dans le but de provoquer le changement de point de contact du fil métallique avec l'outil d'enroulement de fil métallique (6).

2. Machine selon la revendication 1, **caractérisée en ce que** ladite unité de transport de fil métallique (2) est montée sur des guides transversaux (8) supportés par la base (1) de ladite machine, un moyen d'actionnement étant prévu pour actionner ladite unité de transport de fil métallique (2) le long des deux rebords desdits guides (8), lesdits rebords étant respectivement disposés en parallèle et perpendiculairement à ladite direction d'alimentation du fil métallique.

3. Machine selon la revendication 1, **caractérisée en ce que** ladite unité de transport de fil métallique (2) pivote par rapport à ladite base (1) de ladite machine grâce à un axe de pivot (20a) qui est aussi bien sensiblement perpendiculaire à ladite direction d'alimentation du fil métallique que parallèle à l'axe de rotation de l'outil d'enroulement de fil métallique.

4. Machine selon une ou plusieurs revendications précédentes, **caractérisée en ce que** ladite unité de transport de fil métallique (2) comprend un élément guidant le fil métallique dans lequel un passage pour ledit fil métallique (3) est défini, ledit passage du fil métallique s'étendant le long de la direction d'alimentation du fil métallique, et **en ce que** l'élément guidant le fil métallique (5) peut être en rotation de manière contrôlée autour d'un axe dudit fil métallique, s'étendant le long de ladite direction d'alimentation du fil métallique.

5. Machine selon une ou plusieurs revendications précédentes, **caractérisée en ce que** ledit élément guidant (5) le fil métallique (3) est muni de moyens de fixation de fil métallique.

6. Machine selon une ou plusieurs revendications précédentes, **caractérisée en ce que** ledit outil d'enroulement de fil métallique (31) est supporté sur une tige d'outil (30), qui peut être en rotation de manière contrôlée autour d'un axe de rotation perpendiculaire à ladite direction d'alimentation du fil métallique.

7. Machine selon la revendication 6, **caractérisée en ce que** ledit outil d'enroulement de fil métallique est supporté sur un support d'outil qui peut être en rotation de manière contrôlée, qui peut être tourné de manière contrôlée, par rapport à ladite tige (30), autour d'un axe parallèle à ladite direction d'alimentation du fil métallique.

8. Machine selon les revendications 6 ou 7, **caractérisée en ce que** ladite tige (30) peut être actionnée de manière contrôlée le long d'une première direction d'actionnement aussi bien transversale à ladite direction d'alimentation du fil métallique que transversale à l'axe de rotation de ladite tige.

9. Machine selon la revendication 8, **caractérisée en ce que** ladite tige (30) peut être actionnée de manière contrôlée le long d'une seconde direction d'actionnement aussi bien sensiblement perpendiculaire à ladite direction d'alimentation du fil métallique que sensiblement perpendiculaire à ladite première direction d'actionnement.

