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(71) Applicant: **Scattolon, Armenio**
35017 Piombino Dese (PD) (IT)

(72) Inventor: **Scattolon, Armenio**
35017 Piombino Dese (PD) (IT)

(74) Representative: **Gonella, Mario et al**
Propria S.r.l.
Via della Colonna, 35
33170 Pordenone (IT)

(54) Punch with punch stripper

(57) The invention has the objective of realizing a punch and a relative stripper with an outer cylindrical hollow frame (21) integral with a press, a motion transmission means (18) that moves with a linear motion aligned with the axis of said frame, suitable to transmit the working movement to the punch, spring means suitable to urge said motion transmission means (18) toward the relative rest position, to which corresponds the extracted punch, wherein the punch stripper (22) and the punch are applied integrally with and directly on said motion transmission means (18), are inserted within said internal cavity of said outer frame (21), and are suitable to slide within the internal cylindrical wall of said cavity. Said spring means consist of a gas spring and are arranged and operate between said outer frame (21) and said motion transmission means (18), and are incorporated in a portion of said outer frame; the relative rod (41) that emerges therefrom is suitable to abut against a side of a portion, preferably projecting, of said motion transmission means (18).

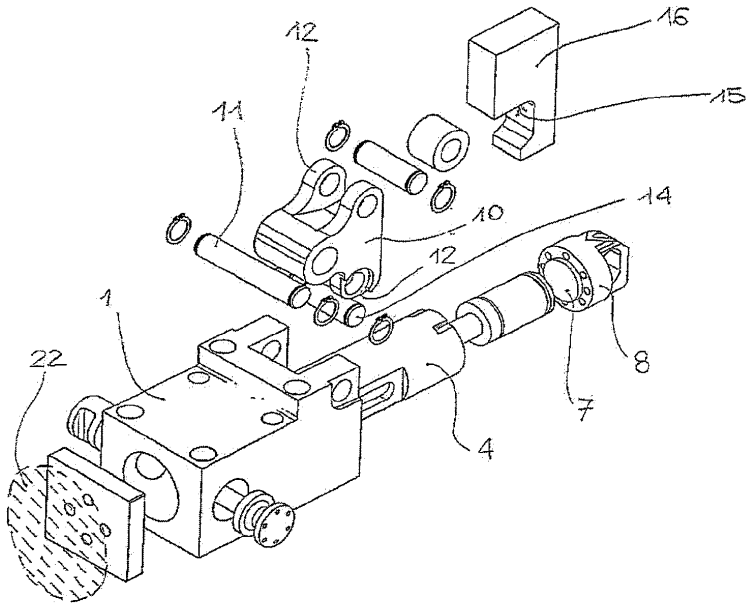


FIG. 2

EP 2 374 555 A1

Description

[0001] The present invention relates to a mould that operates a relative device for processing metal sheets that may be formed by various methods, as they could be deep-drawn, flat, etc., and as portions of plate, and performs on them a particular operation, typically a punching action carried out using a suitable punch with a stripper, as is commonly defined in the relative field of technology.

[0002] Various punchers and strippers of different nature, shape and purposes are known in the art. According to a typical application, said tools must be able to operate on a horizontal axis, for various reasons of convenience, dimensions, costs, etc., that are outside the present scope of interest, and that are particularly interesting for sophisticated processes concerning relatively small and easily manageable pieces, and especially where the force involved is particularly limited.

[0003] Generally, and with reference to Figures 1 and 1A, such tools are made up of: (the references to "vertical" or "horizontal" directions are evidently applicable to said figures as can be seen)

- an internally hollow cylindrical structure 1, that is integral with the fixed frame of the machine on which the present mould is installed;
- a stripper 2 with punch, known in the art and thus shown only in a hatched outline, and mounted on a plate 3 arranged outside said frame 1;
- a return device that substantially includes a spring, based on a hermetic chamber 6 that is bounded by:
- a cylindrical wall 4A of a hollow cylinder 4 that slides within said hollow frame 1 and that is fixedly connected to said plate 3;
- a piston 5 fixedly integral with said frame 1;
- a wall 7 that is itself integral with an element 8 which will be explained later.

[0004] Also arranged therein are a motion transmission element 8, provided with a substantially vertical slot 9, and constrained with one face 8A at one side (right) of said hollow cylinder 4;

- a rotating element 10, pivoted on a pin 11 integral with said frame 1 and provided with two ends 12, 13 that are not opposed to each other but are arranged on two sides of an angle "a" wherein said pin 11 is the vertex;
- wherein one end 12 is provided with a pin 14 inserted into said slot 9 and sliding therein, and the other end 13 is in contact with and receives the movement and the working force from a suitable stroke 15 of a piston 16, generally driven by a press; the latter, depending on the type of application and on other production requirements, may be vertical, but also inclined, or also horizontal.

[0005] In addition, said chamber 6, which forms the elastic element, may contain a mass of gas, or a coiled wire spring.

[0006] The operation of this machine is well known, and it is referred to here for convenience: when the piston 16 performs its down stroke, its beat 15 comes into contact with and pushes the end 13 downward (referring to Fig. 1), thus causing the rotating element 10 to rotate around its own axis (in horizontal position), which also causes the end 12 to rotate.

[0007] If suitably positioned in relation to the just mentioned elements, said end 12 and its pin 14 are pushed with a movement that also comprises a horizontal component; since said pin 14 is engaged and housed in said slot 9, the vertical component of its movement is neutralized by the vertical play offered by the slot 9, while its horizontal component acts upon and pushes said element 8.

[0008] This pushes the hollow cylinder 4 in a movement toward the left (again referring to Fig. 1), which urges said cylindrical wall 4 toward the left and thus at its opposite end it causes said plate 3 and therefore the device 2 to move in the same direction, as desired.

[0009] At the same time, the movement of the hollow cylinder 4 moves said wall 7 toward the fixed piston 5, which reduces the volume of the chamber 6, and thus compresses the spring means contained therein, causing the desired spring reaction.

[0010] In fact, when the piston 16 is raised in the return or release phase, it allows the end 13 to rise back.

[0011] At this point, the spring reaction of the spring means contained in the chamber 6 also imposes a counterclockwise rotation to the end 12, and thus its lifting motion, but also its movement exactly opposite the one described above.

[0012] An obvious consequence of this mechanism, already well known to the expert, is the return travel of the stripper and the relative punch.

[0013] The solution described above, although simple and effective, implies however an undesired increase in the dimensions of the described devices, which are often not acceptable in an operating and production environment in which the productive spaces must be rationalized and exploited as much as possible.

