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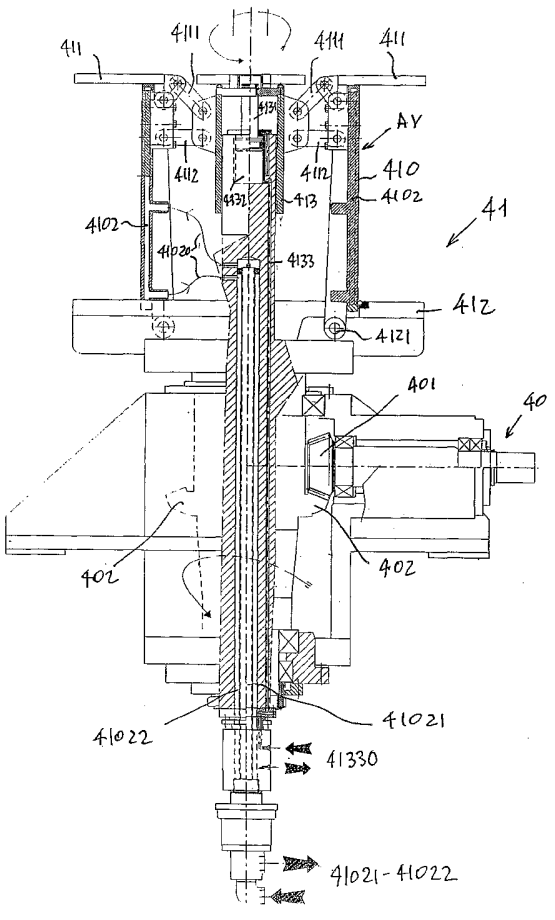
(54) Title: WINDING PLANT FOR ROLLED-STOCK



(57) Abstract: Winding plant for rolled-stock of the type comprising, downstream from a rolling-mill plant: flying cutting means; wire-guide means (3); two winding-machines (4) for the formation of coils; coil transfers means (5); wherein said exterior flange of said reel (AV) is made up of flange sectors (411), hinged to said reel by means of leverism (4111) to be rotated like the petals of a flower: from an open flower position, namely substantially radially orthogonal to the rotation axis of said reel (AV) to form substantially a closed reel for the winding of the rolled-stock to form the said coil (B), to a closed flower position, namely rotated outwards within a diameter lower than the interior diameter of said coil (B) to allow its extraction.

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Published:

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DESCRIPTION

WINDING PLANT FOR ROLLED-STOCK

This invention relates to a winding plant according to the pre-characterizing part of the main claim.

Technical Field

This plant is particularly intended, if not exclusively, to be placed downstream of a wire, band or strip rolling-mill plant, in which instead of fly-cutting the rolled-stock, the latter is wound in coils

Background Art

In the prior art different systems are known for coil-winding the rolled-stock or also wire, for example originating from others plants, in a continuous way, citing as an example:

US-A- 3,796,389 discloses an apparatus for strip winding placed in a feeding line with a split-system for two alternating winding-machines in the winding operation.

A similar plant is disclosed in DE-A-4035193 where substantially a flying cutting shear and splitting-system to split is provided, without stopping the advancement of the wire on either of the two winding-machines so that while the winding is carried out in one machine, it is possible to proceed with the extraction of the coil in the other.

Another similar plant is explained in EP1126933 in which a handling device is associated to each winding-machine to draw out axially the coil from the stopped winding-machine and transfer it to evacuating transfer means, while the other is winding.

Drawbacks of the Prior Art

The known solutions have operating speed limits and moreover are structurally complex and expensive.

The winding process can involve stops due to tangling and due to the fact that handling arrangements and storage of the coil are impractical and quite slow.

The machines are cumbersome.

Both systems therefore present one or more of the aforementioned drawbacks and limitations.

In particular the solution EP1126933 is very complex and inefficient particularly with the limited speed of the system for opening and closing the reel that takes place with the system in the form of a flag-opening cap, with all the resultant drawbacks. The complexity of the latter solution derives furthermore from the of pick-up and movement system of the pulled coil by means of ground guide-rails, trolleys and the like. All these embodiments make the system very complex, cumbersome and difficult to access and maintain. In conclusion, it is unreliable. The operating speed is further limited by the complex structure of systems for wire entry guidance and control of the coil after formation for pick-up.

Aim of the Present Invention

The aim of the present invention is to avoid the aforementioned drawbacks and improve the performance of the plant, to improve the quality and/or to reduce the cost of the treated material.

Summary of the Invention

The winding plant according to the present invention is concretized according to the characteristics of the main claim.

The characteristics of the sub-claims refer to particularly advantageous solutions.

Advantages

The advantages obtained achieve the pre-established aims and in particular allow a high functional performance to be achieved and moreover allow a qualitatively good product to be obtained at a reduced production cost.

All this is obviously favoured by the vertical axis coil extraction system.

Brief Description of Drawings

The characteristics of the invention and other related features will be better understood with the aid of the attached figures enclosed as a non-limitative example, in which:

- Fig.1 represents a side schematic view in elevation of the winding plant applied to the end portion of a rolling-mill line during the winding phase or winding in a first winding-machine of two coordinated adjacent winding-machines supplied by a shunter with associated flying cutting shear device,

- Fig. 1A represents the phase of depositing the coil in the binding station.

- Fig.2 represents an overview of the plant in Fig.1 in which the two adjacent winding-machines are seen associated to a flag-transfer, namely with a column with a rotating overhanging arm to extract the coils from either of winding-machines and discharge said coils in a tying back, transfer and stock station Fig.2A.

- Fig.3A and 3B represent, in an elevated side-view, the mullion-transfer as in previous Figures, respectively without coil, lowered and with coil raised for transfer by means of rotation.

- Fig.3C represents a plan-view of the coil pick-up device with four jaws, placed at the end, under the portal arm of the mullion-transfer device.

- Fig.4, 4A represent respectively a side view in elevation and a plan view of a winding-machine, from the feeding side of the wire to be wound (AB), with the pair of wire-guide jaws lowered around the winding reel of the wire to allow the automatic threading of the wire deviated from the upstream splitting flying shear (4C-2,3), while the pair of rolls that maintain the coil compact at the end of the winding are rotated upwards from the winder(4B-422).

- Fig.5 represents a view of the phase immediately subsequent to the threading of the wire and the start of winding (F), with the opposite jaws of the wire-guide (4C-431) immediately raised with a small disengagement movement from the previous wire-guide position, this movement being very fast since it is not integrated into the total disengagement mechanism that takes place in a subsequent phase.

- Fig.6 and 6A represent a view of the same device as in previous Figures but in which the opposite wire-guide jaws are completely shifted by means of rotation on a different articulation, in sending-away from the winder (AV), while the two pairs of opposite

rolls (422) have been rotated in approach against the wire coil that has been formed in rotation (B)

- Fig. 7 represents in an enlarged view the constructive details of the wire-winding reel (winder) for the formation of the coil, in partial axial section to illustrate the respective moving mechanism and cooling device.

Said winder or winding-reel being in the winding position.

- Fig.7A represents a view of the winder (AV) as in the previous Figure, in which in partial axial section, the moving mechanism is still visible and the latter has been transformed from a closed reel to a conic reel (410) with the upper flange of the reel (411) rotated upwards, namely towards the axis and towards the exterior to allow the axial extraction of said coil (B).

- Fig.7B represents a plan-view of the reel-mandrel sectors, of which there is a total of four, that form in a movable way the winding reel, namely the core of the winding reel, with a hatched-view of the respective inner hollows, these channels being for the circulation of cooling water and therefore for the dispersion of heat that the hot-rolled wire introduces into winding the coil, together with the special external undulated shape of said nippers/mandrel-sectors, in order to minimize contact with the wire and to allow the optimum dispersion of the heat by means of aeration.

- Fig.8 represents a front view of a nipper (410) of the madrel of the reel, with a view of the respective internal to-and-fro serpentine channel (4102) for its cooling.

