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(54) Electromechanically operated die cutting machine

(57) Electromechanically operated die-cutting machine, of the type comprising a translating operating head (7) with a striking surface (15) carrying the dinking dies which performs a vertical to-and-fro movement in respect of the plane (2) supporting the material (M) to be machined. In said machine, the to-and-fro movement of said striking surface (15) is produced by an operating unit (13) comprising a screw and nut unit (16-17) with planet rollers (18), operated by an electric mover (9) which is electronically controlled by a programme.

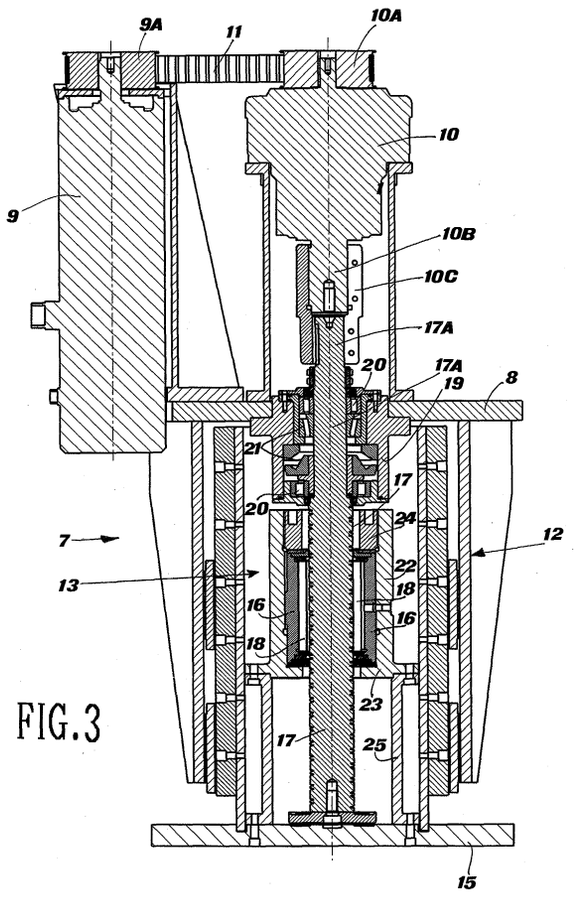

FIG.3

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Description

[0001] The present invention concerns an electromechanically operated die-cutting machine.

[0002] As well known to the skilled in the art, die-cutters are machines apt to perform the die cutting, namely the cutting into sections of sheet or plate materials (particularly leather and hide, their substitutes, plastic sheet materials and roll and plate boards, and the like) by means of tools, called dinking dies, consisting of a blade shaped according to the profile of the sections being cut. In the die-cutting machines, the dinking dies project downwards from a striking surface, which is moved down towards a plane supporting said materials, so that the dinking dies may hold onto such materials up to cutting out said sections therefrom, to then move up again.

[0003] The die-cutting machines used at present are hydraulically operated by considerably powerful oil-pressure means which comprise a pump and a cylinder-piston unit operating as a high-speed actuator.

[0004] Due to the actual nature of said oil-pressure means, these machines have various limits, such as a high structural complexity and high production costs, considerable use and consumption of high energy with a low yield, ecological problems due to disposal of the waste materials, high levels of noise, but above all setting difficulties and scarce repeatability of the performances, which thus make it impossible to obtain an actual control of the cutting characteristics within the limits which the present quality requirements tend to impose. With the cylinder-piston hydraulic units as used up-to-date on these machines - which, operating on an "ON/OFF" basis, allow to control but not to adjust the downward movements of the striking surface carrying the dinking dies - it is in fact impossible to make exact choices of speed, acceleration, pressure force, times and strokes of the striking surface, that is, to adjust the performances of the machine according to requirements and consequently obtain an efficient repeatability of such performances.

[0005] The attempts made in the past to conceive die-cutting machines not involving the limits determined by their hydraulic working had never given concrete satisfactory results due to the difficulty met in applying, with mechanical means, such high pressure forces and speeds of the working stroke as are required, and/or in obtaining an acceptable control and flexibility of the working process.

