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(11) **EP 0 931 601 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
28.07.1999 Bulletin 1999/30

(51) Int. Cl.⁶: **B21C 1/00**, B21C 43/04

(21) Application number: **98830031.5**

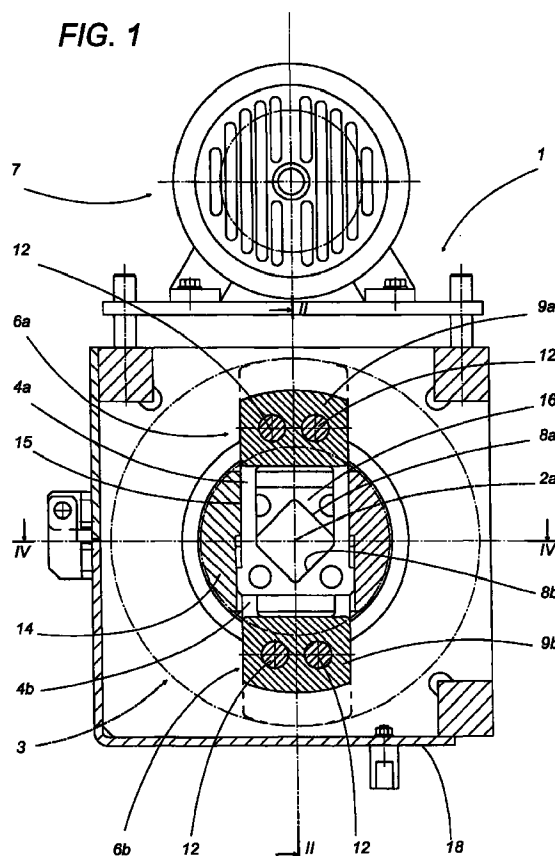
(22) Date of filing: **23.01.1998**

(84) Designated Contracting States:
**AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC
NL PT SE**
Designated Extension States:
AL LT LV MK RO SI
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(54) **Device for mechanical cleaning of wire rod for the production of drawn metal wires**

(57) A device (1) for mechanical cleaning of wire rod (2) for the production of drawn metal wires, comprises a press (3) having clamping jaws (4a,4b) which support a layer (5) of steel wool, wrapped around the wire rod (2), pressing it against the wire rod (2) advancing between the jaws (4a,4b) themselves and holding it to prevent it from being tugged by the wire rod (2); operating elements (6a,6b) which support the jaws (4a,4b) and which are slidingly guided with respect to one another transversely to the wire rod (2); and means (7) for driving the operating elements (6a,6b) able to allow to move the jaws (4a,4b) mutually closer or farther away with respect to the wire rod (2). The jaws (4a,4b) rotate around the wire rod (2) and tighten by centrifugal effect the steel wool layer (5) onto the wire rod (2) in such a way as to remove therefrom the oxide coating the underlying metal and to make on the wire rod (5) helicoidal grooves for anchoring the drawing lubricant.



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Description

[0001] The present invention relates to the mechanical cleaning of lengthened semi-finished iron products commonly called wire rods, destined in particular to the production of drawn metal wires.

[0002] Drawing, as is universally known, is a technological process whereby semi-finished products with roughly round cross section are reduced into wires with progressive reductions in cross section effected by moving through a succession of die plates of decreasing diameters. Such a process applied to iron products necessarily requires a preliminary preparation of the semi-finished item which influences very heavily the drawing process itself.

[0003] It is well known that the wire rod, being produced in a hot process, normally is coated with layers of oxide, of hydroxide, of calamine which need to be carefully removed before drawing, since their presence gives rise to numerous drawbacks, among them a production of poor quality wires, a rapid wear of the die plates and a severe limitation of the drawing speed.

[0004] Such preparation is performed in the prior art by means of operating methods which essentially derive from two concepts corresponding respectively to chemical or mechanical methods.

[0005] Chemical methods are effected by means of apparatuses and processes that essentially perform the wet pickling of the wire rod. Solutions of this kind offer very high quality of cleaning, however they entail considerable plant and operating costs and, above all, severe drawbacks in terms of environmental pollution.

[0006] Mechanical methods, though providing in general a lower quality of cleaning than the one offered by the solutions using the chemical method, are currently preferred to them because they entail less of an impact on the environment and better economics, both in terms of plant costs and in terms of operating costs.

