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(54) **A burr shearing device**

(57) The present invention relates to a device for shearing the burrs of a semi-finished part for obtaining a sheared part. The device comprises a fixed matrix die (2) and a punch (4) moved by a cylinder (9). The matrix die is arranged above the punch. Moreover, both the ma-

trix die (2) and the punch (4) exhibit an opening for loading the semi-finished part, so as to load also asymmetric parts, through a robot arm controlled so as to load the matrix die or the punch based on the exposed face of the semi-finished part.

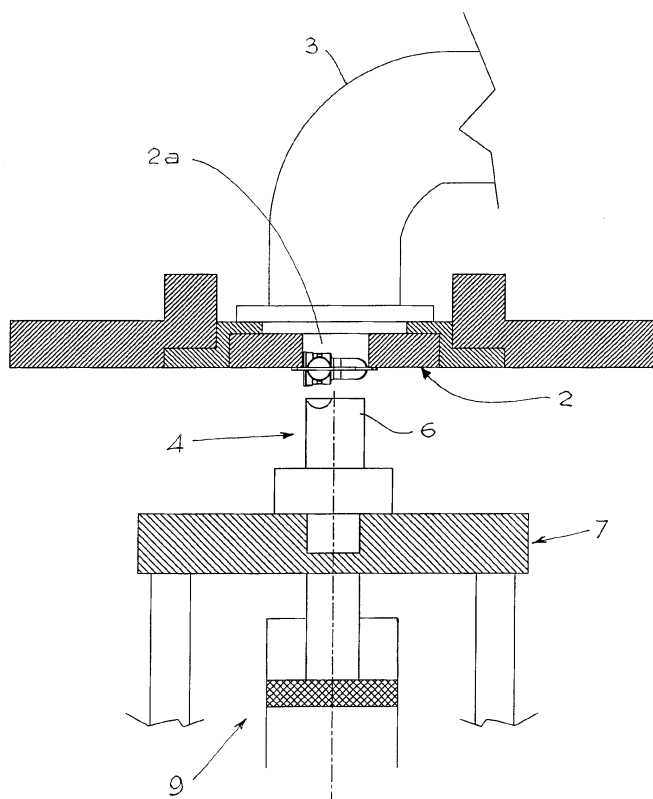


Fig. 1a

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Description

[0001] The object of the present invention is a burr shearing device, especially intended for shearing the burrs of a semi-finished part, for example resulting from a casting, die-casting or forging process.

[0002] It is known that a semi-finished part obtained by casting or forging exhibits a central body, corresponding to the desired shape for the finished part, and a set of burrs that need to be sheared.

[0003] The shearing operation is carried out on a shearing device, called shearing machine, comprising a matrix die, on which the semi-finished part rests, and a top punch, suitable for moving for shearing the burrs. Die and punch are aligned along a vertical axis, perpendicular to a ground plane on which the machine rests.

[0004] Several embodiments of shearing machines of the above type are known. Some embodiments are described, for example, in documents US 3,554,065, US 4,665,785, US 6,237,454, US-A1-2005/0081694.

[0005] Once sheared, the part drops through the matrix die while the sheared burrs fall on the shearing plane, where the semi-finished part rests, and generally they are moved away by air blowing.

[0006] In a further known embodiment, the matrix die and the top punch are aligned along an axis which is tilted relative to the vertical axis. In embodiments of this type, the part drops through the matrix die and the sheared burrs drop by gravity into a collecting box.

[0007] However, these solutions exhibit disadvantages due to the load of some semi-finished parts on the matrix die. Sometimes, based on the shape or weight of the semi-finished part, it is advisable to collect the semi-finished part with a loading arm on which the semi-finished part rests. In this case, in order to load it into the matrix die it is necessary to rotate the loading arm to upturn the semi-finished part and then position it into the matrix cavity.

[0008] The object of the present invention is to provide a device for shearing burrs of a semi-finished part which should overcome the disadvantages mentioned with reference to the prior art.

[0009] Such object is achieved by a shearing device obtained according to claim 1. The dependent claims describe embodiment variations.

