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(54) **MACHINE FOR ASSEMBLING AND HANDLING MOLDS FOR PRESSES**

(57) A die splitter machine (1) for opening and splitting or closing and joining upper and lower die halves (51, 52) of a die for hydraulic or mechanical presses comprises: at least one lower supporting table (2; 12; 22) adapted to support a lower die half (51) of the die; an upper supporting table (3; 13) for supporting and moving an upper die half (52) of the die; and a column (4) slidably supporting the upper supporting table (3; 13); the lower supporting table (2; 12; 22) and the column (4) are movable with respect to each other about a first vertical rotation axis (X) at least between a first operating position (A), in which the lower supporting table (2) is aligned with and below the upper supporting table (3; 13) to open and split or close and join the upper and lower die halves (51, 52), and a second operating position (B), in which the lower supporting table (2; 12; 22) and the upper supporting table (3; 13) are angularly spaced to allow approaching and operating on the upper and lower die halves (51, 52).

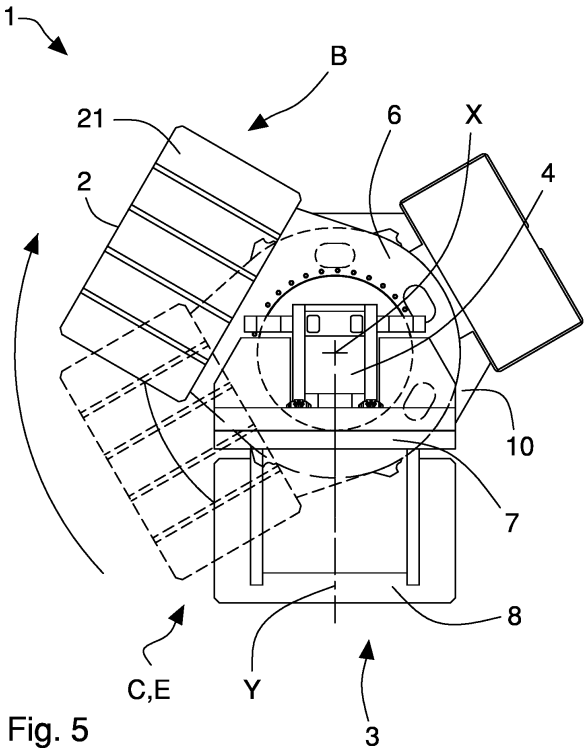

Fig. 5

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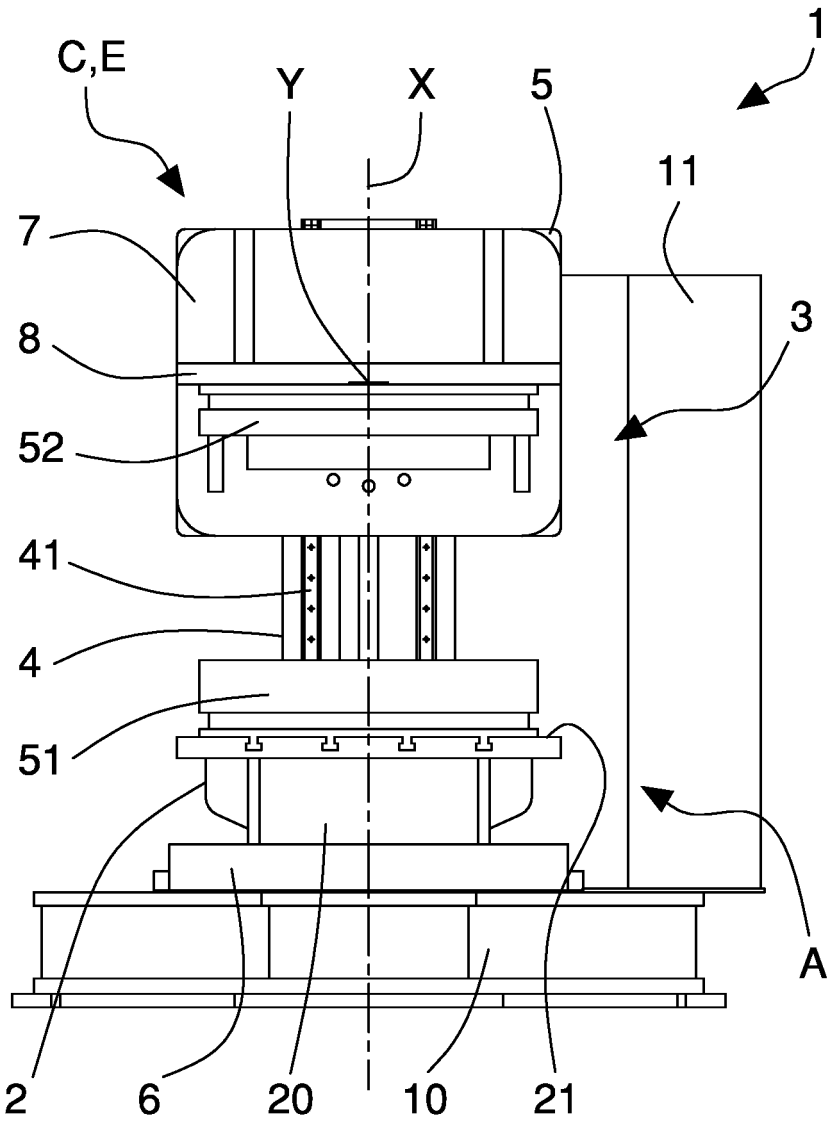


Fig. 6

Description

[0001] The invention relates to machines and apparatuses for assembling, disassembling and moving dies used on hydraulic or mechanical presses. In particular, the invention relates to a machine for opening and disassembling or closing and assembling a press die so as to allow check and control, testing and maintenance operations.

[0002] The known dies, for example for processing sheet metal or plastic material, for die casting, for injection, etc., typically comprise two die halves, of which the lower die half (die or matrix) is generally mounted on a fixed base of the press, while the upper die half (counter-die or punch) is mounted on the movable part of the press which is provided with vertical movement, for closing and opening the die itself.

[0003] To carry out check and control, testing and maintenance operations, in particular of the shearing parts of the two die halves, the need to split and overturn the upper die half is known, to allow the operator to access the shearing parts of both die halves.

[0004] Especially in the case of large dies, the opening or disassembly operation for splitting the two die halves and the closing or assembly operation for joining the two die halves are particularly difficult, complex and dangerous due to the weight and dimensions of the aforesaid dies and require several operators who must use special jacks or cranes or other lifting systems. Alternatively, so-called "die splitter" or "die-opening" machines are known and used which allow a single operator to easily and safely perform automatically or semi-automatically the opening and closing operations of a die.

[0005] These machines typically comprise a lower supporting table on which the lower die half of the die can be positioned and fixed and a supporting structure formed by two parallel and side-byside columns which slidably and rotatably support an upper crosspiece or plate adapted to couple, lift and rotate the upper die half. The lower supporting table is linearly movable in the horizontal direction approaching, or moving away from, the supporting columns. The upper crosspiece is rotatably fixed at both ends to two carriages sliding along the respective columns and therefore, in addition to being linearly movable in a vertical direction, it is rotatable about a horizontal axis orthogonal to the direction of movement of the lower supporting table.

[0006] In an initial step of an opening procedure, the mounted or closed die is positioned on the lower supporting table, with the lower half die being rested and fixed on said lower supporting table. The lower supporting table is in a spaced position from the supporting structure so that the latter does not interfere with the loading and locking operations of the die on the lower supporting table.

[0007] The lower supporting table is then moved inside the supporting structure between the two aligned supporting columns and below the upper crosspiece, so that the latter can couple and then lift the upper die half, splitting it from the lower die half that remains on the lower supporting table. The lower supporting table is returned to the spaced position and the upper die half, after being rotated about the horizontal axis by 180°, is lowered more or less to the height of the lower supporting table. The two open and suitably spaced apart die halves, arranged with the cutting parts exposed and facing upwards, are thus easily accessible by the operators for check and control, testing and maintenance operations.

[0008] The closing procedure of the die is carried out by following the steps above described in the reverse order.

[0009] The known die splitter machines are expensive due to the presence of the two supporting columns and the linearly movable lower supporting table.