[0007] The present invention relates specifically to a device for mechanical cleaning of wire rod for the production of drawn metal wires, comprising a press having clamping jaws which support a layer of steel wool, wrapped around the wire rod, pressing it against the wire rod as it advances between the jaws themselves, in such a way as to remove the oxide particles externally coating the underlying metal, holding the steel wool layer to prevent it from being tugged by the wire rod itself; operating elements which support the jaws and which are slidingly guided one with respect to the other transversely to the wire rod; and means for driving the operating elements able to allow to tighten or to move mutually away the jaws with respect to the wire rod. Such a device is already known from document IT 01.266.365 in the name of the same Applicant.

[0008] The device recalled above has proven itself to be particularly advantageous thanks to the fact that it combines the advantages of a reduced influence on the natural environment, characteristic of mechanical meth-

ods, with numerous other advantages, among them a considerable simplicity of construction, low plant costs, low operating costs, a practically nil ratio of tooling costs per unit of product, a consistent cleaning quality, regardless of the quantity of wire rod being processed.

[0009] Within the field of mechanical wire rod cleaning operations is also the preparation of the metal surface in order to favour the suitable anchoring of the pulverulent lubricant, which is normally placed on the wire rod, after removal of the coating oxide and before introduction into the die plate.

[0010] In the wire rod cleaned with such prior art device, anchoring, in addition to being entrusted to the natural microporosities of the metal which characteristically presents a rough, orange peel-like surface, is entrusted to a series of parallel scratches, obtained longitudinally to the wire rod, by the removal of material effected by the steel wool.

[0011] Such preparation has yielded fully satisfactory results, however it would be desirable to create the conditions for even more effective anchoring and, above all, anchoring that can be modulated at will according to some generally variable technological parameters, among them the characteristic chemical composition of the wire rod metal, the conditions of supply of the wire rod, the type of lubricant in use, the desired drawing speed.

[0012] The object of the present invention therefore is to solve the problems mentioned above. According to the invention this object is attained by a device for mechanical cleaning of the wire rod, of the type indicated in the preamble to claim 1, wherein the jaws which clamp the steel wool on the wire rod rotate around the wire rod which advances between the jaws.

[0013] Such a characteristic allows to obtain on the outer surface of the wire rod helicoidal grooves which, with the same longitudinal development of the wire rod increase the length of the scratches extending correspondingly the anchoring areas of the lubricant.

[0014] Moreover, through the variation of the rotating speed of the jaws, for the same speed of advance of the wire rod, in the device according to the invention it is possible to increase or decrease, as needed, the pitch of the helicoidal scratches allowing an actual control of the mechanical forming of the anchoring areas of the lubricant.

[0015] The technical characteristics of the invention, according to the aforesaid purposes, can be clearly seen from the content of the claims reported below and its advantages shall be made more evident in the detailed description that follows, made with reference to the accompanying drawings, which show an embodiment provided purely by way of non limiting example, in which:

- Figure 1 is an overall view of the device shown according to the direction of advance of the wire rod and partially sectioned according to a plane trans-

verse to that direction;

- Figure 2 is an overall view of the device partially sectioned according to a plane of trace II-II in Figure 1, which view also bears an indication of the trace of the mentioned cross section plane of Figure 1, indicated as I-I;
- Figure 3 is an overall view corresponding to Figure 2 showing in particular the device in one of its operating conditions;
- Figure 4 is a view of the device sectioned according to a section plane of trace IV-IV of Figure 1 and shown with some parts removed the better to highlight others;
- Figure 5 is a detailed view of some components of the invention.

[0016] According to the figures of the accompanying drawings, the invention relates to a device 1 for mechanical cleaning of iron wire rod 2, employed in particular for the production of metal wires by means of drawing. The device 1 essentially comprises (Figures 1, 2 and 3) a press 3 coaxial with, and revolving around, a line of advance 2a along which the wire rod 2 advances with continuous motion, in a way known in the prior art, towards a drawing plant located downstream and not shown since it does not interest the invention.

[0017] The press 3 is provided with jaws 4a,4b for clamping the wire rod 2 supported by operating elements 6a,6b borne by a cylindrical body 14 internally hollow (see also Figure 4) which is axially crossed by the wire rod 2 and is rotatively mounted on a casing 18 which supports the cylindrical body 14 itself in correspondence with its opposite ends, by means of related rolling supports 19.

[0018] More in particular, the operating elements 6a,6b of the press 3 (Figures 1 and 2) together with the related jaws 4a,4b, are actuated by a plurality of plane metal plates in mutual assembly. The plates individually present essentially rectangular lengthened shape and are provided with a part crossed by an ample polygonal opening 16 which identifies the jaws 4a,4b which, in turn, present closed annular conformation and bear in particular "V" shaped operative surfaces 8a,8b.

