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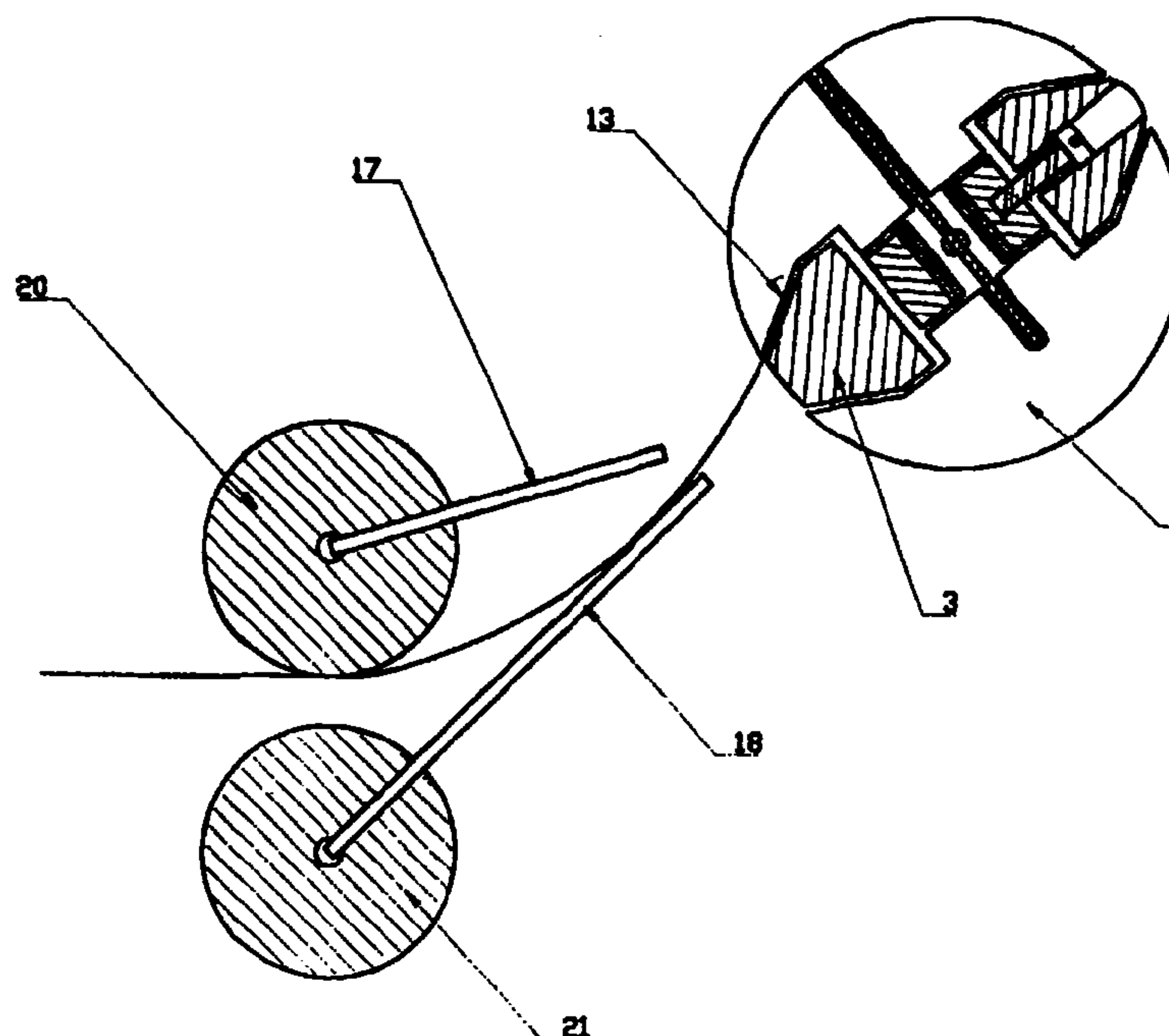
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(54) **MANDRIN DE SERRAGE PNEUMATIQUE POUR MACHINES
D'EMBOBINAGE DE BANDE A AME CREUSE ET DISPOSITIF
DE POSITIONNEMENT ASSOCIE**

(54) **PNEUMATIC CLAMPING MANDREL FOR CORELESS WEB
WINDING MACHINES AND POSITIONING DEVICE
THEREOF**



(57) Cette invention concerne un mandrin (1) adapté à des machines d'embobinage de bande à âme creuse. Le mandrin contient deux extenseurs (2, 3) actionnés pneumatiquement par des cylindres (4, 5). Un des extenseurs sert à prendre et à serrer le bord avant de la bande devant être enroulée pour former des rouleaux à âme creuse. Cette invention concerne également un dispositif assurant le transport du bord avant de la bande jusqu'au dispositif de serrage du mandrin.

(57) The invention concerns a mandrel (1) suitable for coreless web winding machines. The mandrel lodges two expanders (2, 3) pneumatically acted by means of cylinders (4, 5). One of the expander is suitable for gripping and clamping the leading edge of the band to be wound for obtaining coreless rolls. The invention includes, in combination, a device for the transport of the leading edge of the band to the clamp of the mandrel.

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(21) International Application Number: PCT/IT98/00274 (22) International Filing Date: 13 October 1998 (13.10.98) (30) Priority Data: PC97A000030 14 October 1997 (14.10.97) IT (71) Applicant (for all designated States except US): OFFICINA MECCANICA PRATI PIETRO [IT/IT]; Via Filetto Est, 5, I-50034 Marradi (IT). (72) Inventor; and (75) Inventor/Applicant (for US only): PRATI, Pietro [IT/IT]; Via Filetto Est, 5, I-50034 Marradi (IT). (74) Agent: FARNESE, Giuseppe; Studio Brevetti Internazionale, Via S. Marco, 10, I-29100 Piacenza (IT).		(81) Designated States: AU, CA, CN, JP, KP, SG, US, Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>Without international search report and to be republished upon receipt of that report.</i>
(54) Title: PNEUMATIC CLAMPING MANDREL FOR CORELESS WEB WINDING MACHINES AND POSITIONING DEVICE THEREOF 		
(57) Abstract The invention concerns a mandrel (1) suitable for coreless web winding machines. The mandrel lodges two expanders (2, 3) pneumatically acted by means of cylinders (4, 5). One of the expander is suitable for gripping and clamping the leading edge of the band to be wound for obtaining coreless rolls. The invention includes, in combination, a device for the transport of the leading edge of the band to the clamp of the mandrel.		

PNEUMATIC CLAMPING MANDREL FOR CORELESS WEB WINDING
5 MACHINES AND POSITIONING DEVICE THEREOF

The field of application of the present invention
10 concerns the winding machines of webs or tapes made of paper
or plastic material.