[0010] Furthermore, such machines have the disadvantage of having significant dimensions, in particular in plan, which sometimes make problematic their use in workshops and small factories.

[0011] An object of the present invention is to improve the known die splitter machines for assembling, disassembling, handling dies used on hydraulic or mechanical presses.

[0012] Another object is to provide a compact die splitter machine, having compact dimensions and sizes, in particular in plan.

[0013] A further object is to achieve a solid, reliable and versatile die splitter machine that is also economically built.

[0014] Another further object is to achieve a die splitter machine that allows operating on a plurality of dies.

[0015] These objects and others are achieved by a die splitter machine according to one or more of the claims set forth below.

[0016] The invention can be better understood and implemented with reference to the attached drawings which illustrate some exemplifying and non-limiting embodiments thereof, in which:

- figure 1 is a front view of the die splitter machine of the invention which illustrates, in particular, a lower supporting table and an upper supporting table respectively in a first operating position and in a raised and gripping position;
- figure 2 is a side view of the machine of figure 1;
- figure 3 is a partial and section side view of the die splitter machine of figure 1 illustrating in particular driving means of the lower supporting table and the upper supporting table;
- figure 4 is a top plan view of the die splitter machine of figure 1;
- figure 5 is a top plan view of the die splitter machine of figure 1 with the lower supporting table in a second operating position and, shown in a dashed line, in an intermediate position;
- figure 6 is a front view of the die splitter machine of figure 1 associated with a lower die half and an upper

die half respectively fixed to the lower supporting table and to the upper supporting table;

- figure 7 is a front view of the die splitter machine of figure 6 with the lower supporting table in an intermediate operating position and the upper supporting table in a raised and overturned position;
- figure 8 is a front view of the die splitter machine of figure 6 with the lower supporting table in an intermediate operating position and the upper supporting table in a lowered and overturned position;
- figure 9 is a front view of a variant of the die splitter machine of the invention provided with an arm for lifting and moving loads;
- figures 10 and 11 are front and side views, respectively, of a variant of the upper supporting table;
- figures 12 and 13 are front and side views, respectively, of a variant of the lower supporting table provided with a tilting supporting plane, the latter in a lowered horizontal position;
- figure 14 is a front view of the lower supporting table of figure 12 with the supporting plane in a vertical raised position;
- figures 15 and 16 are front and side views, respectively, of another variant of the lower supporting table;
- figure 17 is a top plan view of another embodiment of the die splitter machine of the invention provided with a plurality of lower supporting tables;
- figure 18 is a top plan view of a further embodiment of the die splitter machine of the invention provided with a plurality of lower supporting tables.

[0017] Referring to figures 1 to 9, a die splitter machine 1, also called die-opening machine, is illustrated that is adapted to open and split or close and join upper and lower die halves 51, 52 of a die for hydraulic or mechanical presses.

[0018] The die splitter machine 1 comprises a lower supporting table 2 adapted to support a lower die half 51 of the die, an upper supporting table 3 adapted to support and move an upper die half 52 of the die and a column 4 which slidably supports the upper supporting table 3.

[0019] The lower supporting table 2 and the column 4 are movable with respect to each other about a first vertical rotation axis X at least between a first operating position A, in which the lower supporting table 2 is aligned with and below the upper supporting table 3 to allow to open and split or close and join the upper and lower die halves 51, 52, and a second operating position B, in which the lower supporting table 2 and the upper supporting table 3 are angularly spaced to allow an operator to approach the upper and lower die halves 51, 52, for example to perform check and control, testing and maintenance operations.

[0020] In the embodiment shown in the figures, the die splitter machine 1 comprises a first platform 6 to which the lower supporting table 3 is fixed and which is rotatable about the first rotation axis X. The platform 6 is rotatably mounted on a bed 10 of the machine 1 to which the column 4 is also fixed. For this purpose, the first platform 6 has a ring shape and has an external protrusion 6a to which the lower supporting table 2 is fixed and a central opening 6b through which the column 4 is fixed to the bed 10.

[0021] An electrical cabinet 11 containing the electrical and electronic controls and drives of the die splitter machine 1 is also fixed to the bed 10.

[0022] The platform 6 allows the lower supporting table 2 to be rotated between the first operating position A, in which it is aligned with and below the upper supporting table 3, and the second operating position B, in which the lower supporting table 2 is rotated and angularly spaced with respect to the upper supporting table 3.

[0023] First driving means 31 are included inside the bed 10 to rotate the first platform 6 about the first rotation axis X.

[0024] The first driving means 31 comprise, for example, a first rotary electric motor 34 with a gearbox capable of rotating, by means of a pinion 35, a toothed crown 36 connected to and coaxial with the first platform 6.

[0025] Alternatively, the first driving means can comprise a drive pulley driven by the first rotary electric motor 34 and engaged by a belt with a fifth wheel fixed to the first platform 6.

[0026] In a variant of the die splitter machine 1 of the invention not illustrated in the figures, the first platform rotates the column 4 with respect to the lower supporting table 2 which is instead fixed, supported and connected to the bed 10. In this case, the upper supporting table 3, connected to the column 4, is rotated between a respective first operating position, in which it is aligned with and above the lower supporting table 3 and a respective second operating position in which it is rotated and angularly spaced with respect to the lower supporting table 2.

[0027] The die splitter machine 1 also comprises a carriage 5 slidably fixed to the column 4, movable on the latter along a first direction V, in particular vertical, and supporting the upper supporting table 3 rotatably about a second rotation axis Y, in particular horizontal and orthogonal to the first rotation axis X. More precisely, the carriage 5 is slidably coupled to linear guides 41 of the column 4 and is moved by second driving means 32 between a raised position C, in which the carriage 5 with the upper supporting table 3 is farther away from the bed 10, and a lowered position D, in which the carriage 5 with the upper supporting table 3 is closer to the bed 10, for example to allow access to the upper die half 52 connected thereto, as better explained in the following description.

[0028] The second driving means 32 comprise, for example, a second rotary electric motor 37 with a gearbox that moves the carriage 5 by transmission means of the screw-nut type. More precisely, the second electric motor 37 rotates a vertical screw 38 engaged with a nut screw 39 fixed to the carriage 5 and unable to rotate.

[0029] The upper supporting table 3 comprises a plate

7 which is rotatably fixed to the carriage 5 and a crosspiece 8 fixed to the plate 7 and provided with a respective supporting surface 9 having coupling means 28 for fixing the upper die half 52.

[0030] The coupling means comprise, for example, a plurality of T-shaped slots 28 for a manual connection of the upper die half 52 to the supporting plane 9 of the crosspiece 8 or one or more permanent magnets for an automatic connection of the upper die half 52.

[0031] The supporting plane 9 is orthogonal to the first rotation axis X.

[0032] The upper supporting table 3 is rotated about the second rotation axis Y by third driving means 33 associated with the carriage 5 and comprising a rotary electric motor not illustrated in detail in the figures.

[0033] The upper supporting table 3 is rotated by the third driving means 33 between a gripping position E in which the respective supporting plane 9 of the crosspiece 8 is substantially horizontal and facing the bed 10, for example to allow the upper die half 52 to be fixed to the supporting plane 9 of the crosspiece 8, and an overturned position F in which the upper supporting table 3 is rotated 180° and the supporting plane 9 of the crosspiece 8 is substantially horizontal and facing upwards.

[0034] The lower supporting table 2 comprises a base 20 which is fixed to the first platform 6 and supports a respective supporting plane 21 provided with respective coupling means 28 for fixing the lower die half 52. The coupling means comprise, for example, a plurality of T-shaped slots 28 for a manual connection of the lower die half 51 to the supporting plane 21 of the lower supporting table 2 or one or more permanent magnets for an automatic connection of the lower die half 51.

[0035] The operation of the die splitter machine 1 of the invention includes, in an initial step of a procedure for opening a die that consists of a lower die half 51 and an upper die half 52, positioning and locking the lower die half 51 to the lower supporting table 2 arranged in the first operating position A, the upper supporting table 3 being arranged in the raised position C and in the gripping position E.