[0019] The plates are housed in the cylindrical body 14 moving through prismatic guides 15 obtained in the cylindrical body 14 itself and oriented radially thereto. They are also set side by side, and are assembled in mutual succession in order to form opposite and monolithic plate packs 11, wherein individual plates are stacked longitudinally to the wire rod 2 and are held together by pairs of cylindrical rods 12 which cross the plates of each pack 11 and which are provided at their ends with arresting bolts 13.

[0020] The plates of each of the packs 11 succeed each other along the direction of advance 2a of the wire rod 2 alternating in an orderly manner with the corresponding plates of the opposite pack 11 in such a way as to make the overall jaws 4a,4b of the press 3 able

mutually to penetrate within each other; jaws 4a,4b which by virtue of the "V" conformation of the operative surfaces 8a,8b of the individual plates surround in combination with each other the wire rod 2 for its entire length of crossing of the press 3.

[0021] By virtue of the particular feature described above, the operating elements 6a,6b of the press 3 and of the jaws 4a,4b integral and monolithic therewith are slidably movable within the guide 15 of the cylindrical body 14 and can slide one with respect to the other in a direction transverse to the line of advance 2a of the wire rod 2, and in the two senses of such transverse direction with opposing motions.

[0022] The driving means 7 of the operating elements 6a,6b comprise a pulley 19, integral with the cylindrical body 14, and a motor 20 operatively connected by a transmission belt 21 which transmits to the cylindrical body 14 a rotation around the line of advance 2a of the wire rod 2. In correspondence with the rotation of the cylindrical body 14, the operating elements 6a,6b of the press 3 are subjected to centrifugal forces which, directed radially to the cylindrical body 14, tend to move the operating elements 6a,6b away from each other and consequently clamp the jaws 4a,4b against the wire rod 2 interposed thereto (as shown in Figure 3). In correspondence with the inactive condition of the motor 20 the operating elements 6a,6b instead remain motionless maintaining the ability to float freely within the guides 15 of the cylindrical body 14.

[0023] From the observation of Figure 1 it is possible to note that the plate conformation conferred to the operating elements 6a,6b of the press 3 is particularly advantageous since it allows to concentrate, at a suitable distance from the axis of rotation 2a of the cylindrical body 14, masses 9a,9b dimensioned in such a way as to apply to jaws 4a,4b centrifugal forces of optimal intensity in relation with the angular velocity of the cylindrical body 14.

[0024] In a further enhanced embodiment, shown in Figure 5, the device 1 also comprises means 10 for synchronising the relative sliding motion of the jaws 4a,4b with respect to the wire rod 2. Such synchronisation means more in particular comprise a wheel 10a externally toothed, supported coaxially and externally to a bush 21 for centring the wire rod 2, and racks 10b,10c which mesh bilaterally with the gear wheel 10a and which, being integral respectively with the jaws 4a,4b of the press 3, allow to move the jaws 4a,4b away or nearer by rigorously identical quantities with respect to the line of advance 2a of the wire rod 2.

[0025] In use, the operation of the device 1 which can be described with reference to Figure 3, entails placing between the jaws 4a,4b of the press 3 a layer 5 of steel wool which is wrapped manually around the wire rod 2. Once this operation is complete, the motor 20 is started which, through the transmission belt 7 makes the cylindrical body 14 rotate around the line of advance 2a with a pre-set angular velocity. As a consequence of the

rotation of the press 3, on the plates are imparted centrifugal forces which place in motion the operating elements 6a,6b which translate in radial direction to the cylindrical body 14 moving away from each other until their slide is stopped by the contact of the jaws 4a,4b with the wire rod 2.

[0026] The annular conformation of the jaws 4a,4b allows to press the steel wool against the wire rod 2 advancing between the jaws 4a,4b themselves allowing to impart on the wire rod 2 a tangential force suitable for removing the oxide externally coating the underlying metal, and able to retain at the same time the steel wool layer 5 preventing it from being removed from the press 3 as a consequence of the tugging action effected by the wire rod 2.

[0027] The rotating motion of the press 3 around the line of advance 2a together with the clamping force of the jaws 4a,4b allows the steel wool layer 5 to cut into the surface of the wire rod 2 making helicoidal scratches therein which are more or less inclined with respect to the line of advance 2a depending on the ratio between the speed of advance of the wire rod 2 and the velocity of rotation of the cylindrical body 14 of the press 3.

[0028] The invention thus fully attains the purposes described above and further presents the possibility of allowing to modulate the control of the density of the scratches to be made on the unit of length of the wire rod 2 simply through the modulation of the velocity of rotation of the press 3. It should also be noted that the device 1 presents high characteristics of intrinsic safety for the operator during the operations for setting the steel wool layer 5. It also has the additional advantage of a certain simplicity of construction which ensures a high operating reliability and low construction and operating costs.