Detailed Description of the Plant in Connection with the Figures

As disclosed in the previous Figures, the winding plant (see Fig.1-1A, 2-2A) includes a split system or splitting of the known type with a flying shear, schematized with (1) that deviates the wire on two lines, alternatively on one or on the other (2) towards one or the other of two respectively adjacent winding-machines (4), with the aid of suitable wire-guide means of the known type (3) for the coil-winding (B).

While a coil forms in a winding-machine, in the adjacent winding-machine that is stopped, the pick-up of the completed coil is carried out, with transfer (5', ..,521).

Coil Transfer (5, Figg.1, 1A, 2, 2, 2A, 3B, 3A, 3B, 3C)

The coil transfer (5' ...,521)Fig.1,521)Fig.1,1A, is of the portal type, namely with a column (51), with a rotary flag-type arm (52-510), whose end (521) carries an opening clamping device with a couple of clamps or cross-opposite jaws (522) for the pick-up and axial extraction of the coil (B) from the winding-machine (AV) of the respective winding device (4, 4a) to transfer it (Fg2) from the stopped winding-machine to a tie/binding back-station by means of two known art opposite binding machines or tie-machines (6) Fig.2A, being provided furthermore with the transfer of the coil to the respective storage of tied coils (B1).

The mullion-transfer is therefore of the portal type and its rotating arm (52) can be raised and lowered by means of a dynamic-fluid piston (520) for the pick-up and deposition action, while rotation is guaranteed by respective motor/ratiomotor (510) at the base of the column on respective thrust-bearing (5101).

The lifting and lowering of the arm (52) being assured by a folded-plate guide (520) with pairs of guide opposite rolls (5201) operating in a sliding way on the column in double-T section.

The pick-up of the coils is facilitated by the clamping device with four clamps that self-centre on the coil (B), opening and closing by means of respective opening and closing fluid operated cylinders (5220).

In this way it is understood that the movement of the transfer is very fast and given that it has open-air excursion, it does not encumber or hamper the surrounding zones allowing moreover greater compactness of the plant. Furthermore, the type of movement is manifestly very simple and very reliable with greatly reduced maintenance.

Winding Groups (4, 4A, 4B, 4C, Fig.4, 4A, 5, 6, 6A)

The two winding groups are identical and adjacent with a wire-winding reel (F) having a reel that can be opened (AV) with a vertical axis.

Each group includes in addition to the central winder (AV-41) two opposite coil-

compacting apparatus (4b) in couples of rolls (422) and two auto-introducing wire-guide jaws to automatically guide the wire at the beginning of winding (4C).

In the centre the reel (41) is found with openable winding reel (AV).

Opposite Coil-Compacting Apparatus (4B)

They include two respective articulated devices (42), placed on one side and one on the other of the winding reel (AV) with respect to the advancing line wire that fits sideways into the reel (AB).

The rolls are mounted on an articulated arm (421) hinged to the base structure (420) and operated in rotation from a spaced position (Fig.4) to a position against the coil (B) Fig.6. The movement occurs by means of a base dynamic-fluid cylinder (4212) on a reacting arm (4210).

Said rolls (422, see Fig.6A) being a pair mounted on a parallelogram (4222) in couples of opposite arms mounted on support rolls (4220) and moved elastically under pressure by respective means with dynamic-fluid cylinder (4221).

In this way the movement is simple and reliable and the orientability of the rolls guaranteed to be unchanged for the suitable control of the end turns of the coil (B) in the winder (4V-41) to avoid the slackness prior to pick-up.

Wire-Guide Group (4C)

The wire-guide group includes two guide opposite jaws entrance semicircular wire (431) hinged sideways horizontally (430) and controlled by a fast-moving dynamic-fluid cylinder (4311) at the end of the movement arm jaw (4310) hinged sideways to the base machine (4301) and rotated in sending-away and approach by means of a re-sending arm (43101) operated by fluid-operated base-cylinder (43102).

In this way it is understood that while with the opposite fluid operated base-cylinders (43102) the sending-away and approach of the drive-introduction jaws wire (431) is carried out, their final movement being precise and fast in order to engage and disengage the wire, with independent, short precise and fast action (4311) that would otherwise prove impossible with this type of performance by the approaching and

spacing-apart mover device with wide excursion (43102).

Therefore, the above allows a very high speed and good performance to be achieved, without danger of tangling or the need to reduce the advancing speed of the wire or use of adapting wire-loops speed.

The short engaging and disengaging movement is clearly visible in Fig.5

Central Winding Group - Winding Reel (4A, Figg.7, 7A, 7B, 8)

It comprises the central winding reel (41) with a closable and openable reel (AV),

Opening and closing of the reel (AV):

Once the opening and closure of the reel (AV), necessary to extract the coil (B) has been completed, occurring by means of four rotatable petal flange sectors (411) with a reacting arm (4111) moved by a sleeve (413) that moves axially by means of a dynamic-fluid cylinder (4131-4132) operated by a dynamic-fluid circuit (4133) with transmission to the base reel (41330) on a non-rotating coaxial axis with respect to the rotating reel (AV).

The advantage of this solution is very important for the compactness and simplicity of the rotation guaranteed by the connection shaft end (4131) with respect to the sleeve (413).

Variation of the External Shape of the Reel Mandrel (AV)

The reel mandrel (AV) is composed of four sectors, namely four nippers (410), hinged to the base (4121) of a flange rest-coil lower reel (412).

On the upper part the reel-mandrel movable sectors (410) are articulated (4112) to said axially movable sleeve (413).

In this way, when the movable sleeve (413) is raised the upper flanging petals (411) are open, namely orthogonal to the reel axis and allow coil formation (B) during winding, and the sectors of the reel-mandrel (410) are parallel and form a cylinder (Fig.7).

When the coil is finished, to allow easy extraction, the movable internal sleeve (413) withdraws downwards simultaneously operating:

- the petals of the upper flanging of the reel that close upwards like a flower,
- the sectors of the core that re-enter on the upper part (410, Fig.7A) determining a conical shape with an upper base size less than the lower base.

In this way the extraction of the coil (B) is allowed and facilitated by means of the jaws of the clamping device (522).

Cooling System

The sectors or nippers of the semicircular shaped reel mandrel (410) are internally holed with channels (4102). The channels convey on a connecting duct (41020) with a duct inside a double coaxial channel (41021, 41022).

In this way the cooling of the reel is guaranteed.

Furthermore the external shape of said core nippers or sectors is undulated by means of alternate longitudinal counterbores (4101).

In this way the contact of the surface of the reel mandrel (AV) with the coil (B) is reduced and a circulation of air through these longitudinal counterbores is facilitated.

The reel (AV) rotates coaxially to the central axis by means of motorization of the type known with connection to bevel-type drive (40, 401-402).

Winding Cycle

The start of coil-winding occurs by means of said device with movable semicircular opposite jaws (431) in association with the wire-introduction system (AB) for first adherent turns to the base side or flange of the reel (AV) of the winding-machine.

This device receives the wire (F) from the dispenser (2-3) while it is closely fitted to the reel mandrel (AV) and subsequent to the priming of the first turns, it must quickly free the coil forming area. To do this with maximum efficiency, the fast movement of rapid displacement (short rotation 4310, Fig.5) is used.

Subsequently, with other slower and wider rotation movements (4310-43102) the wire-guide jaws sending-away is carried out, leaving free the space to the approach said control rolls' last coil turns (422).

In this way when the coil stops, the last turns are held closed until the clamping device

(522) of the transfer (5) intervenes, whose four jaws are rotated to 45° to clamp the coil (B) between said rolls (422).

Subsequently, the rolls (422) move away and the coil (B) still remains clamped by the clamping device. At the same time the reel (AV) is also opened thus tightening and closing the upper flanging petals that are oriented upwards.

In this way the closed coil is also loosened internally and it can be easily removed upwards with the lifting of the arm (52) of the mullion-transfer (5) and it can be rotated rearward for the deposition into the binding-machine with two opposite binding groups (6).

At this point the cycle repeats thus returning the priming wire-guide jaws in the position adjacent to the reel mandrel (AV) to receive a new wire (F) to wind (Fig.4).