[0036] Once the lower die half 51 is locked, the upper supporting table 3 is lowered so that the upper die half 52 can be fixed thereto. Once the upper die half 52 is locked, the upper supporting table 3 is moved along the first direction V in the raised position C (figure 6) and then rotated 180° about the second rotation axis Y in the overturned position F to arrange the upper die half 52 with its inner operative portion, for example provided with cutting edges, facing upwards (figure 7).

[0037] At the same time, the lower supporting table 2 is moved to the second operating position B by rotating the first platform 6 about the first rotation axis X to allow an operator to access and operate on the lower die half 51.

[0038] The first platform 6 can also be rotated before or after moving the upper supporting table 3 to the raised position C.

[0039] At this point, the upper supporting table 3 can be moved to the lowered position D, so as to allow an operator to access and operate on the upper die half 52 (figure 8). In the lowered position D the supporting plane 9 of the crosspiece 8 of the upper supporting table 3 (in the overturned position) is approximately at the same height, with respect to the bed 10, of the supporting plane 21 of the lower supporting table 2.

[0040] The closing and assembly procedure of the die 50 includes the execution in reverse of the different steps above described for the opening procedure.

[0041] Therefore, the die splitter machine 1 of the invention has very small dimensions, in particular in plan, since in order to allow to assemble or disassemble a die and/or to access and check a lower die half, the lower supporting table 2 must not be linearly moved away from the supporting column 4 of the upper supporting table 3 (which requires linear guides extending from a bed of the machine), but must simply be rotated about the column.

[0042] By virtue of such a particular structural design and in that the machine comprises only one column 4 for supporting and moving the upper supporting table 3, the die splitter machine 1 of the invention, in addition to being compact, is cheaper while being robust, reliable and versatile.

[0043] Figure 9 illustrates a variant of the die splitter machine 1 of the invention that differs from the above-described embodiment in that comprises a loading arm 30 mounted rotatably cantilevered on a top of the column 4 and usable in cooperation with a tackle for lifting and moving heavy objects and parts during the disassembly of the die halves.

[0044] Figures 10 and 11 illustrate a variant of the upper supporting table 13 that comprises a pair of brackets 18 slidably supported by the plate 7 in place of the crosspiece 8 fixed to the plate 7. More precisely, the brackets 18 are slidably fixed to guides 45 of the plate 7 so as to be movable with respect to each other, to vary a relative distance. The brackets 18 have respective supporting planes 19 that are orthogonal to the first rotation axis X and substantially horizontal when the upper supporting table 13 is in the gripping position E or in the overturned position F. The supporting planes 19 of brackets 18 are provided with respective coupling means 28 for fixing the upper die half 52. The coupling means comprise, for example, a plurality of T-shaped slots 28 for a manual connection of the upper die half 52 or one or more permanent magnets for an automatic connection of the upper die half 52.

[0045] Figures 12 and 14 illustrate a variant of the lower supporting table 12 provided with a tilting supporting plane 14 that is rotatably fixed to a respective base 15 of the lower supporting table 12 so that it can be arranged in a horizontal lowered position to receive the lower die half 51, and a vertical raised position, to allow easy access to and inspection of the lower die half 51.

[0046] The tilting supporting plane 14 is provided with respective coupling means 28 for fixing the upper die half

52. The coupling means comprise, for example, a plurality of T-shaped slots 28 for a manual connection of the upper die half 52 or one or more permanent magnets for an automatic connection of the upper die half 52

[0047] With reference to figures 15 and 16, another variant of the lower supporting table 22 is illustrated which comprises a pair of parallel supports 23 slidably fixed to a respective base 24 by respective guides 25 so as to be linearly movable with respect to each other to vary a relative distance. The supporting planes of the two supports 23 are provided with respective coupling means 28 for fixing the lower die half 51. The coupling means comprise, for example, a plurality of T-shaped slots 28 for a manual connection of the upper die half 52 or one or more permanent magnets for an automatic connection of the upper die half 52.

[0048] Figure 17 illustrates another embodiment of the die splitter machine 1 of the invention which differs from the embodiment above described and illustrated in figures 1 to 8 for the first platform 16 which supports a plurality of lower supporting tables 2 arranged angularly spaced about the aforesaid rotation axis X. The platform 16 is rotatably mounted about the first rotation axis X on the bed 10 to which the column 4 is also fixed. The platform 16 is ring-shaped and has a central opening 16b through which the column 4 is fixed to the bed 10.

[0049] Both the lower die halves 51 and the upper die halves 52 can be fixed on the lower supporting tables 2. Thereby, this embodiment of the die splitter machine 1 of the invention allows to open and disassemble or close and assemble in sequence a plurality of dies (for example four in the example of a machine of the figure which comprises eight lower supporting tables 2), allowing to reduce operating times and increase productivity.

[0050] Figure 18 illustrates a further embodiment of the die splitter machine 1 of the invention which differs from the embodiments described above and illustrated in that it comprises a base structure 27 having a rectangular shape in plan, which supports on opposite longitudinal sides 27a, 27b respective pluralities of lower supporting tables 2, adjacent to and aligned with each other, in particular regularly spaced.

[0051] The die splitter machine 1 further comprises a second platform 26 which supports the column 4 and is rotatably movable about the first rotation axis X and linearly along a second direction S parallel to the longitudinal sides 27a, 27b of the base structure 27 to allow positioning the upper supporting table 3 at any of the lower tables 2 on which both the lower die halves 51 and the upper die halves 52 can be fixed.

[0052] In particular, the base structure 27 comprising guide rails 29 adapted to slidably support the second platform 26 along the second direction S.

[0053] Thereby, the die splitter machine 1 of the invention in this embodiment allows to open and disassemble or close and assemble in sequence a plurality of dies (for example four in the example of a machine of the figure which comprises eight lower supporting tables 2), which allows to reduce operating times and increase productivity.

Claims

1. Die splitter machine (1) for opening and splitting or closing and joining upper and lower die halves (51, 52) of a die for hydraulic or mechanical presses, comprising:

   - at least one lower supporting table (2; 12; 22) adapted to support at least one lower die half (51) of said die;
   - an upper supporting table (3; 13) for supporting and moving an upper die half (52) of said die;
   - a column (4) slidably supporting said upper supporting table (3; 13);

   said lower supporting table (2; 12; 22) and said column (4) being movable with respect to each other about a vertical first rotation axis (X) at least between a first operating position (A), in which said lower supporting table (2) is aligned with and below the upper supporting table (3; 13) to open and split or close and join said upper and lower die halves (51, 52), and a second operating position (B), in which said lower supporting table (2; 12; 22) and said upper supporting table (3; 13) are angularly spaced to allow approaching to and operating on said upper and lower die halves (51, 52).

2. Die splitter machine (1) according to claim 1, comprising a first platform (6; 16) supporting said at least one lower supporting table (3) and rotatable about said first rotation axis (X).

3. Die splitter machine (1) according to claim 1 or 2, comprising a plurality of lower supporting tables (2; 12; 22) arranged angularly spaced about said first rotation axis (X), said lower supporting tables (3; 13) and said column (4) being movable relative to each other about said first rotation axis (X).

4. Die splitter machine (1) according to claim 1, comprising a base structure (27) supporting at opposite longitudinal sides (27a, 27b) thereof respective plurality of adjacent and aligned lower supporting tables (2; 12; 22) and a second platform (26) supporting said column (4) and movable rotatably about said first rotation axis (X) and linearly along a second direction (S) that is parallel to said longitudinal sides (27a, 27b) of said base structure (27) to allow positioning said upper supporting table (3; 13) at any of said lower supporting tables (2; 12; 22).

5. Die splitter machine (1) according to any preceding claim, comprising a carriage (5) slidably fixed to said

column (4), movable on the latter along a first direction (V), in particular parallel to the first rotation axis (X), and supporting said upper supporting table (3; 13) rotatably about a second rotation axis (Y), in particular orthogonal to the first rotation axis (X).

6. Die splitter machine (1) according to claim 5, wherein said upper supporting table (3; 13) comprises a plate (7) rotatably fixed to said carriage (5) and supporting a crosspiece (8) or slidably a pair of brackets (18), movable relative to each other.

7. Die splitter machine (1) according to claim 2 or 4, comprising first driving means (31) for rotating the platform (6; 16; 26) about the first rotation axis (X).