[0010] Further features and advantages of the device according to the present invention will appear more clearly from the following description, made by way of an indicative non-limiting example with reference to the annexed drawings, wherein:

[0011] Figure 1a shows a matrix die and a punch of a device according to the present invention, in a loading configuration of said matrix die;

[0012] Figure 1b shows the matrix die and the punch of Figure 1a in an approach configuration;

[0013] Figure 2a shows the device according to the invention in a loading configuration of the punch;

[0014] Figure 2b shows the matrix die and the punch

of Figure 2a in an approach configuration;

[0015] Figure 3a shows the device according to the invention in a shearing configuration;

[0016] Figure 3b shows a perspective view of the device of Figure 3a;

[0017] Figures 4a and 4b show an asymmetric semi-finished part, respectively in an arrangement that shows the left or the right face;

[0018] Figures 5a to 5c show an operating sequence of punch actuating means;

[0019] Figures 6, 7a, 7b and 8 schematically show an operating sequence of a shearing apparatus comprising the device according to the invention; and

[0020] Figure 9 shows an embodiment diagram of the device collecting means according to the present invention.

[0021] In accordance with the annexed figures, reference numeral 1 globally denotes a device for shearing the burrs of a semi-finished part, for example an asymmetric semi-finished part S (figures 4a and 4b).

[0022] The shearing device 1 can be arranged on a ground plane T-T, for example coinciding with the working level of the site where the systems are installed.

[0023] Device 1 comprises a fixed matrix die 2 having a seating cavity 2a which exhibits an access opening (figures 1a and 1b).

[0024] In other words, said seating cavity 2a of the fixed matrix die 2 is an example of embodiment of seating means, suitable for seating at least partly the part body P of said semi-finished part S.

[0025] The seating cavity is suitable for seating at least partly the semi-finished part S, leaving burrs B outside the access opening.

[0026] In other words, the access opening of the seating cavity is shaped as the part body P of the semi-finished part S. In this way, the semi-finished part S can be inserted into the access opening so that the part body P is partly seated into the seating cavity 2a, whereas burrs B remain outside the cavity, resting on the matrix die surface.

[0027] According to a preferred embodiment, said device 1 comprises means for supporting the matrix die 2 suitable for fixing said matrix die to the device structure.

[0028] Device 1 further comprises holding means suitable for holding the semi-finished part S into the seating cavity of the matrix die.

[0029] In particular, said holding means are suitable for influencing said semi-finished part with an action that at least overcomes the gravity action acting on said semi-finished part.

[0030] According to a preferred embodiment, said holding means comprise intake means suitable for providing an air flow flowing through said access opening of the matrix die 2, for influencing said semi-finished part S with such an action as to hold it into said seating cavity 2a of the matrix die.

[0031] Preferably, said holding means comprise at least one intake duct 3 in fluid communication with said

seating cavity 2a and with pumping means suitable for generating said air flow.

[0032] Device 1 further comprises a punch 4 exhibiting a shearing end 6 suitable for influencing said semi-finished part S when seated into said seating cavity 2a for shearing burrs B from the part body P and obtaining the sheared part.

[0033] Punch 4 is movable from a bottom limit position, wherein the shearing end 6 occupies a bottom limit height relative to said ground plane T-T, and a top limit position, wherein said shearing end 6 occupies an top limit height relative to said ground plane T-T. The bottom limit height is smaller than the top limit height.

[0034] In the top limit position, the shearing end 6 is suitable for influencing the semi-finished part S for carrying out the shearing.

[0035] In other words, the matrix die 2 is arranged above punch 4, so that said punch 4 must carry out a movement from bottom upwards to carry out the shearing of the semi-finished part S.

[0036] Preferably, said device 1 comprises means for guiding punch 4 suitable for guiding said punch for the movement.

[0037] According to a preferred embodiment, said guiding means comprise a shearing head 7.

[0038] Device 1 further comprises actuating means suitable for moving said punch for the movement. Preferably, said actuating means comprise at least one oil-pressure cylinder 9.

[0039] Preferably, said device 1 comprises speed variation means suitable for varying the movement speed of punch 4 between the bottom limit position and the top limit position.

[0040] In particular, said speed variation means comprise said punch actuating means.

[0041] Said speed variation means are suitable for imposing a higher speed on the punch between the bottom limit position and an intermediate approach position and for imposing a lower speed on said punch between the intermediate approach position and the top limit position.