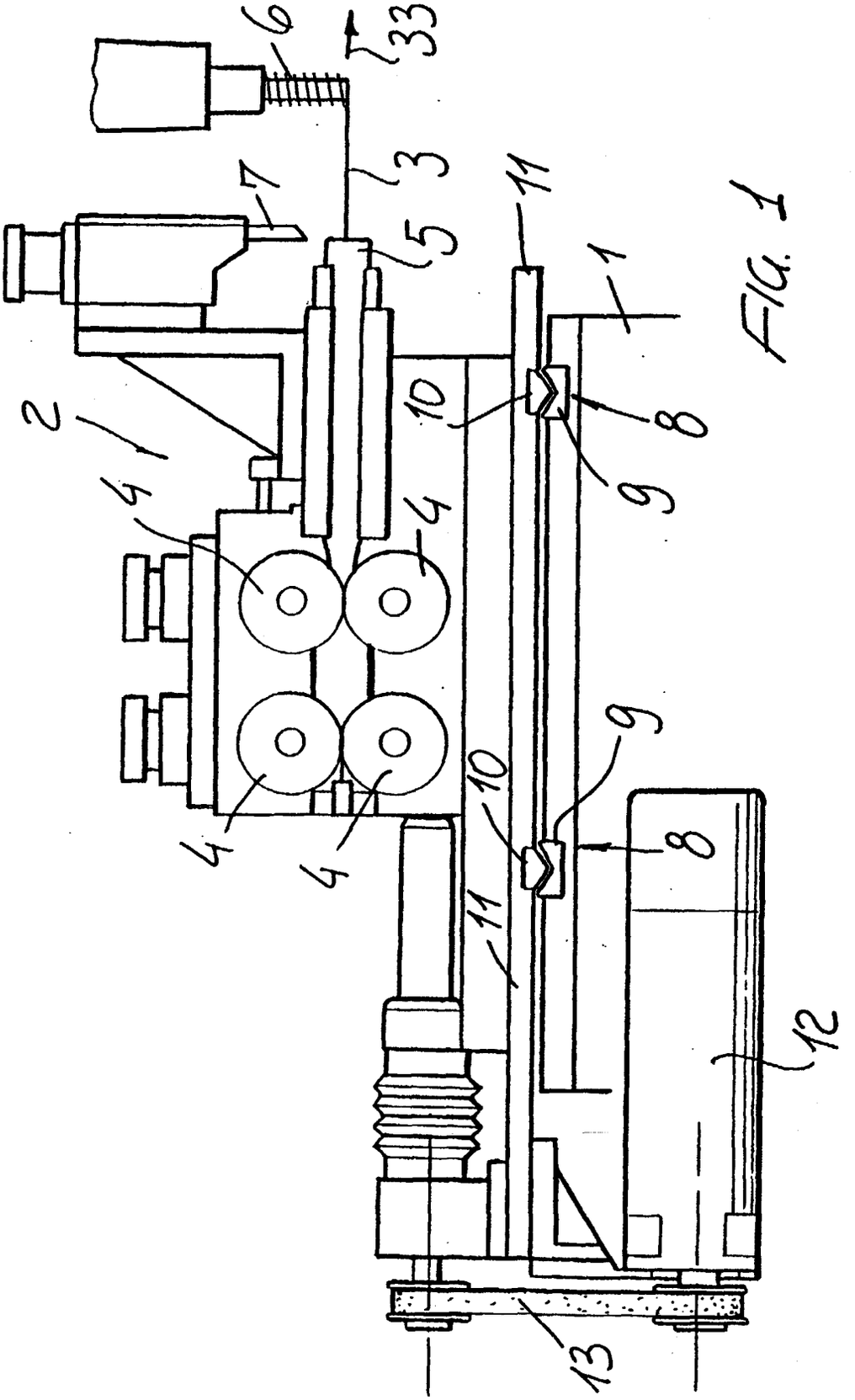


FIG. 1

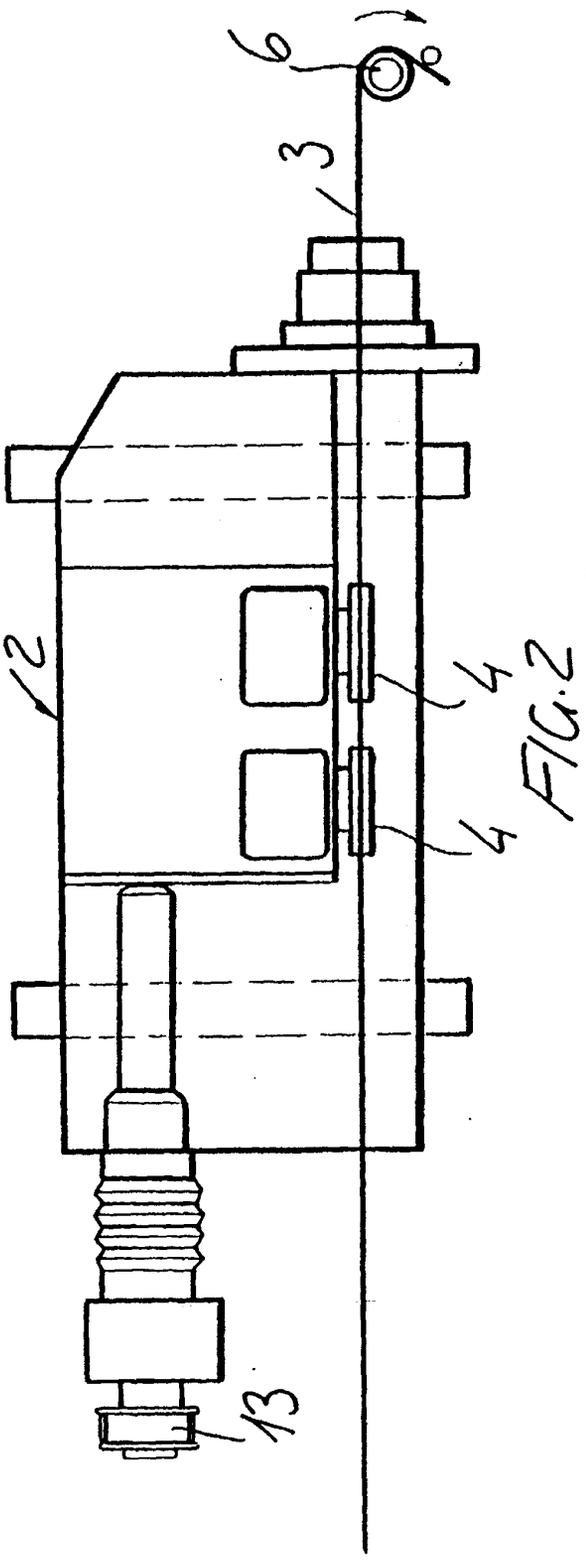