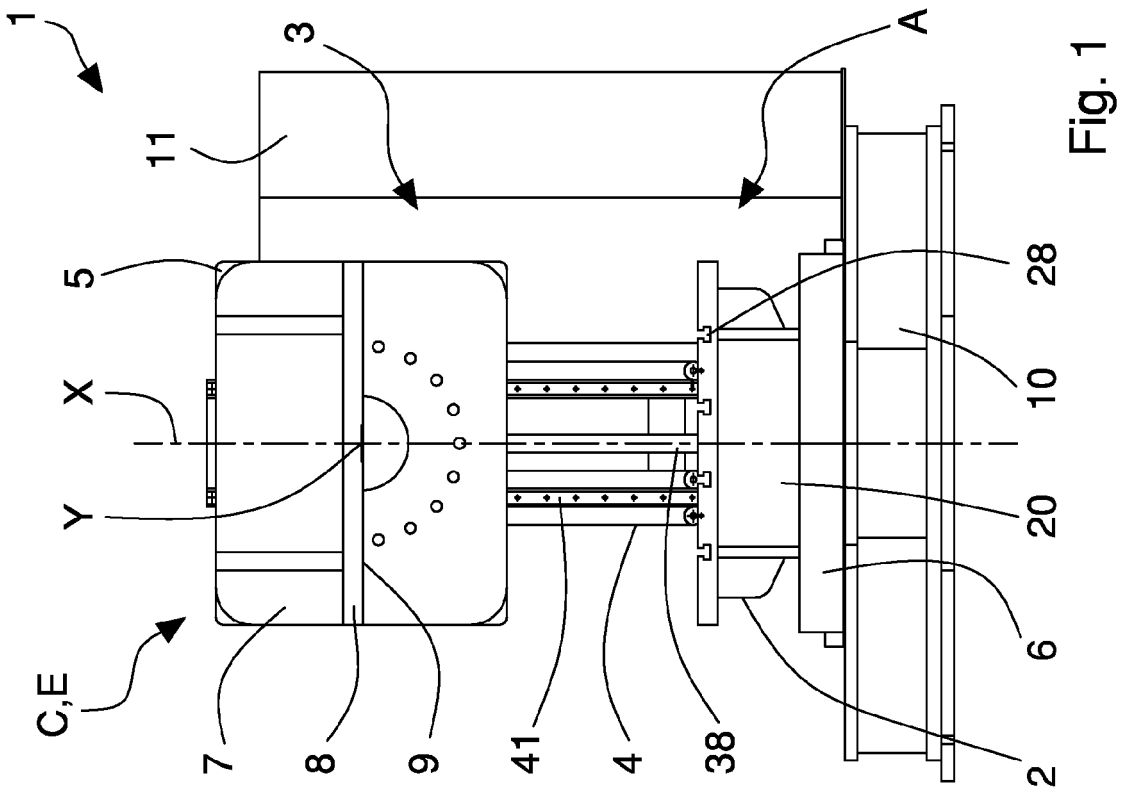
8. Die splitter machine (1) according to claim 5 or 6, comprising second driving means (32) for moving said carriage (5) along the column (4).

9. Die splitter machine (1) according to claim 5 or 6, comprising third driving means (33) for rotating said upper supporting table (3) about the second rotation axis (Y).

10. Die splitter machine (1) according to any preceding claim, wherein said lower supporting table (12) comprises a tilting supporting plane (14).

11. Die splitter machine (1) according to any of claims 1 to 9, wherein said lower supporting table (22) comprises a pair of parallel supports (23) slidably fixed to a base (24) so as to be linearly movable relative to each other.

12. Die splitter machine (1) according to any preceding claim, comprising a loading arm (30) rotatably cantilevered on a top of said column (4).


1
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A
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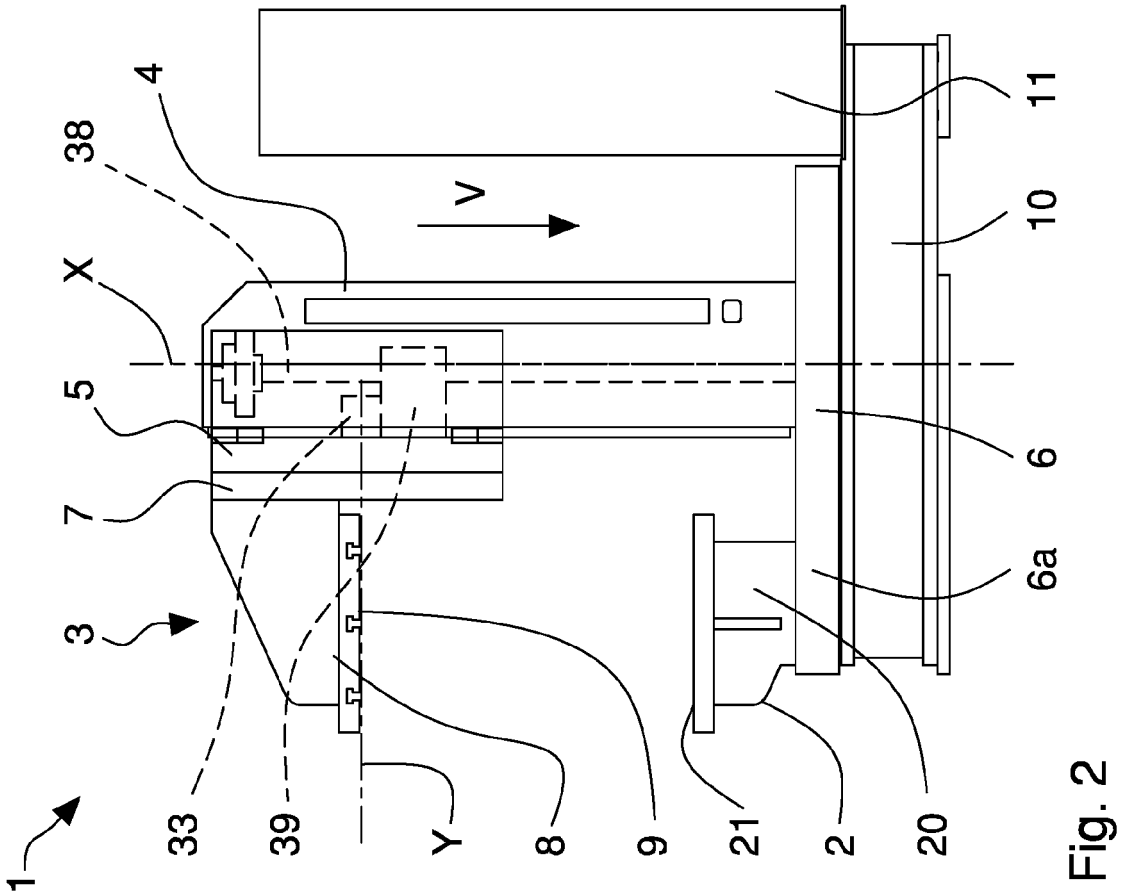
Fig. 1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38
V
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X
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6a
3
1
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Y
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Fig. 2