[0006] This is now obtained with the present invention, which concerns an electromechanically operated die-cutting machine apt to overcome the aforementioned drawbacks, while maintaining or improving the performances of the hydraulically operated die-cutting machines for what concerns the die-cutting power and the working times. This die-cutting machine is simpler than the hydraulically operated machines, both as far as construction and as far as working, it drastically reduces the overall dimensions, the energy consumptions and the ecological problems connected therewith and, above all, it can be set with precision and rapidity, so as to guarantee a good repeatability of the performances, thus behaving as a numerically controlled machine tool; this result was highly sought after by the users, but quite impossible to reach with the known die-cutting machines.

[0007] The die-cutting machine according to the invention - of the type comprising a translating operating head with a striking surface carrying the dinking dies which performs a vertical to-and-fro-movement in respect of the plane supporting the material to be machined - is characterized in that the to-and-fro movement of said striking surface is produced by an operating unit comprising a screw and nut unit with planet rollers, operated by an electric mover which is electronically controlled by a programme.

[0008] Preferably, the control of said electric mover operating the screw and nut unit with planet rollers will be combined with the control of the motors which determine the movements of the translating operating head and, possibly, the feeding of the material on its supporting plane, and said controls will be carried out electronically by means of a single programme.

[0009] The electromechanically operated die-cutting machine according to the invention can be efficiently realized by providing therein an operating head, a bearing plate of which supports, on its top, an electric mover and a reduction unit and holds, underneath, a stout casing which houses said operating unit, slidable verticalwise and coaxially to the reduction unit and ending below with a striking surface to which there are fixed the dinking dies.

[0010] The invention will now be described in further detail, with reference to a preferred embodiment thereof, illustrated on the accompanying drawings, in which:

[0011] Fig. 1 is a perspective assembly view of the electromechanically operated die-cutting machine according to the invention;

[0012] Fig. 2 is an axonometric view, with disassembled and partly removed portions, of the translating head of the die-cutting machine of fig. 1, comprising the striking surface carrying the dinking dies; and

[0013] Fig. 3 is a section view of the head shown in fig. 3, with the striking surface carrying the dinking dies mounted thereon.

[0014] As shown on the drawings, the electromechanically operated die-cutting machine according to the invention comprises, in known manner, a bed 1 with a plane 2 supporting the material M to be machined, and an upper bridge structure 3 having two uprights 4 and a crosspiece 5. An operating head 7 is mounted on the bridge structure 3, translating on guides 6 by means of suitable sliding blocks (not shown), also in known manner.

[0015] According to the invention, the operating head 7 comprises a bearing plate 8 which supports, on its upper part, an electric mover 9 and a reduction unit 10,

operated by the mover 9 through a toothed drive belt 11 winding onto toothed pulleys 9A and 10A, and which carries, in its lower part, a stout casing 12 housing an operating unit 13 which is mounted slidable verticalwise and coaxially to the reduction unit 10, for example on guiding saddles 14 (fig. 2) provided into the casing 12, and which is connected at the bottom to a striking surface 15 to which there are fixed dinking dies (not shown on the drawings). Alternatively, the dinking dies could be mounted on a plane rotating in respect of the striking surface 15, said plane (not shown) being associated to the operating unit 13.

[0016] The operating unit 13 has, in its inner part, a screw and nut unit 16-17 with planet rollers 18, coaxial to the reduction unit 10, a smooth extension 17A of the screw 17 crossing the bearing plate 8 through a central hole 8A thereof; the screw 17 is apt to rotate (by way of a rigid coupling 10C) together with the outlet shaft 10B of the reduction unit 10. The rotations of the screw 17 with planet rollers 18, caused by the reduction unit 10 - changing into linear movements of the nut 16 - hence give rise to vertical to-and-fro movements of the whole unit 13, and thus of the striking surface 15 (starting from the top dead center position, shown in fig. 3). The screw and nut unit 16-17 with planet rollers 18 allows to support the very high loads

- both static and dynamic, with a high number of revolutions
- which, during work, ensue from the cutting action of the dinking dies.

[0017] The mover 9 of the operating head 7 consists of an electric servomotor variator apt to reach high speeds and accelerations, which supplies high powers.

[0018] The reduction unit 10 suitably amplifies the torque to be applied onto the screw 17 and efficiently absorbs the torsional impacts.