In particular, the subject of the present invention is a
mandrel, which is mountable on the aforesaid said machines,
specifically addressed for making coreless rolls of said webs
15 or tapes, in cooperation with means for the positioning of the
webs in order to automatically insert their initial edges into
the suitable seats of the mandrel.

At the present state-of-the-art, machines for winding
rolls or bobbins of web-like materials, like paper or plastic,
20 use mandrels whereon a support of plastic or other material
suitable for such a function, usually of cylindrical shape, is
inserted and thereto the initial edge of the web to be wound
is fixed ; the necessity of such a support is dictated either
by the final use of the rolls, for example in labeling
25 machines, either, also, by the difficulty of winding the webs
without said support in a totally automatic way.

Some methods for winding coreless rolls of paper, in
particular toilet paper, are already domain of the state-of-
the-art, as disclosed by WO 96/28079 and US 3,853,279. In the
30 cited documents the front edge of the band to be wound is
wetted for being stucked to the winding mandrel, so as to
obtain a temporary gluing to said mandrel at least for its
first two or three rotations : said rotations form the
suitable anchoring for winding the web, while avoiding its
35 sliding from the mandrel.

Further applications concerning webs with a core provide particular glues to fix the front edge of the band to the mandrel ; such glues evaporate or dissolve during the winding operation.

The use of bands or tapes without core is often requested.

In fact, the use of a core, besides being more costly for the cost of the core itself, complicated in many cases the charging and replacing of rolls in distributors, like i.e. in the automatic labeling machines, in some telefax machines and in some distributors of toilet paper.

Furthermore, the use of the core, when it is not dictated by its function, comports longer winding time to obtain the rolls and more complex operations, due to the necessary fixing of the front edge of the web material to the core and the insertion of the latter on the mandrel, which are manual operations ; also, the reliability of the production process, due to (whenever the securing of the initial edge should fail) the possible slipping of the paper about the core, would be affected.

The present invention solves the above mentioned problems by means of a mandrel configured for being actuated by pneumatic means and which overcome the need of the core of millboard or other material by means of clamps for gripping the leading edge of the web.

Similar solutions are provided by leaf-type air shafts, as in US 3,863,857, by using expansible elements : the complexity of the expansible mandrels of the prior-art is nevertheless a limitation for what concerns their reliability and their costs.

Furthermore, the composite structure of prior-art
expansible mandrels complicates their maintenance and reduces
5 their life-cycle, reducing as well their ability to strengths
at high rotation speed.

More examples of such composite mandrels are given in US
5,123,604 and US 4,195,792.

The mandrel of the present invention vis-à-vis the
10 prior-art improves the clamping system for gripping the
leading edge of the web material to be wound and allows the
complete automation of the operation of leading the front edge
to the mandrel clamping system and of securing it for initial
winding.

15 Said automation is achieved by means of a transport
system which cooperates with the mandrel and suitable for
leading the front edge of the web towards the clamping system
and providing automatic insertion into the slot of the mandrel
clamps, as better described below.

20 The main embodiment of the invention and its functioning
is better explained by means of Figureures, whereas :

- Figure 1 shows the cross-section of the clamping
mandrel and its elements of the preferred embodiment.

- Figure 2 shows the plant of the clamping mandrel and
25 the shape of its body for lodging the various working
elements.

- Figure 3 and 4 illustrate the longitudinal and
perspective view of the mandrel.

- Figure 5, 6 and 7 represent the phases of working of
30 the mandrel.

- Figure 8 represents the schematic view of the web
winding machine for the understanding of the mechanism of the
present invention, for what concerns the leading of the band
edge towards the mandrel.

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- Figure 9 shows in details the mechanism of insertion of the band into the mandrel.

In the cylindrical body of the mandrel 1 of Figure 1, two seats 13 and 14 are shaped for lodging respectively the expander 2 and the clamping expander 3, actuated by pistons 4 and 5 ; a duct 6 for the adduction of compressed air is drilled along the axes of the body of said mandrel 1.

The duct 6 is communicating with the series of seats 7, therein said pistons 4, 5 are lodged as illustrated by Figure 2.

The number of pistons and their spacing is determined by the length of mandrel 1, so as to assure that expanders 2 and 3 are actuated for its entire length without misalignments.

The preferred embodiment of the mandrel, as from Figure 3, shows the duct 6 closed by the cap 8 at the free end of the mandrel, opposite to the air supply end, so to form a closed chamber, wherein the pressurised air exercises pressure on the pistons 4 and 5 lodged in seats 7.

To the end of securing said chamber 7 by air-tightness under pressure, pistons 4 and 5 are provided, respectively, by O-rings 15 and 16.

The expander 2 is connected to pistons 4 by means of screws 9 : these screws 9 are calibrated for allowing between said pistons 4 and said expander 2 a clearance 10 of the order of some tenth of millimeter ; said clearance 10 allows a freedom degree in the positioning of said expander 2 for an easier lock of the opening 13 of the mandrel during the expansion phase.

The expander 3, which acts as a clamp, is let disconnected from pistons 5, and therefore, when it is in idle state (absence of pression in chamber 6) it falls by gravity, leaning against the shaped wall of mandrel 1 and so letting a greater opening between itself and the interior wall 13 of the shaped cavity of said mandrel 1.

Said expander 3, which in the closed position
5 (expansion) grips the leading edge of the web, is provided
along its length with a rubber or plastic string 12 apt to
secure a better grip of said leading edge of the web.

Mandrel 1 is crossed in each of the seats 7 of the
pistons 4 and 5, and in correspondence with duct 6, by plugs
10 11 acting as separators of pistons 4 and 5, in order to avoid
that in the opening phase (expiration of air from duct 6) said
pistons 4 and 5 would close entirely the hole 6, so
compromising its functioning : in fact in the following phase
of expansion the compress air in the so obstructed duct 6
15 would impede the outwardly pushing of pistons 4 and 5.

The working of the mandrel of the present invention may
be better understood by means of Figures 5,6,7.

As from Figure 5 at the beginning of each winding
process of web material in rolls, it is created in the duct 6
20 a decompression and pistons 4 and 5 are then sucked towards
the interior of mandrel 1.

A transport and positioning mechanism, hereinafter
better described, leads the front edge of the web into the
slot 13, between the clamping expander 3 and the internal
25 wall of the mandrel, as shown in Figure 6. Subsequently, it is
admitted compressed air which acting on pistons 4 and 5 pushes
outwardly the expanders 2 and 3, so that the external walls of
the expanders adhere with the internal walls of the shaped
seats of mandrel 1 and, indeed, closing tigthnessly the
30 opening of said mandrel 1.

The clamping expander 3 grips and holds the band to be
wound during the rotation of mandrel 1 till the completion of
the entire roll.