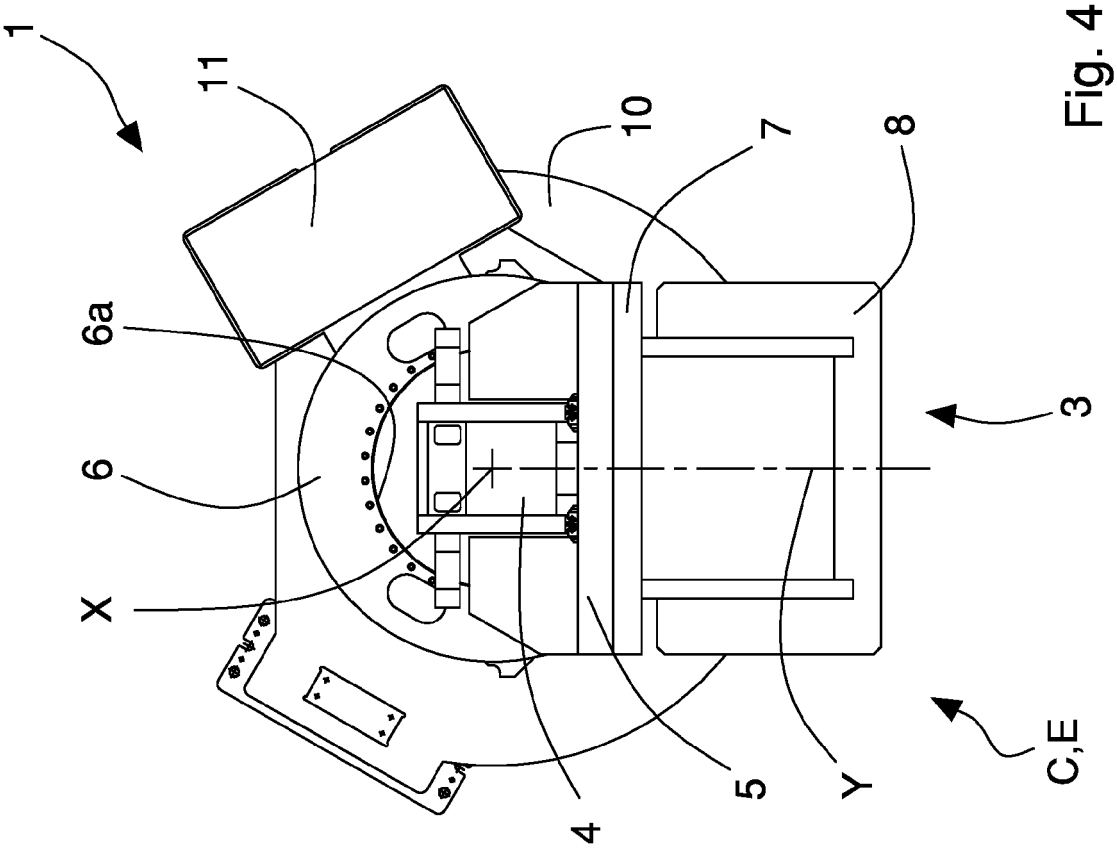

Fig. 4

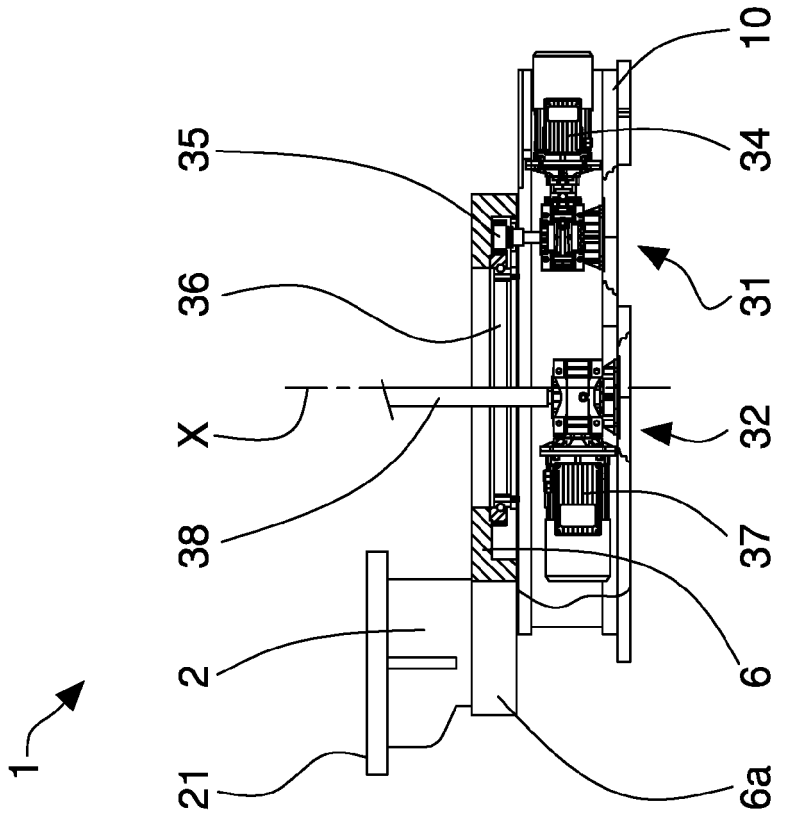

Fig. 3

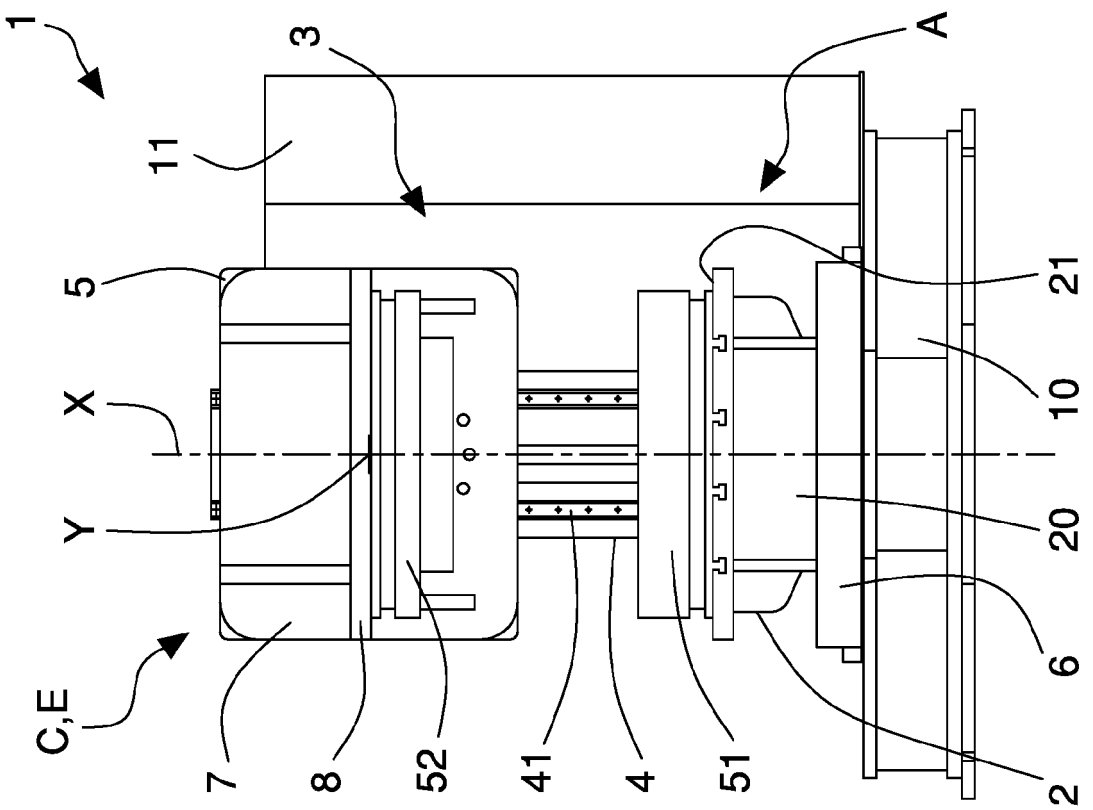

Fig. 6

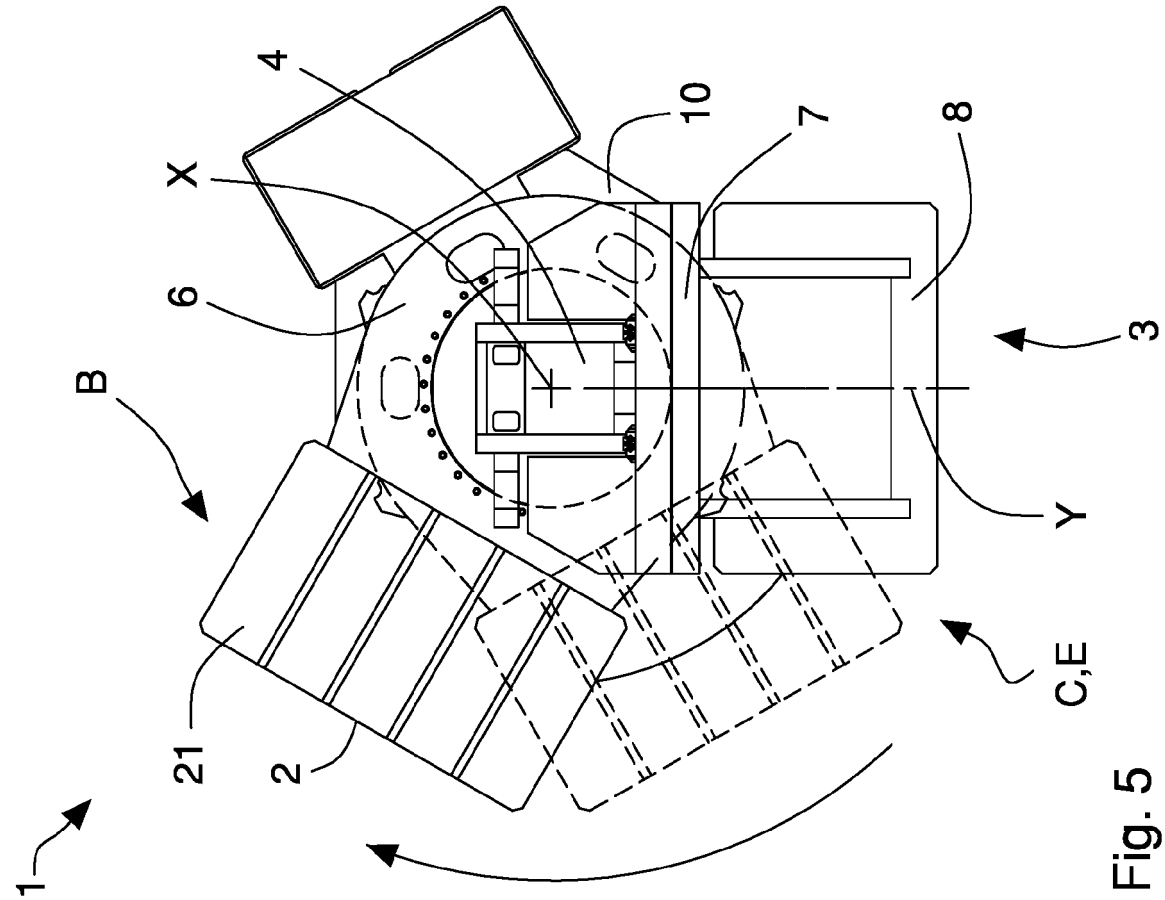

Fig. 5