Claims

1. Winding plant for rolled-stock of the type involving downstream of a rolling-mill plant:

- rolled flying cutting means (1) and two-way splitting (2);
- coil-winding wire-guide means (3);
- at least two winding-machines (4) for the formation of coils (B) in which each winding-machine includes a reel (AV) comprising an openable exterior flange to allow the extraction of the coil (B) once it has been completed, the entire assembly associated with movable wire drive-introduction means (43) to start winding for coil formation (B);
- coil transfers means (5) capable of removing said coil (B) from said reel (AV) to transfer it elsewhere;

characterized in that:

- said exterior flange of said reel (AV) is composed of flange sectors (411), hinged to said madrel-reel by means of leverism (4111) to be rotated like petals of a flower:
- from an open-flower position, namely substantially radially orthogonal to the rotation axis of said reel (AV) to form substantially a closed reel for the winding of the rolled-stock to form said coil (B),
- to a closed-flower position, namely rotated outwards within a diameter lower than the interior diameter of said coil (B), to allow extraction.

2. Winding plant for rolled-stock, according to claim 1, characterized in that said movement of said flange sectors (411) occurs by means of an internal movement device (413) with internal linkage articulation (4111) to said reel (AV) with axial channelling on the central axis to said non-rotating reel (4133).

3. Winding plant for rolled-stock, according to previous claim, characterized in that said internal movement of said flange sectors (411) articulates rotationally (4111-413) to a shaft (4131) of an axial dynamic-fluid cylinder (4132).

4. Winding plant for rolled-stock, according to any of claims 1-3, characterized in that:

- the madrel of said reel (AV) includes longitudinal sectors (410) hinged on one side to the base flange of the reel (4121-412) and on the other, movable in approaching and sending-apart from the reel axis, from an external cylindrical form to a conical external form with the lower base smaller than the interior diameter of said coil, for said coil extraction (B), said articulated movement (4112) using the same internal movement means (4112-413) of said flange sectors (411), so that:
- when the form of the madrel of said reel (AV-410) is cylindrical, said external flange sectors are open in an open-flower shape in the form of a reel for the winding of the coil;
- when the form of the madrel of said reel (AV-410) is conical, said external flange sectors are in a closed-flower shape, namely oriented outwards with a diameter lower than the interior diameter of said coil (B) for its extraction.

5. Winding plant for rolled-stock, according to previous claim, characterized in that:

- said longitudinal sectors (410) include channels (4102) for the circulation of cooling fluid.

6. Winding plant for rolled-stock, according to previous claim, characterized in that:

- said circulation of cooling fluid occurs by means of coaxial transmission (41021,1022) on a non-rotating central axis with respect to the reel (AV).

7. Winding plant for rolled-stock, according to any of the three previous claims, characterized in that:

- said longitudinal sectors (410) have an external undulated surface with longitudinal counterbores (4101).

8. Winding plant for rolled-stock, according to any of the previous claims, characterized in that:

- said movable wire drive-introduction means (43) are mounted on two interdependent movements:

- a first for rotational arm excursion (4301,4310,4310143102) in approach to or

complete sending-away from said reel (AV);

- a second for a limited and rapid excursion towards and away from the wire-guide position for the formation of the first coil turns in a position adjacent to said reel (4311) by means of pivoting the arm end of said first movement (4310).

9. Winding plant for rolled-stock, according to any of the previous claims, characterized in that:

it comprises two series of opposite movable rolls (422), by means of rotatable arms (421-420) and a dynamic-fluid movement system (4212) for bringing said opposite movable rolls (422) from a position rotated upwards in sending-away to a position against the formed coil (B) in said reel (AV), said rolls (422) being mounted on an opposite articulation of the parallelogram type (4222) on a roller-carrier (4220) with means elastically pressing (4221) against said coil (B) when said wire-guide means (4C) are withdrawn moving out of said reel (AV).

10. Winding plant for rolled-stock, according to any of the previous claims, characterized in that:

- said coil transfer means (B) are of the type with a column (5) with a flag-type arm (52) of the rotatable portal type (510-5101), provision being made for said rotary arm to be equipped with means for its lifting and lowering (520, 5200-5201) and at the end of the arm (521) including engaging means for clamping with clamps or jaws substantially opposite with cross-clamps (522) capable of opening to seize said coil (B), extract it from a winding reel (AV) of said winding-machines and deposit it after rotation outside in a respective zone for further working (B1-6).