[0029] The structure of the device 1 into packs 11 of plates lastly allows to construct modular devices 1 wherein simply by varying the number of plates comprising the individual packs 11 it is possible to increase or reduce the mechanical cleaning capacity according to specific needs.

[0030] The invention thus conceived can be subject to numerous modifications and variations, without thereby departing from the scope of the inventive concept. Moreover, all components may be replaced with technically equivalent elements.

Claims

1. Device (1) for mechanical cleaning of wire rod (2) for the production of drawn metal wires, comprising a press (3) having clamping jaws (4a,4b) which support a layer (5) of steel wool, wrapped around the wire rod (2), pressing it against the wire rod (2) advancing between the jaws (4a,4b) themselves and holding it to prevent it from being tugged by the wire rod (2); operating elements (6a,6b) which support the jaws (4a,4b) and which are slidingly guided

with respect to one another transversely to the wire rod (2); and means (7) for driving the operating elements (6a,6b) able to allow to move the jaws (4a,4b) closer or farther apart with respect to the wire rod (2), characterised in that the jaws (4a,4b) rotate around the wire rod (2).

2. Device, according to claim 1, characterised in that the jaws (4a,4b) have operative surfaces (8a,8b) shaped to encompass in mutual combination the wire rod (2) travelling through the press (3).
3. Device, according to claim 1 or 2, characterised in that the driving means (7) are designed to clamp the jaws (4a,4b) against the wire rod (2) with forces acting in the direction moving the operating elements (6a,6b) away from each other.
4. Device, according to one of the previous claims, characterised in that the driving means (7) are designed to impart to the operating elements (6a,6b) a rotation around the wire rod (2), such as to induce centrifugal forces able to tighten the clamping jaws (4a,4b) onto the wire rod (2).
5. Device, according to claim 4, characterised in that it comprises concentrated masses (9a,9b), integral with the clamping jaws (4a,4b).
6. Device, according to claim 1, characterised in that it comprises means (10) for synchronising the relative sliding motion of the jaws (4a,4b) with respect to the wire rod (2).
7. Device, according to claim 6, characterised in that said synchronising means (10) comprise a wheel (10a) externally toothed, supported coaxially to the wire rod (2) and racks (10b,10c) which mesh with the gear wheel (10a) and which are integral respectively with the jaws (4a,4b) of the press (3).
8. Device, according to claim 1, characterised in that it comprises at least three clamping jaws (4a,4b) which are set side by side and which succeed each other along the wire rod (2) alternating each other in an orderly manner.
9. Device, according to claim 8, characterised in that it comprises a plurality of said jaws (4a,4b) which are mutually assembled in packs (11) having stacking length oriented longitudinally to the wire rod (2).