[0042] Preferably, said speed variation means are oil-pressure means (figures 5a, 5b and 5c) suitable for varying said speed by the action of a fluid, for example oil, on said punch.

[0043] In particular, said speed variation means comprise a dual jack exhibiting a first chamber 8 having nominal section A' and a second chamber 10 having nominal section A''. The first section A' is smaller than the second section A''. The chambers can be fed with oil under pressure.

[0044] In the bottom limit position, oil is fed to the first chamber 8, so that the punch moves from the bottom limit position to the intermediate approach position (figure 5b). Such approach occurs at a first speed.

[0045] During such approach, a quantity of oil flows into the second chamber 10, by an intake action.

[0046] In the intermediate limit position, oil is fed to the second chamber 10, so that the punch moves from the

intermediate limit position to the top approach position (figure 5c). Such movement occurs at a second speed.

[0047] The rate at which oil is fed to the chambers being equal, the first speed is greater than the second speed.

[0048] The punch movement from the bottom limit position to the intermediate position is called approach stroke, since said movement is suitable for bringing end 6 of punch 4 in the proximity of the semi-finished part held into the matrix die, without carrying out the shearing, but such as to carry out the shearing making the punch perform a further movement, smaller than the approach stroke.

[0049] The punch movement between the intermediate position and the top limit position is called shearing stroke since end 6 of punch 4, influencing the semi-finished part held into the matrix die, carries out the shearing.

[0050] In a preferred embodiment, end 6 of punch 4 exhibits a seating suitable for seating at least partly the part body P of said semi-finished part S.

[0051] According to a preferred embodiment, said seating exhibits at least one suction cup suitable for hooking the part body P of the semi-finished part S or at least one intake duct for sucking the semi-finished part and holding said semi-finished part onto the punch.

[0052] Moreover, device 1 comprises first discharge means suitable for discharging the semi-finished part from the seating cavity of the matrix die.

[0053] According to a preferred embodiment, said first discharge means comprise a piston, for example hydraulic or pneumatic, comprising a stem suitable for crossing said seating cavity of the matrix die for influencing, at a side opposed to that of action of said punch, the semi-finished part S seated into said seating cavity 2a.

[0054] According to a preferred embodiment, moreover, said discharge means are suitable for crossing also said intake duct for reaching the semi-finished part arranged into the seating cavity of the matrix die.

[0055] Device 1 further comprises position detecting means, suitable for detecting the position of the semi-finished part into the seating cavity of the matrix die and for emitting a signal corresponding to a correct position or to an incorrect position.

[0056] According to a preferred embodiment, said detecting means are suitable for detecting the extension of the approach stroke carried out by the punch. In yet other words, if the semi-finished part S is not properly positioned in the matrix die or in the punch, in the intermediate approach position end 6 of punch 4 is at a lower height as compared to that it would be at if the semi-finished part position were correct, as the incorrect position does not allow said semi-finished part to be seated into the matrix die.

[0057] Said detecting means are suitable for detecting the height reached by the punch when the semi-finished part abuts against the matrix die and is supported by the punch, emitting a signal corresponding to a correct po-

sition or to an incorrect position of said semi-finished part S.

[0058] According to a preferred embodiment, device 1 further comprises second discharge means suitable for discharging the semi-finished part S from the seating cavity of punch 4.

[0059] According to a preferred embodiment, device 1 further comprises collecting means suitable for allowing the collection of the sheared parts (figure 9).

[0060] According to a preferred embodiment, said collecting means comprise a collecting box 12 internally comprising at least two separate spaces.

[0061] In particular, said collecting box 12 exhibits a temporary collecting space 14, directly in fluid communication with said intake duct 3 connected to the matrix die 2 of device 1.

[0062] Inside the temporary collecting space 14 there is arranged the intake unit of said intake means, whereas outside said space there is arranged the driving motor of said intake unit.

[0063] Moreover, the collecting box 12 exhibits a discharge space 16, separated from the temporary collecting space 14 by separating means.

[0064] According to a preferred embodiment, said separating means comprise a movable gate 15, for example movable from a closed configuration, wherein it separates said temporary collecting space 14 from said discharge space 16, to an open configuration.