[0014] In fact, the overall dimensions and therefore the size of the above devices depend substantially on the fact that the stripper (with the relative punch) and the spring element are located geometrically in series with each other, on the basis of the consideration that the force produced by the press must be received by both said spring element and the stripper, on both of which it must be able to act.

[0015] It would therefore be desirable, and it is the main objective of the present invention, to be able to produce a mould of the type generally described suitable to substantially reduce the horizontal dimension, or at any rate the dimension aligned with the direction of alignment of the stripper, without being penalized by any other short-

coming.

[0016] This objective is achieved by a mould comprising mainly a frame stably connected to a punch and a relative stripper with which it is usually associated, built and operating according to the appended claims.

[0017] Some characteristics and advantages of the invention will be evident from the description which follows, by way of example and not of limitation, with reference to the enclosed drawings, wherein:

- Figure 1 illustrates a median longitudinal cross section of a mould according to the known art;
- Figure 2 and Figure 3 illustrate respectively exploded perspective views of a mould generally similar to the one in Fig. 1, seen from two diagonally opposite points of view;
- Figure 4 and Figure 4A illustrate two median longitudinal cross sections of a mould according to the present invention, in two distinct states of operation;
- Figures 5 to 8 illustrate the longitudinal median cross sections of the mould of the invention and of a relative stripper and punch in respective subsequent states of operation;
- Figure 9 and Figure 10 illustrate respectively perspective exploded views of a mould generally similar to the one in Figures 4 and 4A, seen from two diagonally opposite points of view;
- Figure 11 illustrates an external perspective view of a mould of the invention, described generally in the preceding figures;
- Figures 12 and 13 illustrate two views representing two longitudinal median cross sections of a mould according to a different embodiment of the present invention, in respective two distinct states of operation.

[0018] According to the invention, and with reference to Fig. 4, the mould includes:

- an internally hollow cylindrical frame 21, integral with the fixed frame of the machine on which the present mould is mounted, and suitable to slidingly house within it said punch and relative stripper 22;
- a motion transmission element 18, provided with a substantially vertical slot 19, and mating one of its faces 18A with the flat face 25 of the hollow outer cylindrical body 24 that receives the working force of said stripper 22;
- a rotating element 210, pivoted on a pin 211 integral with said frame 21, and provided with two ends 212, 213 that are not opposite to each other but are arranged on two sides of an angle "a" wherein said pin 211 is the vertex;
- wherein one of said ends 212 is provided with a pin 214 slidingly inserted into said slot 19, and the other end 213 is in contact with and receives the movement and the working force from a suitable stroke 215 of a driving piston 216, generally driven by a vertical press or an equivalent means.

[0019] Said motion transmission means 18 and stripper 22 are joined to each other, and move according to a common and definite direction of movement "X" and reciprocally in the two movement directions, as their motion is guided by said frame 21.

[0020] Essentially, and in a nutshell, it will be seen that the whole assembly, which according to the art described above (Fig. 1) is made up of:

- the plate 3;
- the hollow cylinder 4, and relative wall 7;
- the piston 5,
- and thus the chamber 6,

is completely eliminated.

[0021] In its place, the stripper/punch assembly 22 is directly inserted, said assembly being itself known from Italian Patent (Application) No. PN 2008A00005, and from Patent WO 2008/055631 A1, referred to herein for the sake of brevity.

[0022] In this figure, and in the subsequent ones, the stripper is understood as being included in the components circled together and identified by number 22.

[0023] In fact, the stripper is not involved in the present invention, even though the invention aims at achieving a better use of the same, and therefore no particular description of the stripper will be provided.

[0024] This stripper 22, and more specifically its ring-shaped face 25 on the hollow cylindrical body 24 that receives the working force driving the stripping mould, is applied on said face 18A, so that said motion transmission element 18 drives the stripper assembly 22 directly, without any intermediate means.

[0025] It is thus evident that the mould dramatically reduces its dimension in the direction of operation of the stripper, as it completely eliminates the space previously taken up by the spring and the relative connected devices, like the chamber 6, the hollow cylinder 4, etc.

[0026] However, if the mould were left like this, it would be left without the device, generally obtained by means of a spring, that enables its return when the piston 16 is lifted, and therefore it would not be possible to make the mould effectively operational.

[0027] This problem is easily solved by providing a suitable spring applied between a suitable position of said cylindrical frame 21 and a suitable position of said motion transmission element 18.

[0028] Said spring may be made in various ways known in the art, and therefore it can be achieved by inserting a wire coil spring, a gas-driven spring, etc.

[0029] In particular, it may be advantageous to use a gas spring in which the relative cylinder 40 is mounted on said frame 21, and in which the resulting sliding rod 41 is applied, also by simple contact, on a suitable external portion of said motion transmission element 18.

[0030] Advantageously, the body of the cylinder 40 can

be obtained by simply forming it within a wall of said frame 21, while the sliding rod 41 is positioned and remains apt to engage on a corresponding side 42 of a suitable frontal portion 29, itself also but not necessarily projecting, of the motion transmission element 18 (Fig. 10); this solution is preferred if a further reduction of the size of the frame 21 in general is desired, because in this way it is not necessary to reserve and take up any additional volume in which to house the gas spring.

[0031] The value of the invention is based on the fact that according to the known art it has been considered that (specifically during the mould release phase):

- > the spring included in the stripper and forming an integral part of the same, <
- > and the spring necessary for the backward return of the motion transmission element 18 <

acted in succession in time with respect to said stripper.

[0032] In fact, according to the known art (Figs. 1, 1A), it is shown that:

- first said stripper must be approached to the plate to be processed, and then the internal spring shown symbolically by the chamber 6 in Figure 1 must be activated,
- and then, when the stripper comes into contact with the plate, the spring element, that is the compressed gas spring included in said stripper, is also naturally activated.

[0033] Thus, the fact that the two distinct spring elements should be activated in sequence, one after the other, and the fact that both act on the punch, evidently suggested that these two spring elements should necessarily also be located mechanically in series, in the sense that the force transmitted by the motion transmission element 8 should also be exerted across the mould return spring (that is said chamber 6) before arriving to act on the stripper.

[0034] Contrary to what just described above, the present invention has shown that this requirement is really only apparent, and that the force transmitted by said motion transmission element can be "distributed" in two different ways; that is, it can be:

- transmitted directly to said stripper,
- and simultaneously or subsequently, it can also be used to load a gas spring that serves as a travel return means of the same motion transmission element.