FIG.2

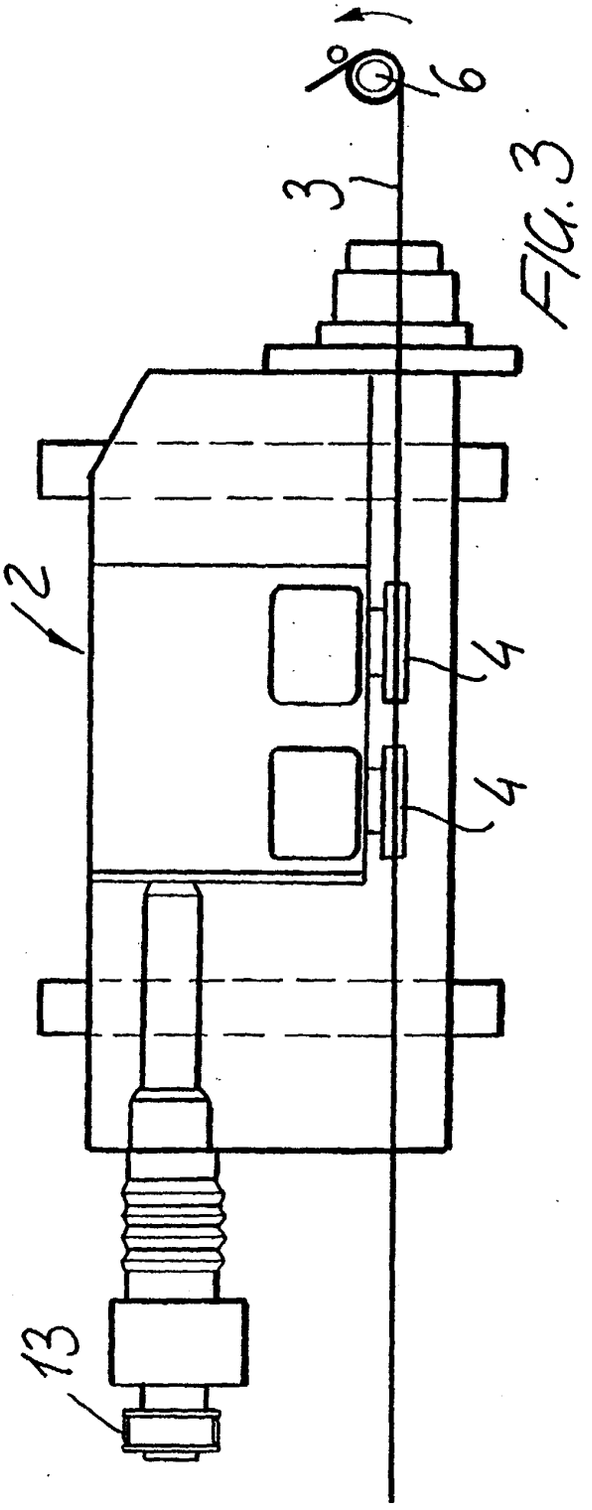