[0019] The operating unit 13 comprises: - a thrust bearing flange 19 mounted by means of radial roller bearings 20 and axial thrust bearings 21 on the upper smooth extension 17A of the screw 17 with planet rollers 18; - a seat 22 for the nut 16 with a lower end plate 23 and an upper inner locking ring 24; a spacing flange 25 which connects the nut seat 22 to the striking surface 15.

[0020] The means to carry out the horizontal translation of the operating head 7 forward and backward along the guides 6 of the bridge structure 3, as well as the means to feed the material M on the plane 2 when it is a sheet material wound into a roll, are not being described herein as they consist of conventional means known to the experts of die-cutting machines. The same applies to the special structure of the supporting plane 2 and to the various safety devices which have to be provided on these machines, which also form part of conventional technique.

[0021] It should instead be expressly noted that, according to the invention, the mover 9 of the machine is electronically controlled by means of a software programme specially foreseen for the purpose. Since the mover 9 acts onto an exclusively mechanical system, said programme enables the operator to preset, with no particular difficulties, a suitable setting of the cutting speed, accelerations, pressure forces, working times and strokes (starting and stopping positions) of the striking surface 15 carrying the dinking dies, namely to adjust, as wished, the machine performances; above all, it ensures an efficient repeatability of such performances, as it had always been hoped for, but it had never been possible to obtain in any way in the hydraulically operated machines, due to the actual nature of the oil-pressure control means used therein, as already seen above. The results obtained actually derive from having been able to combine the use of a particularly stout and fast electromechanical system to operate the striking surface - based on a screw and nut unit with planet rollers - with the use of a software programme, whose instructions are carried out each time in an exactly repeatable manner. It is thus possible to obtain, as wanted, the actual control of the die-cutting characteristics, particularly for what concerns the cutting speed and power along and during the whole downward working stroke of the striking surface with dinking dies, with the possibility to adapt the machine to the most varied types of materials and machinings, so as to obtain quality levels unforeseeable up-to-date.

[0022] It should also be noted that the same software programme which electronically controls the mover 9 of the die-cutting machine can also be entrusted with the control of the motors which determine the movements of the translating head and/or the feeding of the material on its supporting plane and/or also the eventual rotation of the plane carrying the dinking dies. This allows to achieve further important advantages for a particularly efficient running of the die-cutting machine according to the invention, which can thus be operated - for the first time - as a numerically controlled machine.

[0023] It is anyhow understood that other embodiments of the mechanically operated die-cutting machine according to the invention can be provided, differing from the one described and illustrated heretefore by way of example. Such different embodiments and any variants thereof are of course to be considered, in every respect, as falling within the protection field of the present invention.

Claims

1. Electromechanically operated die-cutting machine - of the type comprising a translating operating head (7) with a striking surface (15) carrying the dinking dies which performs a vertical to-and-fro movement in respect of the plane (2) supporting the material (M) to be machined - **characterized in that**, the to-and-fro movement of said striking surface (15) is

produced by an operating unit (13) comprising a screw and nut unit (16-17) with planet rollers (18), operated by an electric mover (9) which is electronically controlled by a programme.

2. Electromechanically operated die-cutting machine as in claim 1), wherein the control of said electric mover (9) operating the screw and nut unit (16-17) with planet rollers (18) is combined with the control of the motors which determine the movements of the translating head (7) and, possibly, the feeding of the material (M) on its supporting plane (2), said controls being carried out electronically by means of a single programme.

3. Electromechanically operated die-cutting machine as in claims 1) and 2), comprising an operating head (7) a bearing plate (8) of which supports, on its top, said electric mover (9) and a reduction unit (10) and holds, underneath, a stout casing (12) which houses said operating unit (13), slidable verticalwise and coaxially to the reduction unit (10) and ending below with a striking surface (15) to which there are fixed the dinking dies.

4. Electromechanically operated die-cutting machine as in claim 3), wherein said operating unit (13) is slidable on guiding saddles (14) provided into the casing (12).

5. Electromechanically operated die-cutting machine as in claims 1) to 4), wherein the dinking dies are mounted on a plane rotating in respect of the striking surface (15), said plane being associated to said vertically slidable operating unit (13).