[0065] The discharge space 16 comprises a discharge wall 20 suitable for being moved for allowing the part discharge from said collecting box 12 to an external container 22.

[0066] In other words, said discharge wall 20 is movable, for example turnable, from a closed configuration wherein it closes the discharge space 16 and allows the collection of sheared parts into said space, to an open configuration, suitable for discharging the sheared parts into the external container.

[0067] Device 1 is suitable for cooperating with gripping means suitable for collecting the semi-finished part from a loading plane and for arranging it into said device 1 for shearing. Said device and said gripping means form a shearing apparatus 30.

[0068] According to a preferred embodiment, said gripping means comprise a robot arm 32, suitable for collecting the semi-finished part from the loading plane and bringing it to device 1.

[0069] Preferably, said arm 32 comprises a base portion 34 and an end portion 36, operatively connected to said base portion.

[0070] Moreover, said arm 32 comprises a gripping hand 37, suitable for gripping said semi-finished part and arranging it at the end of said end portion 36 of arm 32.

[0071] According to a preferred embodiment, said gripping means comprise rotation means suitable for operatively connecting said base portion 34 to said end portion 36 or said end portion 36 to said hand 37 for upturning the gripped semi-finished part.

[0072] Said shearing apparatus further comprises recognition means suitable for recognising the arrangement taken by said semi-finished part S on said loading plane.

[0073] In fact, it should be noted that some semi-finished parts exhibit such shape that if on the loading plane they rest on one side, the part body P exhibits a first face, for example called left face, whereas if they rest on the other side, the part body exhibits a second face, called right face, not coinciding with the left face by simple rotation about an axis perpendicular to the support plane. Such semi-finished parts are called asymmetric.

[0074] Said recognition means are suitable for recognising the arrangement of the semi-finished part S, detecting whether said semi-finished part exhibits an arrangement of the part body P with left face or with right face. Said recognition means generate an arrangement information corresponding to the arrangement detected for the semi-finished part.

[0075] The shearing apparatus further comprises management means, operatively connected to at least said recognition means and said gripping means.

[0076] Said management means are suitable for sending a control signal to said loading means based on said arrangement information received from said recognition means.

[0077] For example, if the arrangement of the part body P is according to a right face, the loading means are controlled for collecting the semi-finished part and loading it onto the seating of punch 4 suitable for seating the right face of the part body. If the arrangement of the part body is according to a left face, the loading means are controlled for collecting the semi-finished part and loading it, after upturning, into the seating cavity of the matrix die, provided with an access opening shaped according to the left face of the part body.

[0078] Preferably, said recognition means comprise a camera.

[0079] According to further embodiments, said shearing apparatus comprises a device for upturning the parts, for example of the type shown in the World Application PCT/IT03/00755 by the same Applicant.

[0080] For simplicity of description, hereinafter we shall assume that the access opening of the seating cavity of the matrix die is shaped as the left face of the part body, whereas the seating of the punch is suitable for seating the right face of the part body.

[0081] In the standard operation of the shearing apparatus, in a pre-load configuration, the semi-finished part S is arranged on the loading plane, in such a position relative to arm 32 as to be collected by said arm.

[0082] According to a first operating case, the semi-finished part rests on the loading plane so that the part body shows the left face.

[0083] The detecting means detect the face of the semi-finished part and identify the part body in the arrangement with left face. Such information is allocated in an arrangement information and transmitted to said management means.

[0084] In an imminent collection configuration (figure 6), the loading arm of the apparatus is arranged with the gripping hand 37 above the semi-finished part.

[0085] In a collection configuration, the semi-finished part is at least partly seated into said gripping hand 37 and lifted off the loading plane. In other words, arm 32 collects the semi-finished part S.

[0086] In said configuration, the semi-finished part is held by the gripping hand of the arm, to prevent dropping by gravity. In other words, the gripping hand keeps the semi-finished part raised, gripping it from top. Such configuration is called top gripping configuration.

[0087] The management means, based on said arrangement information, control said gripping means for loading the semi-finished part into the seating cavity 2a of the matrix die 2.

[0088] Following the command received from said management means, said arm 32 carries out a movement for bringing the semi-finished part S between punch and matrix die and in particular, the semi-finished part S is upturned thanks to the rotation of the gripping hand relative to the end portion 36 of arm 32 (figure 7b). In other words, the gripping hand 37 grips the semi-finished part S from the bottom. Such configuration is called bottom holding configuration.