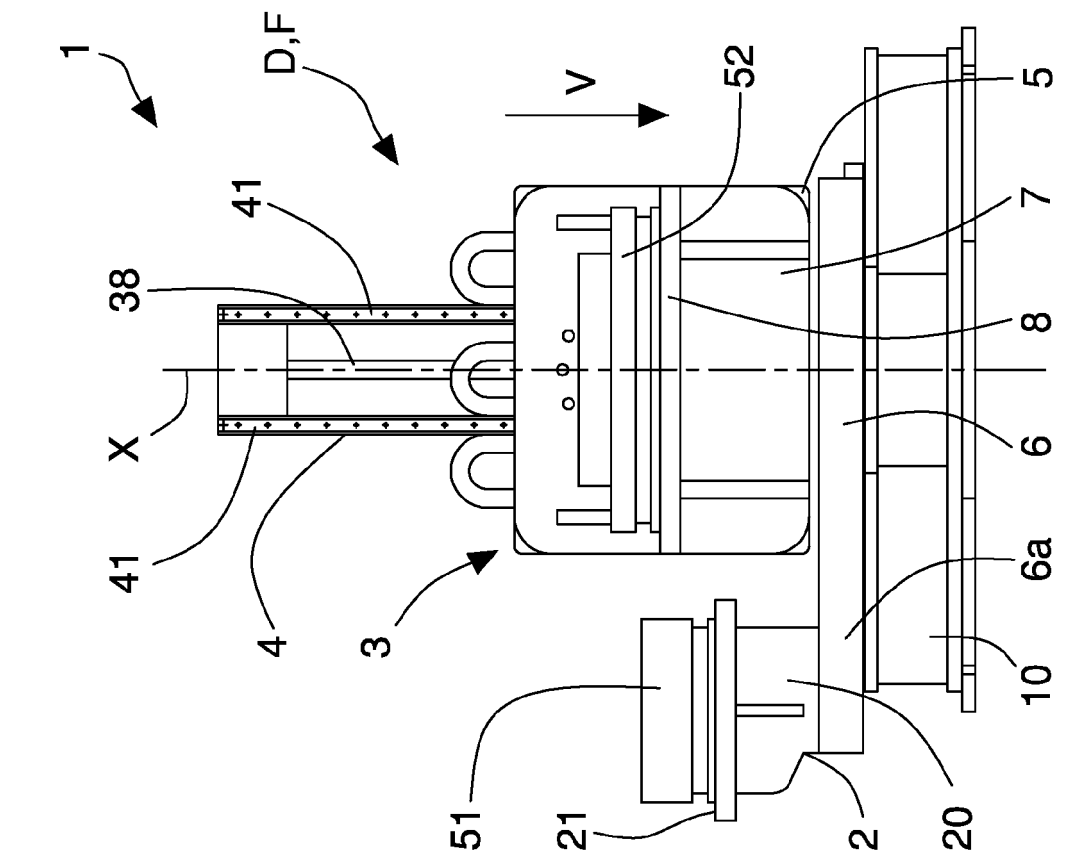
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Fig. 8

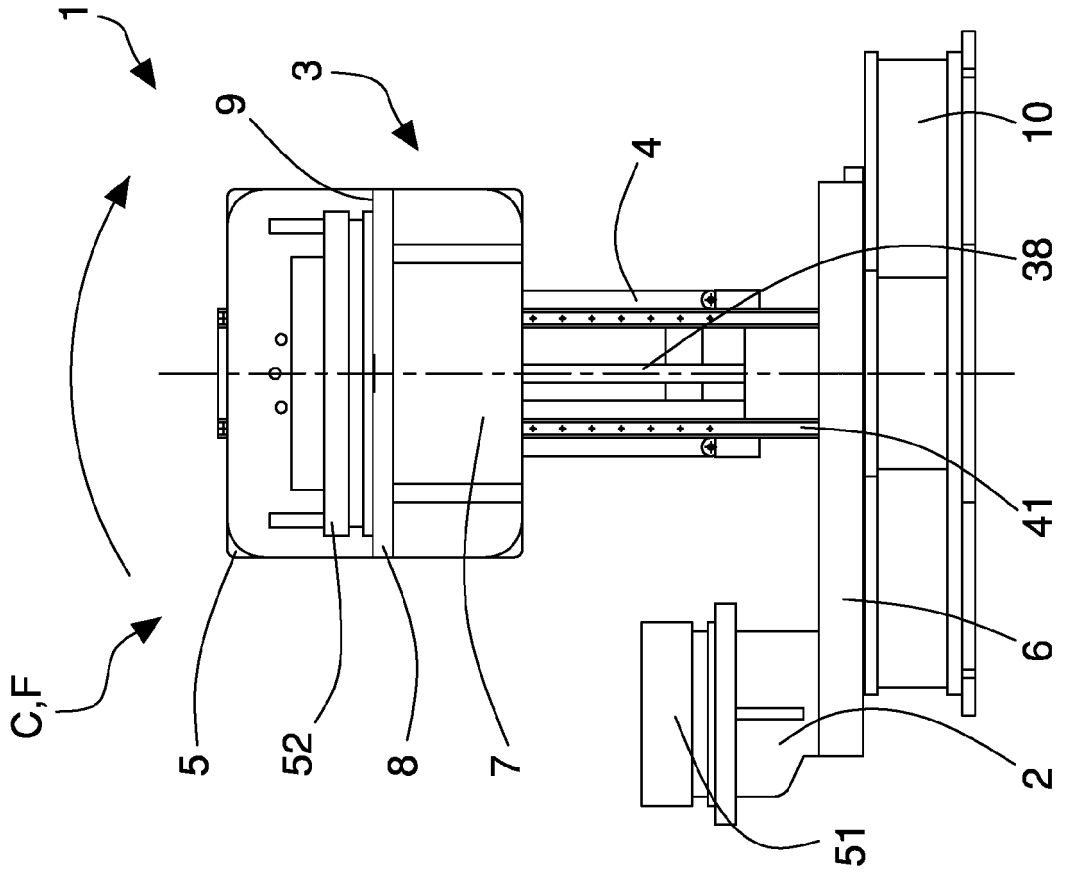
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Fig. 7