[0035] With the substance of the present invention explained in this way, its operation will be immediately clear to the expert in the field.

[0036] Figures from 5 through 8 illustrate in fact respective phases of operation of the mould of the invention, and of the respective stripper.

[0037] Considering the explanations just provided, the content of each of said figures will be immediately evident to an expert in the field, thus avoiding having to give a tedious and unnecessary detailed description.

[0038] It is here only indicated that:

- Figure 5 shows how the mould is arranged at rest, that is both before the mould is brought up to the plate 30 and before the activation of the punch;
- Figure 6 shown an intermediate moment in which the mould is approached to the plate 30, without however the punch coming into contact with it;
- Figure 7 shows a moment in which the mould is at the end of its forward travel, and the punch has completely penetrated into the plate 30 and perforated it;
- Figure 8 illustrates an immediately subsequent phase, with the upper vertical mould beginning its upward return, pulling the rotating element 210 with it.

[0039] Note in particular the progressively shorter length of the sliding rod 41 with respect to the position of the motion transmission element 18 in Figures 5, 6 and 7, and the corresponding position of the punch 23 with respect to its outer guide 23B.

[0040] It can in fact be seen that the instant the gas spring of the cylinder 40 starts to operate is not synchronized with the operation of the stripper, and this explains an essential feature of the present invention.

[0041] With reference to Figures 4 and 4A, a problem may arise in relation to the position of the stripper. In fact it is normally required that said stripper 22 must not be able to rotate or move generally with respect to the mould, or to a fixed reference. For this purpose, a useful improvement is achieved if a precision alignment means, preferably a pin 28 or an equivalent element, is inserted between the two mating faces 18A of said motion transmission element and said ring-shaped flat face 25 of the hollow cylindrical body 24.

[0042] Such a pin 28 must not be confused with other connection means, such as for example screws, bolts or similar devices, which must not in any case be inserted between said two mating faces 18A and 25 for the obvious need of guaranteeing that during the return travel said motion transmission element 18 does not also pull with it the relative stripper 22.

[0043] The solutions described above solve in a simple and suitable manner the stated problem of limiting the size of the stripper actuation mould. However, there remains the problem of limiting costs, due to the fact that the presence of the rotating element 210 implies a relative increase in cost and complexity, which are justified if the mould is expected to operate with high productivity and speed but much less justified in case of much lower production volumes. In effect, the function of said rotating element is only to rotate the direction of a force transmitted in a linear motion from a first direction, according to which it is supplied to the mould, to a second and different

direction, according to which it acts on said stripper.

[0044] In order to solve this problem more simply, and with reference to Figures 12 and 13, a useful improvement of the invention consists of forming said driving means 18 in the shape of an asymmetric wedge, that is, one having as its lower side a flat surface 19A, inclined at an angle "b" with respect to said direction of movement "X".

[0045] The back side also, here identified with 19B, of said motion transmission means 18, is in turn correspondingly inclined by the same angle "b", and is dimensioned and positioned in such a manner that said two sides 19A and 19B match each other, being also arranged on a common plane "Y".

[0046] Thus it will be evident that, examining Figures 12 and 13, if the piston 216 is lowered, its lower side 19A slides against, and pushes downward, the side 19B, matching and similarly inclined, of the motion transmission means 18.

[0047] Owing to the inclination "b" of the plane "Y", with respect to said side 19B, a force component is determined and acts on this in alignment with said defined direction of movement "X" of the same means 18 and consequently of the stripper 22; thus as a final result said force component urges and therefore causes the movement of the means 18 and the relative stripper 22 in said desired direction "X".

[0048] Although this last variant embodiment may suffer some small problem due to the fact that said two sides 19a and 19B must slide reciprocally, with possible problems of friction, and of overheating, although for low volumes of production and particularly with sufficiently slow pace of production, such drawbacks occur in effect in an appreciable extent, and may after all be accepted, thanks to the certain and significant advantages of simplicity and cost of the relative present embodiment.

Claims

1. Mould for punch stripper, (22, 23) comprising:

- an outer supporting frame (21), which is substantially cylindrical, hollow, firm to a machine or a stamping machine,
- a motion transmission means (18) apt to be moved with linear motion parallel to a defined movement direction (X), and of transferring the working/extraction force to operate said punch stripper, to same said stripper (22),

to said punch stripper (22),

- wherein said motion transmission means (18) may be urged by an acting means, preferably a piston (216),
- elastic means able of urging said transmission means (18) towards the related resting position, corresponding to the extracted punch,

characterized in that said punch stripper (22) and related punch are solidly and directly mounted to said motion transmission means (18).

2. Mould for punch stripper according to claim 1, **characterized in that** it comprises a rotating element (210) pivoted on a pin (211) solid to said frame (21), and provided with two ends (212, 213) angled (a) to each other with respect to said pin (211), said rotating element (210) being apt to receive the working force from said acting means (216) on one of its ends (212), and of transferring through the other end (213) a respective working/extraction motion to said transmission means (18).

3. Mould for punch stripper according to claim 1, **characterized in that**

- said acting means (216) and said motion transmission means (18) are provided with respective corresponding sides (19A, 19B) which can be coupled to each other on a common plane (Y),
- said common plane is inclined (b) with respect to said movement direction (X) of said motion transmission means (18),
- and the motion of said acting means (216) causes the progression or the return run of said motion transmission means (18) with a motion which is parallel to said movement direction (X) due to the reciprocal sliding of and pushing between said outer corresponding sides (19A, 19B).

4. Mould for punch stripper according to claim 1, **characterized in that** said stripper is inserted inside the inner cavity of said outer substantially cylindrical and hollow frame (21), and is able of sliding on the inner cylindrical wall of said cavity.

5. Mould for punch stripper according to any of the previous claims, **characterized in that** said elastic means are arranged and operate between said outer frame (21) and said motion transmission means (18).

6. Mould for punch stripper according to claim 5, **characterized in that** said elastic means include a gas spring (40, 41) or, alternatively, a metal coil spring.

7. Mould for punch stripper according to claim 6, **characterized in that** said elastic means include a gas spring (40, 41) whose outer cylinder is embodied, and preferably integrated, inside a portion of said outer frame (21).

8. Mould for punch stripper according to claim 6 or 7, **characterized in that** said motion transmission

means (18) comprises a portion (19), a side (42) of which is externally oriented towards said cylinder of said gas spring, and **in that** the rod protruding outwards of said gas spring is apt to be engaged against the facing said side (42) of said portion (19), which is preferably protruding.

