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(54) **A FABRIC WEB PRESSING ASSEMBLY**

(57) A fabric web pressing assembly (1) has a frame (2), a first cylinder (4) rotatable around its rotation axis and coupled in a fixed manner with respect to the frame (2), and a second cylinder (3;5), which is rotatable around its rotation axis, parallel to the axis of the first cylinder (4), and is adjacent to the latter to define a passage (P1;P2) engaged, in use, by the fabric web; the second cylinder (3;5) is coupled to the frame (2) so as to be movable away from and towards the first cylinder (4) to vary a width of the passage (P1;P2) under the action of an actuation system (14) which has at least one hydraulic jack (15) and at least one spring shock absorber (16).

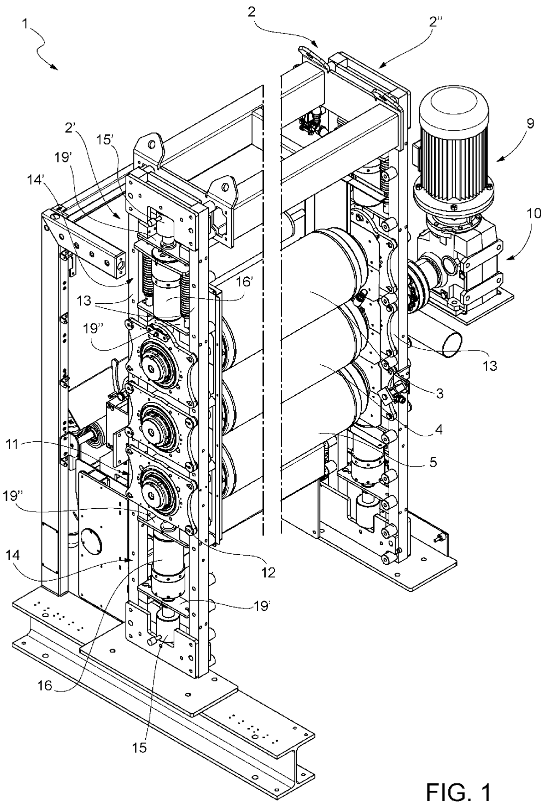


FIG. 1

Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This patent application claims priority from Italian patent application no. 102023000011463 filed on June 6, 2023, the entire disclosure of which is incorporated herein by reference.

TECHNICAL FIELD

[0002] The present invention relates to a fabric web pressing assembly; such assembly is advantageously utilized for extracting a liquid from a fabric web while the latter advances along a longitudinal direction thereof.

PRIOR ART

[0003] In the fabric web production and treatment sector, it is known to treat the fabric webs making them continuously advance along a predefined path, for subjecting them to various treatments. A known treatment provides for immerging the fabric web in a liquid contained in a tub so as to perform, for example, bleaching, scouring, washing or impregnation of the fabric web.

[0004] The immersion treatment is generally followed by a pressing of the fabric web. In order to almost totally extract the liquid absorbed during the immersion, a high pressure is exerted, thereby obtaining a squeezing; vice versa, by exerting lower pressures, partial quantities of liquid are extracted, thereby obtaining an impregnation of the cloth. A known pressing operation provides for making the fabric web pass through two rotating cylinders (or rollers) having parallel axes which press the fabric web in a radial direction on its opposite surfaces, determining the extraction of the liquid impregnating it.

[0005] Specifically, a known pressing assembly comprises a cylinder having a fixed rotation axis with respect to a frame, and a cylinder having a movable axis with respect to the frame. The cylinder having a movable axis can be approached to, or moved away from, the fixed cylinder so as to regulate the radial squeezing force during the passage of the fabric web.

[0006] Normally, linear pressure values of approximately 50 kg/cm are reached for the squeezing of a fabric web.

[0007] Solutions are known which provide for a translational movement of the movable cylinder with respect to the fixed one. In such solutions, for example, the movable cylinder is coupled to the frame by means of linear guides.

[0008] Other solutions provide for a tilting movement of the movable cylinder by means of a lever pivoted on the frame.

[0009] Both above-mentioned known solutions make use of an actuation of pneumatic type, for example air bellows (or air pistons) of known type.

[0010] However, in order to reach the maximum pressure values required by a typical squeezing process, in the solutions where the movable cylinder translates, it is necessary to utilize bellows of enormous size which therefore require consistent installation spaces. Such problem is smaller when utilizing a lever-operated tilting system, which allows multiplying the thrust of the pneumatic actuator in a mechanical manner. However, also in this case, the dimensions are significant.

[0011] Furthermore, by utilizing pneumatic actuation systems, low precision and scarce repeatability of the positioning of the movable cylinder are tendentially obtained, due to the compressibility of the air in the actuators, to the detriment of a homogeneous squeezing of the fabric web and of the precise control of the process parameters.

[0012] The need is thus felt to reduce the dimensions of the actuation systems of the known pressing assemblies described above.

[0013] The further need is felt to increase the precision and the repeatability of the positioning of the movable cylinders. In particular, the need is felt to obtain a pressure on the fabric which is optimal, and preferably by using a contained number of components. Furthermore, it is preferable to continue utilizing a source of compressed air for generating the squeezing force on the fabric.

[0014] Document FR1217340A corresponds to the preamble of claim 1 and describes a hydraulic device for controlling cylinders, in particular for pressing mechanisms, wherein the work piston enters into action by means of a compression spring.

SUMMARY OF THE INVENTION

[0015] The object of the present invention is to manufacture a fabric web pressing assembly, which enables satisfying in a simple and cost-effective manner at least part of the needs set forth above.

[0016] According to the present invention, a fabric web pressing assembly is provided, as claimed in claim 1.

[0017] According to the present invention, a fabric web pressing machine is further provided comprising two distinct pressing assemblies, each manufactured according to claim 1.

[0018] The dependent claims define particular embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The invention will now be described with reference to the accompanying drawings, which illustrate a non-limiting example embodiment thereof, wherein:

- Figure 1 is a perspective view, with parts removed for clarity, of a first machine having a preferred embodiment of the fabric web pressing assembly according to the present invention;
- Figures 2 and 3 are front views of two details of the

pressing assembly of Figure 1;

- Figures 4 and 5 show a perspective cutaway view, according to a vertical section plane, of the details of Figures 2 and 3;
- Figure 6 shows a detail sectioned according to a section plane identified by line VI-VI in Figure 2;
- Figure 7 is a front view of a second machine, comprising two distinct pressing assemblies, according to the present invention; and
- Figure 8 shows a control diagram of the pressing assembly according to the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

[0020] In Figure 1, reference numeral 1 indicates a pressing assembly for compressing a fabric web (schematically indicated by a dash-dot line in Figures 2 and 3). Such pressing assembly is used for extracting liquid from the fabric web, following, for example, its immersion inside a tub or tank containing a treatment liquid.

[0021] The assembly 1 comprises a frame 2, which in the illustrated non-limiting example, comprises two portal structures 2', 2" formed by steel profiles having a square section and being substantially identical. The two structures 2', 2" are arranged at opposite ends of the assembly 1, facing each other, and are constrained to each other by metallic longitudinal members. Preferably, for each structure 2', 2", the frame 2 further comprises two pairs of fixed crossbeams 19',19" (one pair arranged in the upper portion and the other pair in the lower portion of the frame structure 2', 2"), for example at a same distance from each other. Such fixed crossbeams 19 are functional to the constraint of other components of the assembly 1, as it will be described in the following.

[0022] The assembly 1 comprises three cylinders (also called rollers) 3, 4, 5 supported at their axial ends on the two frame structures 2', 2". The three cylinders 3, 4, 5 have rotation axes which are horizontal and parallel to and substantially aligned with one another along a vertical direction.

[0023] The cylinders 3, 4, 5 preferably have a same diameter, they have for example a metallic core, and are externally covered with semi-elastic materials (rubber or elastomers) or rigid materials (hard chromium plating); the cylinders used in the assembly 1 are of known type, therefore they will not be specifically described in the following.

[0024] As is illustrated in Figure 1, the cylinder 4 is interposed between the cylinders 3 and 5, and is coupled to the frame 2 by means of coupling means configured so that the axis of the cylinder 4 is fixed, and so that the latter is rotatable around such axis, with respect to the frame 2.