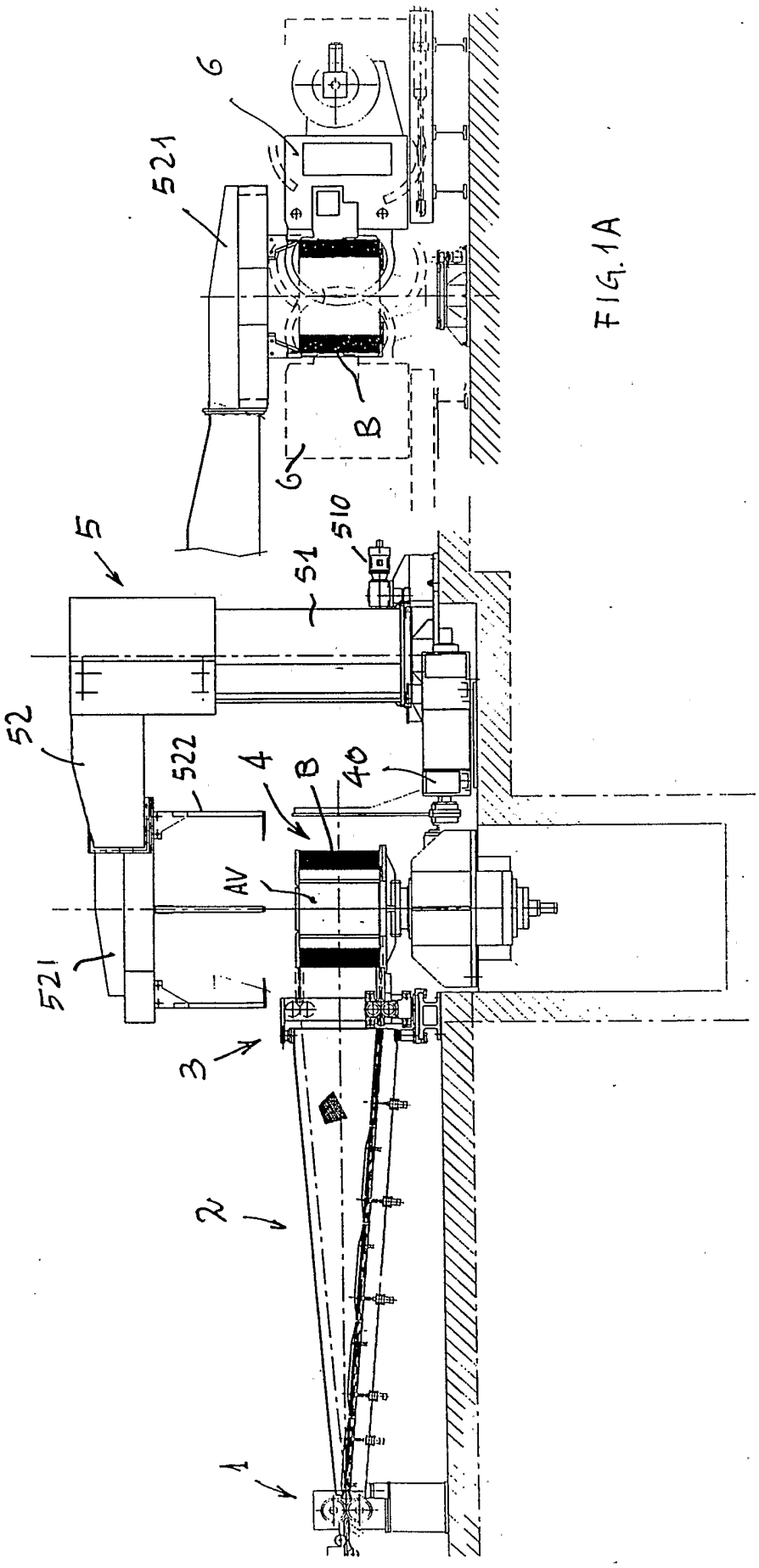


FIG. 1A

FIG. 1

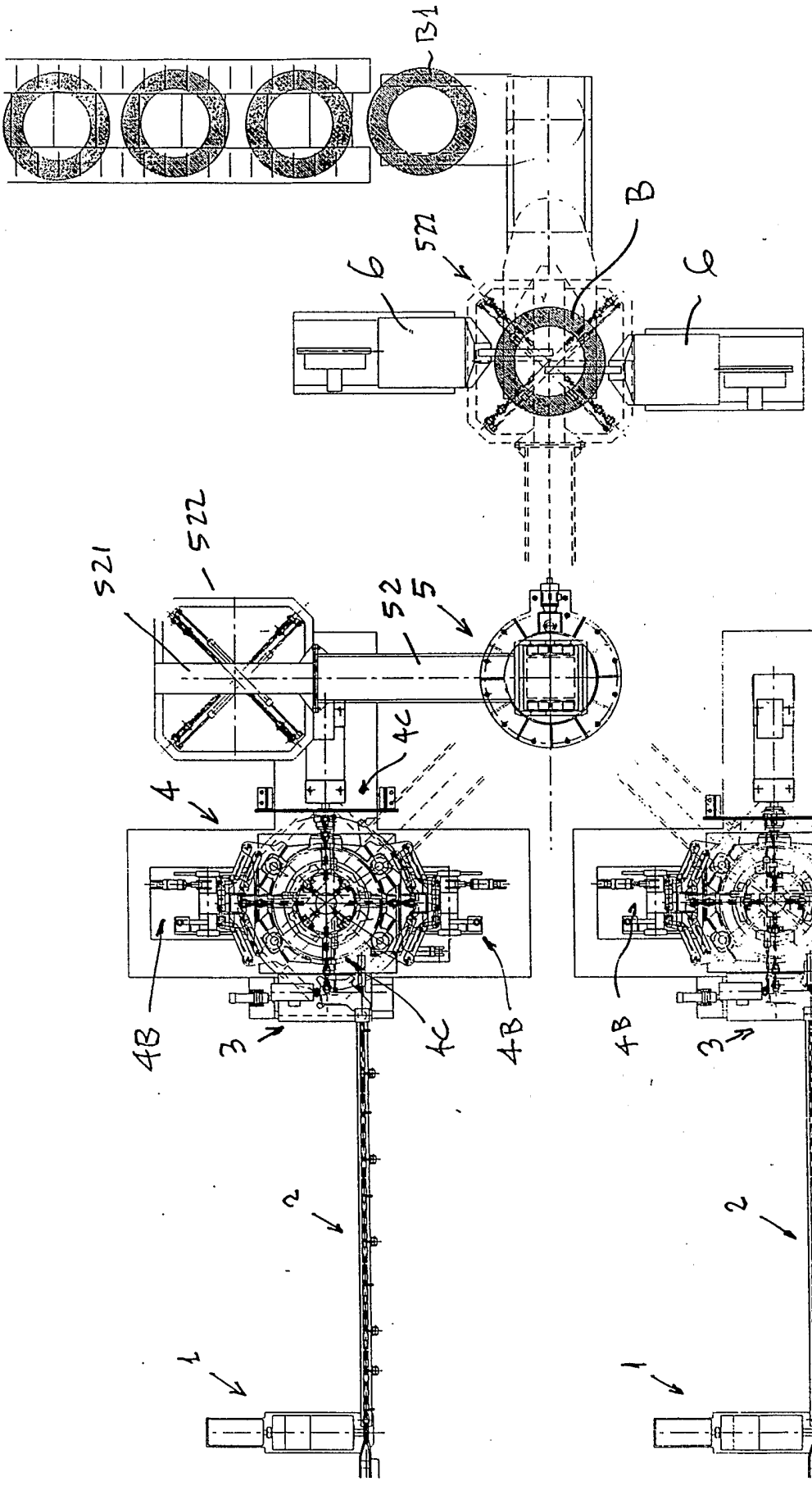


FIG.2A

FIG.2

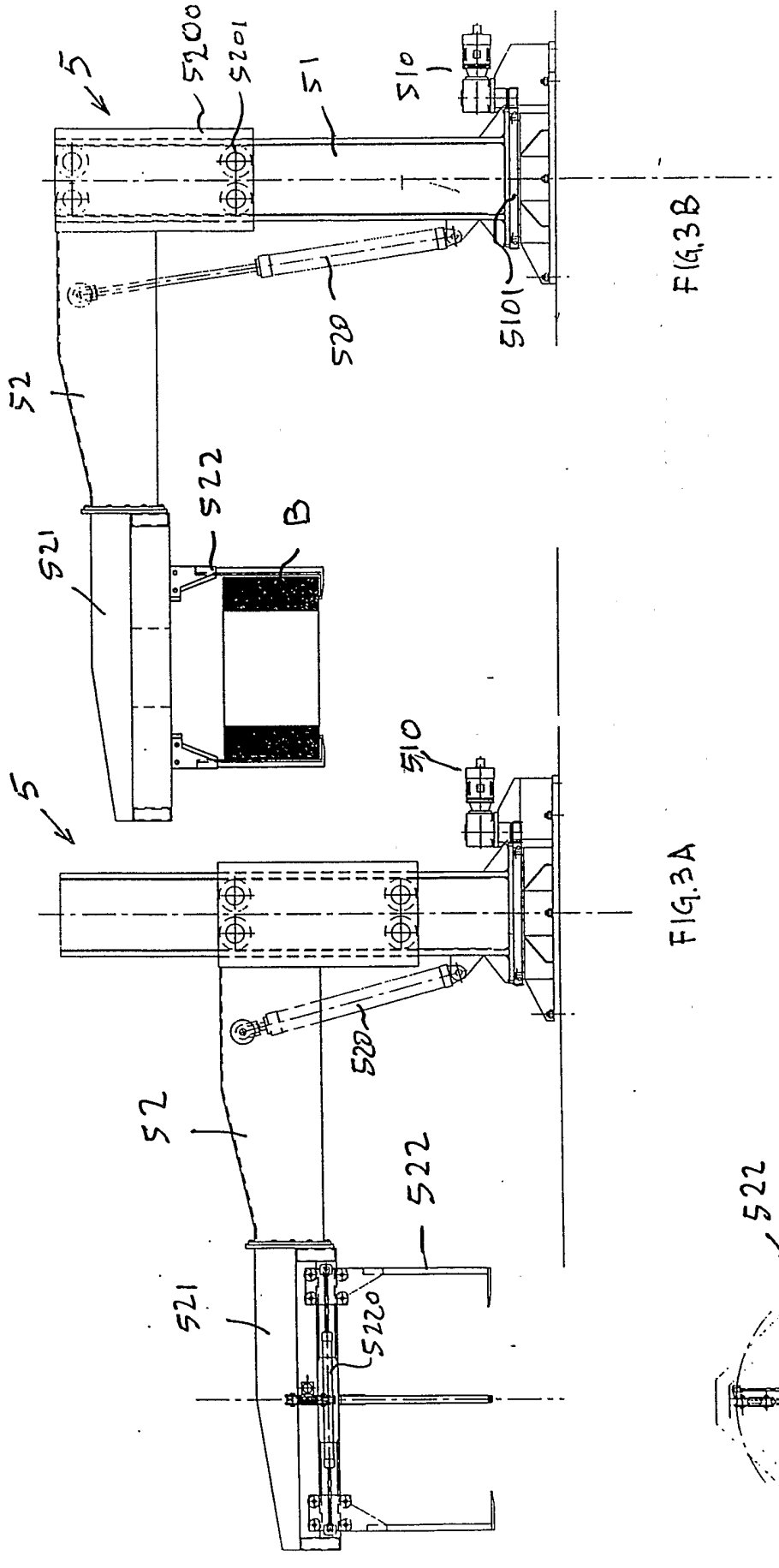


FIG.3B

FIG.3A

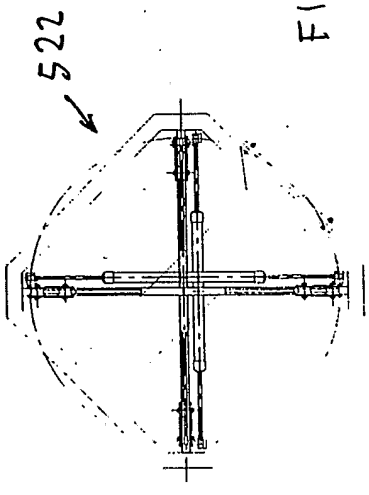


FIG.3C