When the roll is formed, the evacuation of air from duct 6 makes pistons to be moved by depression towards the interior of mandrel 1; the expander 2 it is retracted and the expander 3 falls, by gravity, against the internal wall of its seat while opening the slot 13 and so allowing the easy slipping off the mandrel 1 of the roll.

Although the above described operation could be effected by using a single clamping expander, the embodiment of the present invention makes use of two expanders in order to, when the winding is completed, help removing the roll from the mandrel : the second expander 2, when retracted, creates an embossed zone on the external surface of mandrel 1 so impeding the adhesion of the first turn of the roll to said mandrel and its possible unwinding.

The automatic insertion of the leading edge of the web into slot 13 of clamp 3 of mandrel 1 is made possible by means of positioners 17 and 18, fixed about the axis of guiding rollers 20 and 21 as described in Figures 7 and 8.

A block 19, comprising two guiding rollers 20 and 21, lifts up at the initial phase of winding, and displaces from the initial position 22 to the position 23 next to the mandrel 1 ; at the same time the arms 17 and 18, fixed on the axis of rollers 20 and 21 rotate in order to precisely position the leading edge of the web for the insertion into slot 13 of the open clamp 3. Once the initial zone of the band to be wound is inserted into slot 13, compressed air is let in duct 6 : pistons 4 and 5 are pushed outwardly and clamp 3 closes ; mandrel 1 starts then the revolution for the winding cycle of the roll.

The positioning of mandrel 1 is obtained by means of
5 mechanical phasers ; said phasers are transmission organs
comprising a heart shaped cam acted by pistons : the concave
zone of said cam corresponds to the idle mechanism of
rotation of the mandrel, which, therefore, stops always in the
same angular position.

10 The displacement of block 19 and of the arms 17 and 18,
in order to insert automatically the front edge of the web
into slot 13 of clamp 3, are pneumatically controlled and
coordinated by means of microprocessors, so as the control of
the adduction and emission of air phases of the compressed air
15 in duct 6.

All pneumatic functions of the mandrel of the present
invention, in combination with the positioning system of the
leading edge of the web, are performed by the normally
installed compressors on the winding machines of the type
20 described, whereas additional air paths and valves are
controlled by the above said microprocessors.

Mandrel 1 is set to the right angular position for the
automatic insertion of the leading edge of the web by means of
a pneumatically controlled heart shaped cam.

25 The above description it is not a limit to other
possible embodiments that the mandrel of the present invention
can permit without addition of the described subject matter ;
also, the pneumatic control of the expanders should not be
considered as narrowing the disclosure by excluding different
30 electro-mechanical embodiments based on the same principe
which do not extend the present subject matter.

The same application of the mandrel of the invention to
web winding machines cannot be intended a limit to
applications for clamping front edge of webs in different
35 apparatus, like i.e. fax machines and printers.

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CLAIMS

5 1- A combination of a mandrel and a device for
positioning a leading edge of a band ~~next to said mandrel~~
preferably for coreless web winding machines the cylindrical
body of said mandrel (1) is provided of two seats (13,14)
lodging a first expander (2) and a second clamping expander
10 (3), said seats (13,14) being in communication, by means of
cylindrical seats (7) shaped transversally to the body of
said mandrel (1), with a duct (6) coaxial to the longitudinal
axis of said mandrel (1), said duct (6) being closed at the
free end, opposite to the air supply end, of said mandrel (1)
15 by a cap (8) ; a first series of pistons (4) and a second
series of pistons (5) are lodged in said seats (7) in
correspondence, respectively with a first expander (2) and a
second clamping expander (3) characterised in that the device
for positioning the leading edge of a band next to said
20 clamping expander (3) comprising a first arm (17) fixed to
the axes of a first guiding roller (20) and a second arm (18)
fixed to the axes of a second guiding roller (21), said first
roller (20) and second roller (21) being positioned one upon
the other with their axis vertically aligned for tangentially
25 guiding thereinbetween the said band towards first (17) and
second (18) arms, said second arm (18) being of a length
superior to said first arm (17), said first and second arms
(17,18) being suitable to obtain by rotation the exact angle
of insertion of the leading edge of said band into clamp (3)
30 of said mandrel (1), said expanders (2,3) acted pneumatically
outwardly said mandrel (1) by compressed air admitted in
duct (6), whereas said expanders (2,3) are acted inwardly
said mandrel (1) by suction of air from said duct (6).

AMENDED SHEET

5 2- The combination according to claim 1 characterised in that said mandrel (1) is provided of pins (11) in a median position of seats (7) in correspondance of duct (6), said pins (11) acting as separators of pistons (4,5) for freeing said duct (6) during the phase of air suction.

10 3- The combination according to claim 1, characterised in that the clamping expander (3) of mandrel (1) is provided with a plastic or rubber string (12) along its length on the closure wall of said expander (3), in correspondance with the
15 internal closure wall (14)

 4- The combination according to claim (1) characterised in that pistons (4,5) are provided with O-rings for air tightness under pressure in seats (7).

20 5- The combination according to claim (1) characterised in that arms (17,18) and positioning device (19) are pneumatically controlled, whereas the angular position of mandrel (1) for the insertion of the leading edge of the web
25 is controlled by a mechanical phaser comprising a pneumatically acted heart shaped cam, the concave zone thereof corresponding to the idle position of the rotation mechanism of mandrel 1.