[0025] In particular, in the illustrated embodiment, on each axial end, the cylinder 4 is supported in an identical manner on the frame structures 2', 2", therefore we will consider, in the following, the sole left end of the cylinder 4, namely the one supported by the structure 2'.

[0026] As is illustrated in Figures 4 and 5, the axial end of the cylinder 4 is supported by a bearing 7, in particular a roller bearing, more in particular a bearing with a double rim of rollers. The bearing 7 is housed in a support 6 preferably formed by a pair of plates 18 facing each other along the rotation axis of the cylinder 4. Besides, the support 6 is fixed to the structure 2', for example by four pins 8. As is better illustrated in Figures 2 and 3, each plate 18 has a central portion and four lobes, which radially protrude and are symmetrical, two by two, with respect to a vertical middle plane and a horizontal middle plane on which the rotation axis lies: the four pins 8 are arranged at such four lobes.

[0027] As is illustrated in Figures 4 and 5, the plates 18 are arranged on opposite axial parts of two vertical uprights which constitute part of the structure 2' and, in turn, are arranged in diametrically opposite positions with respect to the cylinders. Therefore, one of the plates 18 is arranged towards the outside of the frame 2, whereas the other one is arranged towards the inside. The four pins 8 firmly constrain the aforementioned lobes to the two vertical uprights.

[0028] As is illustrated in Figure 1, an axial end of the cylinder 4 (in particular the one supported by the structure 2'') is connected to an electric motor 9, for example by means of a transmission 10. In particular, the axis of the motor 9 is arranged at right angle with respect to the axis of the cylinder 4. For example, the transmission 10 comprises a pair of bevel gears.

[0029] As is illustrated in Figure 2, the cylinder 5 is arranged in a position adjacent to and underlying the cylinder 4 so as to define a passage P1 between the side surfaces of the two cylinders 4, 5 (the profile of which is indicated by a dashed line), and such passage P1 is engaged, in use, by the fabric web while the latter advances along a longitudinal direction thereof (tangential with respect to the rotation axes of the cylinders) according to the direction indicated by the arrow F1.

[0030] The cylinder 5 is coupled to the frame 2 through coupling means 20 which make it rotatable around its rotation axis. According to the illustrated non-limiting embodiment, the cylinder 5 is idle, namely, unlike the cylinder 4, is not actuated during rotation.

[0031] Such coupling means 20 further allow the cylinder 5 to move away from and towards the cylinder 4, so as to vary a width of the passage P1 and thus vary the entity of the pressure radially exerted on the fabric.

[0032] As is illustrated in Figures 2 and 4, the coupling means 20 comprise, for each axial end of the cylinder 5, a support member 11 coupled by means of a bearing 7' to such axial end, so as to allow the rotation around its axis with respect to the support member 11. The coupling between cylinder 5, bearing 7' and support member 20 is performed in a manner identical to the coupling between cylinder 4, support 6 and bearing 7. According to other embodiments not illustrated, the coupling can be any coupling which enables the rotation of a member with respect to another one. In particular, the coupling can provide for bearings and supports of different type or mountings of different type.

[0033] In the illustrated non-limiting embodiment, the support member 11 of the cylinder 5 is formed by two plates 18'. Preferably, the plates 18' have the same characteristics of the plates 18, described above, therefore such characteristics will not be repeated for brevity. According to variations not illustrated, the support member 11 can have a different structure, or can comprise one single plate and/or plates having a different conformation.

[0034] A hinge 12 couples the support member 11 to the structure 2' so that it is rotatable around a hinge axis parallel to the rotation axes of the cylinders 4 and 5.

[0035] As is better illustrated in Figure 6, preferably, the hinge 12 comprises a pin (or a pivot) mounted in the same manner of the pins 8 which constrain the support 6 to the structure 2', namely connects the two plates 18' together to a vertical upright of the structure 2' interposed between them. In particular, the hinge 12 is arranged at one of the four lobes of the plate 18', in particular in the lobe arranged at the bottom right in the front view of Figure 2.

[0036] It is thus evident that the plates 18' are orthogonal to the axis of the hinge 12.

[0037] The coupling means 20 further comprise at least one rectilinear guide 13 which is carried by the frame 2 and is slidably coupled to the support member 11 so as to guide the rotation in a plane orthogonal to the axis of the hinge 12. Preferably, two parallel rectilinear guides 13 are provided, in diametrically opposite positions with respect to the cylinder 5. The two guides are fixed with respect to the frame 2, and extend in tangential direction with respect to the hinge axis. Specifically, the guides 13 are defined by the vertical uprights described above.

[0038] Advantageously, in the illustrated embodiment, the support member 11 is hinged by means of the hinge 12 to one of the rectilinear guides 13.

[0039] At the other three lobes, where the hinge 12 is not provided, the plates 18' support, in fixed relative positions, respective sliding blocks 21 which are slidingly coupled to the guides 13 and guarantee the sliding of the support member 11 on the guide 13. As is illustrated in Figure 6 for one single lobe, in fact, two sliding blocks 21 are respectively fixed to the plates 18' and are in contact with the guide 13 on one and the other side of the structure 2'.

[0040] Thanks to the coupling means 20, the cylinder 5 can rotate (tilt) around the axis of the hinge 12. According to an embodiment not illustrated, the coupling means 20 are configured so as to enable the cylinder 5 to translate along the guide 13, without lateral displacements.

[0041] By moving the support members 11 which support the cylinder 5, it is possible to vary the width of the passage P1 between the cylinder 4 and the cylinder 5 and in this manner allow, on the one hand, the pressing of fabric webs having different thickness and, on the other hand, vary the squeezing pressure applied to the fabric web.

[0042] The approaching to the cylinder 4 and thus the narrowing of the passage P1 are determined by an actuation system 14 which pushes the support members 11 to the ends of the cylinder 5.

[0043] For each axial end of the cylinder 5, the actuation system 14 comprises a respective hydraulic jack 15 and a respective spring shock absorber 16. At each axial end of the cylinder 5, the actuation is performed in the same manner, therefore reference will be made to only one of the two axial ends, illustrated in Figures 2 and 4, for brevity.

[0044] The jack 15 comprises a rod movable along a thrust axis which is preferably orthogonal and incident with respect to the rotation axis of the cylinder 4. The rod of the jack 15 acts coaxially on a piston 39 of the shock absorber 16. The jack 15 comprises a jacket which is fixed to the frame 2. In particular, the rod of the jack 15 is axially slidable through the fixed crossbeam 19' of the structure 2'. The crossbeam 19' guides, in use, the sliding of the piston 39.

[0045] According to an aspect of the present invention, the jack 15 is a high-pressure hydraulic jack, for example dimensioned for maximum thrusts of 20 tons (with hydraulic pressures of 70 Mpa) while coming out of its rod; the jack 15 is of the simple-acting type, therefore the re-entering of its rod is obtained by means of a spring (not illustrated) inside the jacket.

[0046] The spring shock absorber 16 is coaxial to the jack 15, is a component distinct from the jack 15, and is interposed between the latter and the support member 11 along the aforementioned thrust axis.

[0047] According to a non-limiting embodiment, and as is illustrated in Figure 4, the shock absorber 16 comprises a casing and a spring unit, preferably Belville washers, arranged one above the other along the aforementioned thrust axis in the casing. The piston 39, as mentioned above, is actuated by the jack 15 for compressing the springs, and it is thus subject to the counterthrust of the springs.

[0048] The shock absorber 16 further comprises a rod 17 which is integral with the casing, extends along the thrust axis and is axially movable with respect to the frame 2 towards the support member 11, in response to the compression of the springs of the shock absorber 16.

[0049] More in particular, the rod 17 is slidable in a guide seat axially obtained through the fixed crossbeam 19".

[0050] Preferably, the rod 17 has an end face resting directly on the support member 11 along the thrust axis. More preferably, it is resting on an outer ring of the bearing 7', which is interposed between the two plates 18'.

[0051] In use, when the jack 15 is actuated, its rod comes out of the jacket and exerts a thrust on the springs of the shock absorber 16 through the piston 39 along the thrust axis; such springs transfer an axial translation to the rod 17. The rod 17, being in direct contact with the support member 11, exerts a thrust on it driving it into rotation (upwards) around the axis of the hinge 12, causing the cylinder 5 to approach the cylinder 4 and thus the reduction in the width of the passage P1.