6. Electromechanically operated die-cutting machine as in claims 1) to 5), wherein said vertically slidable operating unit (13) comprises, in its inner part, a screw and nut unit (16-17) with planet rollers (18), coaxial to the reduction unit (10), the screw (17) crossing, with a smooth extension (17A) thereof, said bearing plate (8) through a central hole (8A) thereof, and being apt to rotate - by way of a rigid coupling (10C) - together with the outlet shaft (10B) of said reduction unit (10).

7. Electromechanically operated die-cutting machine as in claims 1) to 6), wherein said mover (9) consists of an electric servomotor variator, which is apt to reach high speeds and accelerations, and which supplies high powers.

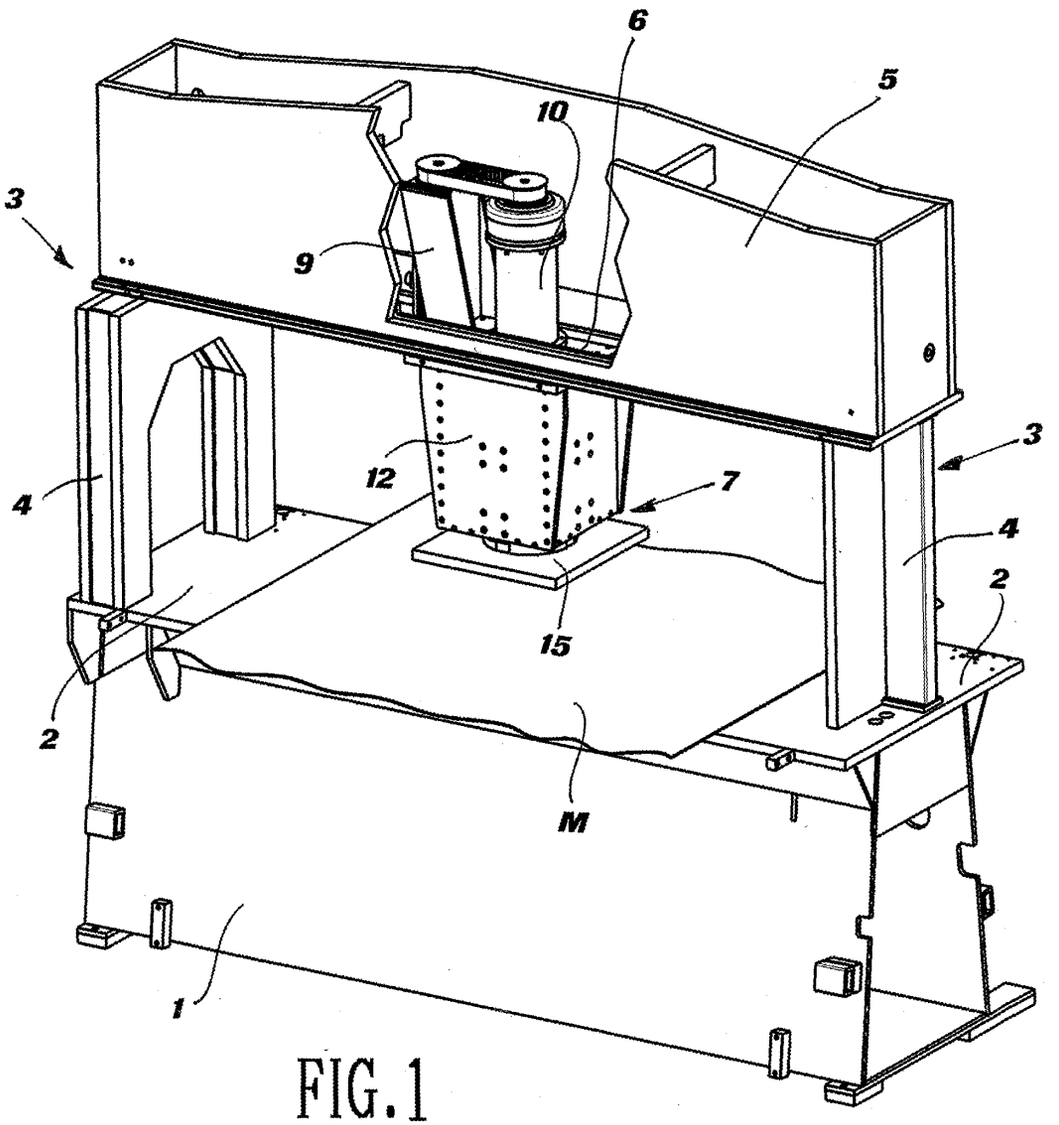

FIG.1

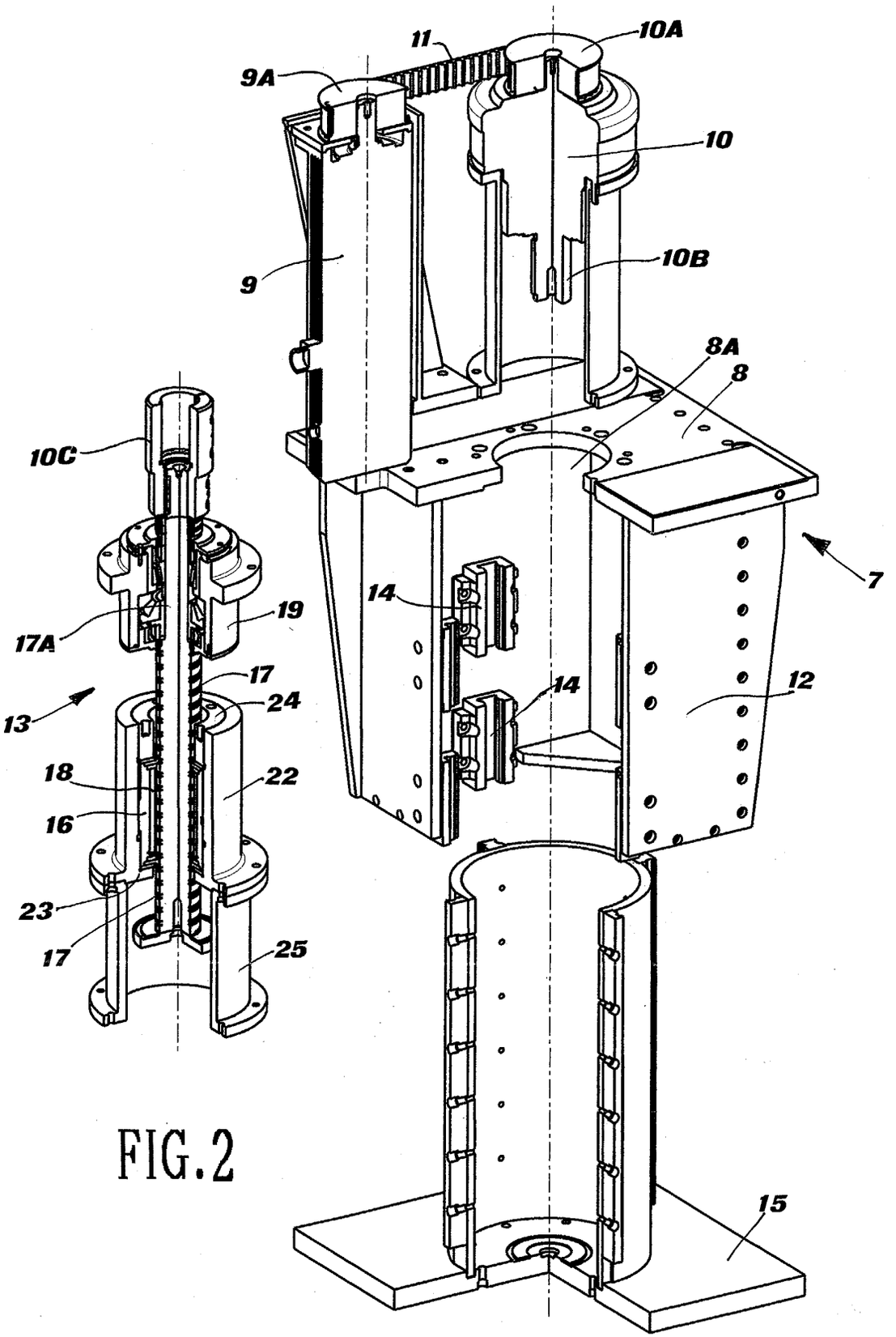
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FIG.2