FIG.3

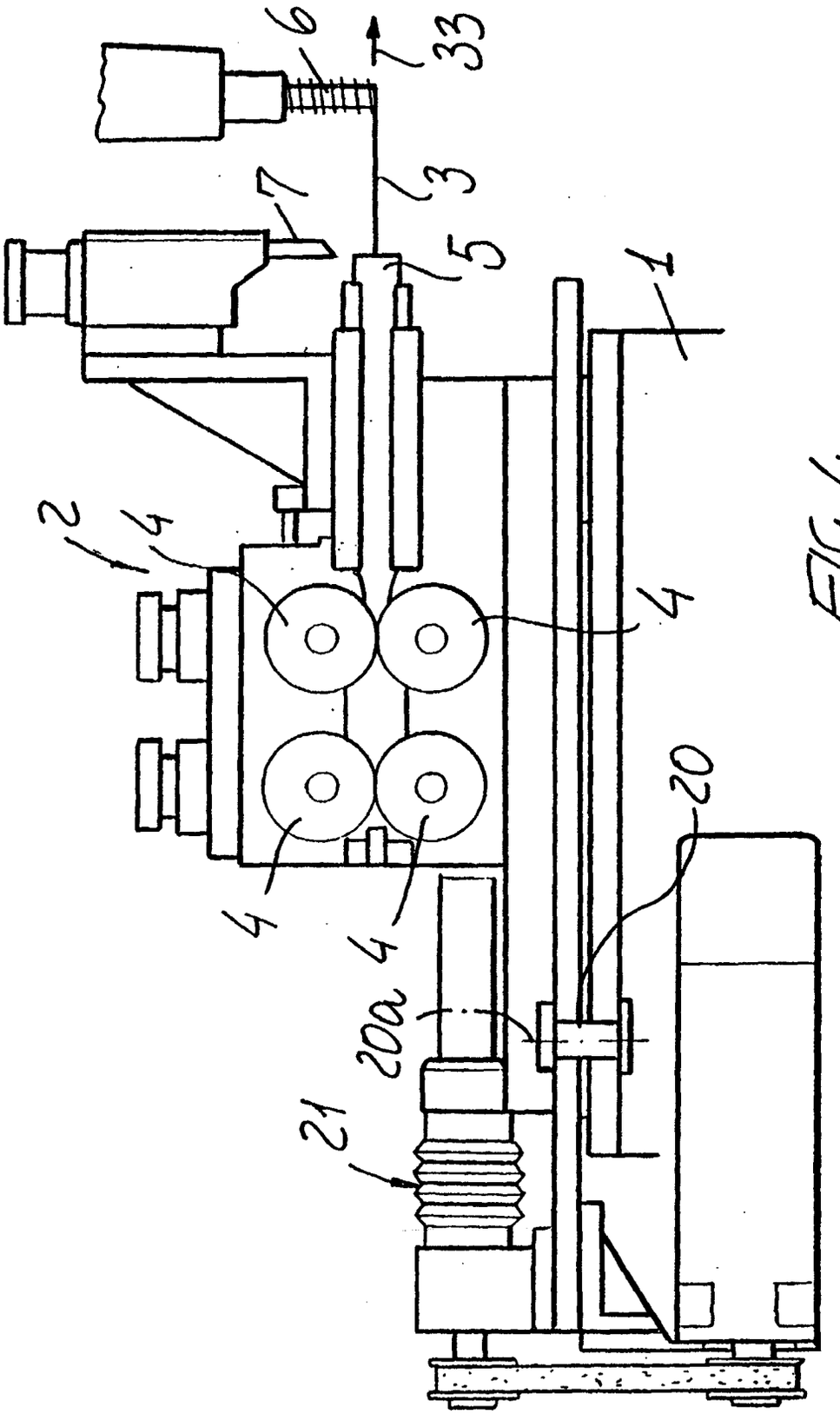


FIG. 4

FIG. 5