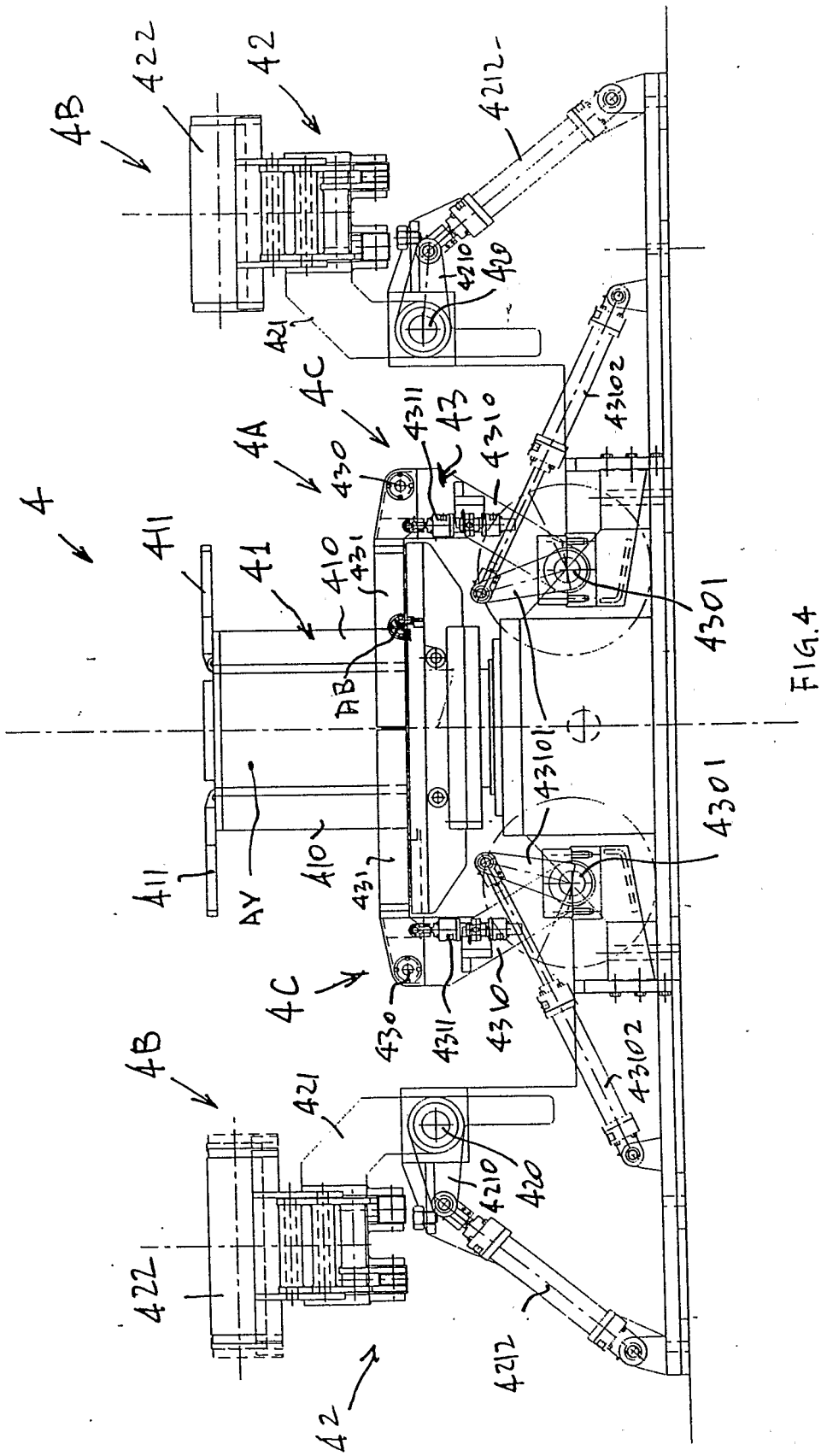

4
4A
4B
4C
41
411
410
431
42
422
421
4210
420
4212
430
4311
43
4310
43102
4301
43101
AB
AY

FIG.4

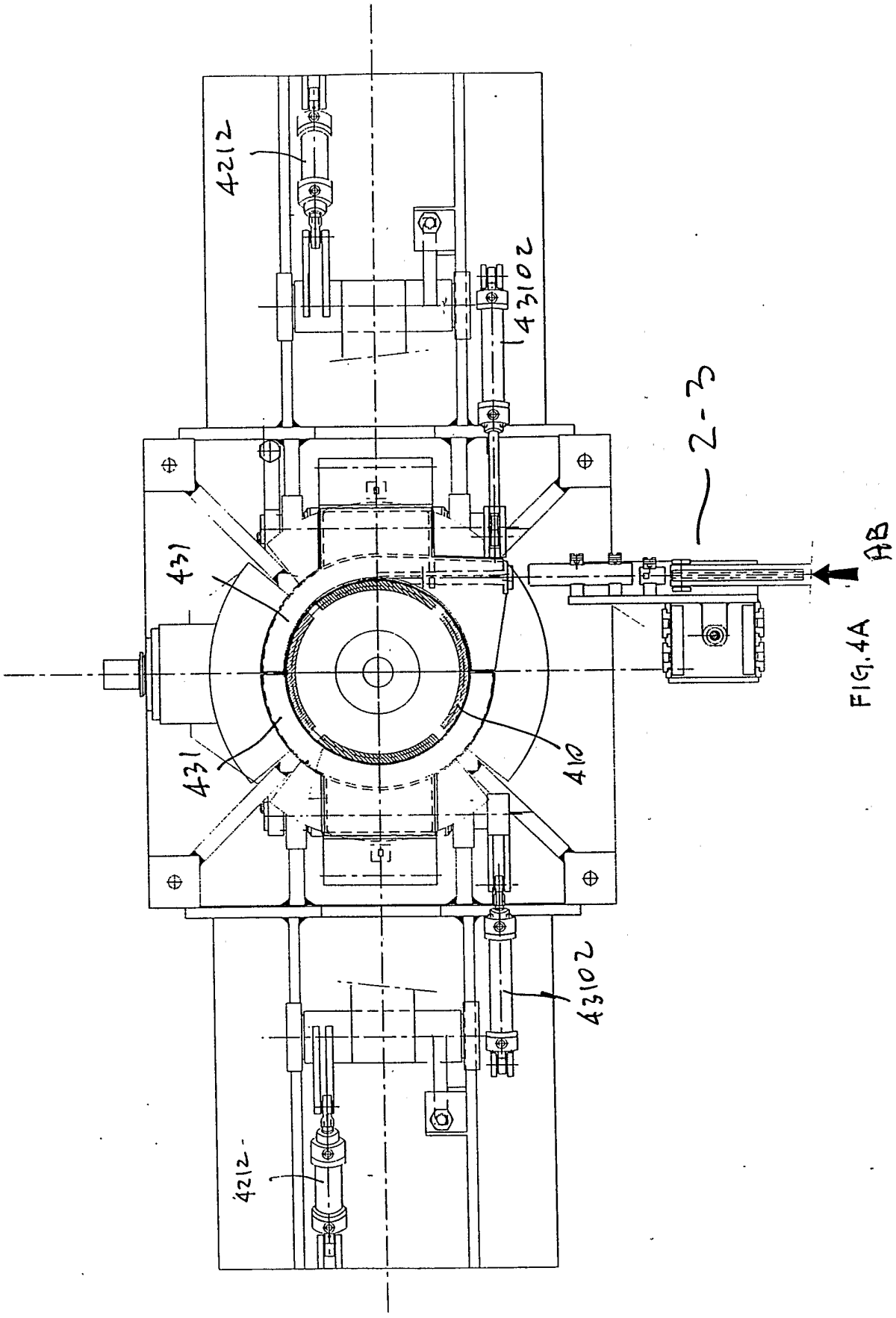


FIG. 4A

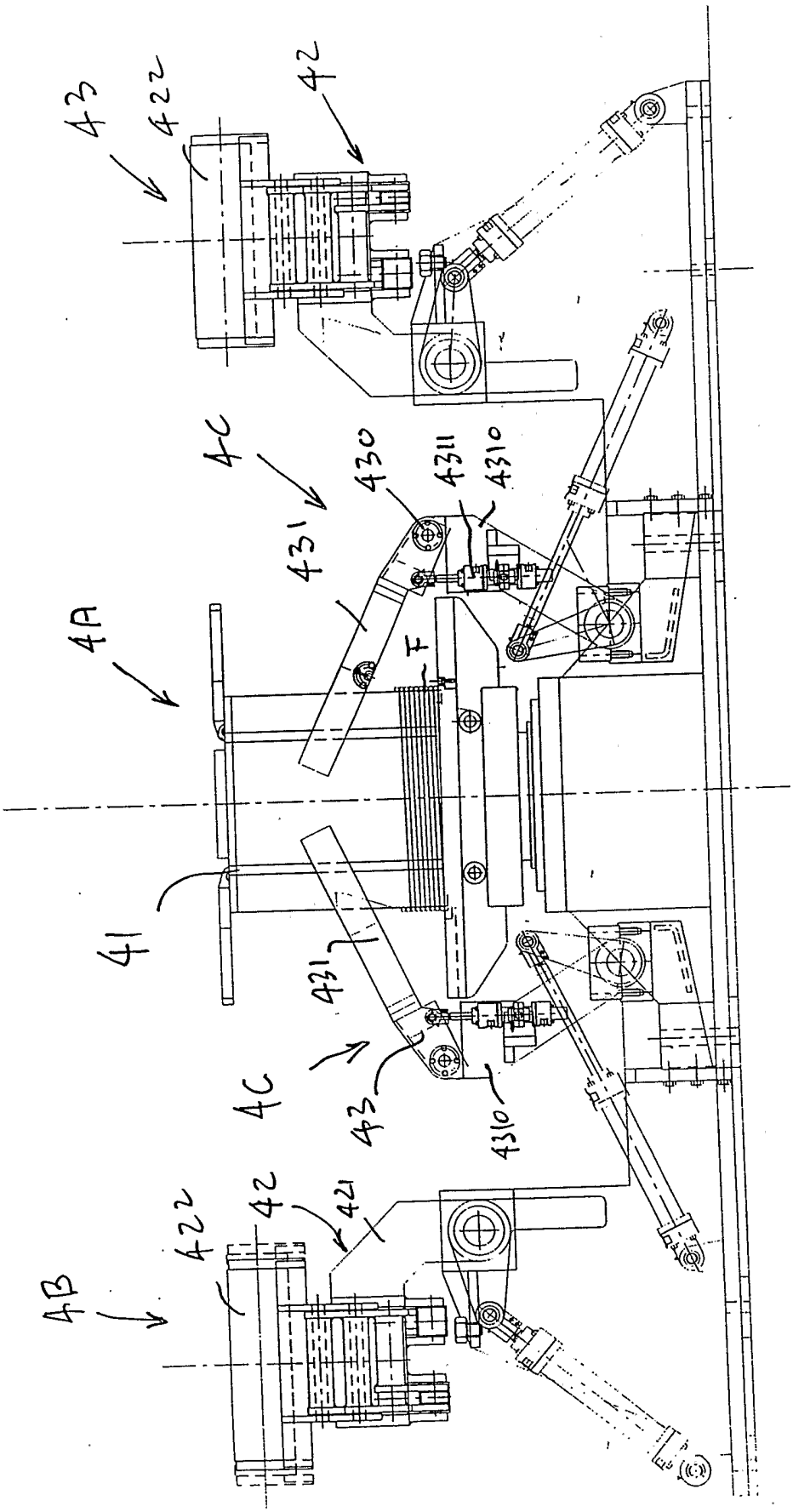
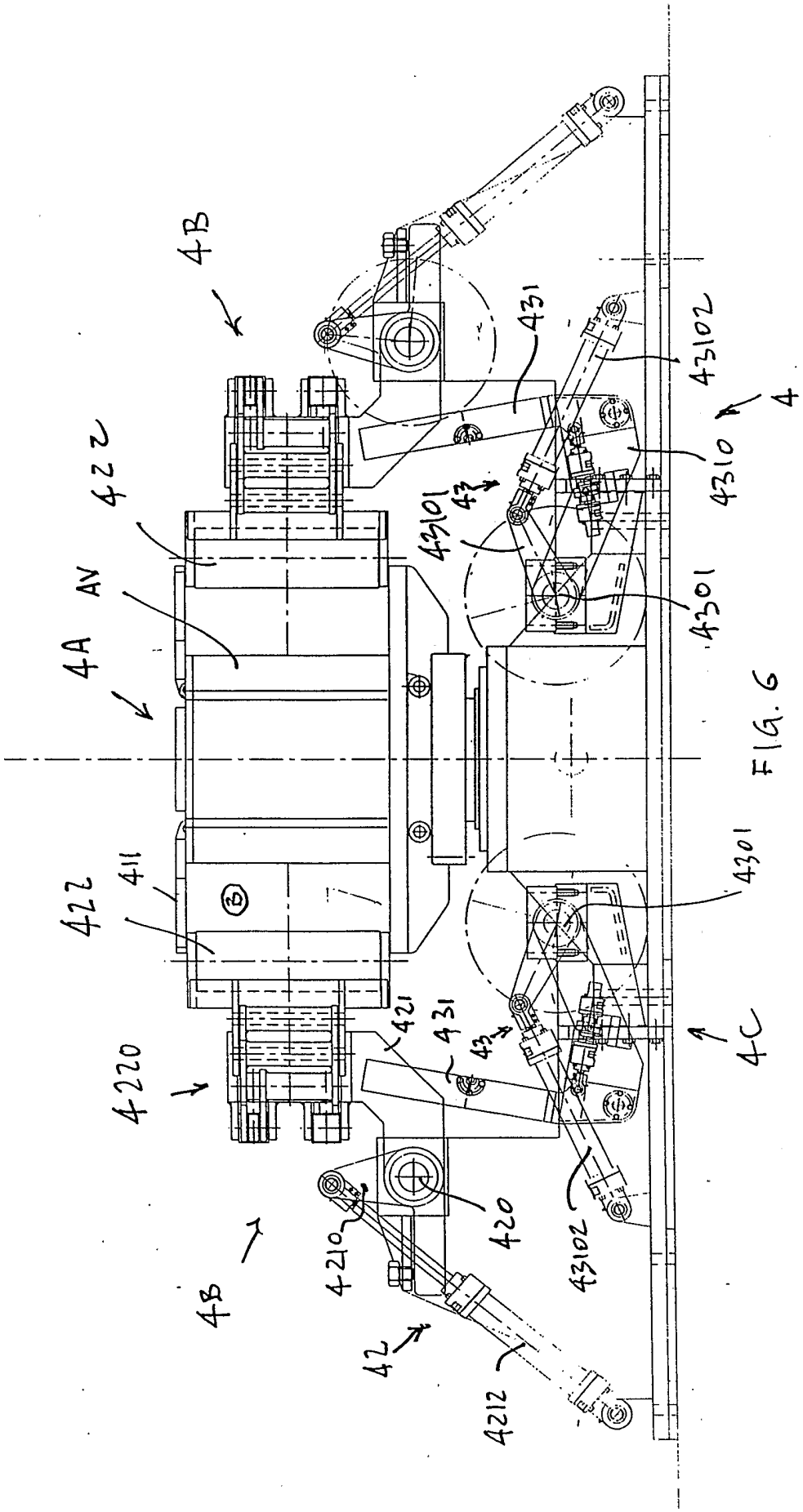


FIG.5


4B
431
43102
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43101
43
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4310
AV
4A
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420
4210
43102
4B
42
4212