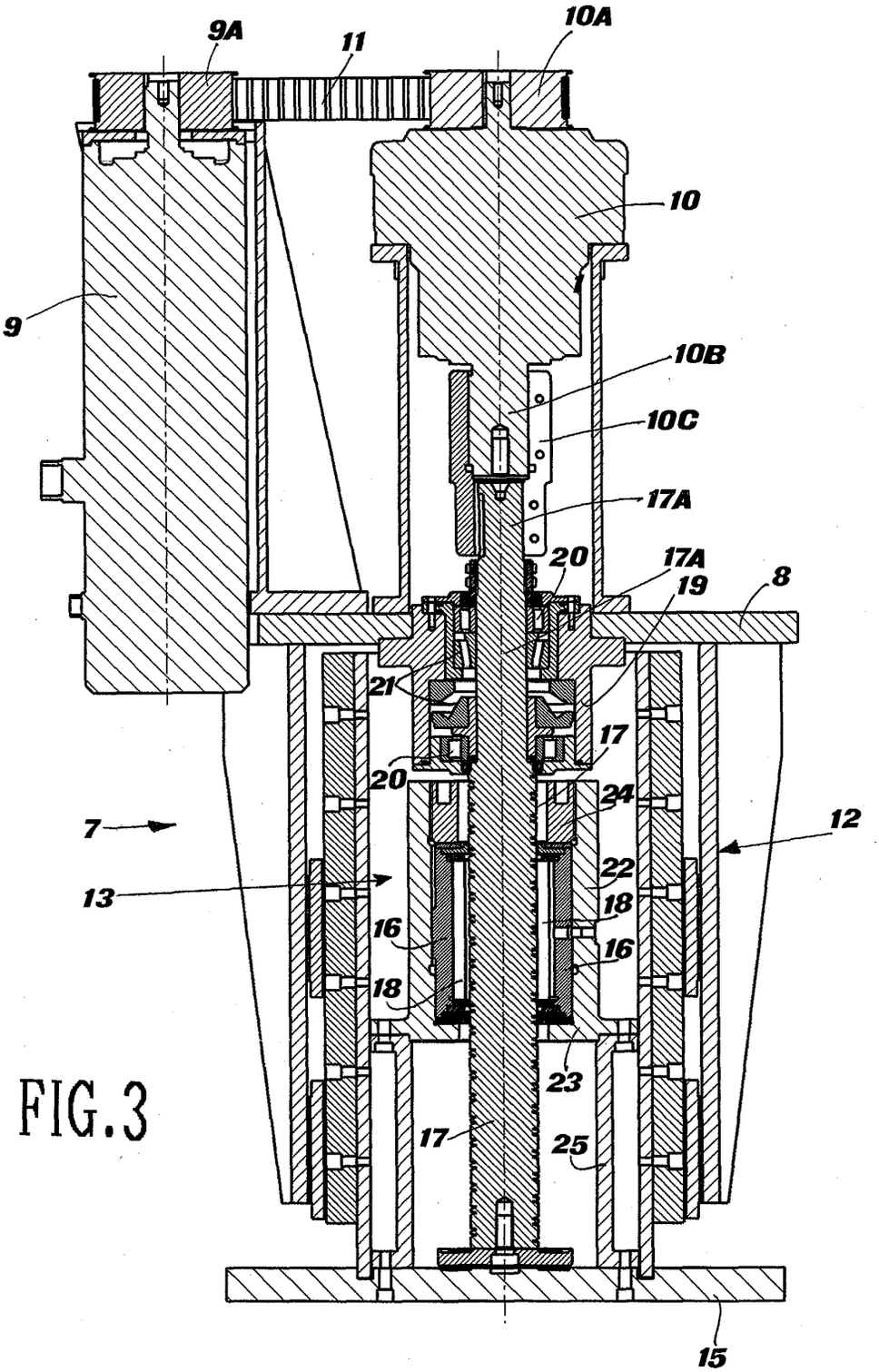
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FIG.3

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EUROPEAN SEARCH REPORT

Application Number
EP 03 42 5051

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A	DE 24 58 796 A (PLATZ WILHELM) 16 June 1976 (1976-06-16) * page 6, paragraph 1 *	1-7	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B26F
B26D
B30B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	20 August 2003	Vaglienti, G

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