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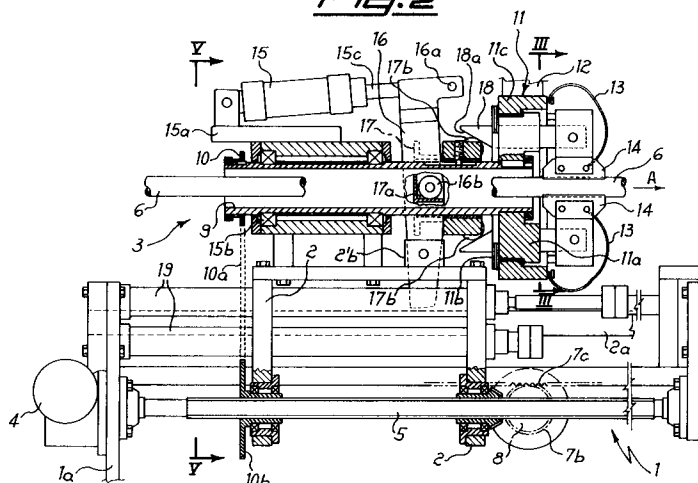
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21.04.93 Bulletin 93/16**Via Bombai 1****Maderno, Brescia(IT)**(84) Designated Contracting States:
AT BE CH DE ES FR GB IT LI LU NL SE(74) Representative: **Raimondi, Alfredo, Dott. Ing.**(71) Applicant: **BREVETTI ELETTROGALVANICI
SUPERFINITURE B.E.S. s.r.l.
Via Aristotele 4
I- 20047 Brugherio (Milano)(IT)****Prof. et al****Dott. Ing. Prof. RAIMONDI ALFREDO S.r.l.****Piazzale Cadorna 15****I-20123 Milano (IT)**

(54) **Device capable of bringing about continuously the feeding, rotation and electrical connection of bars and the like in electrolytic deposition plants.**

(57) A device capable of bringing about continuously the feeding, rotation and electrical connection of bars and the like in electrolytic deposition plants, comprising a fixed frame (1) to which are made integral means (4,5) for generating a rotary movement capable of being transmitted, via appropriate driving facilities (10,10a,10b) to a rotary head (3) equipped with components (2) moving in a rectilinear direction on frame (1) under the pulling action of means (7,7a,7b,7c) capable of converting into rectilinear

movement the rotary movement of shaft (5) whereby they are actuated, there being made integral with such rotary head (3) a mandrel (11) provided with clamping facilities (14) charged with current and capable of undergoing controlled closure for the clamping and charging with current of such tubular component (6), there being furthermore provided means to control the position of carriages (2) and means (19) for the rapid return thereof to the cycle start position.

Fig.2**EP 0 537 834 A1**

The object of this invention is a device capable of bringing about continuously the feeding, rotation and electrical connection of bars and the like in electrolytic deposition plants.

It is known that, in the processing of tubular components such as tubes, bars, drive shafts and the like which are to undergo surface finishing treatment by electrodeposition of metal, it is necessary to feed such bars continuously into the processing tanks containing the anodes, causing them simultaneously to rotate on their own axis to improve the uniformity of the plating and at the same time keep them charged with current, in a continuous manner, so as to cause them to perform the function of a cathode in order to receive the metal ions from the electroplating bath. There are also known some devices capable of feeding such bars by making them move in a forward direction toward the processing tanks while simultaneously rotating on their own axis; such devices are, however, devoid of a power unit supplying the negative charge for closing the electrolytic circuit, such charge being instead provided separately via suitable devices which normally include mercury baths capable of improving the characteristics of the said charge.

Such devices, however, given the presence of mercury, are considered extremely hazardous and polluting and therefore have little appeal to manufacturers.

There is therefore posed the technical problem of providing a device for the continuous feeding of bars to an electroplating or like plant capable of imparting to substantially tubular components a rectilinear forward movement and a simultaneous rotary movement around their own axis, providing them at the same time and in a continuous manner with a negative polarity of a potential difference; such device should furthermore be capable of operating in a substantially dry condition without the use of hazardous and/or polluting chemical substances, and should be readily adaptable to the various diameters of the bars which are to be fed to the process in order to avoid complicated and costly adaptation operations including replacement of parts.

The device should moreover be capable of being easily applied to both new and existing plants and should likewise be easily replaceable even temporarily to facilitate maintenance where necessary.