[0052] The entity of the axial translation of the rod of the jack 15 and of the rod 17 of the shock absorber 16 is defined based on the fabric, the hydraulic pressure, the deformability of the covering material of the cylinders, etc, fundamentally depending on the process needs.

[0053] The actual entity of the pressing on the fabric web is determined by varying the compression force on the springs present of the casing of the shock absorber 16: the springs transfer such pressure force to the support member 11.

[0054] With regard to the moving away step of the cylinder 5 from the cylinder 4, no actuation system is provided for pulling the support member 11, but rather the force of gravity is exploited. In fact, once the pressurization of the jack 15 has been interrupted or reduced, the shock absorber 16 lowers and thus tends to move away from the support member 11, by effect of its own weight; similarly, by gravity, the support member 11 rotates around the hinge axis 12 downwards, thereby widening the passage P1.

[0055] According to what is illustrated in Figure 3, the cylinder 3 is located, instead, in a position above the cylinder 4 and is substantially vertically aligned with the cylinder 4. The cylinder 3 is constrained to the frame 2 by means of coupling means 20' and is approached/-moved away with respect to the cylinder 4 by means of an actuation system 14': the components of the coupling means 20' and of the actuation system 14' are analogous to the ones described above for the coupling means 20 and for the actuation system 14, therefore they will not be described again and will be indicated by the same reference numerals utilized above, followed by an additional index (').

[0056] Therefore, like the cylinder 5, the cylinder 3 is idle, its rotation axis is movable away from and towards the cylinder 4 and is actuated, at each axial end, by a respective jack 15' and by a respective spring shock absorber 16'.

[0057] The hinge 12' is arranged in a position diametrically opposite the hinge 12 with respect to the rotation axis of the cylinder 4; in other words, the hinge 12' is located on one of the two lobes of the plates 18" arranged at the top, whereas the hinge 12 is located on one of the two lobes of the plates 18' arranged at the bottom.

[0058] In the specific illustrated example, the support member 11' has a slightly different shape from the support member 11. In particular, the support member 11' differs from the support member 11 for the fact that each of the plates 18" has a slight upper protrusion. Such protrusion has a slot 22, elongated in a direction which is transverse to the thrust axis of the rod 17', i.e. tangential or circular with respect to the rotation axis of the cylinder 3. The rod 17' of the shock absorber 16', as is illustrated in Figure 5, has a hole engaged by a pin 23, orthogonal to the thrust axis. The pin 23 is axially fixed with respect to the rod 17' and engages the slots 22 of the plates 18", preferably with clearance along the thrust axis of the rod 17' .

[0059] The slot 22 and the pin 23 define constraining means which hook the rod 17' to the support member 11' which supports the cylinder 3, and thus allow lifting the cylinder 3 in response to an upstroke of the rod 17' of the shock absorber 16'.

[0060] Also the rod 17 of the shock absorber 16 actually has the same conformation, i.e. has a transverse hole, which however is not used for any pin, as it is not necessary (since the moving away of the cylinder 5 from the cylinder 4 is guaranteed by the force of gravity). In other words, for simplicity and uniformity in production, the components used in the shock absorber 16 and 16' are identical. According to a variation not illustrated, also the plates 18' could have the same shape of the plates 18", for uniformity in production.

[0061] As is illustrated in Figure 3, a spring return system 24 is interposed between the shock absorber 16' and the fixed crossbeam 19". Such system 24 has the function of lifting the rod 17' in the absence of hydraulic pressure in the jack 15'.

[0062] Preferably, the system 24 comprises a movable crossbeam 25, which is guided along the thrust axis of the jack 15', by means of two guide rods 40 which are parallel to the vertical uprights of the structure 2'. The crossbeam 25 is fixed with respect to the casing of the shock absorber 16' and thus also to the rod 17' and is further parallel to the fixed crossbeams 19', 19".

[0063] The system 24 further comprises a pair of springs 26, for example coil springs, arranged between the fixed crossbeam 19'' and the movable crossbeam 25, on the opposite sides of the shock absorber 16'. The springs 26 are respectively guided by the guide rods 40, which are placed between the crossbeams 19' and 19'' and pass through the movable crossbeam 25. The springs 26 have respective upper ends which are pushed by the movable crossbeam 25 so as to be compressed downwards, i.e. towards the crossbeam 19", during the pressurization of the jack 15'.

[0064] According to what is illustrated in Figure 3, during a typical pressing operation, the fabric web engages a passage P2 between the cylinders 3 and 4 and slides according to the direction F2.

[0065] When the jack 15' is actuated, it pushes the rod 17' by means of the springs of the shock absorber 16'. The end face of the rod 17' is in contact with the support member 11' and, translating, it pushes it and thus drives it into rotation with respect to the hinge 12' (downwards), causing the cylinder 3 to approach the cylinder 4, therefore the width of the passage P2 is reduced. In this step, the shock absorber 16', translating downwards under the thrust of the jack 15', generates the descent of the movable crossbeam 25, thereby compressing the springs 26.

[0066] When the jack 15 is depressurized, the pair of springs 26, previously compressed, extends causing the movable crossbeam 25 to newly move upwards. The movable crossbeam 25, in turn, carries the shock absorber 16' with it upwards and thus its rod 17': the latter, being hooked to the support member 11' through the pin 23 and the slot 22, in turn drags the support member 11' and the cylinder 3 with it upwards.

[0067] The pin 23, being able to slide along the slot 22, does not hinder the rotation of the support member 11' around the axis of the hinge 12'.

[0068] As mentioned above, also a certain vertical clearance is present in the pin-slot coupling (i.e. the width of the slot 22 along the thrust axis is greater than the diameter of the pin 23): such clearance enables the pin 23 not to be stressed during the pressurization of the jack 15'; in other words, the downward thrust is transferred to the support member 11' only from the end face of the rod 17', resting on the support member 11'.

[0069] According to the preferred embodiment described above, the assembly 1 is formed by three cylinders 3, 4, 5, in particular one (4) actuated during rotation and the other two (3, 5) idle. However, the pressing assembly 1 can be formed by only two cylinders, for example 3 and 4 or 4 and 5. In general, the assembly 1 is thus formed by at least two cylinders, one actuated during rotation and an idle one, or both actuated during rotation, or both idle.

[0070] In fact, the fabric web does not necessarily have to be subject to two pressing steps, passing through the passages P1 and P2 in succession. On the contrary, a pressing process can provide for one single pressing step passing through the passage P1 or P2.

[0071] Figure 7 shows a different embodiment, relative to a machine 38 comprising two distinct and independent pressing assemblies 1', 1", each manufactured according to the characteristics described above.

[0072] What described in the foregoing for the pair of cylinders 4 and 5, is valid for the assembly 1'. In other words, the cylinders 4' and 5' of the assembly 1' are identical to the cylinders 4 and 5. The same is valid for the assembly 1", in which the cylinders 4" and 3" are identical to the cylinders 4 and 3.

[0073] Preferably, the assemblies 1' and 1" are aligned with each other along a vertical direction, for reducing the dimensions.

[0074] During a fabric web pressing operation, the web (schematized with dash-dot line) enters from the passage P3 defined by the cylinders 4' and 5' in the direction indicated by the arrow F3. Subsequently, it is guided by the return pulleys or cylinders (not illustrated) up to the passage P4 defined by the cylinder 4" and 3", according to the direction indicated by the arrow F4.

[0075] Based on the process requirements, it is possible for the web to be pressed only once, between the cylinders 4' and 5' or only once between the cylinders 4" and 3".

[0076] The diagram illustrated in Figure 8 refers to the two jacks 15, but the same considerations are valid also for the jacks 15'.

[0077] The chambers to be pressurized of the jacks 15 are connected to a hydro-pneumatic control unit 27 which supplies pressurized oil in response to a pneumatic supply and amplifying the oil pressure with respect to that of such pneumatic supply. The control unit 27, per se, can be a component available on the market, therefore it will not be specifically described.

[0078] The control unit 27 has an inlet 28 for receiving compressed air and an outlet 29 for delivering pressurized oil to the pair of jacks 15.

[0079] Advantageously, the control unit 27 regulates, in use, the oil pressure of the jacks 15 based on the pressure of the compressed air at the inlet. In practice, by utilizing the pneumatic pressure of a common compressed air source provided in the plant where the pressing assembly 1 is installed, oil is pumped into the hydraulic circuit.