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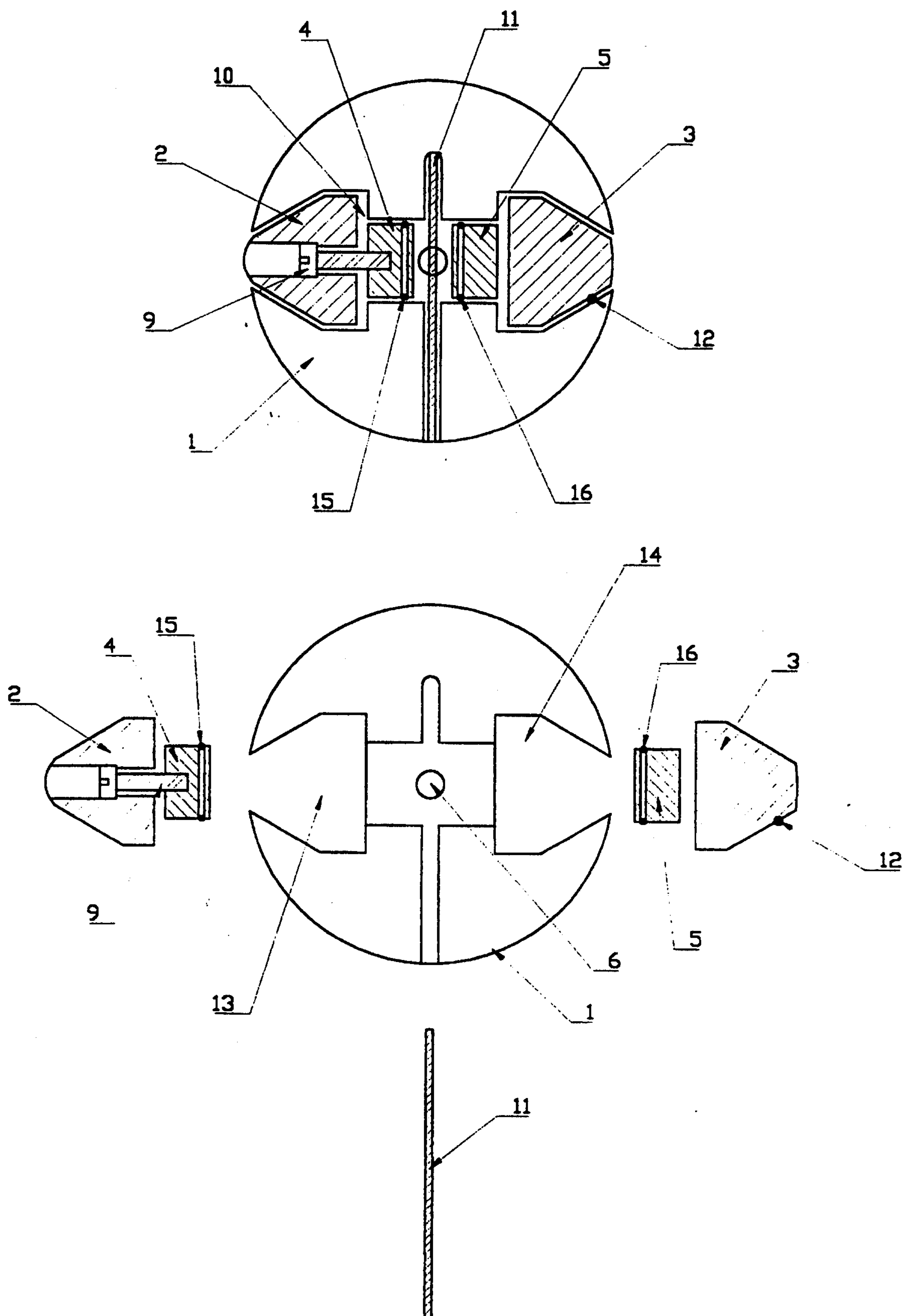


FIG. 1

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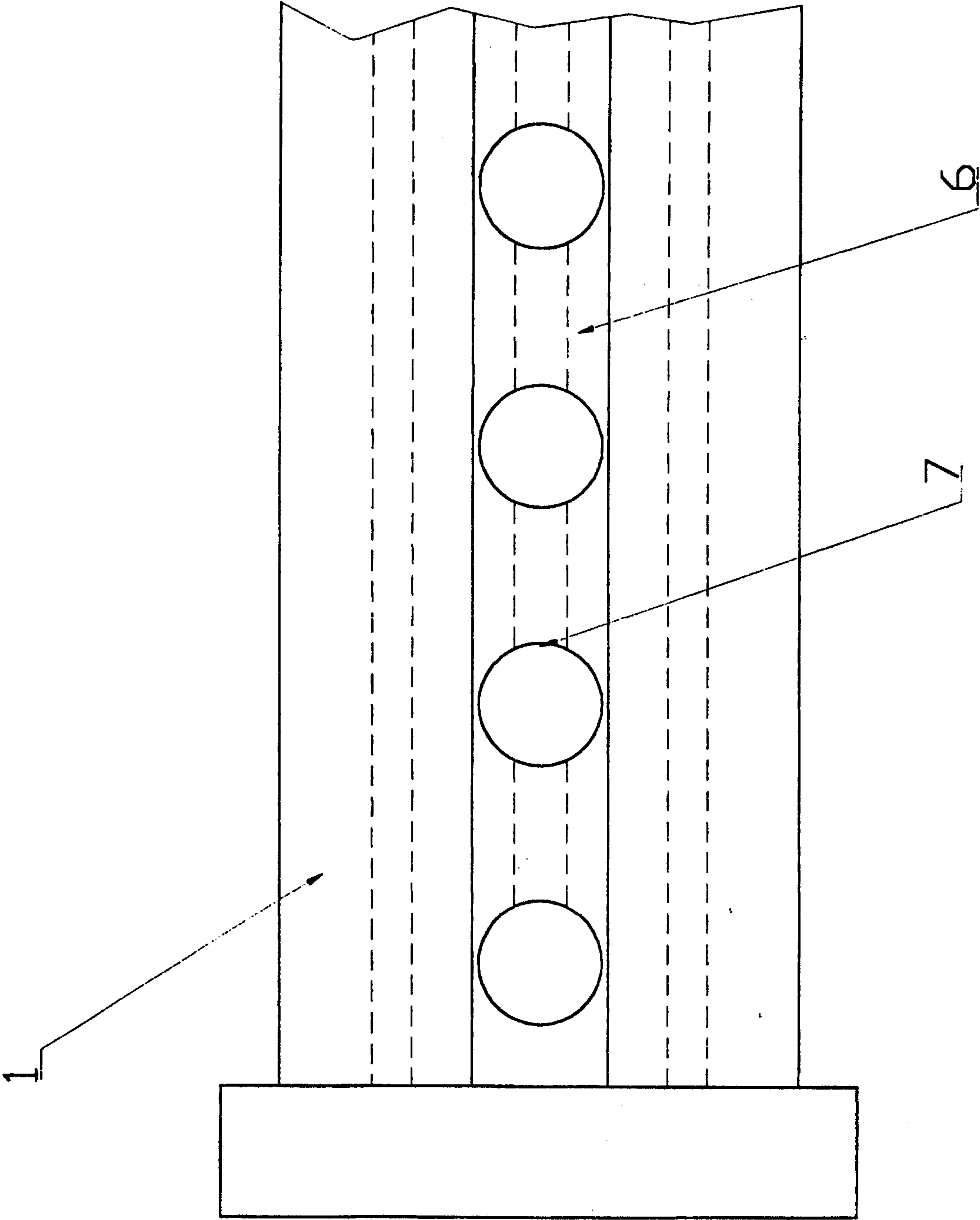