FIG. 6

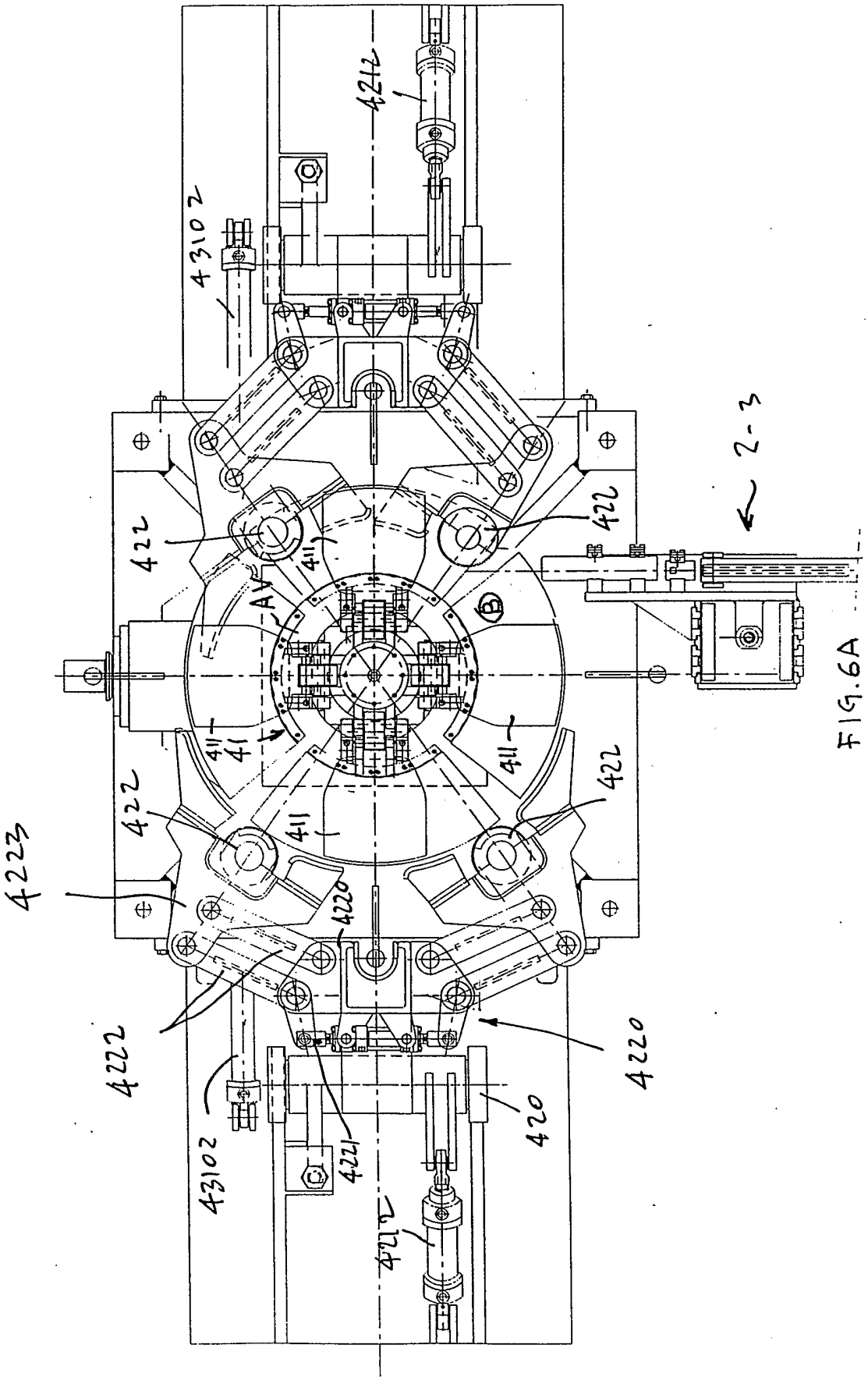
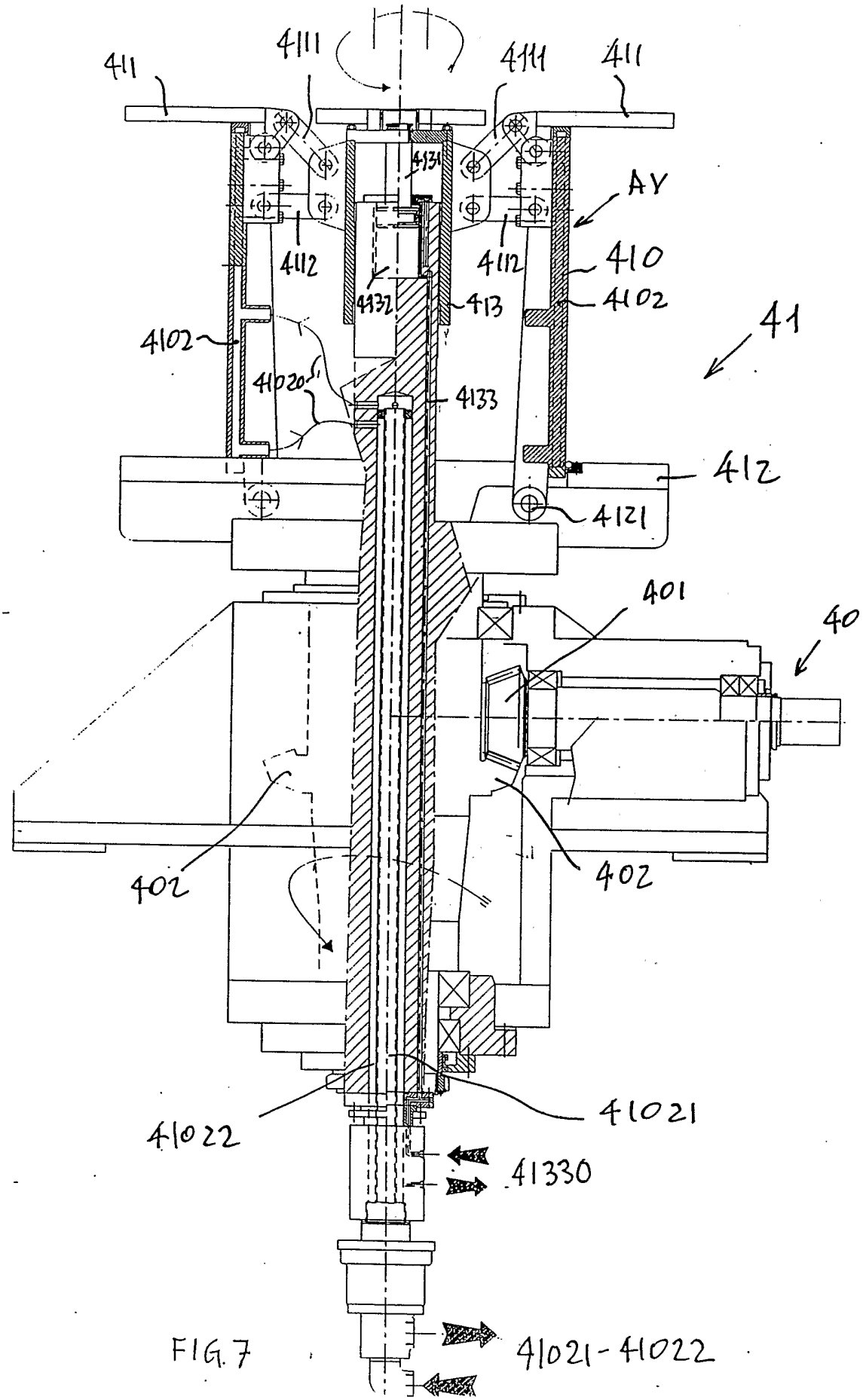