[0080] The control unit 27 comprises a dynamic hydraulic press 36 (defining a pressure multiplier) which, by increasing the oil pressure, produces the thrust on the cylinder 5.

[0081] Preferably, the assembly 1 further comprises a control system comprising a microprocessor 35 which deals with regulating the oil pressure of the jacks 15 in closed loop communicating with the control unit 27. In other words, the system detects the oil pressure in the jacks 15 or in their hydraulic supply circuit, by means of a pressure transducer 30; the microprocessor 35 operates a comparison between the detected pressure values and a pre-set reference value (setpoint) and provides an output signal in response to the outcome of the comparison.

[0082] In the illustrated preferred embodiment, the pressure transducer 30 is an analogue pressure switch with electronic detection. The pressure setpoint is defined depending on the desired linear pressure value between the cylinders 3,4 (for example values up to $50 \div 60$ Kg/cm). According to a preferred but non-limiting embodiment, the desired linear pressure value is input by a user through a user interface 34, consisting of for example a touch panel, and the hydraulic pressure setpoint is calculated consequently by the microprocessor 35.

[0083] The control system further comprises a pair of solenoid valves 32, 33 controlled by the microprocessor 35 by means of the aforementioned output signal for varying the supply of the compressed air sent to the inlet 28 of the control unit 27 and thus vary the oil pressure in the supply circuit to the jacks 15.

[0084] The solenoid valve 32 is configured so as to determine the pneumatic pressure at the inlet 28 and in the press 36. The solenoid valve 33 is configured so as to determine an oil discharge from the press 36, by means of a pneumatic control line 37.

[0085] In particular, once the setpoint has been reached, the jacks 15 can be insulated from the rest of the system in the working step.

[0086] Therefore, the microprocessor 35 deals with correcting the pressure by communicating with the solenoid valves 32 and 33. If it is necessary to increase the pressure, the solenoid valve 32 is opened; if it is necessary to decrease the pressure, the microprocessor 35 controls the opening of the solenoid valve 33 for determining the discharge of the oil through a discharging flow throttling with end regulation.

[0087] In general, the possible increase or decrease variations of the hydraulic pressure, controlled in feedback by the transducer 30, are adjusted by the opening or closing of the solenoid valves 32 and 33, which by alternatively intervening balance the setting.

[0088] Based on the foregoing, it is evident that the pressing assembly 1 allows, first of all, reducing the dimensions with respect to the actuation systems of the known squeezing assemblies, thanks to the use of hydraulic actuation instead of the pneumatic one. The jacks 15,15' utilized in the assembly 1, in fact, have a much smaller size than the pneumatic cylinders, the axial thrust to be exerted being equal, thanks to the high pressures that can be reached with the hydraulic systems.

[0089] At the same time, it is anyway possible to utilize a pneumatic source, commonly available in the plants, for generating the thrust on the cylinders 3,5. In the specific case, the control unit 27 and the control system can be arranged in a remote zone with respect to the pressing assembly 1, always to the advantage of the installation dimensions.

[0090] The hydraulic actuation further enables increasing the positioning precision and repeatability of the movable cylinders, thanks to the fact that a non-compressible fluid is utilized in the jacks. This allows having a more uniform squeezing of the fabric.

[0091] At the same time, the shock absorbers 16,16' enable absorbing possible sudden thickness variations in the fabric due to knots, seams, etc..., and thus preventing the linear pressure between the cylinders from suddenly increasing in an undesired manner creating deleterious kickbacks and impacts.

[0092] It is then evident that the assembly 1 is flexible, as it can be formed by two, three or four cylinders, at will, as necessary.

[0093] Additionally, the presence of a feedback control of the pressure of the jacks 15 increases the process accuracy with possible continuous corrections.

[0094] On the whole, therefore, the assembly 1 results to be extremely compact, effective, flexible and relatively cost-effective.

[0095] Based on the foregoing it is finally evident that modifications and variations can be made to the assembly 1 and to the machine 38 described with reference to the accompanying figures, which do not depart from the scope of protection of the present invention, as claimed in the appended claims.

[0096] In particular, the cylinders, the plates of the support members, and/or the frame could have different configurations or arrangements with respect to what described and illustrated with reference to the accompanying figures.

[0097] For example, the cylinders could have diameters different from one another, or could be constrained to a frame with different coupling means with respect to the ones described.

[0098] Furthermore, different constraining means could be used for guaranteeing the upstroke of the movable cylinder, when it is arranged in a position above the fixed cylinder.

[0099] Furthermore, the cylinders 3, 4, 5 could be not perfectly aligned in vertical direction.

[0100] Finally, at least theoretically, the movable cylinder 3, 5 could be actuated by one single jack and one single spring shock absorber, arranged centrally.

[0101] Likewise, the hydraulic system for managing the hydraulic flow to the jacks 15, 15' could be adjusted to control units provided with hydraulic electro-pumps instead of having pneumatic-hydraulic control units. In other words, the hydraulic system can be unconstrained from a pressurized (pneumatic) air source.

Claims

1. A fabric web pressing assembly (1), the pressing assembly comprising:

- a frame (2);
- a first cylinder (4) having a first rotation axis and being coupled to said frame (2) so that said first rotation axis is fixed and so that said first cylinder (4) is rotatable around said first rotation axis with respect to said frame (2);
- a second cylinder (3;5), which has a second rotation axis parallel to said first rotation axis and is adjacent to said first cylinder (4) to define a passage (P1;P2) engaged, in use, by said fabric web;
- coupling means (20;20') which couple said second cylinder (3;5) to said frame (2) so that said second cylinder (3;5) is rotatable around said second rotation axis and so that said second cylinder (3;5) is movable away from and towards said first cylinder (4) to vary a width of said passage (P1;P2);
- an actuation system (14;14') to move said second cylinder (3;5) and thus vary said width; wherein said actuation system (14;14') comprises:

  a) at least one hydraulic jack (15;15'), and
  b) at least one spring shock absorber (16;16'), interposed between said hydraulic jack (15;15') and said coupling means (20;20');

characterised in that said coupling means (20;20') comprise, for each axial end of said second cylinder (3;5):

- a support member (11;11') coupled by means of a bearing (7';7") to the respective axial end to allow the rotation of said second cylinder (3;5) with respect to said support member (11;11') around said second rotation axis, and
- a hinge (12;12') that couples said support member (11;11') to said frame (2) so that it is rotatable around a hinge axis parallel to said first and second rotation axes.

2. The pressing assembly according to claim 1, wherein said actuation system (14;14') comprises a pair of hydraulic jacks (15;15') and a pair of spring shock absorbers (16;16'), at opposite ends of said second cylinder (3;5).

3. The pressing assembly according to claim 1 or 2, wherein said hydraulic jack (15;15') has a thrust axis orthogonal and incident with respect to said first rotation axis.

4. The pressing assembly according to any one of the preceding claims, wherein said coupling means (20;20') further comprise at least one rectilinear guide (13), which is fixed with respect to said frame (2), extends in tangential direction with respect to said hinge axis (12;12') and is slidably coupled to said support member (11;11') to guide the rotation around said hinge axis.

5. The pressing assembly according to claim 4, wherein said coupling means (20;20') comprise two parallel rectilinear guides (13), arranged in diametrically opposite positions with respect to said second cylinder (3;5).

6. The pressing assembly according to claim 5, wherein said support member (11;11') is hinged to one of said rectilinear guides (13) by means of said hinge (12;12').

7. The pressing assembly (1) according to any one of claims 4 to 6, wherein each said support member (11;11') comprises at least one plate (18';18'') orthogonal to said hinge axis (12;12') and slidably coupled to said rectilinear guide (13).

8. The pressing assembly (1) according to any one of the preceding claims, wherein said spring shock absorber (16;16') comprises a rod (17;17') resting directly on said support member (11;11') or on an outer ring of said bearing (7';7").

9. The pressing assembly according to claim 8, wherein said second cylinder (3) is arranged in a position above said first cylinder (4), and wherein said pressing assembly (1) comprises constraining means that connect said rod (17') to said support member (11') to lift said second cylinder (3) in response to an upstroke of said rod (17').