FIG. 1

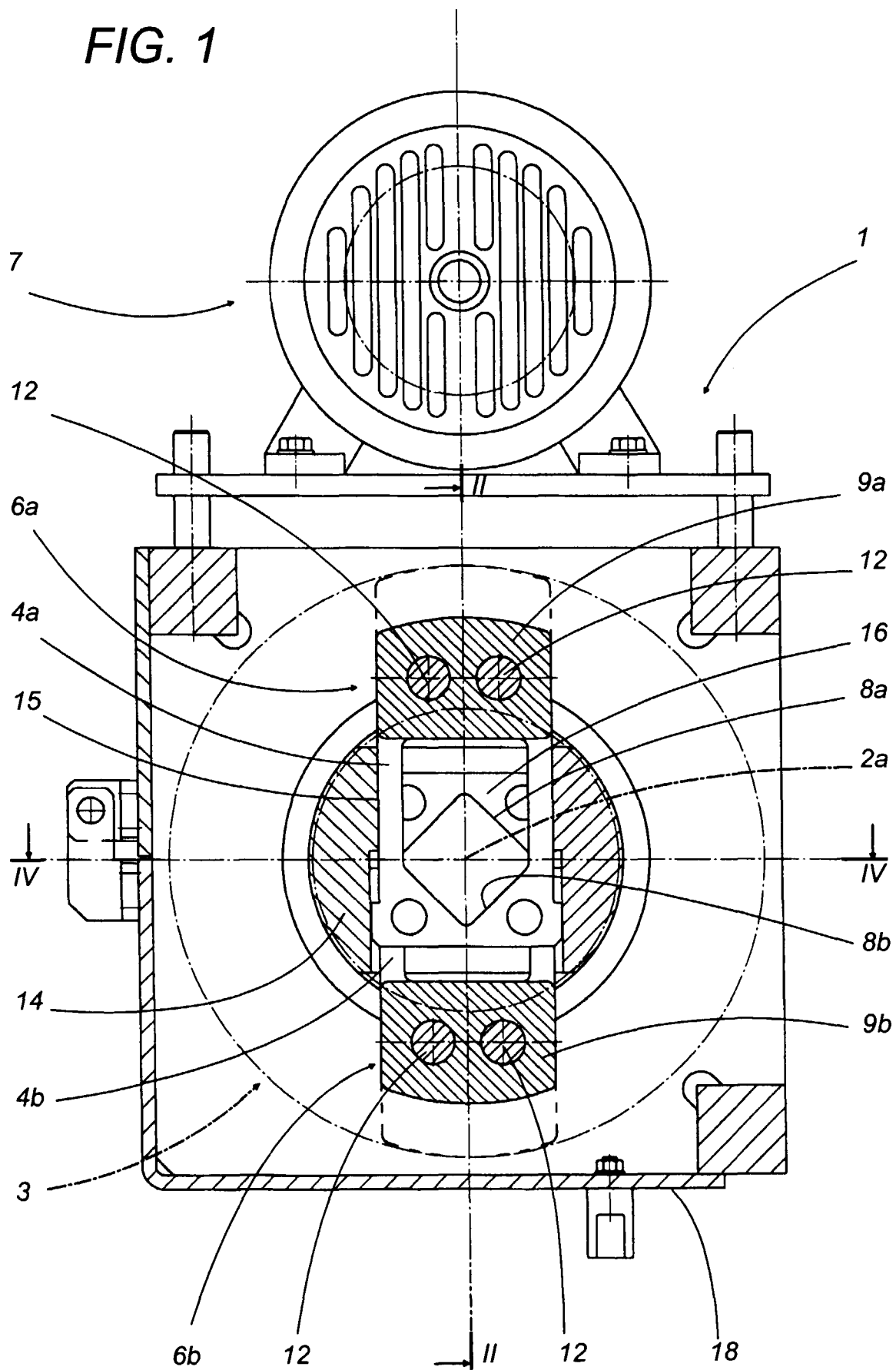


FIG.2