FIG. 2

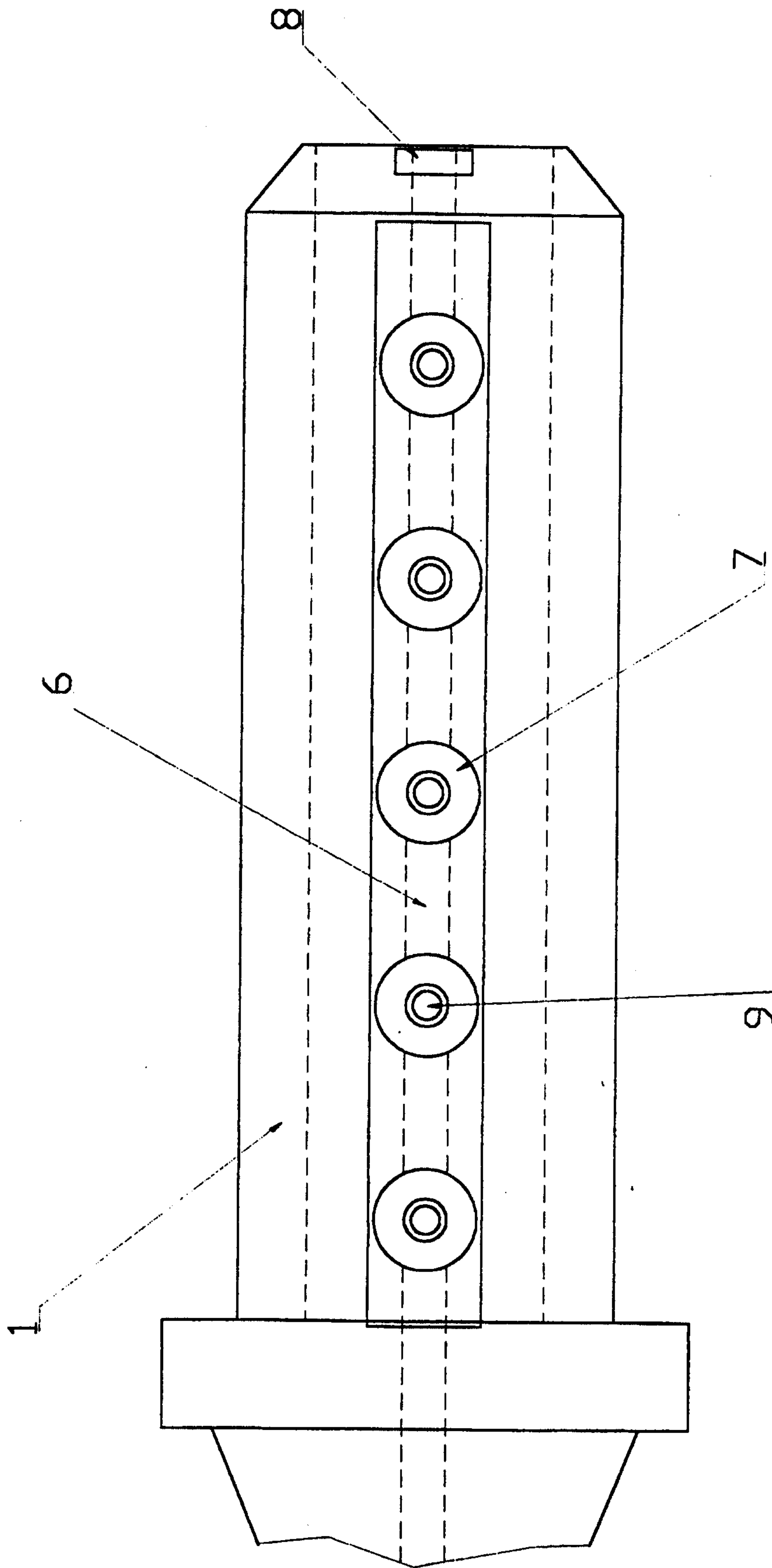


FIG. 3

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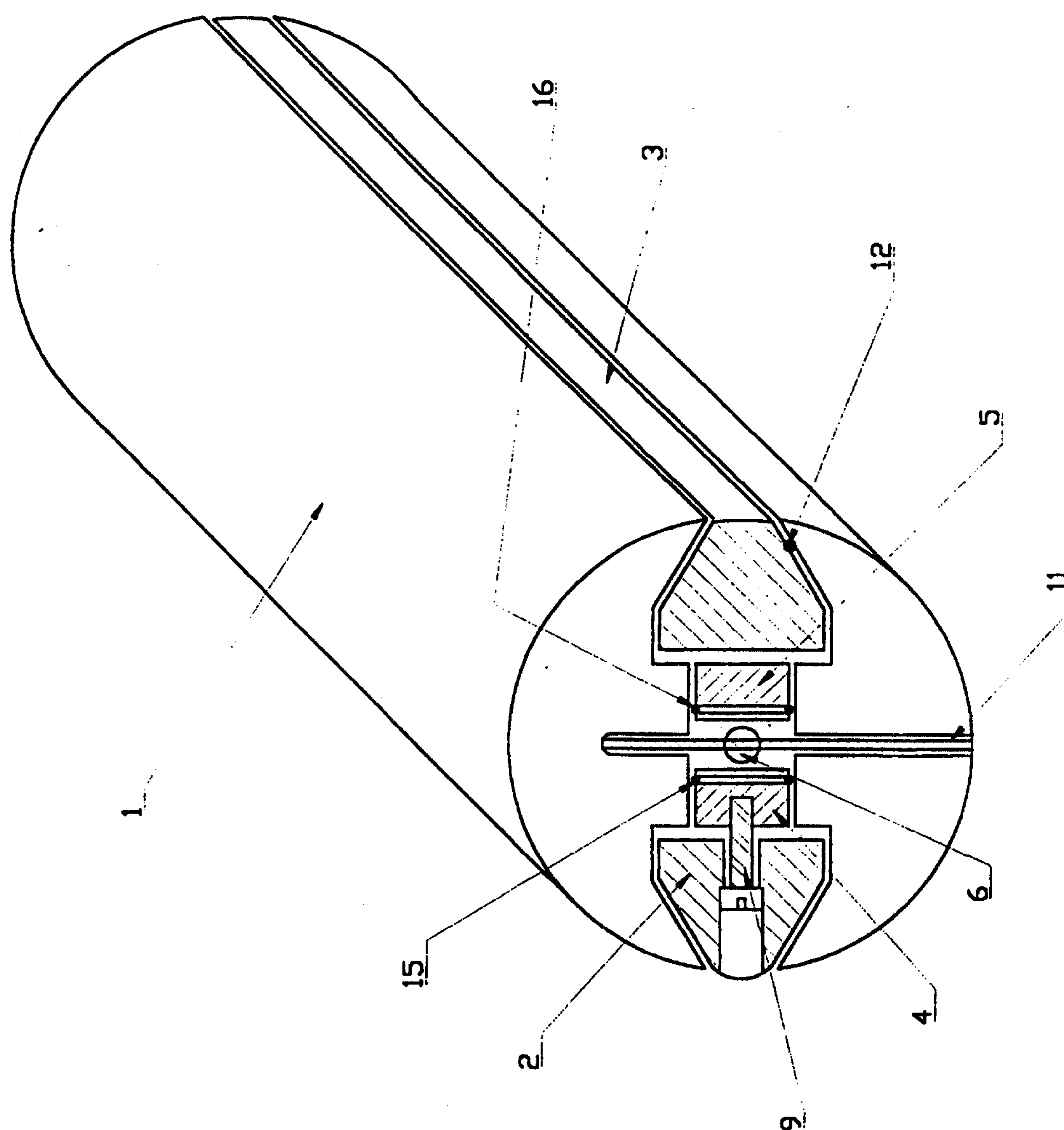