9. Mould for punch stripper according to any of the previous claims, **characterized in that**

- said stripper (22) comprises an outer hollow cylindrical body (24) provided with a respective flat face (25) able of connecting it to said motion transmission means (18),
- said flat face (25), which is preferably ring-shaped, of said outer cylindrical body (24) can be directly engaged, through suitable connecting and precise aligning means (28), on the mating face (18A) of said motion transmission means (18).

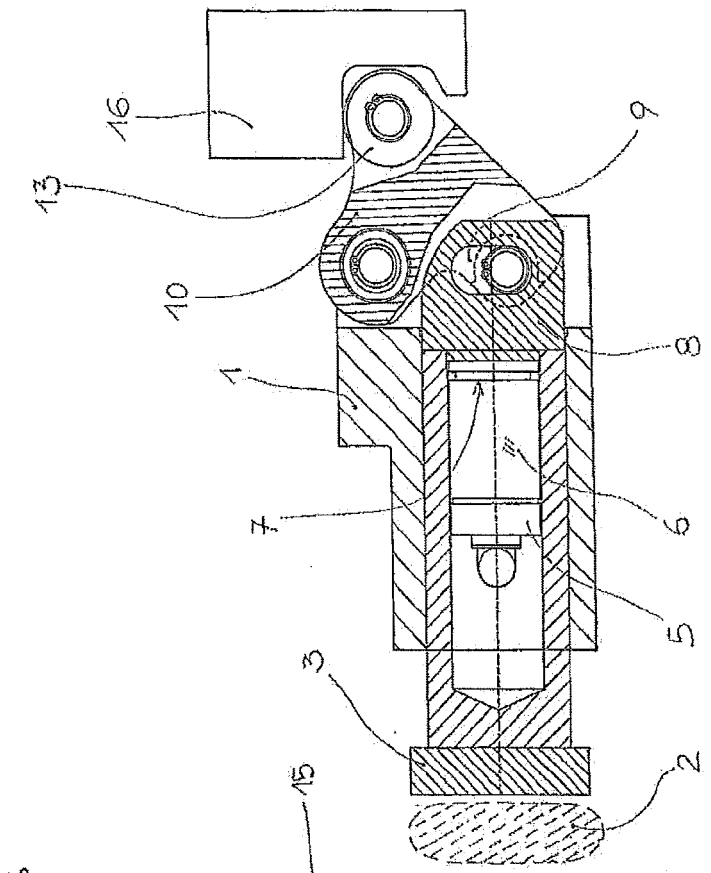


FIG. 1A

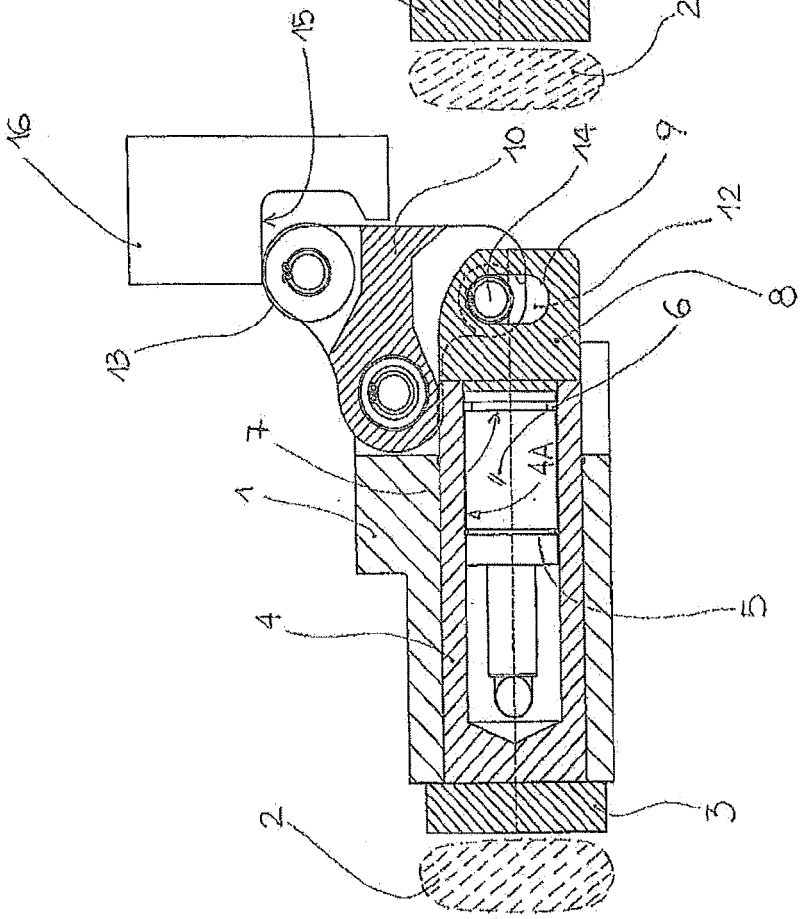


FIG. 1

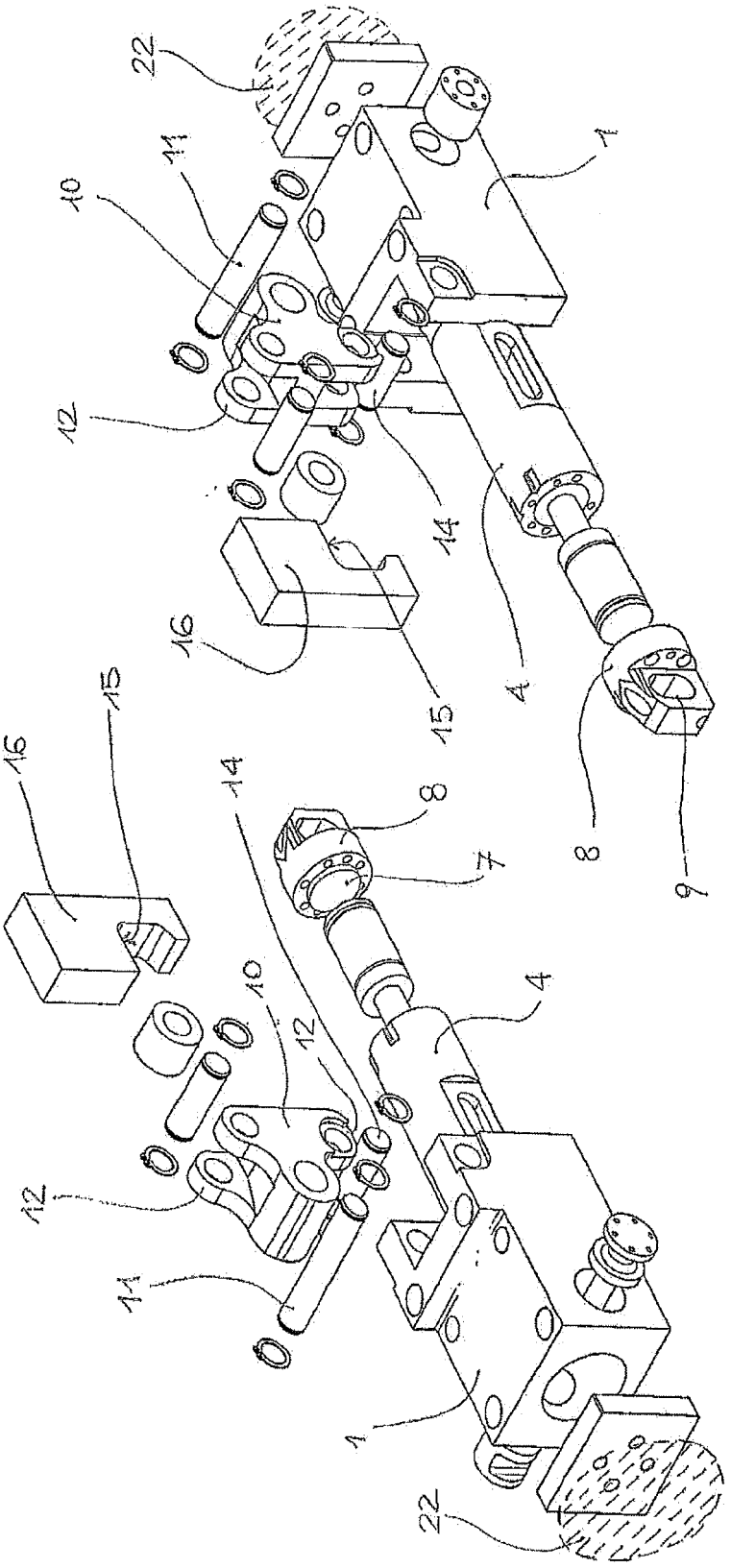
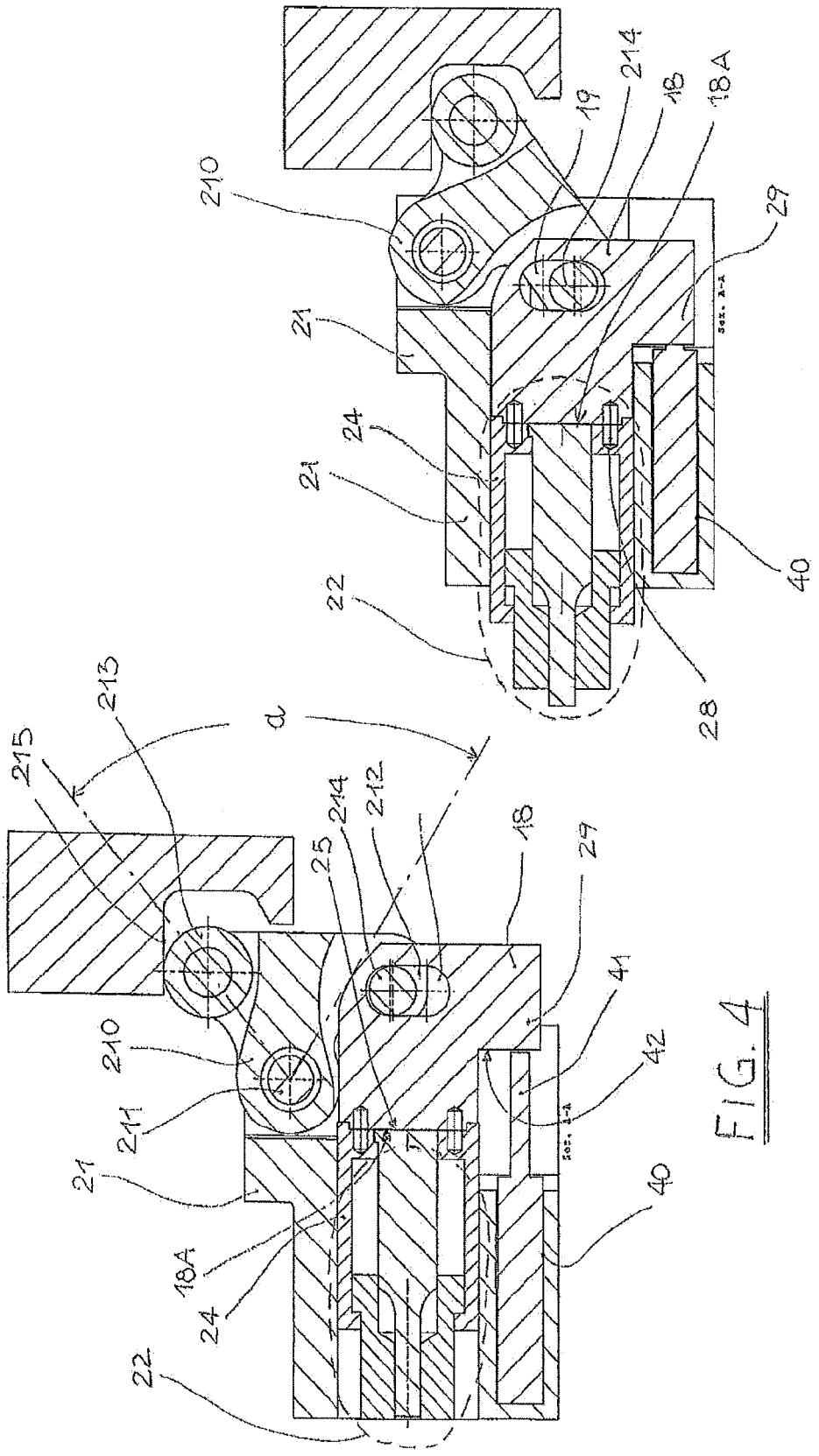


FIG. 3

FIG. 2


210
214
19
18
18A
29
21
24
21
40
22
28
213
215
α
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25
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29
41
42
210
211
21
18A
24
40
22