Such results are obtained by the present invention, which provides a device capable of bringing about continuously the feeding, rotation and electrical connection of bars and the like in electrolytic deposition plants and comprising a fixed frame to which are made integral means for generating a rotary movement capable of being transmitted, by suitable driving equipment, to a rotary head

equipped with components moving in a rectilinear direction on the frame, under the pulling action of means capable of converting into rectilinear movement the rotary movement of the shaft whereby they are actuated, there being made integral with such rotary head a mandrel provided with clamping facilities charged with current by means of power-generating equipment and capable of undergoing controlled closure for the clamping and charging with current of such tubular component, which is thus placed simultaneously in conduction, in rotation on its own axis and in rectilinear movement in a longitudinal direction, there being furthermore provided means to control the stroke of the carriages and means for the rapid return thereof to the cycle start position.

According to the invention is it envisaged that such means of generation of movement shall preferably consist of a motor integral with the fixed frame and bringing about the rotation of a splined shaft, and also that such rotary head shall preferably consist of a hollow component carrying a rotary drive pinion at one end, a device for controlling the closure of such clamps in the middle position, and the said mandrel at the opposite end.

Such mandrel furthermore consists of an annular body externally and coaxially to which is fitted an insulating support carrying in turn an annular commutator made of conductive material on which slide current-carrying brushes for generating the current to be applied to the clamps via suitable conductors, which clamps are made integral with the mandrel by means of articulated arms, designed to control the closure thereof against the return action of springs when rotated by the radial thrust of rollers on an inclined surface at the end of such arms, or to allow opening thereof by means of the said springs when such radial thrust ceases.

The device according to the invention also provides for such radial thrust to be applied/removed by the forward/reverse movement in an axial direction of the said annular body on which are mounted the rollers, the axial movement being controlled by a fork-shaped component which carries rollers co-operating with the annular body and which is made to rotate around a pin integral with the carriage by means of a pneumatic cylinder, such rotation causing forward or return rectilinear movement parallel to the axis of such rollers and therefore of the annular body.

Additionally such means of rapid return of the carriages to the cycle start position are preferably comprised of hydraulic cylinders, the free end of the shaft of each of which is integral with the relevant carriage, rapid return being controlled by limit switches which govern the simultaneous entry into operation of the clutch as well as means for disconnecting the current to the clamps prior to the

opening thereof, substantially consisting of a pneumatic cylinder capable of actuating a pair of contacts, at least one of which is a moving contact, interposed between the said clamps and the negative pole of the power circuit.

Further details may be obtained from the following description with reference to the attached drawings, which show:

- In figure 1 : a schematic side view of the device according to the invention applied to an electroplating plant;
- In figure 2 : a partial schematic cross-section drawn according to a vertical plane of the device in fig. 1;
- In figure 3 : a cross-section according to plane III-III of figure 2, and
- In figure 4 : a schematic diagram of the operating cycle of the device according to the invention.
- In figure 5 : a partial cross-section according to drawing plane V-V of fig. 2.

As shown in figure 1, the device 1 according to this invention is essentially comprised of a fixed frame 1a carrying a pair of bars 2a on which are mounted by means of rollers, not illustrated, two carriages 2 to each of which is made integral at the top a head 3; such frame 1 also carries a motor 4 capable of bringing about the rotation of a splined shaft 5 located lengthwise, parallel to the direction of forward movement A of bars 6.

As will become clear later, such splined shaft 5 provides in practice all the movement of the device; by means of a bevel gear 7, keyed to shaft 5, and a clutch 8 there is made to rotate a pinion 7b which is engaged with a rack 7c located parallel to shaft 5 and secured to frame 1, bevel gear 7 being in turn mounted on bearings 2b on which is mounted carriage 2, the latter being forced to move axially in the direction of arrow A following clockwise rotation of shaft 5, there being thus achieved the desired longitudinal forward movement of the carriage and therefore of bar 6 to which it is made integral, as will be explained more clearly hereinafter.

Head 3 of carriage 2 is substantially comprised of a housing 9 to the rear end of which is keyed a pinion 10 which, via a chain 10a, is driven by a crown wheel 10b, keyed in turn to shaft 5, thus causing housing 9 to rotate.

At the end of housing 9 opposite pinion 10 is fitted a mandrel 11 which is substantially comprised of an annular body 11a keyed to housing 9 and rotating integrally therewith; on annular body 11a are coaxially arranged a support 11b made of insulating material supporting in turn a commutator 11c made of conductive material, typically copper, which, on rotating with housing 9, operates the

sliding contact located on current-carrying brushes 12 for the transmission of the negative charge which, via braided conductors 13, is supplied to a pair of likewise conducting clamps 14, designed to close against the action of return springs, not illustrated, on bar 6 which is to be made conductive.