FIG.6A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41330
41021-41022

FIG. 7

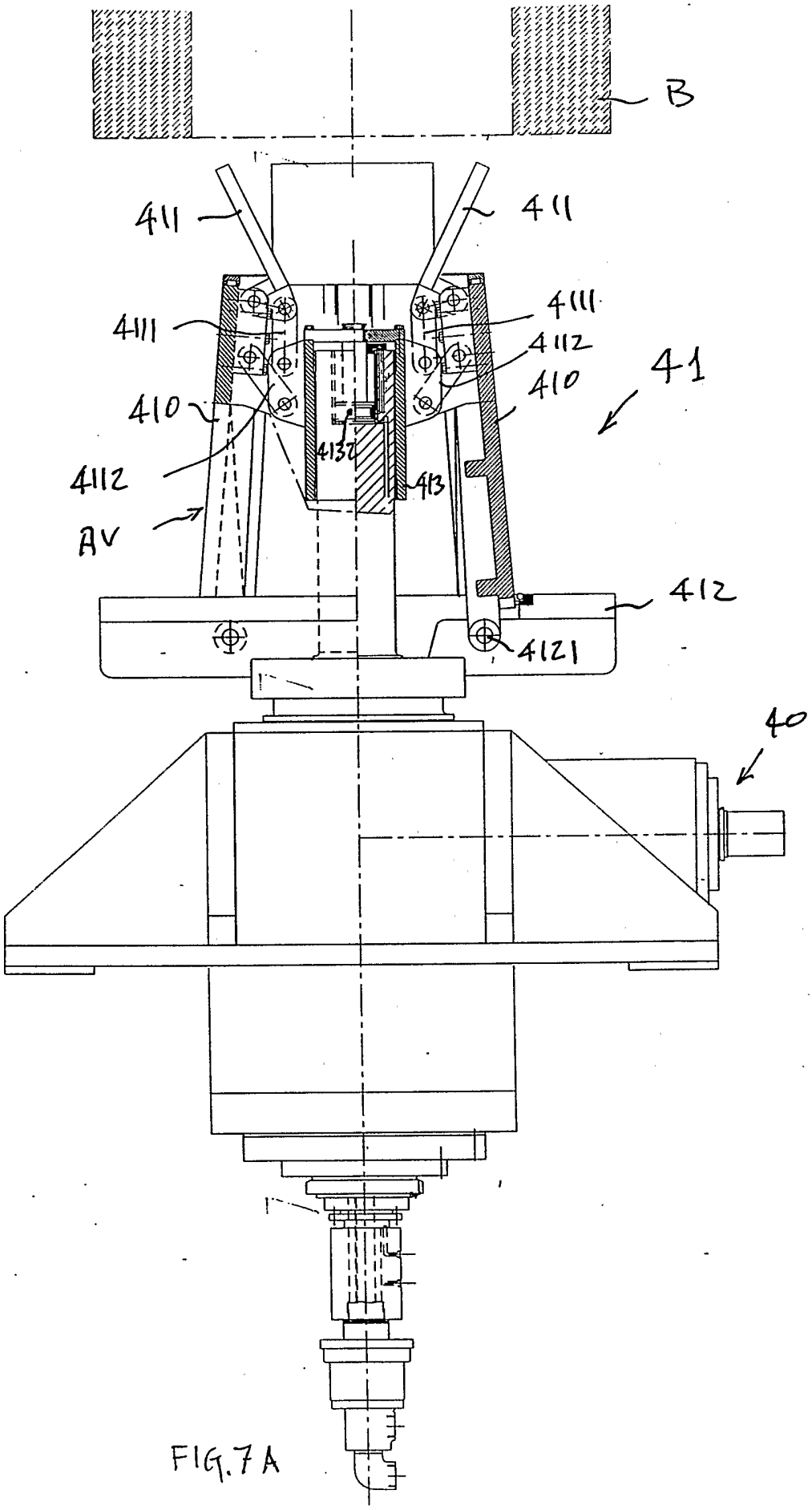

FIG.7A

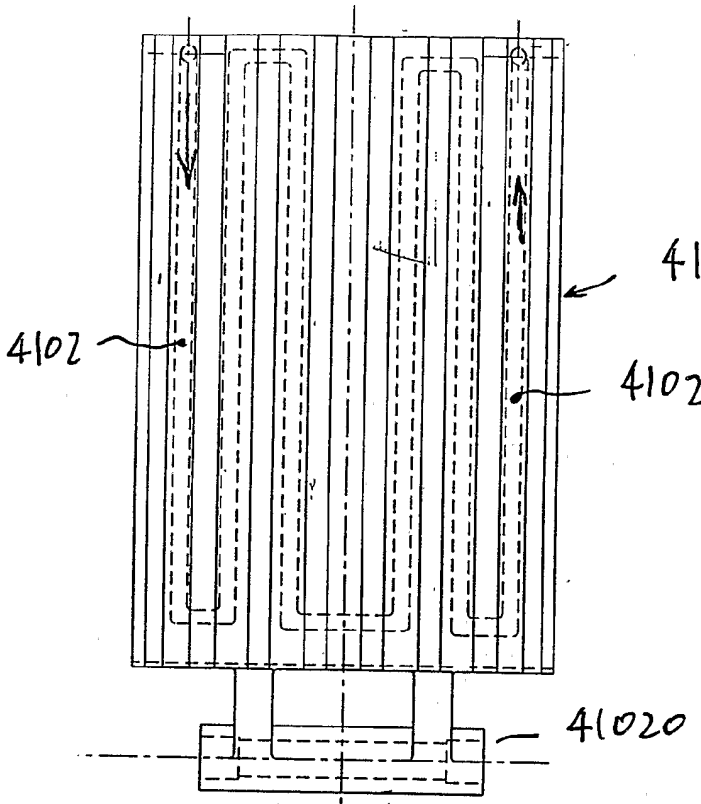

FIG.8

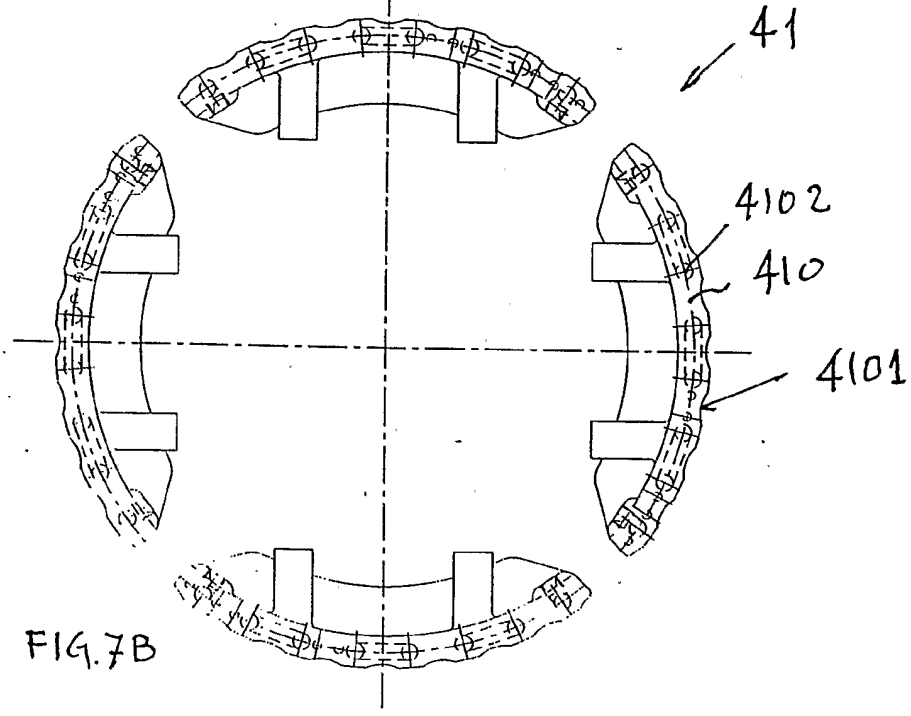

FIG.7B

INTERNATIONAL SEARCH REPORT

ıtional Application No
/IT2004/000339

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B21C47/30 B65H54/58 B21C47/06 B21C47/32 B21C47/34
B65H19/28 B65H18/10 B21C47/24 B21C47/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B21C B65H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 1 126 933 B (DANIELI OFF MECC) 12 March 2003 (2003-03-12) cited in the application paragraphs '0002!, '0017!, '0018!, '0025!, '0026!, '0029! - '0040!, '0057!; figures 1,2,4,5	1-4
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
17 September 2004	24/09/2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Augé, M

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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