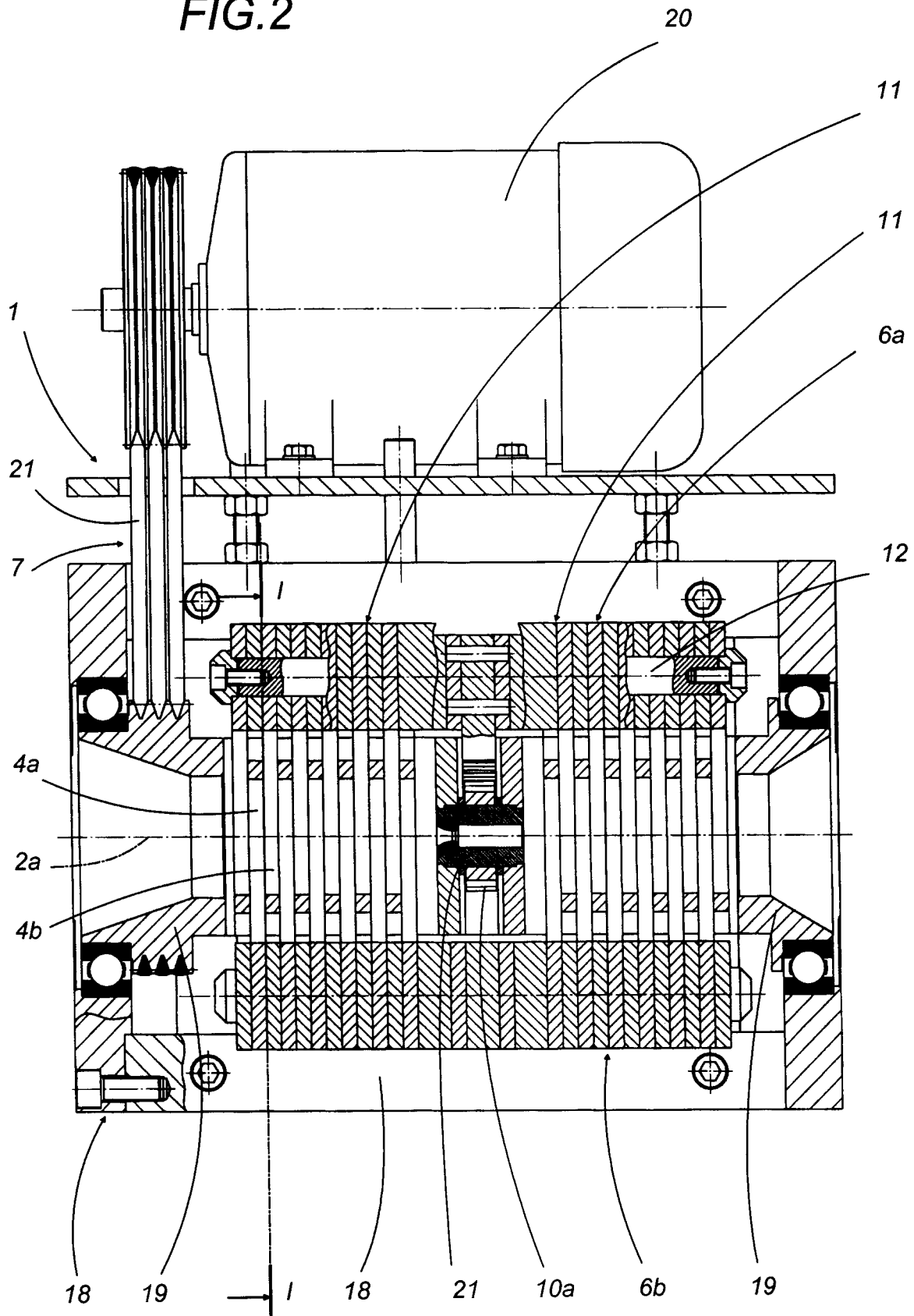
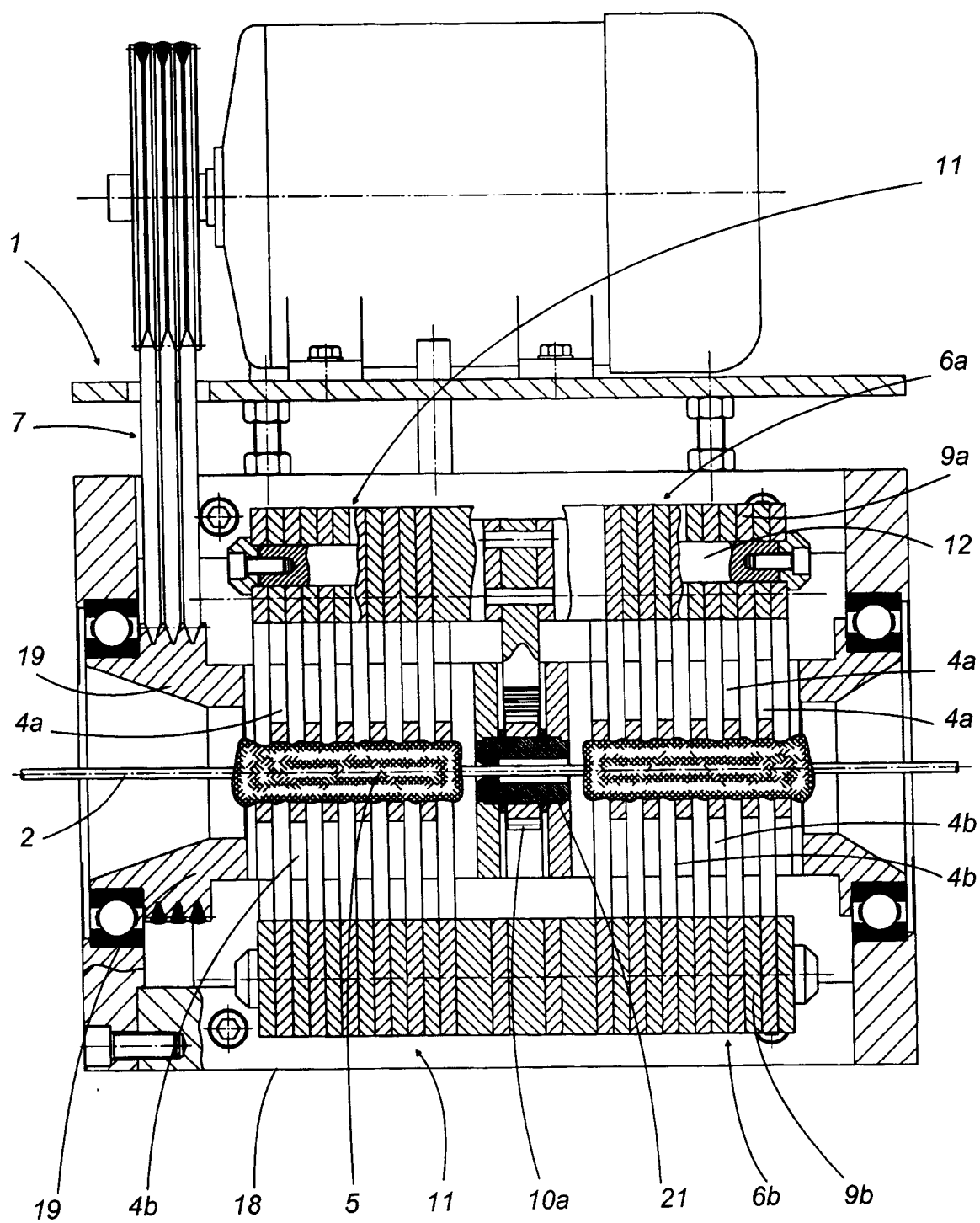