Head 3 is completed by the closing device operated by such clamps 14, which is substantially comprised of a pneumatic cylinder 15 the end of which is rotationally integral with a base 15a mounted idly by means of bearings 15b on carriage 2 and shaft 15c of which has a free end hinged via a pin 16a to the upper end of a fork 16, the lower opposite end of which is hinged to a support 2b secured to carriage 2. In approximately mid-position fork 16 supports a pair of rollers 16b arranged with their axis at right angles to the direction of forward movement and designed to be housed in an annular cavity 17a of a substantially cylindrical hollow body 17, mounted coaxially on housing 9 and moving freely thereon over a short length, under the thrust or return action exerted by rollers 16b operated in either direction by the corresponding movement of fork 16 operated by cylinder 15.

As illustrated in fig. 2, cylindrical body 17 carries a pair of rollers 17b located in contact with a gradient 18a of the relevant arms 18 which operate clamps 14.

The device also has a pair of pneumatic cylinders 19, integral with fixed frame 1, the shaft of which is made integral with carriages 2 to cause them to perform a rapid return stroke as will be described more clearly hereinafter.

As illustrated in fig. 1 the device according to the invention is equipped externally at both facing heads with an electroplating system, so that the heads of mandrel 11 represented in practice by clamps 14 are frontally opposed; there are then made integral, by means of a universal joint, drive shafts 5 driven by a single motor 4, so that both the traversing movements of carriages 2 and the rotary movements of mandrels 11 are fully synchronized, it being particularly important that the forward movement be determined by the pulling action of the front device and not by the thrust action of the rear device, in order to prevent any impact of bars 6 which, on bending, could come into contact with anodes 20 and cause shortcircuiting.

In fig. 1 is likewise shown a circuit-breaker assembly which is operated by cylinder 23 and allows breaking of contacts 21 and 22 to disconnect the current prior to any opening of the relevant clamps 14 on bar 6.

With reference to figs. 2 and 4, the operation of the device is as follows:

At the start of the cycle and with bar 6 already inserted in the mandrels, fork 16 of each mandrel

11 is pushed forward so that rollers 16b acting on gradients 18a bring about the rotation of arms 18 and the consequent closure of conducting clamps 14 on bar 6.

Once clamps 14 are closed there may take place the application of the charge, which is negative in relation to that of anodes 20, so that cathode bar 6 can receive the finishing material, and at the same time there comes into operation the motor which, via the said gears 7,7a,7b and rack 7c, brings about the forward movement of carriage 2 and, by means of crown wheel 10b, chain 10a and pinion 10, causes the rotation of housing 9 with mandrel 11 which in turn causes to rotate bar 6, which is thus charged, turns on its axis and at the same time advances in the direction of travel.

As will be seen from fig. 4, all the carriages 2A,2B,2C,2D simultaneously start to traverse in the direction of travel and advance until front carriages 2B,2D reach the end of their stroke, resulting in the activation of an appropriate signal which actuates cylinder 23 and opens contacts 21,22, causing disconnection of the current at clamps 14 of rear carriages 2A,2C and the return of shaft 15c of piston 15, resulting in the retraction of fork 16 and of body 17 the rollers 17b of which, on disengaging gradient 18a of arms 18, allow the opening thereof (dotted line in fig. 2) through the return action of springs, resulting in the opening of clamps 14; there is subsequently released clutch 8 which disengages pinion 7b from rack 7c and there are enabled fixed longitudinal cylinders 19, which return the relevant carriages 2A,2C to the initial position in a rapid stroke.

Once such initial position is reached, there are reclosed clamps 14 and subsequently contacts 21,22 of the circuit-breaker assembly, then rear carriages 2A,2C initiate an identical sequence of return of front carriages 2B,2D which, in the manner already described, return in a rapid stroke to the initial position and resume the cycle of forward movement in conjunction with the corresponding rear carriages 2A,2C.

As is apparent from the foregoing description, the device according to the invention makes it possible to feed the bar continuously and at the same time cause it to perform a continuous rotation around its own axis while being maintained at the same time at a negative potential relative to that of the anode; it is furthermore apparent that the device can be readily adapted to the different diameters of the bars to be fed by means of the greater or lesser closure of the retaining and current-supplying clamps and that operation in a dry condition allows easy and safe application and removal thereof to and from the processing plants.