FIG. 4

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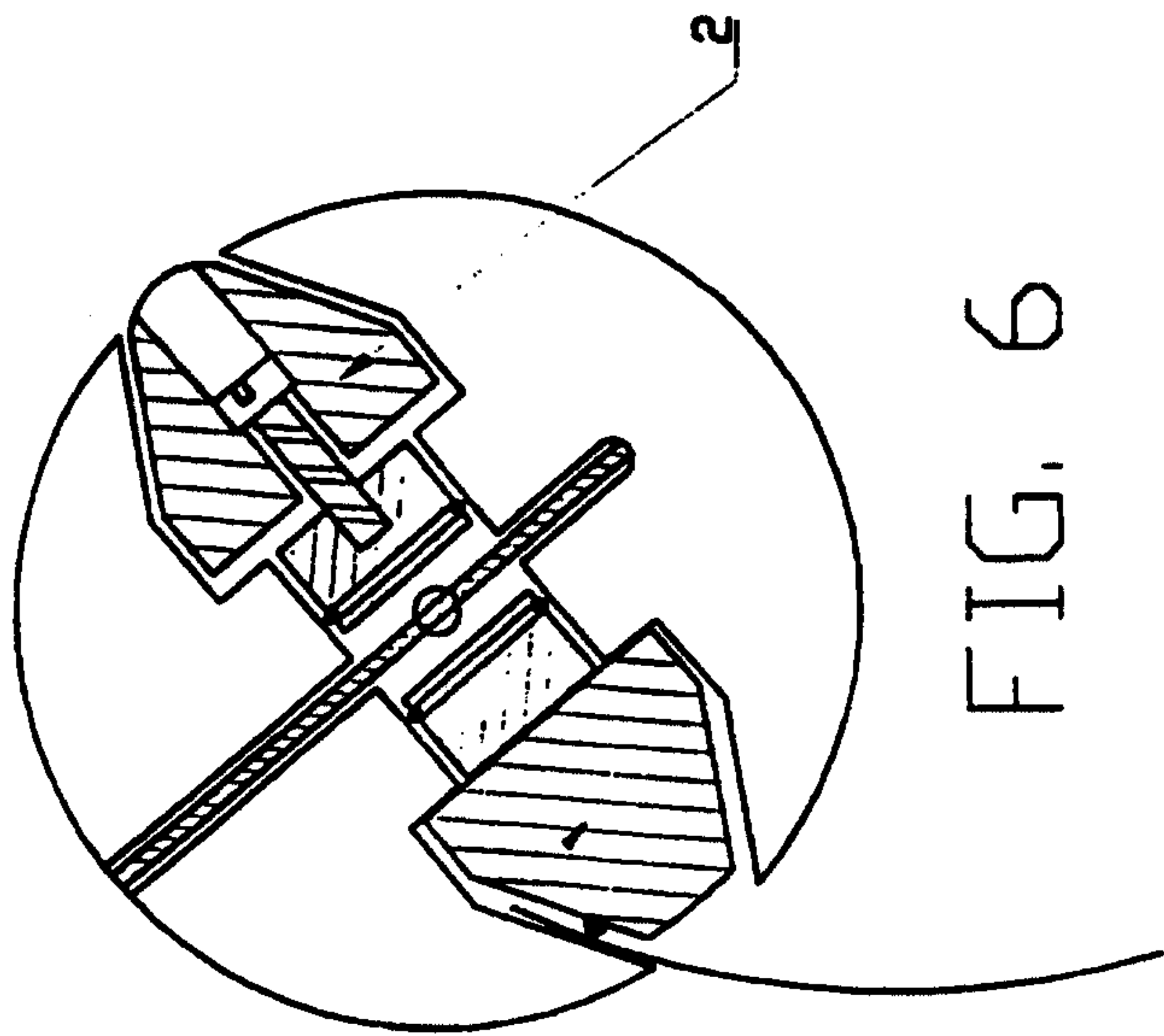