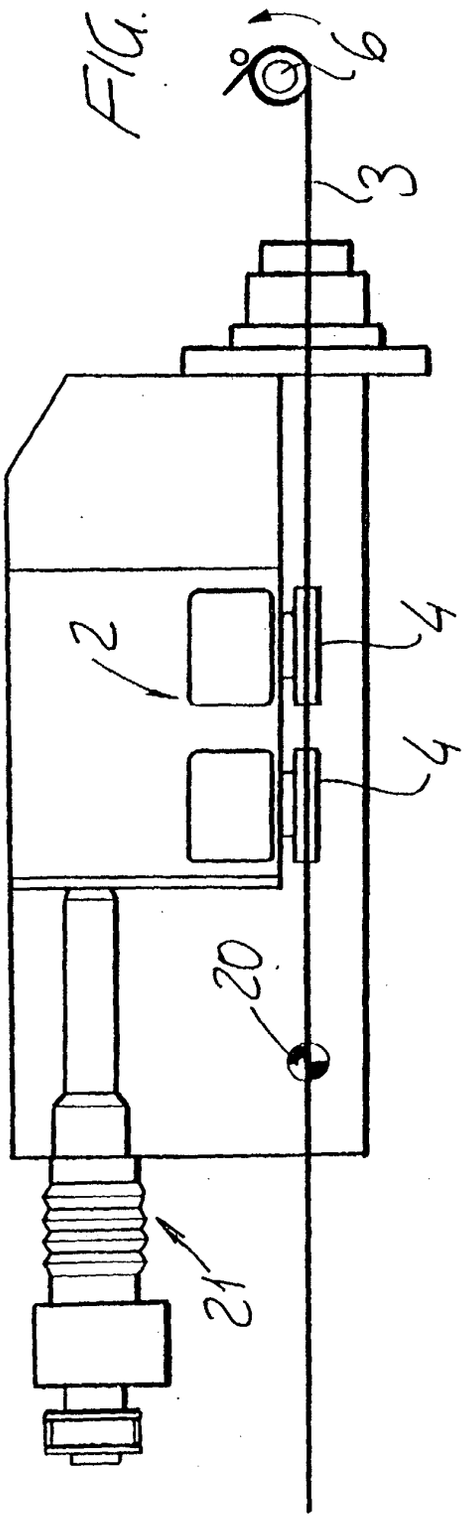
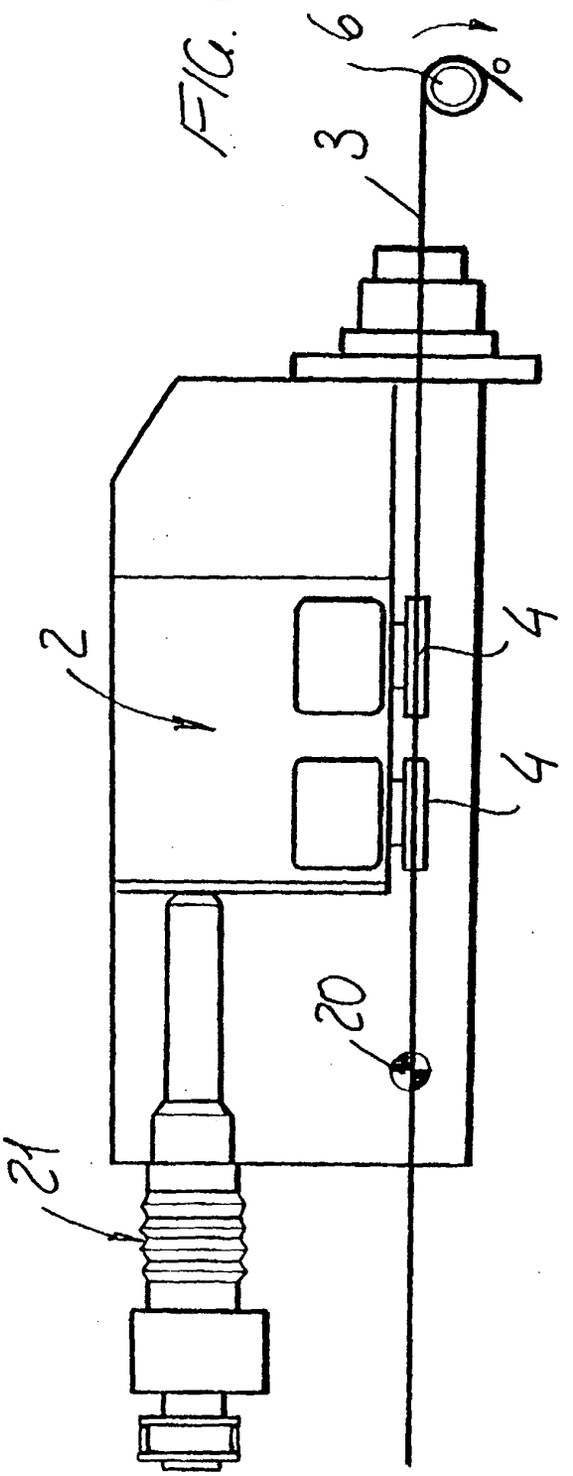