Many alternatives may be introduced in the practical implementation of the various constituent

parts of the device without thereby departing from the scope of the invention in regard to its general features.

Claims

1. A device capable of bringing about continuously the feeding, rotation and electrical connection of bars and the like in electrolytic deposition plants, characterized in that it comprises a fixed frame (1) to which are made integral means (4,5) for generating a rotary movement capable of being transmitted, via appropriate driving facilities (10,10a,10b) to a rotary head (3) equipped with components (2) moving in a rectilinear direction on frame (1) under the pulling action of means (7,7b,7c) capable of converting into rectilinear movement the rotary movement of shaft (5) whereby they are actuated, there being made integral with such rotary head (3) a mandrel (11) provided with clamping facilities (14) charged with current by means of power-generating equipment (11c,12) and capable of undergoing controlled closure for the clamping and charging with current of such tubular component (6), which is thus placed simultaneously in conduction, in rotation around its own axis and in rectilinear movement in a longitudinal direction, there being furthermore provided means to control the stroke of carriages (2) and means (19) for the rapid return thereof to the cycle start position.
2. A device capable of bringing about continuously the feeding, rotation and electrical connection of bars and the like in electrolytic deposition plants according to claim 1, characterized in that such means of generation of movement are preferably comprised of a motor (4) integral with fixed frame (1) and causing the rotation of a splined shaft (5).
3. A device capable of bringing about continuously the feeding, rotation and electrical connection of bars and the like in electrolytic deposition plants according to claim 1, characterized in that such rotary head (3) is preferably comprised of a hollow component (9) carrying a rotary drive pinion (10) at one end, a device (17) for controlling the closure of such clamps (14) in the middle position and the said mandrel (11) at the opposite end.
4. A device according to claim 1 characterized in that such mandrel (11) consists of an annular body (11a) externally and coaxially to which is fitted an insulating support (11b) carrying in

turn an annular commutator (11c) made of conductive material on which slide current-carrying brushes (12) for generating the current to be applied to clamps (14) via suitable conductors (13).

5. A device according to claim 1 characterized in that such clamps (14) are made integral with mandrel (11) by means of articulated arms (18) designed to control the closure thereof against the return action of springs when rotated by the radial thrust of rollers (17b) on an inclined surface (18a) at the end of such arms (18) or to allow opening thereof by means of the said springs when such radial thrust ceases. 5 10 15
6. A device according to claims 1 and 5 characterized in that such radial thrust is applied/removed by the forward/reverse movement in an axial direction of such annular body (17), on which are mounted rollers (17b), the axial movement being controlled by a fork-shaped component (16) which carries rollers (16b) cooperating with annular body (17) and which is made to rotate around a pin integral with carriage (2) by means of a pneumatic cylinder (15), such rotation causing forward or return rectilinear movement parallel to the axis of such rollers (16b) and therefore of annular body (17). 20 25 30
7. A device according to claim 1 characterized in that such means of conversion of the rotary movement of shaft (5) into rectilinear movement of carriages (2) are preferably comprised of a bevel gear (7) keyed to the shaft and actuating a pinion (7b) cooperating with a rack (7c) located parallel to the axis of forward movement and secured to frame (1), between such rack (7c) and pinion (7b) there being interposed a clutch (8) for controlled idling of the drive. 35 40
8. A device according to claim 1 characterized in that such means of rapid return of the carriages to the cycle start position are preferably comprised of hydraulic cylinders (19), the free end of the shaft of each of which is integral with the relevant carriage (2), rapid return being controlled by limit switches which govern the simultaneous entry into operation of clutch (8). 45 50
9. A device according to claim 1 characterized in that such means of transmission of movement from shaft (5) to head (3) are preferably comprised of a crown wheel (10b) connected to 55

pinion (10) via a chain (10a).

10. A device according to claim 1 characterized in that means are provided for cutting the supply of current to clamps (14) prior to the opening thereof, substantially consisting of a pneumatic cylinder (23) capable of actuating a pair of contacts (21,22) at least one of which is a moving contact, interposed between the said clamps and the negative pole of the power circuit.