FIG. 6

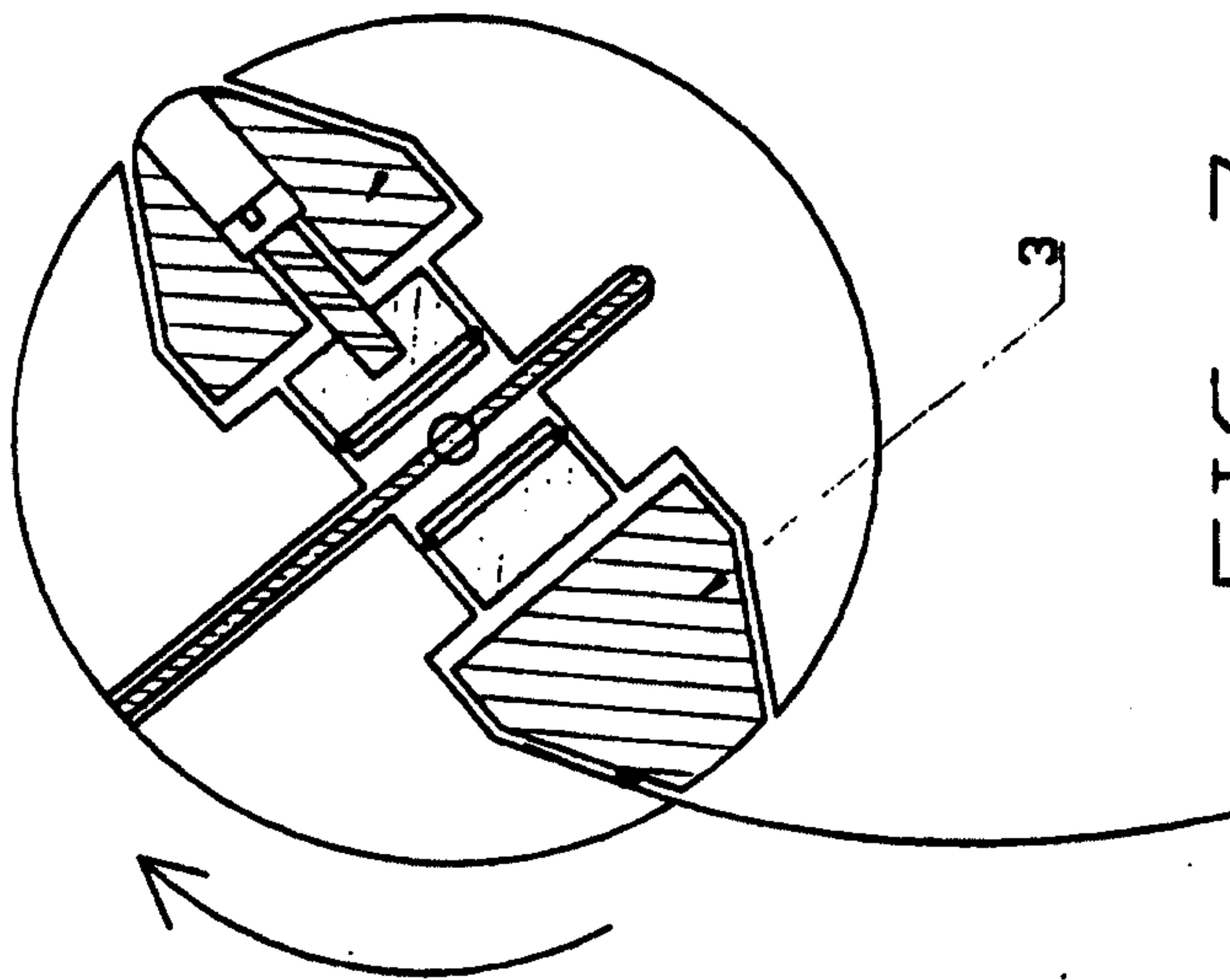


FIG. 7

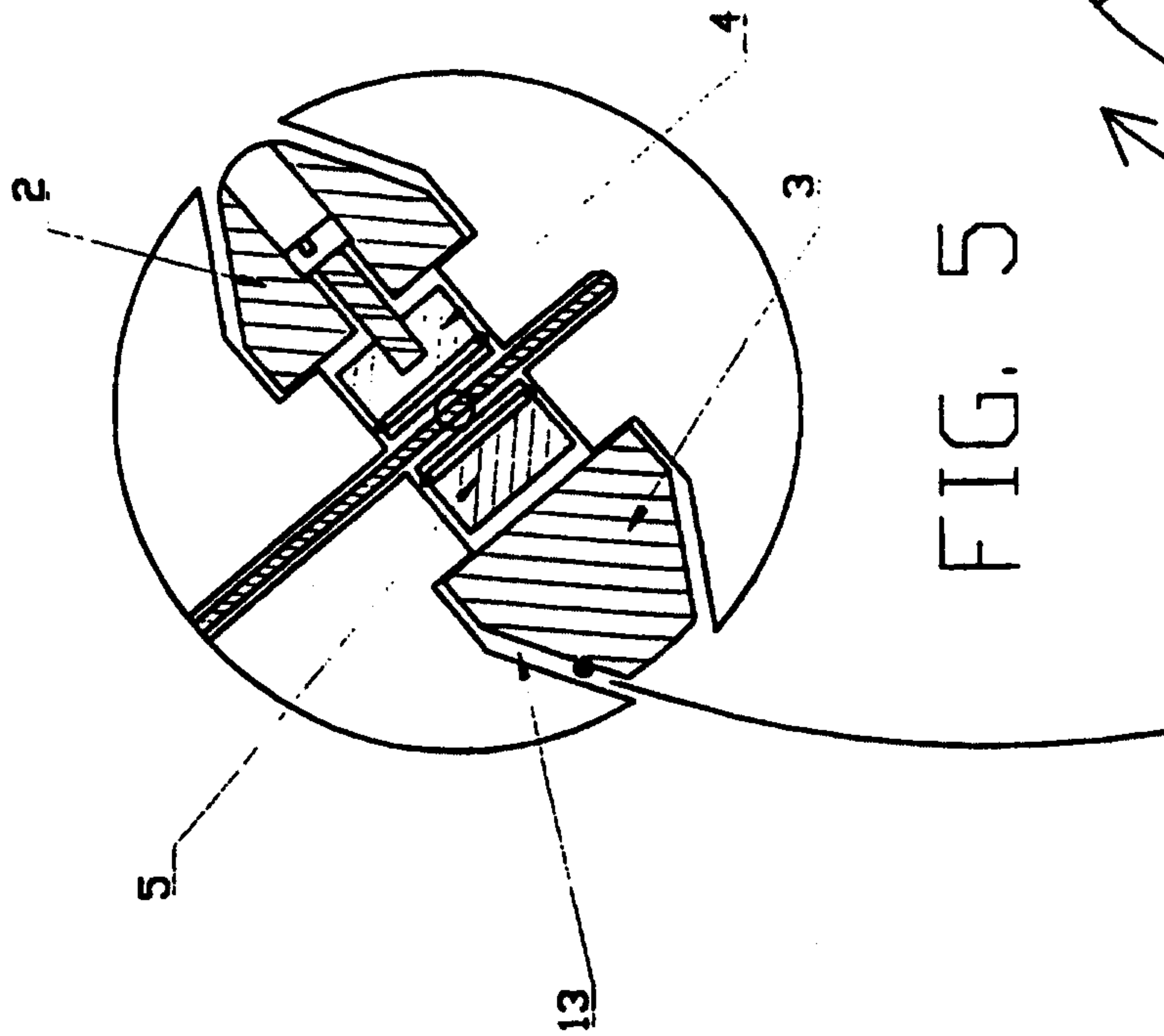


FIG. 5

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