FIG. 6



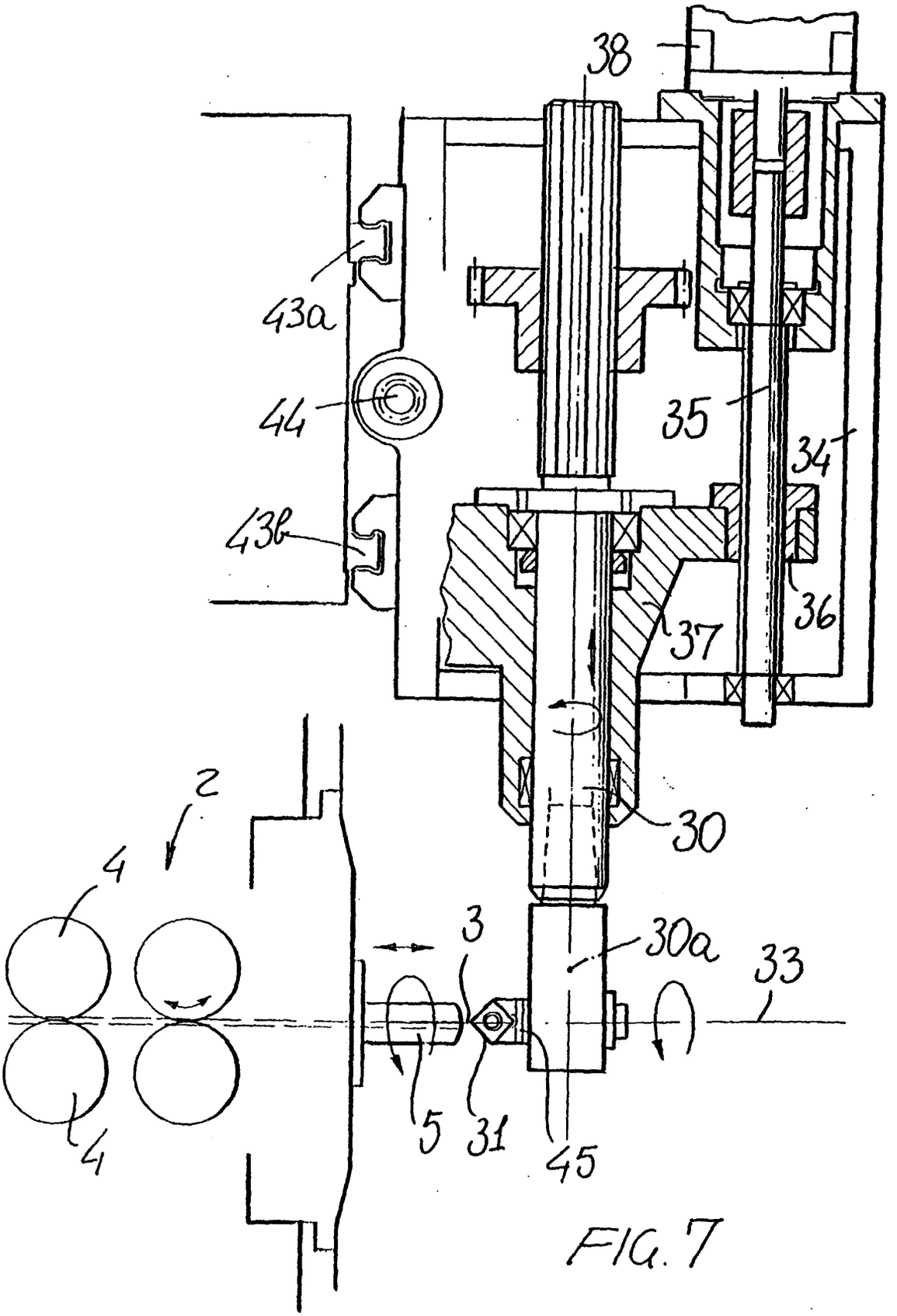