10. The pressing assembly according to claim 9, wherein said constraining means comprise:

- a slot (22) obtained in said support member (11'), elongated in a direction transverse to an axis of said rod (17'), and
- a pin (23) axially fixed with respect to said rod (17') and engaging said slot (22), with clearance along the axis of said rod (17').

11. The pressing assembly according to claim 9 or 10, and comprising a spring return system (24) interposed between said spring shock absorber (16') and said frame (2) to lift said rod (17') in the absence of hydraulic pressure in said jack (15').

12. The pressing assembly according to claim 11, wherein said frame (2) comprises a fixed crossbeam (19") having a guide seat slidably engaged by said rod (17'), and said spring return system (24) comprises:

- a movable crossbeam (25), fixed with respect to a component of said spring shock absorber (16') and parallel to said fixed crossbeam (19"), and
- at least one spring (26) arranged between said fixed crossbeam (19") and said movable crossbeam (25).

13. The pressing assembly according to any one of the preceding claims, wherein said spring shock absorber (16;16') comprises a plurality of Belleville washers placed one above the other.

14. The pressing assembly according to any one of the preceding claims, and comprising a control system comprising:

- a pressure transducer (30) configured to detect pressure values of oil supplied to said jack (15;15') and to provide an output signal, indicative of said pressure values,
- control means (32, 27) controlled to regulate the pressure of the oil supplied to said jack (15;15'), and
- a microprocessor (35) connected to said pressure transducer (30) to receive said output signal and configured to process said output signal and control said control means (32, 27) so as to obtain a variation of said oil pressure depending on at least one predetermined reference value

and on said output signal.

15. The pressing assembly according to claim 14, wherein said control means (32, 27) comprise:

- a hydro-pneumatic control unit (27), which has an inlet (28) for receiving compressed air and an outlet (29) for delivering pressurized oil to said jack (15;15'), and is configured to set the oil pressure based on the pressure of said compressed air; and
- at least one valve (32) controlled by said microprocessor (35) to regulate the pressure of said compressed air.

16. The pressing assembly according to any one of the preceding claims, and comprising a third cylinder having a third rotation axis parallel to said first and second rotation axes, and further coupling means analogous to said coupling means to couple said third cylinder to said frame; said first cylinder being interposed between said second and third cylinders.

17. A fabric web pressing machine (38), the machine comprising two distinct pressing assemblies (1', 1"), each produced according to any one of claims 1 to 15, wherein the first and second cylinders of said pressing assemblies are substantially aligned with each other along a vertical direction.