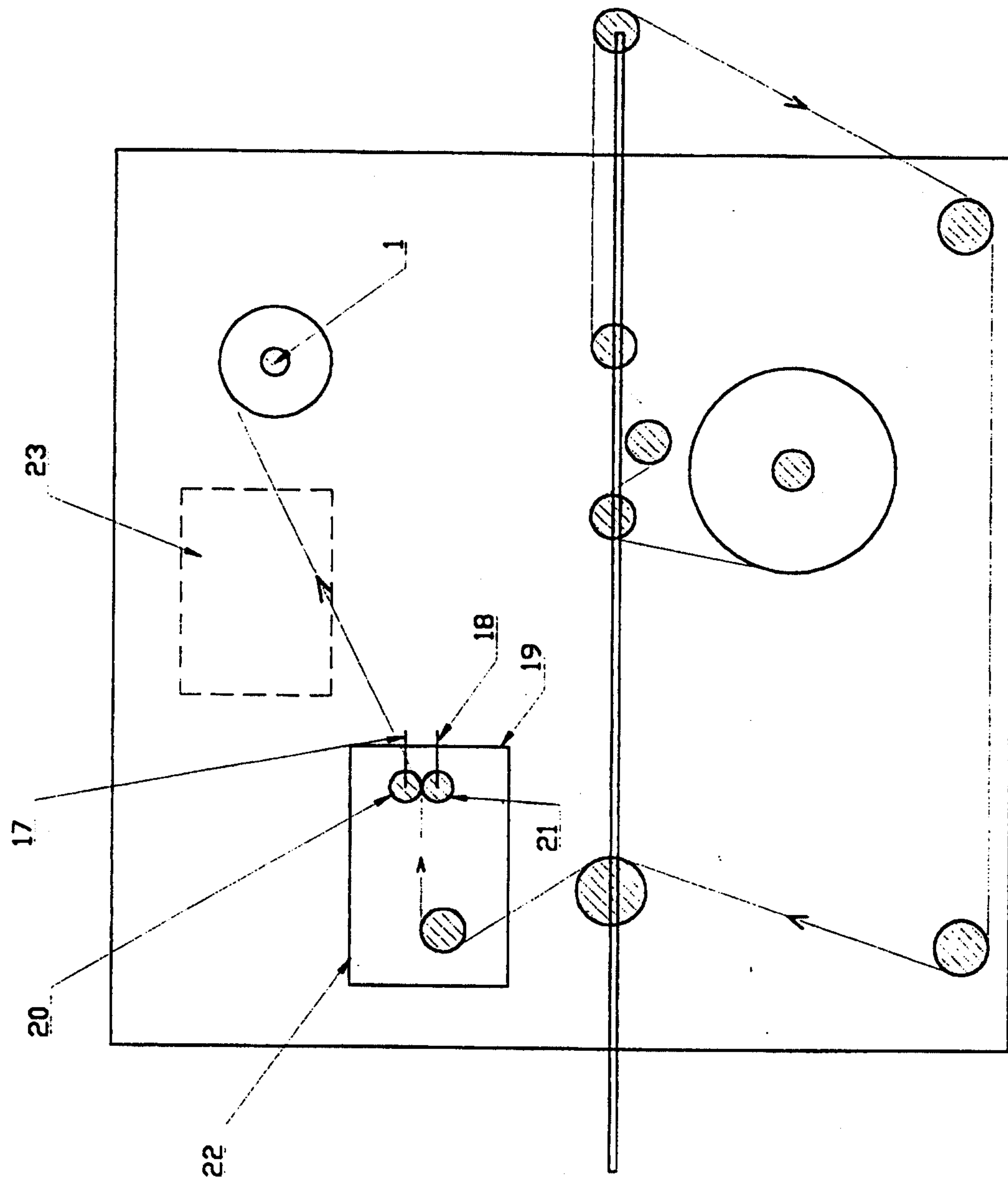


FIG. 8

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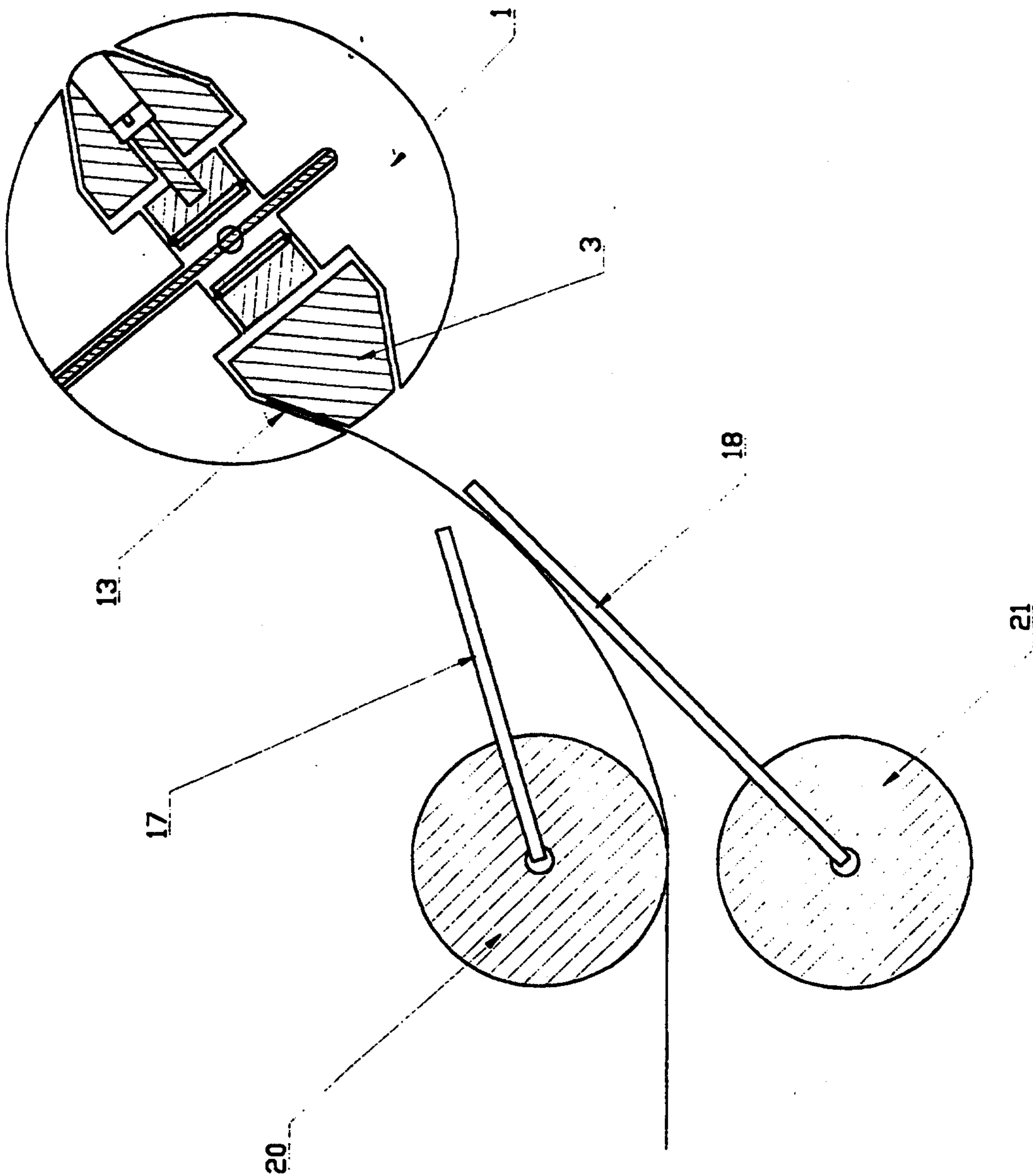


FIG. 9