Fig. 10

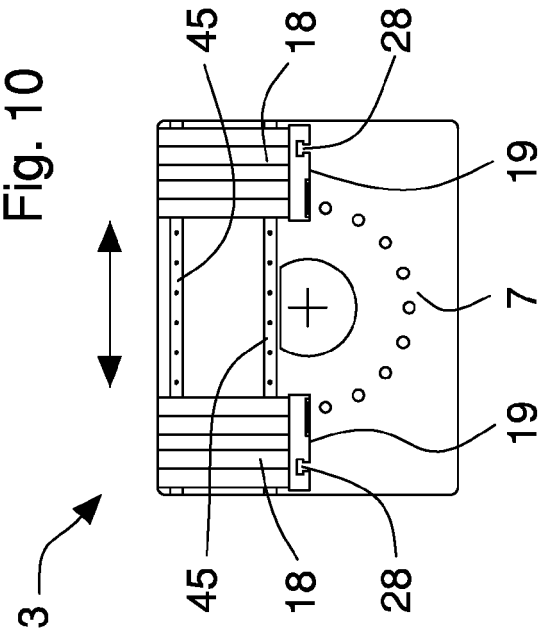


Fig. 11

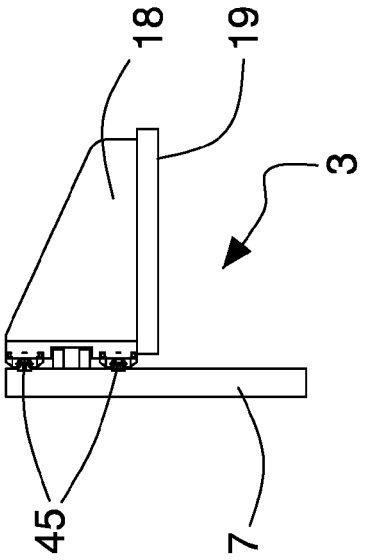


Fig. 9

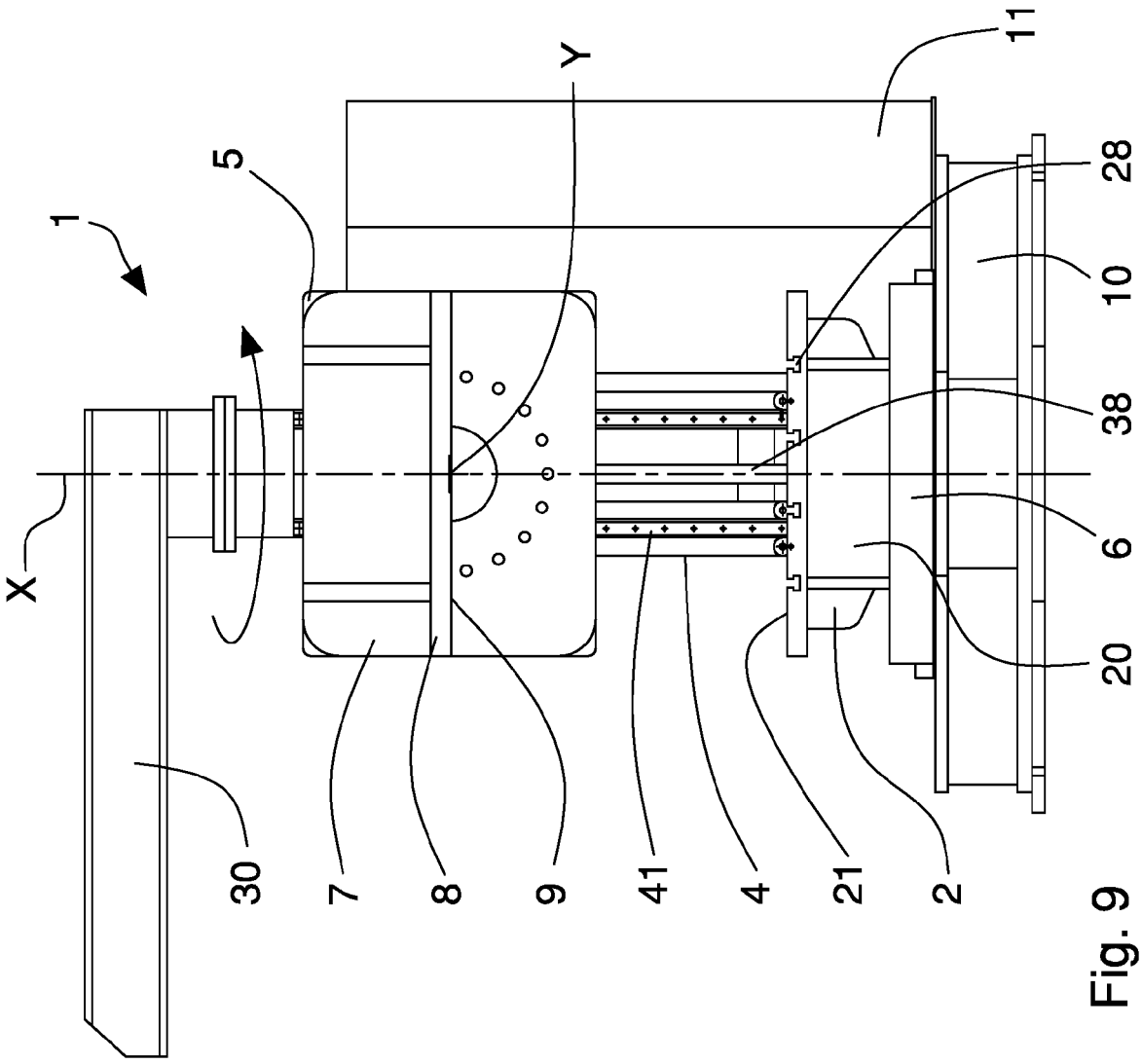
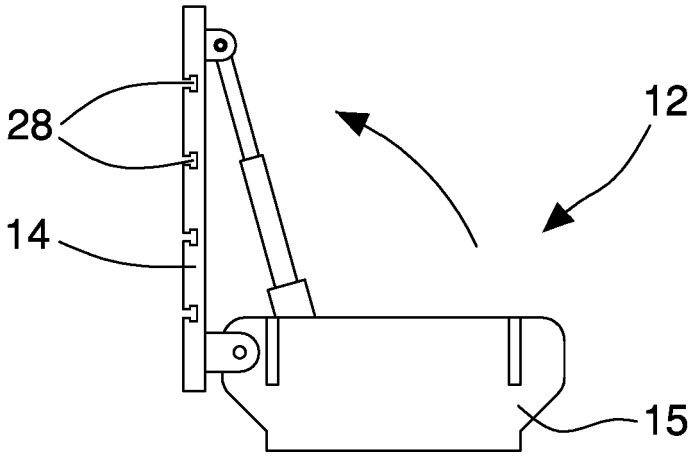