FIG. 4A

FIG. 4

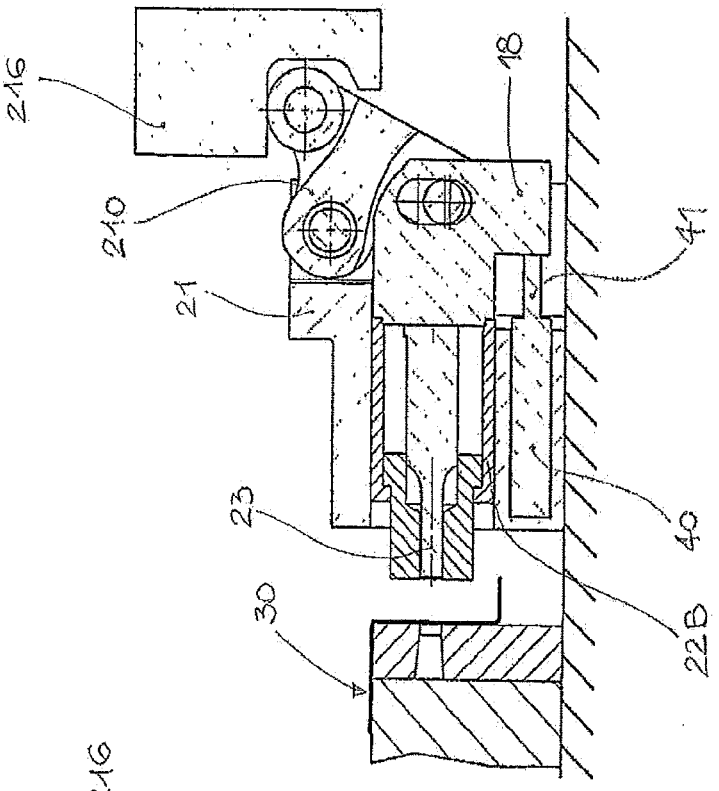


FIG. 6

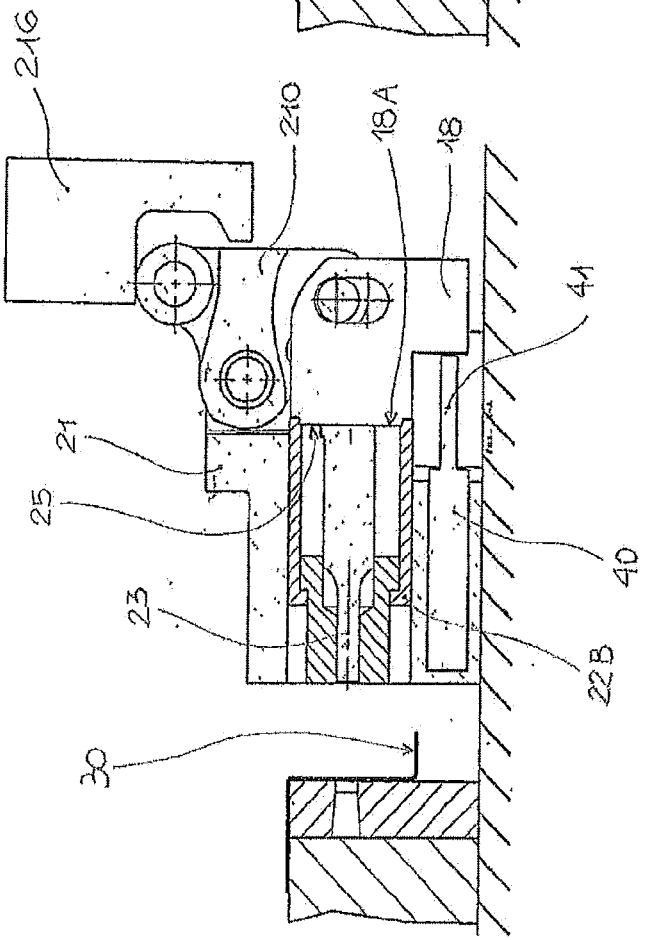


FIG. 5

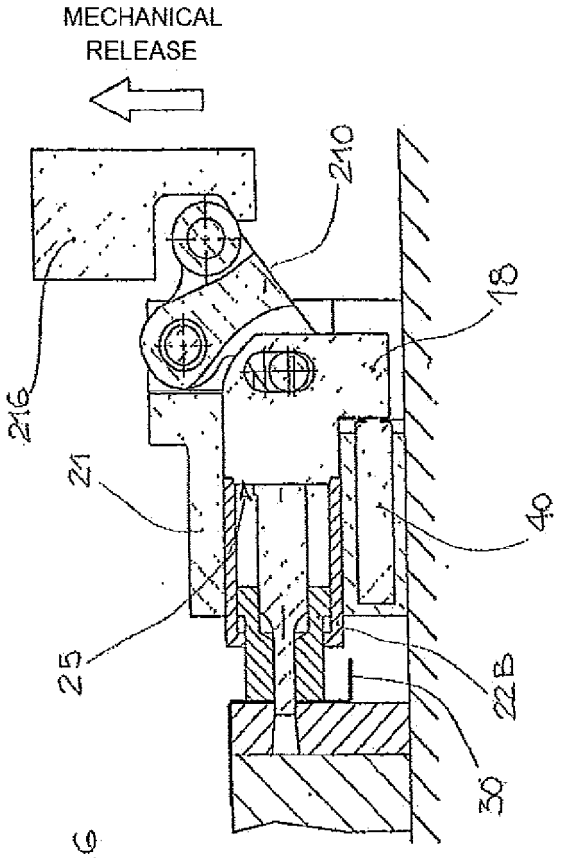
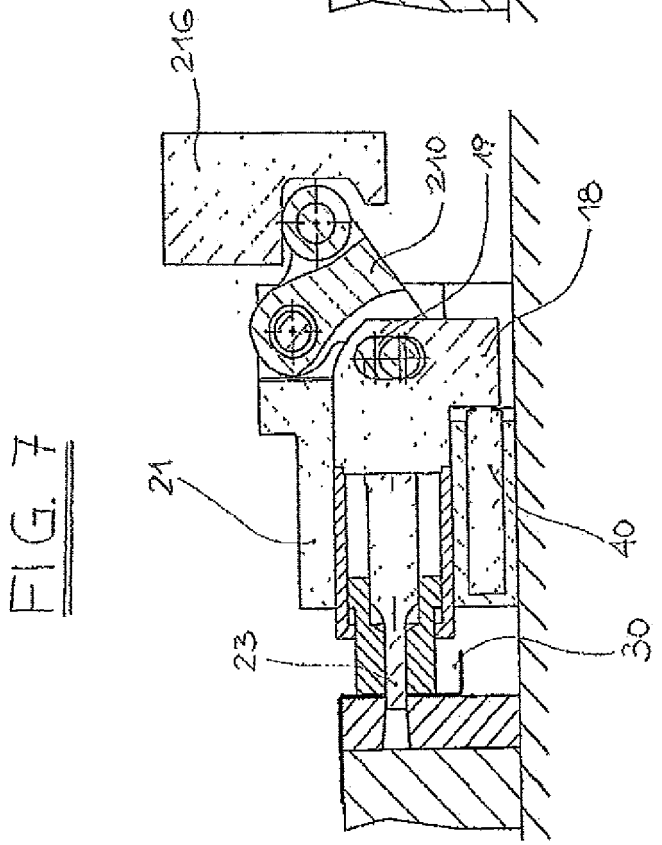