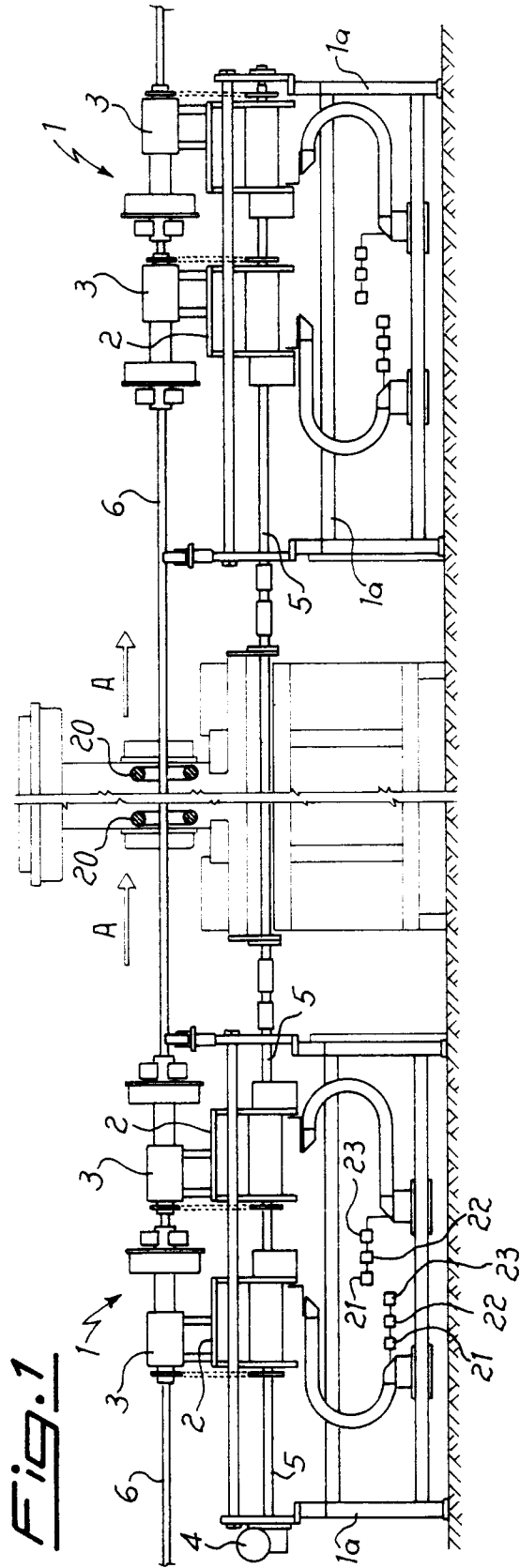


Fig. 4

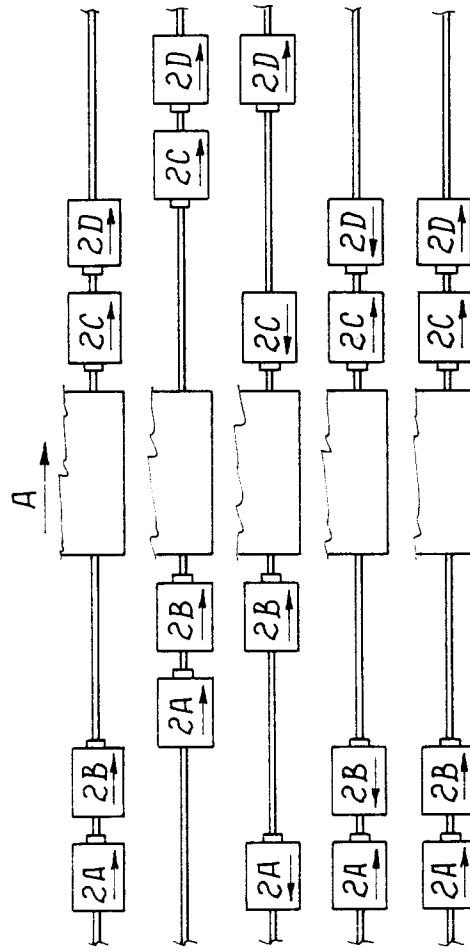
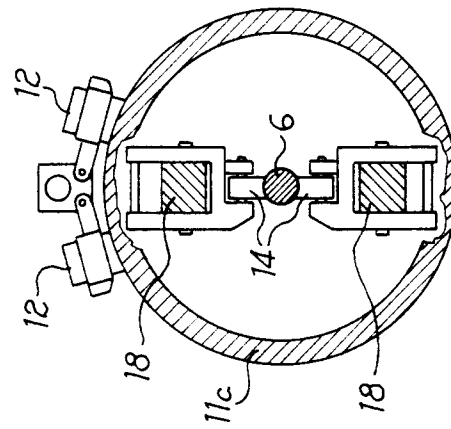
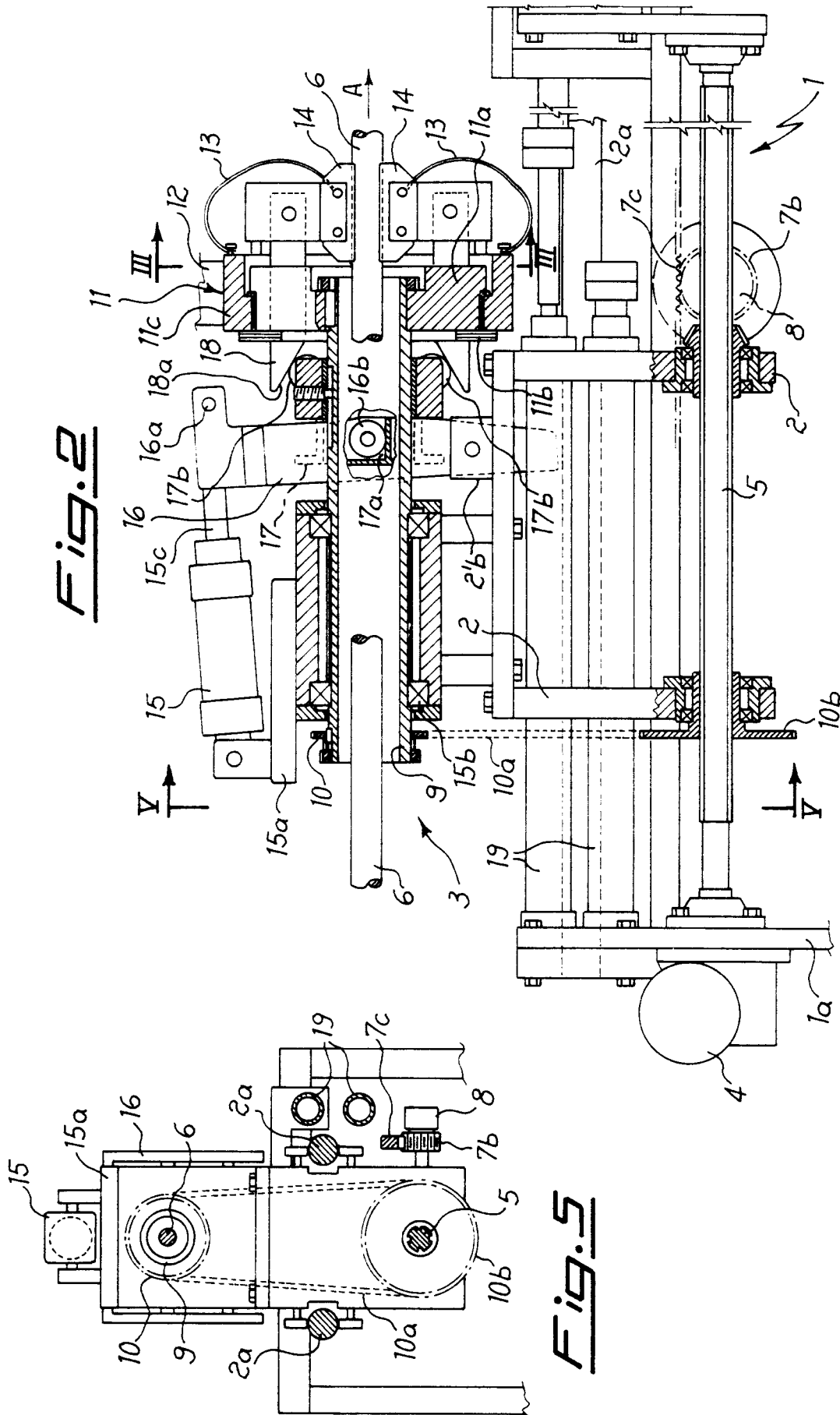


Fig. 3







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EUROPEAN SEARCH REPORT

Application Number

EP 92 20 3060

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	FR-A-2 369 358 (FIAT S.P.A.) * page 3, line 15 - line 33 * * page 4, line 1 - line 4 * ---	1,2,3,4	C25D7/04
A	FR-A-2 045 887 (ANGELINI) * page 5, line 32 - line 35 * -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			C25D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 18 JANUARY 1993	Examiner NGUYEN THE NGHIEP N.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			