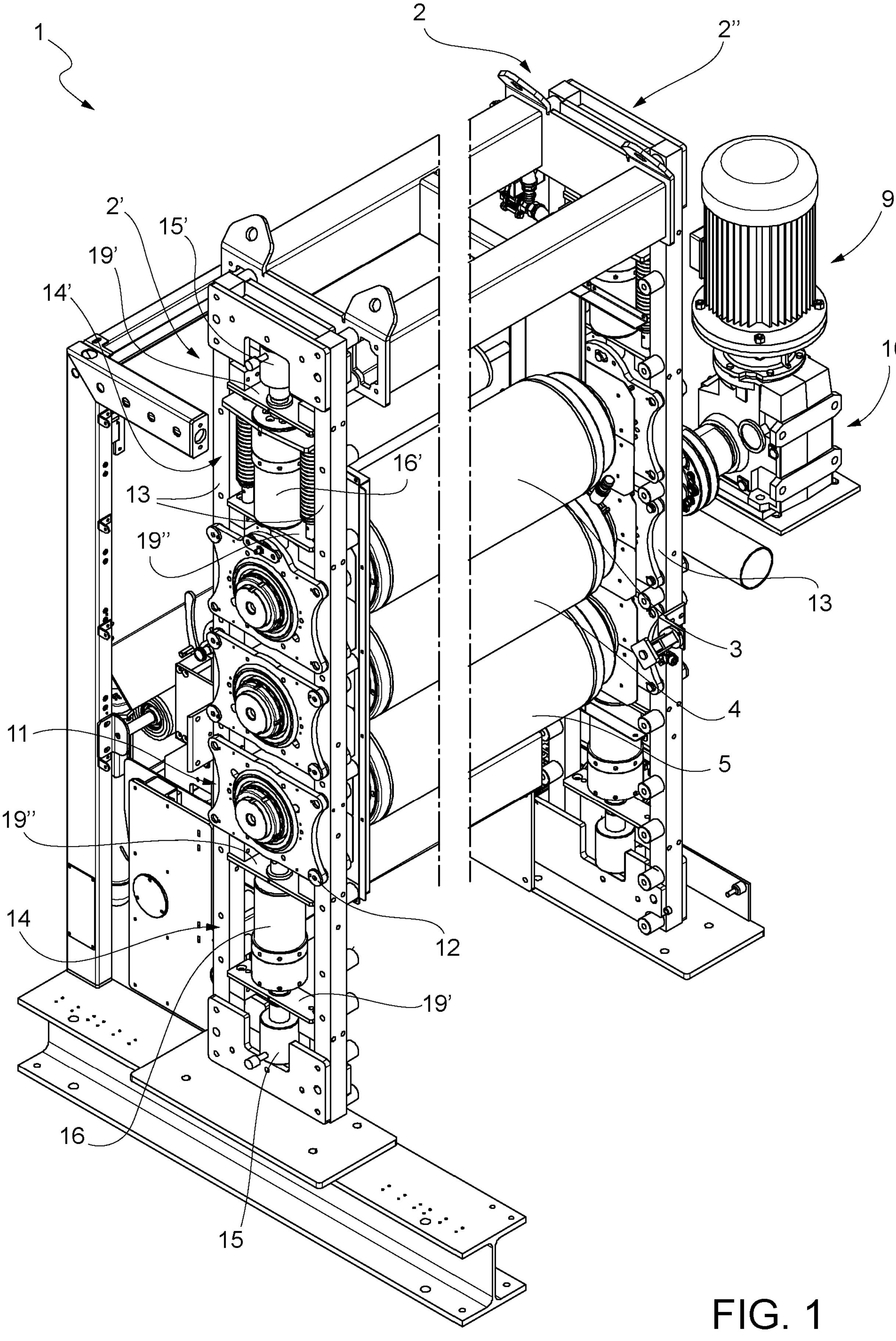


FIG. 1

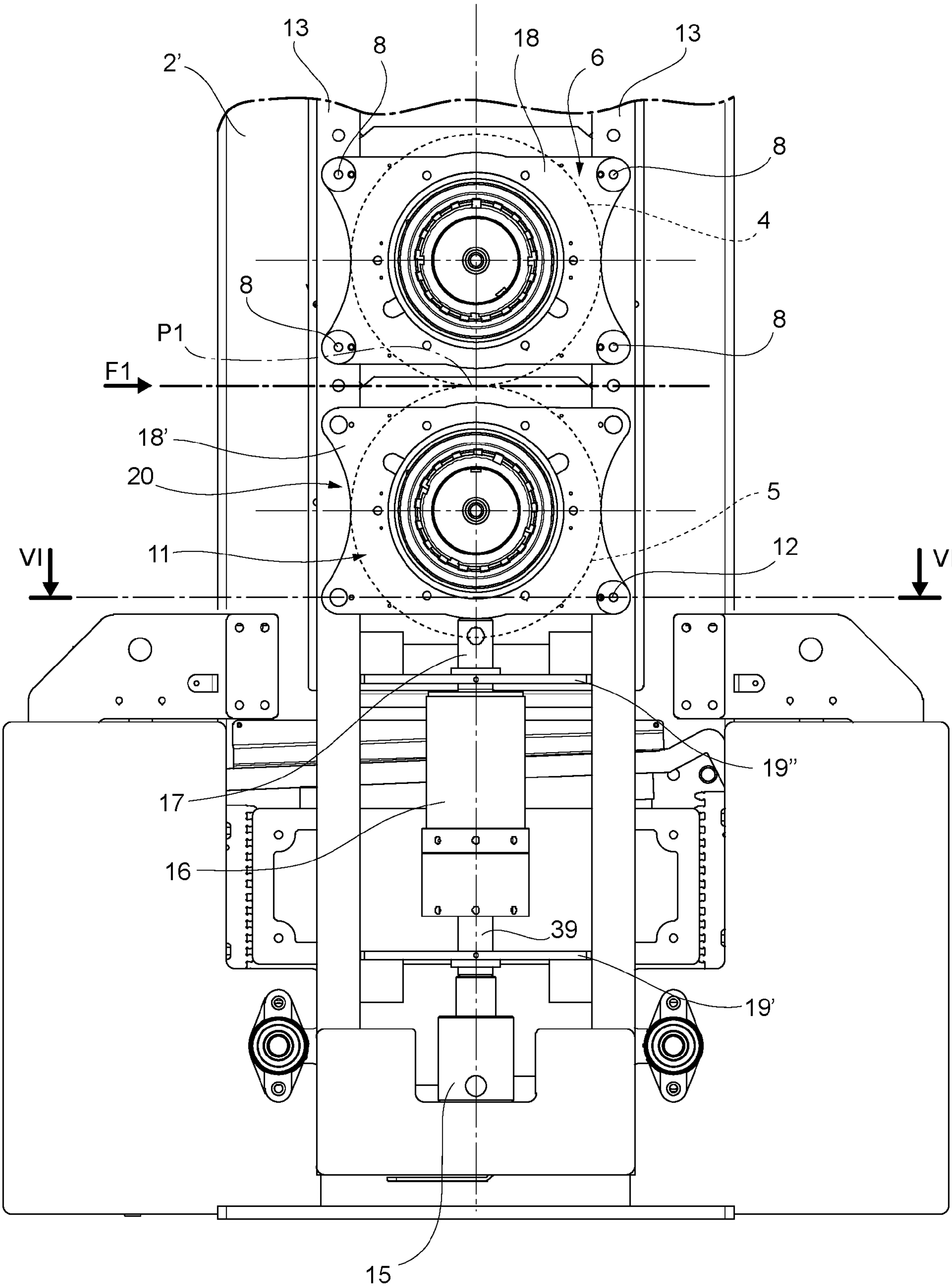


FIG. 2

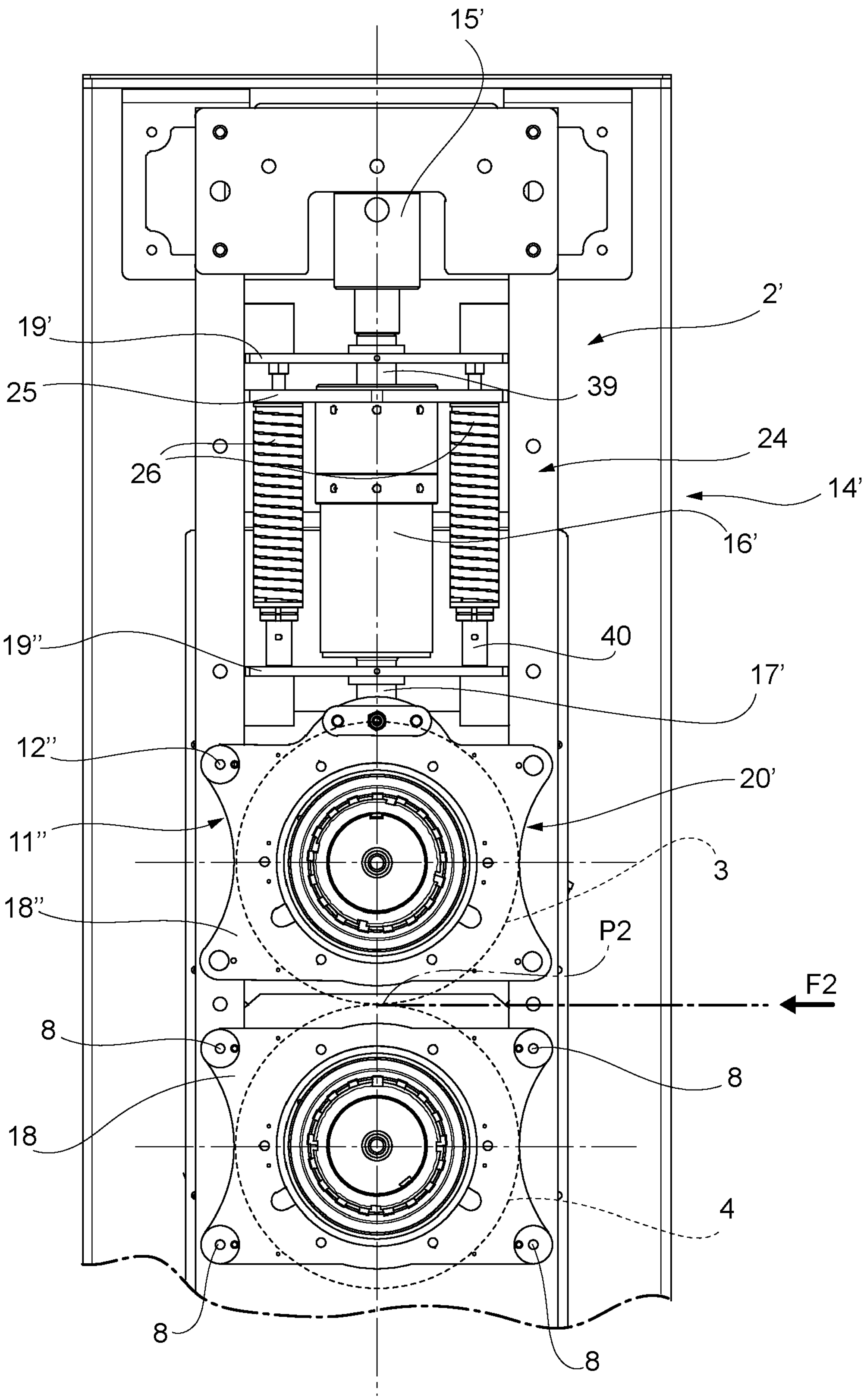