MECHANICAL
RELEASE
210
18
216
21
40
25
22B
30

FIG. 8


216
210
18
18
21
40
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30

FIG. 7

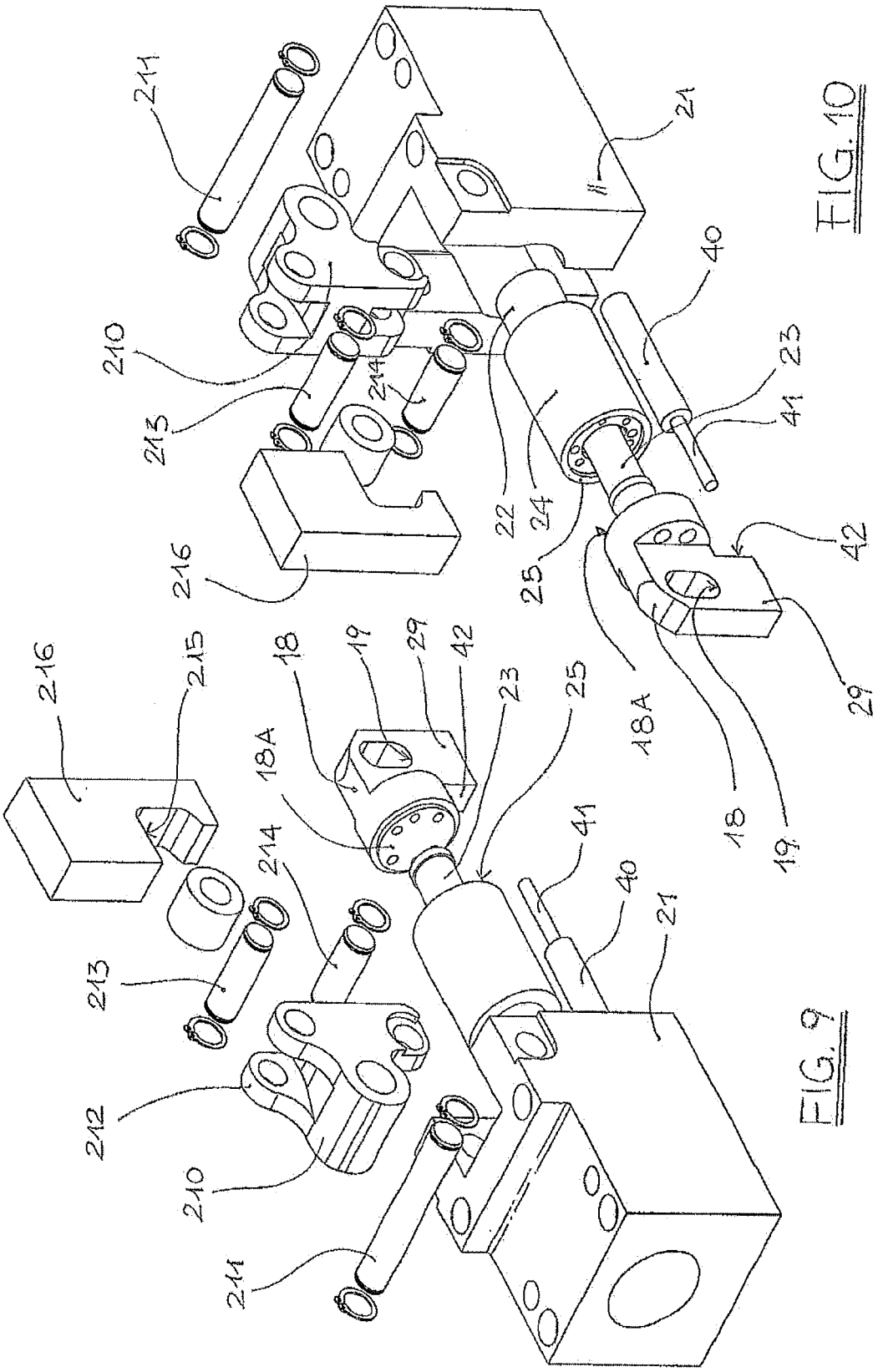


FIG. 10

FIG. 9

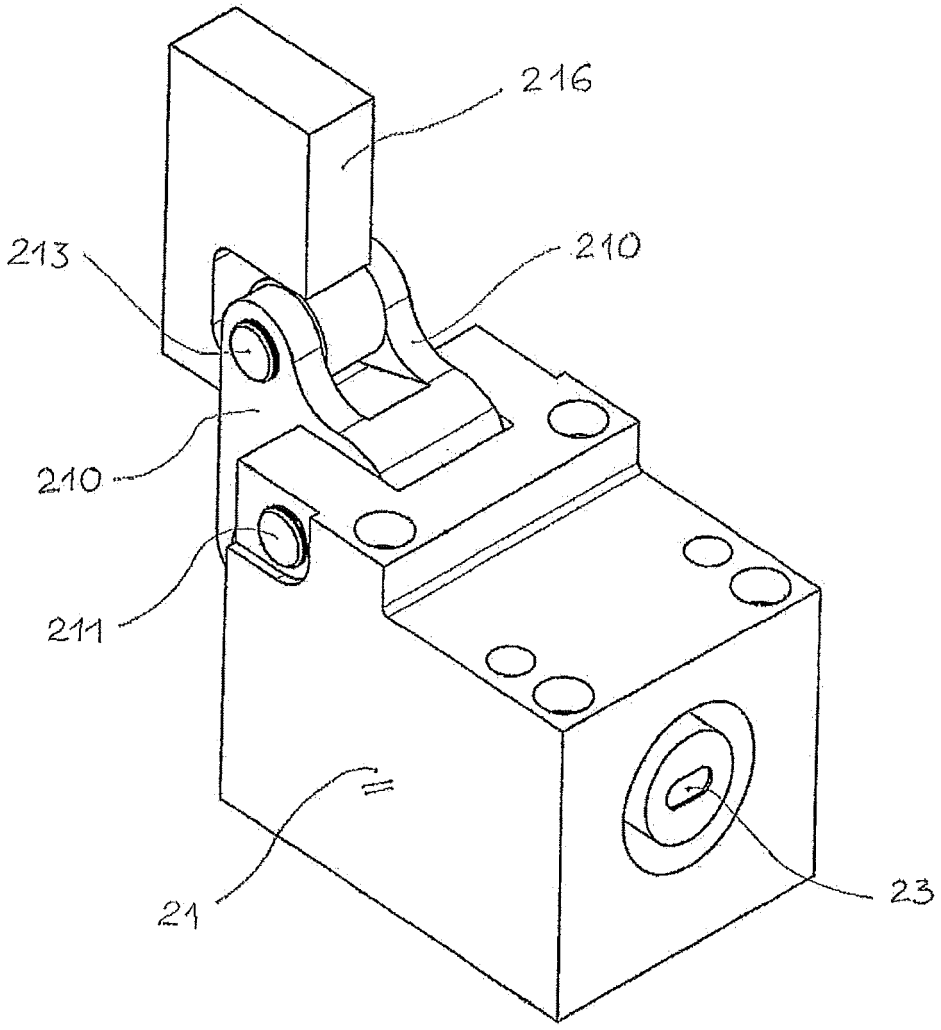


FIG. 11

FIG. 13

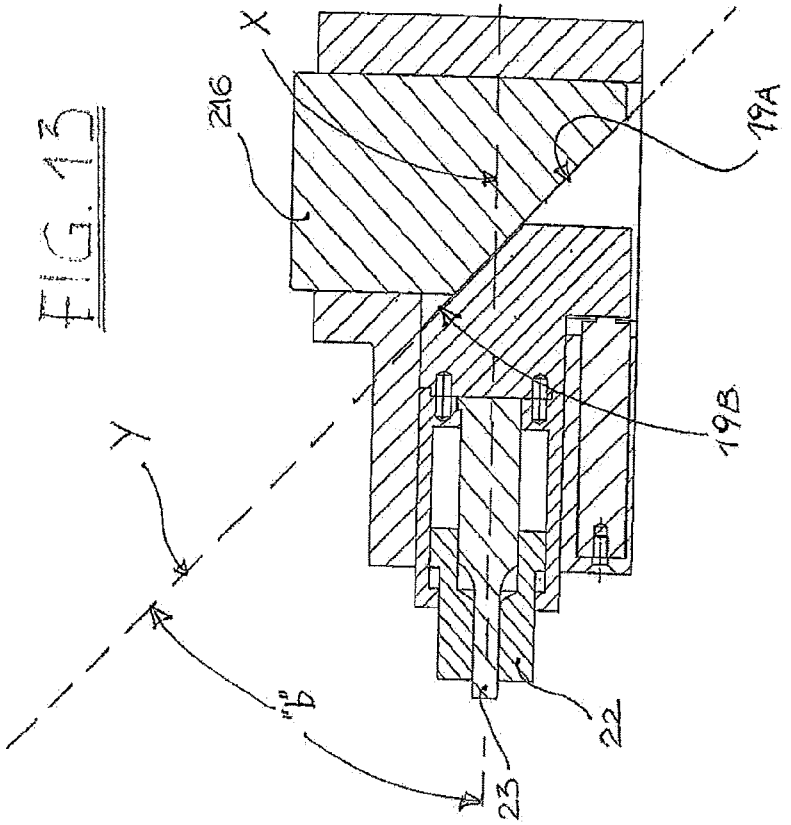
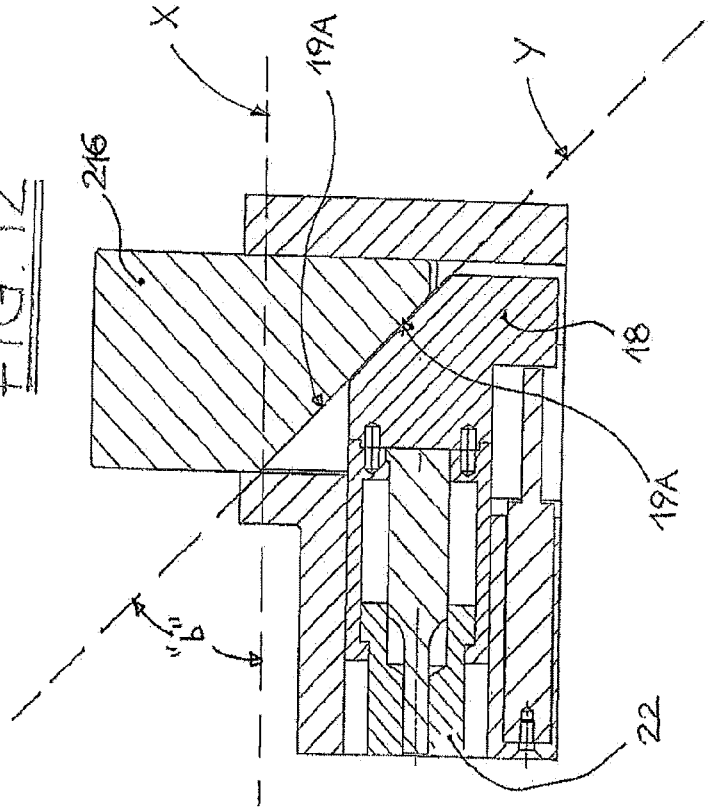


FIG. 12



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EUROPEAN SEARCH REPORT

Application Number
EP 11 15 8150

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 779 113 A (JESTIN P) 18 December 1973 (1973-12-18) * column 1, line 66 - column 2, line 40; figure 1 * -----	1,4-9	INV. B21D45/00
A,D	WO 2008/055631 A1 (STROEMSHOLMEN AB [SE]; EKMAN FREDRIK [SE]; STOLTZ PATRIK [SE]) 15 May 2008 (2008-05-15) * the whole document * -----	1	
A	EP 1 547 703 A1 (UMIX CO LTD [JP]) 29 June 2005 (2005-06-29) * paragraph [0034] - paragraph [0037]; figure 18 * -----	1	
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A	US 5 899 110 A (OBRECHT ROBERT [US]) 4 May 1999 (1999-05-04) * the whole document * -----	1	

TECHNICAL FIELDS SEARCHED (IPC)

B21D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	5 July 2011	Pieracci, Andrea

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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1

EPO FORM 1503 03.82 (P04C01)

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05-07-2011

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REFERENCES CITED IN THE DESCRIPTION

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