Fig. 14



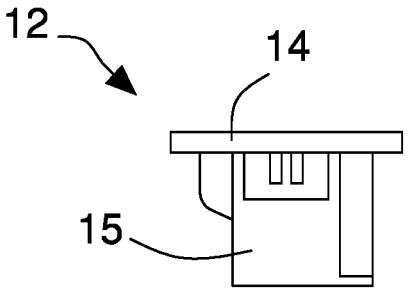


Fig. 13

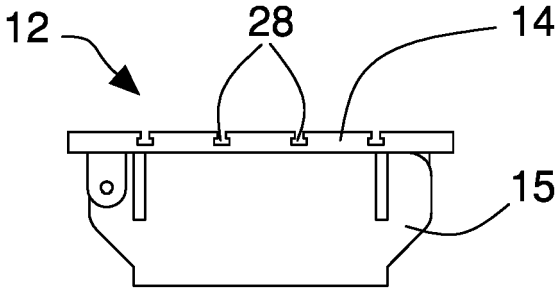


Fig. 12

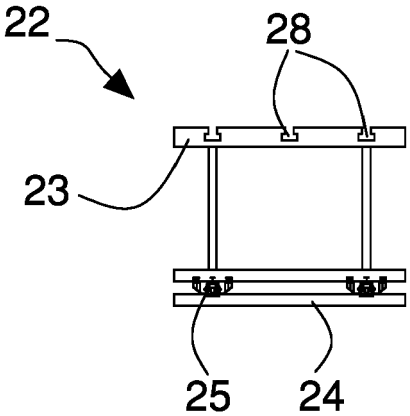


Fig. 16

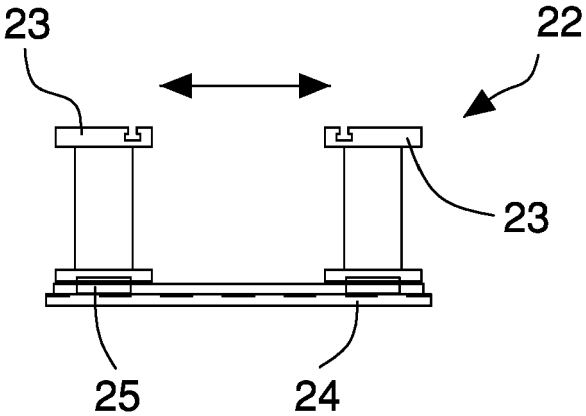


Fig. 15

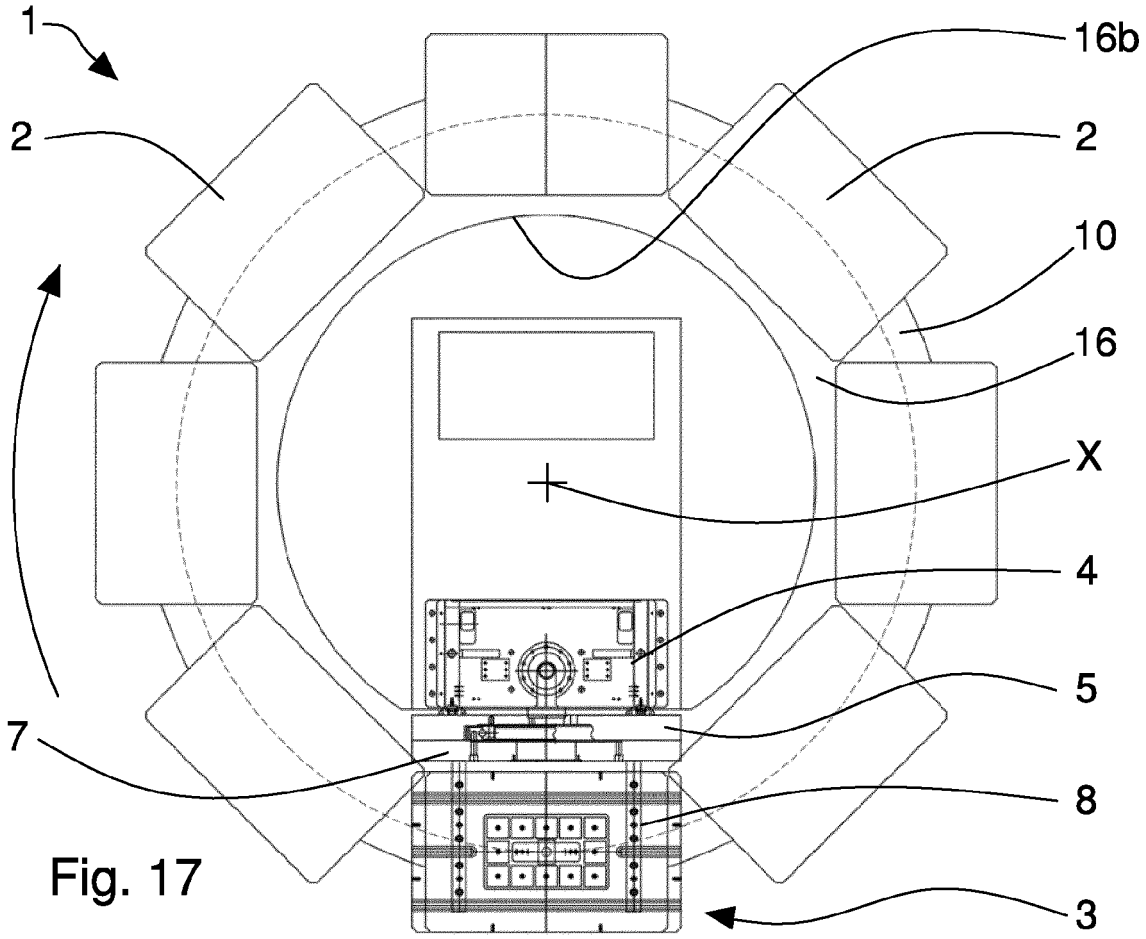


Fig. 17

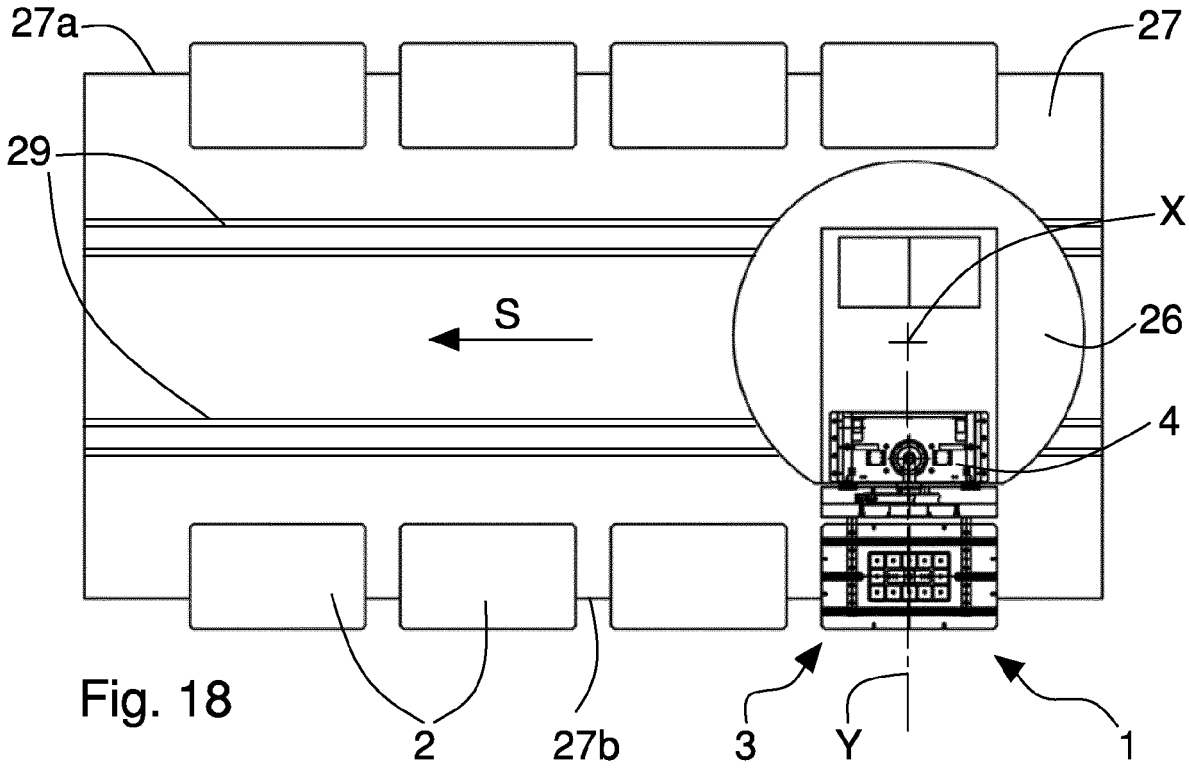


Fig. 18

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EUROPEAN SEARCH REPORT

Application Number
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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	FR 1 392 604 A (MONCHAL ETS) 19 March 1965 (1965-03-19) * page 2, left-hand column, last paragraph - right-hand column; figures 1-3 *	1-12	INV. B21D37/14
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B21D
B21J
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B29C
B22C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	15 June 2022	Vassoille, Philippe

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