FIG. 7

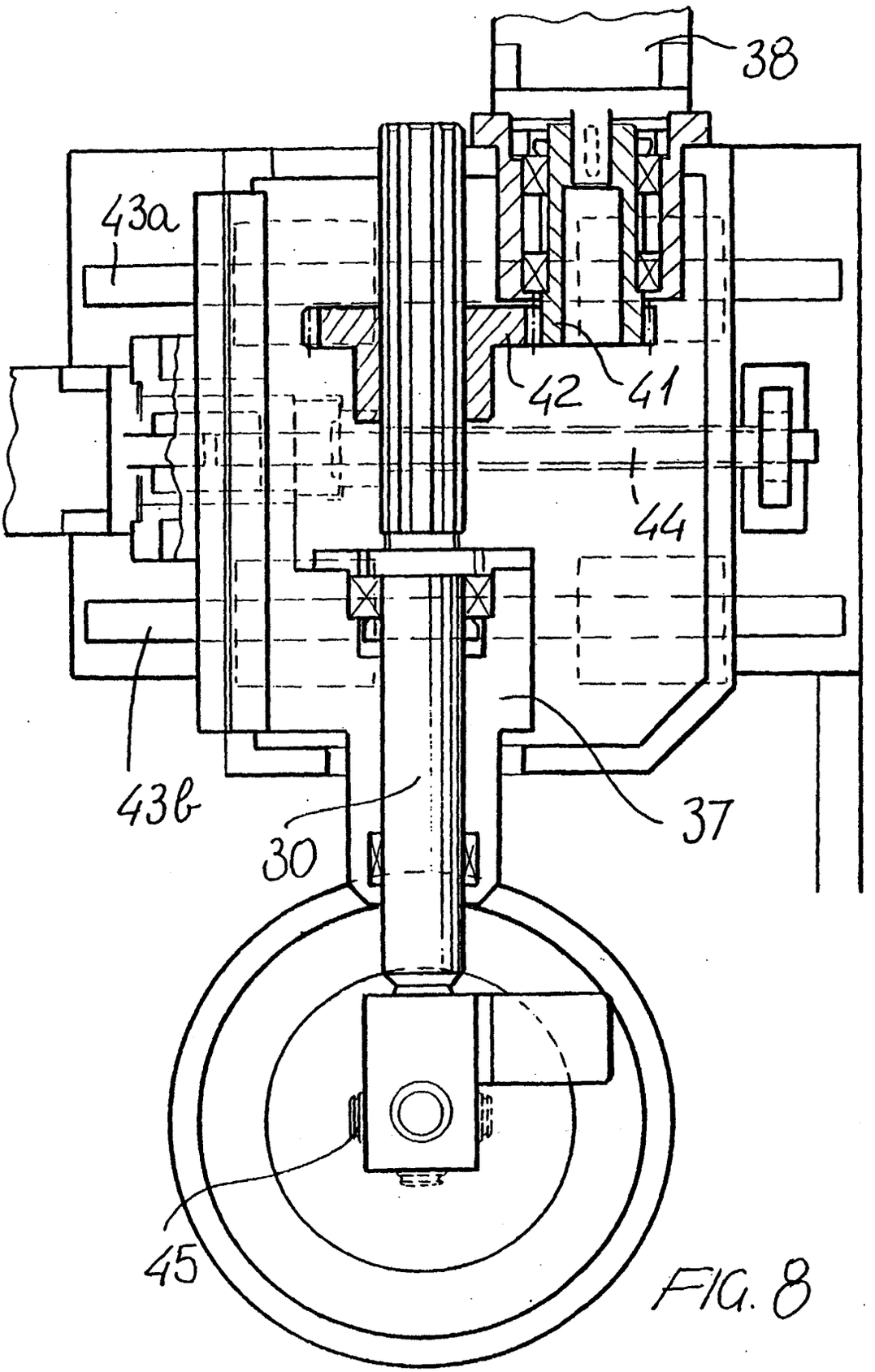


FIG. 8