FIG. 3

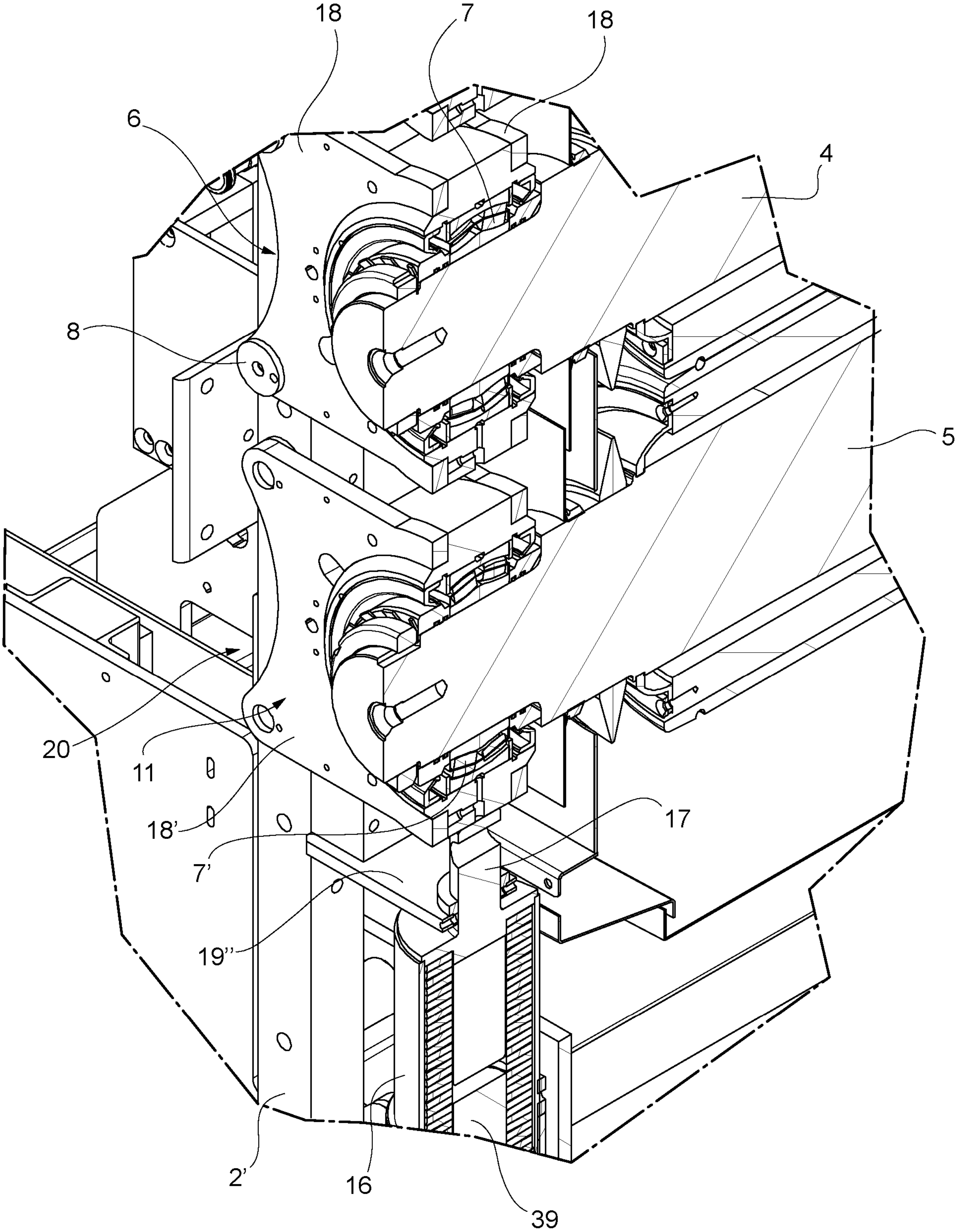


FIG. 4

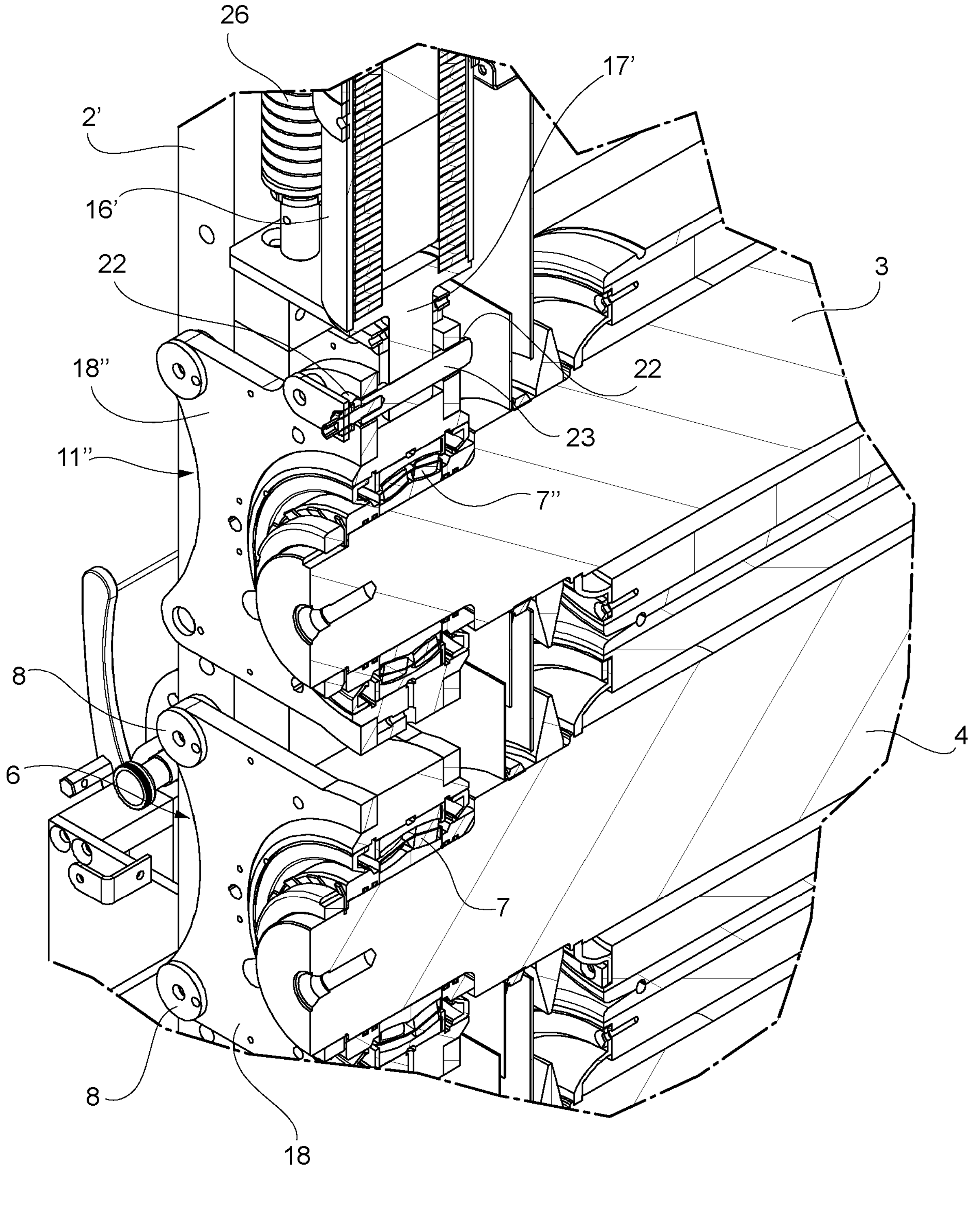
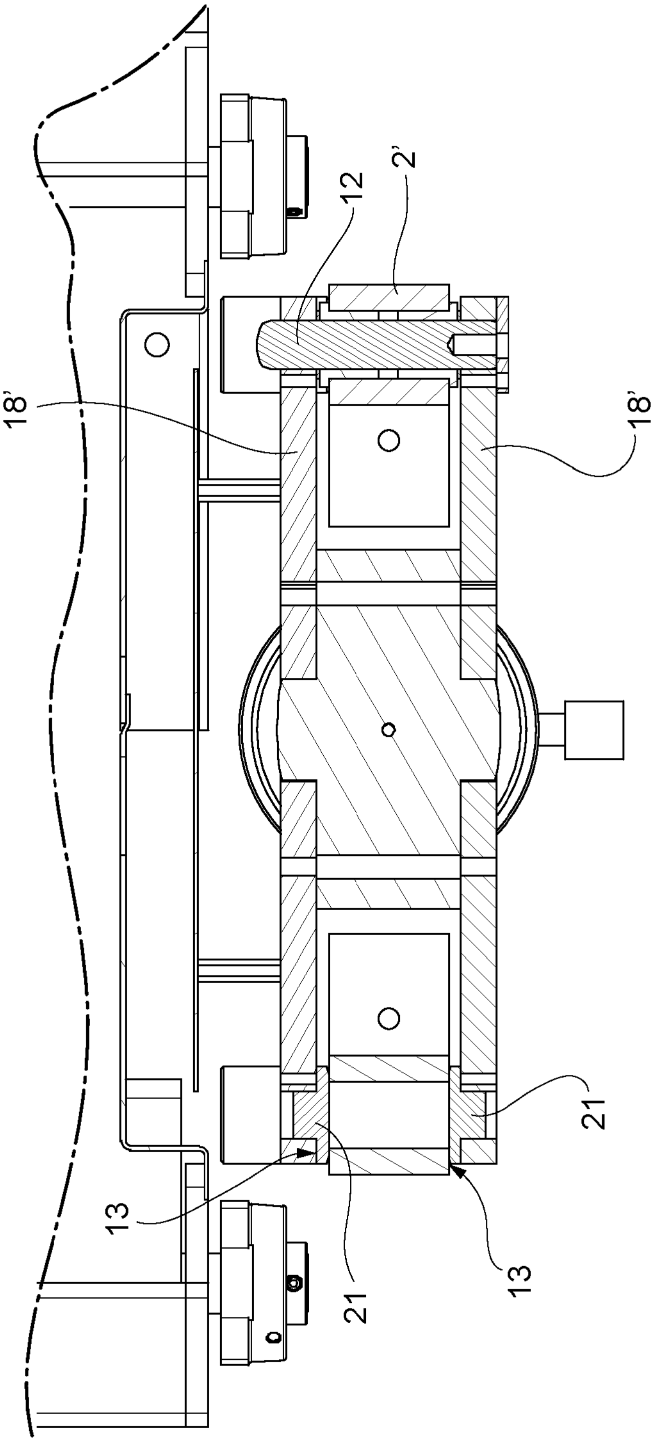