FIG. 3



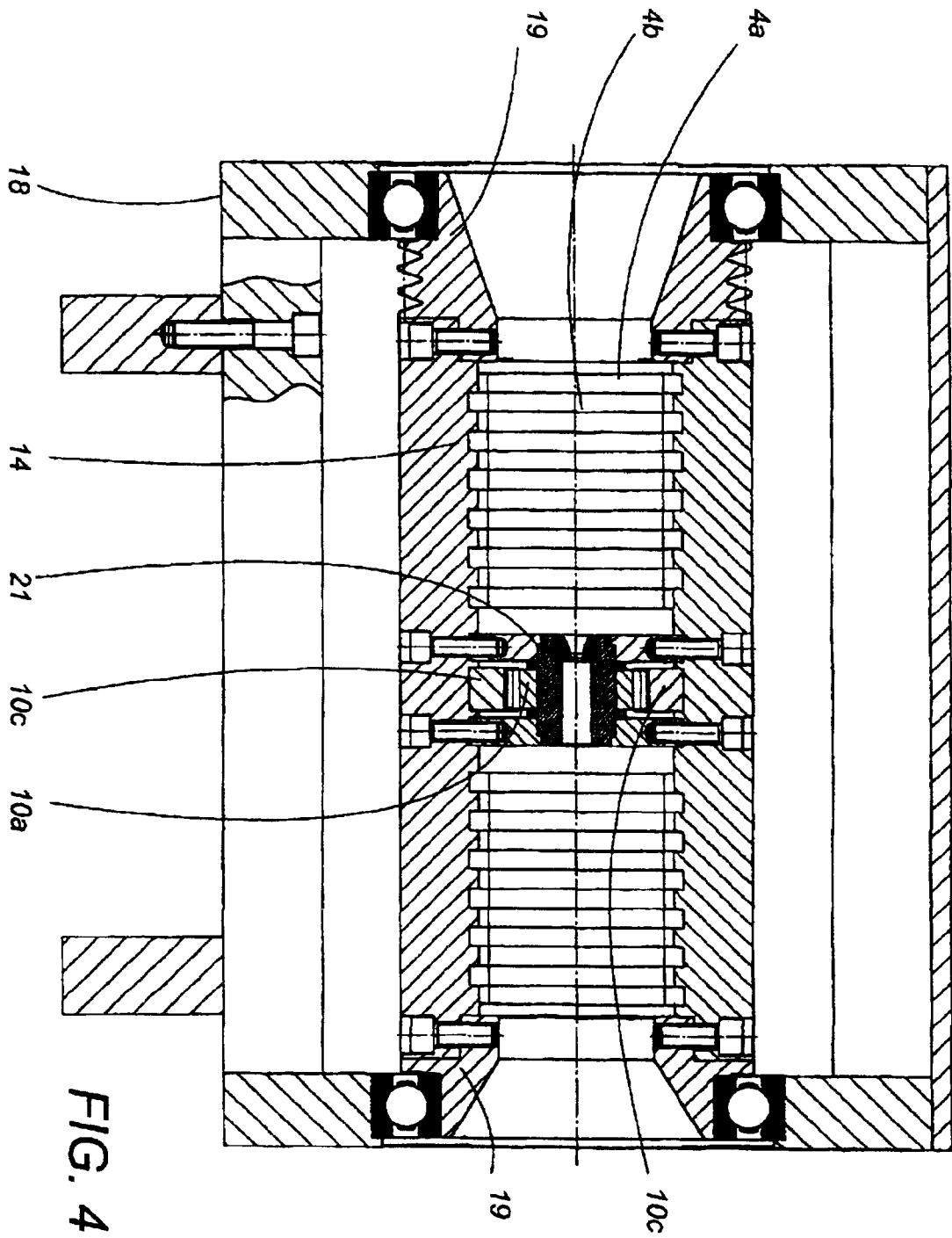


FIG. 4

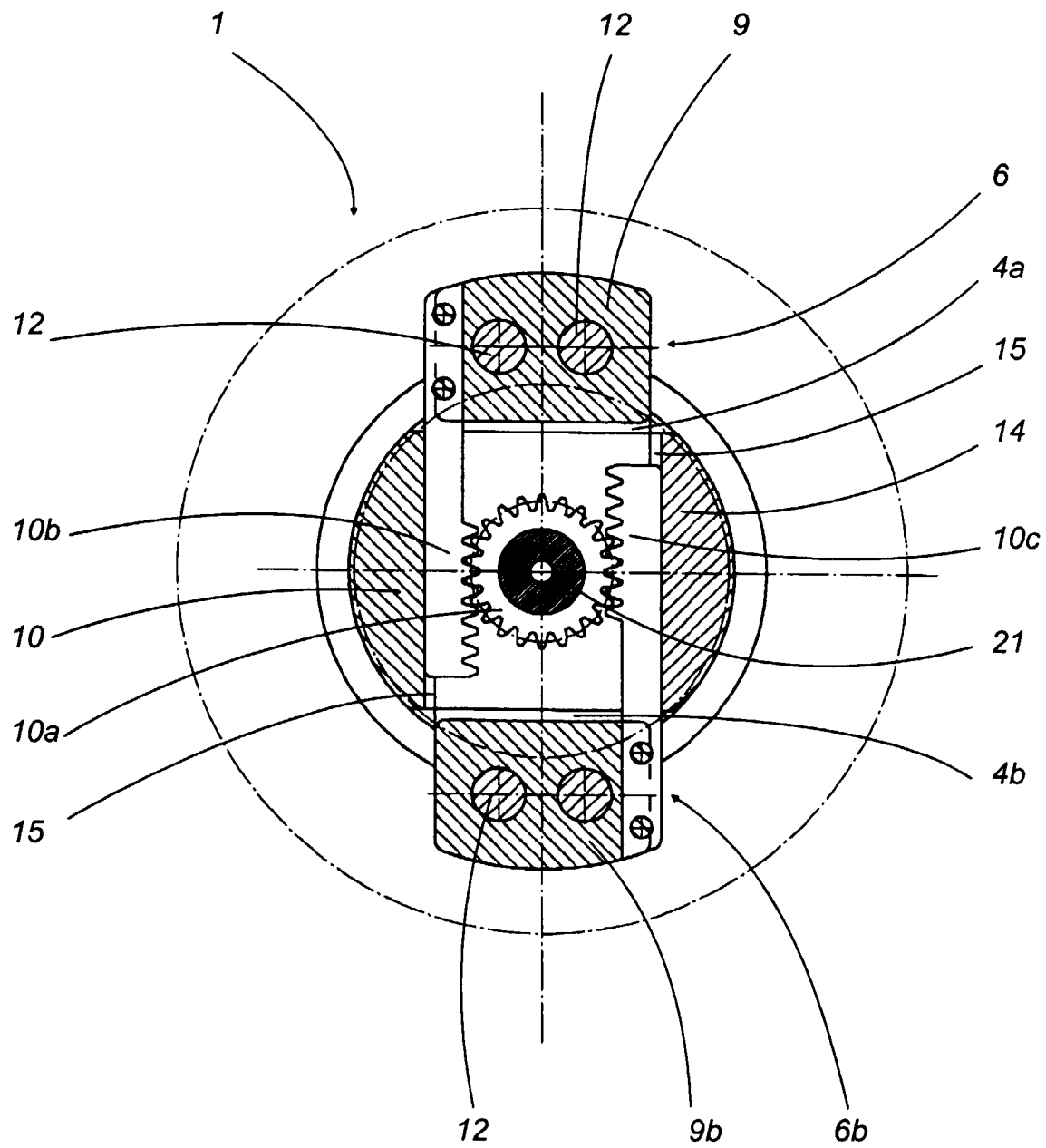


FIG. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 98 83 0031

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.CI.6)
D,Y	EP 0 630 697 A (LISCIANI TRAFILERIE) 28 December 1994 * the whole document *	1-5,8,9	B21C1/00 B21C43/04
Y	DE 38 21 362 C (BENTELER) 3 May 1989 * column 4, line 8 - line 43 * * column 5, line 13 - line 43; figures *	1-5,8,9	
A	US 3 081 524 A (BALLENTINE) 19 March 1963 * column 5, line 33 - line 37; figures 8,9 *	1	
A	DE 912 204 C (SOCIETE METALLURGIQUE DE GORCY)	1	
A	CH 251 466 A (CARLANTONIO SALVI) * figures *	1	
			TECHNICAL FIELDS SEARCHED (Int.CI.6)
			B21C B24B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 19 June 1998	Examiner Barrow, J
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