FIG. 5

FIG. 6



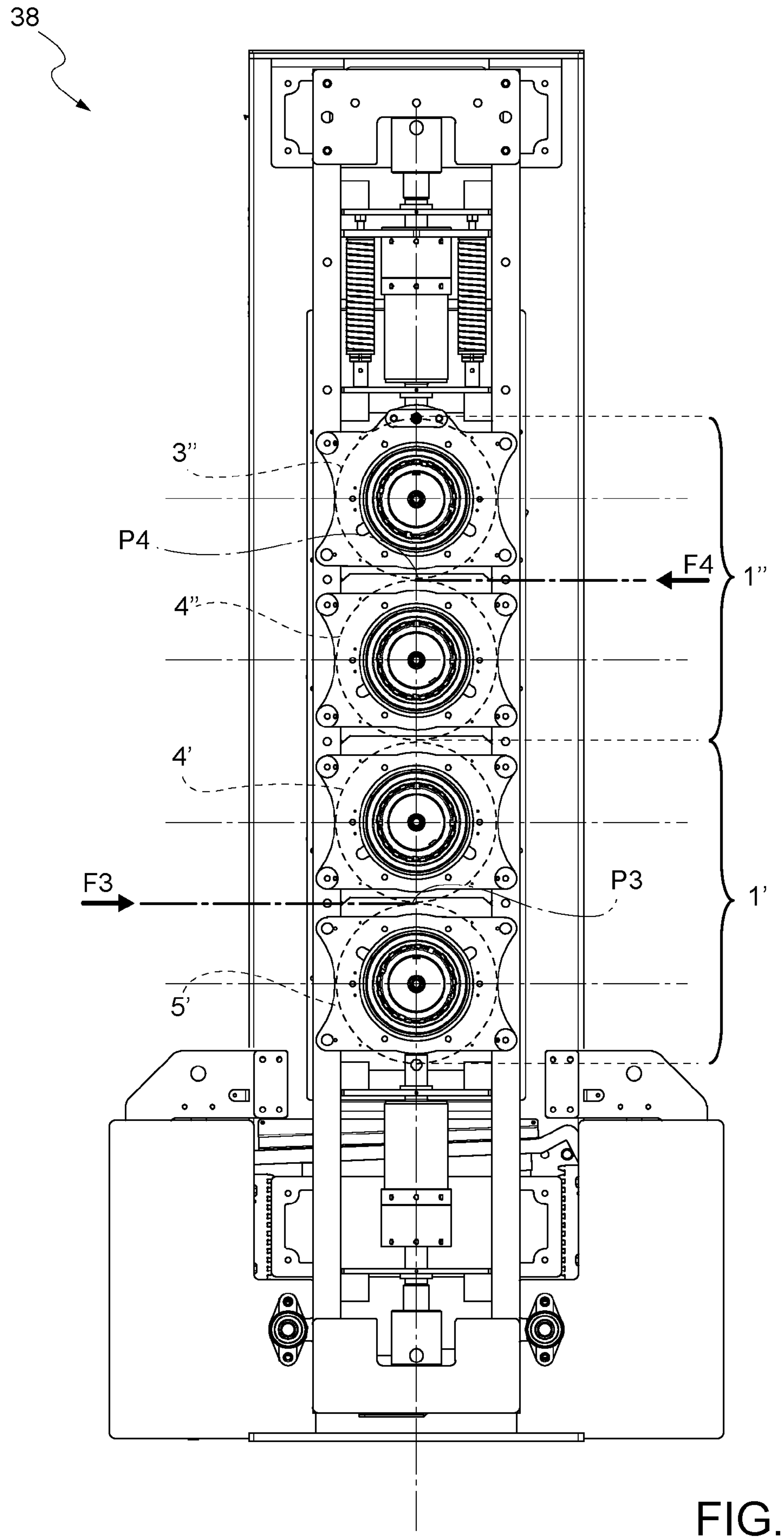


FIG. 7

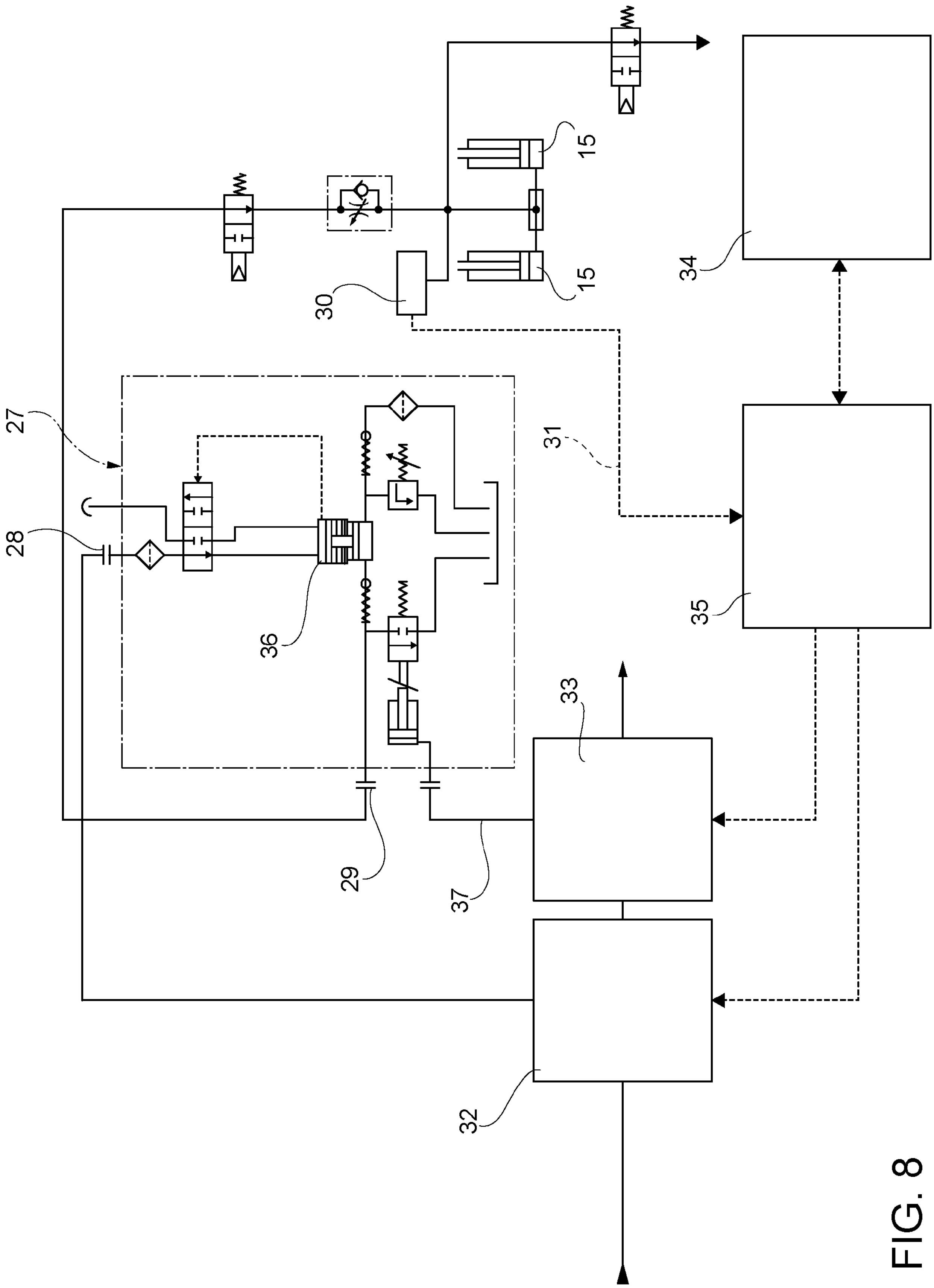


FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 24 17 9513

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	FR 1 217 340 A (SPINNEREI KARL MARX VEB) 3 May 1960 (1960-05-03) * claim 1; figure 1 * -----	1-17	INV. D21G1/00 D06B15/02
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A	CN 218 521 449 U (CHANGZHOU HUIMING PREC MACHINERY CO LTD) 24 February 2023 (2023-02-24) * figures 1-2 * -----	1	

TECHNICAL FIELDS SEARCHED (IPC)

D21J
D21G
D06C

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	29 October 2024	Iamandi, Daniela

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29-10-2024

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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