[0089] Advantageously, said gripping hand carries out adjustment rotations for allowing correct insertion of the part body into the access opening of matrix die 2.

[0090] In a loading configuration onto the matrix die, the part body P of the semi-finished part S is inserted into the access opening of matrix die 2 and is held into said position by the action of said holding means (figures 1a and 7b).

[0091] In particular, said semi-finished part S is held in abutment with the surface of matrix die 2 as the access opening is sheared in the shape of the left face of the part body P and burrs B exit from said opening, as they edge said part body P.

[0092] In a quick approach configuration, punch 4 is raised from the bottom limit position to the intermediate position, wherein it slightly touches the part body P held to the matrix die 2 (figure 1b).

[0093] The detecting means detect the correct position of the part body into the matrix die access cavity, for example by detecting the height reached by the punch.

[0094] If such position is incorrect, the semi-finished part is discharged through the actuation of said discharge means.

[0095] If the position is correct, said management means control said punch for carrying out the shearing stroke.

[0096] In other words, said punch moves from the intermediate limit position to the top limit position, carrying out the shearing of the semi-finished part (figures 3 and 8).

[0097] The burrs detach from the part body and drop by gravity.

[0098] Said holding means suck in the sheared part

body through the intake duct 3, carrying it into the collecting box 12.

[0099] According to a second operating case, the semi-finished part rests on the loading plane so that the part body shows the right face.

[0100] . The detecting means detect the face of the semi-finished part and identify the part body in the arrangement with right face. Such information is allocated in an arrangement information and transmitted to said management means.

[0101] . In an imminent collection configuration, arm 32 of apparatus 30 is arranged with the gripping hand 37 above the semi-finished part (figure 6).

[0102] . In a collection configuration, the semi-finished part is at least partly seated into said gripping hand 37 and lifted off the loading plane.

[0103] . In said configuration, the gripping hand keeps the semi-finished part raised, gripping it from top. Such configuration is called top gripping configuration.

[0104] . The management means, based on said arrangement information, control said collecting means for loading the semi-finished part into the seating of the shearing head. In particular, said management means control the movement of the arm for allowing the approach of the semi-finished part to the punch.

[0105] . Advantageously, said gripping hand carries out adjustment rotations for allowing correct insertion of the part body onto the punch.

[0106] . In a loading configuration onto the punch, the part body P of the semi-finished part S is inserted on the punch and is held into said position by the action of said holding means, in particular by said suction cups or by the action of said suction (figures 2a and 7a).

[0107] . In a quick approach configuration, punch 4 is raised from the bottom limit position to the intermediate position, so that the part body is moved in abutment with the matrix die. In other words, in said intermediate limit position the burrs rest on the surface of matrix die 2, whereas the part body P is seated into the seating cavity of the matrix die (figure 2b).

[0108] . The detecting means detect the correct position of the part body into the matrix die access or on the punch cavity, for example by detecting the height reached by the punch.

[0109] . If such position is incorrect, the semi-finished part is discharged through the actuation of said discharge means.

[0110] . In particular, punch 4 is controlled for carrying out a quick downward movement. In other words, said punch also functions as discharge means.

[0111] . On the other hand, if the position is correct, said management means control said punch 4 for carrying out the shearing stroke.

[0112] . In other words, said punch moves from the intermediate limit position to the top limit position, carrying out the shearing of the semi-finished part (figures 3a and 8).

[0113] . The burrs detach from the part body and drop

by gravity.

[0114] . Said holding means suck in the sheared part body P through the intake duct, carrying it into the collecting box 12.

[0115] . Following repeated shearing operations, several sheared parts collect into the temporary collecting space 14.

[0116] . Periodically, said separating means allow the discharge of the sheared parts from said temporary collecting space 14 to said discharge space 16 while allowing said intake means to continue their correct operation during said discharge operation.

[0117] . In other words, when the separating gate moves from the closed configuration to the open configuration, for allowing the discharge of the sheared parts from the temporary collecting space 14 to the discharge space 16, the discharge wall 20 is in a closed configuration so as to prevent the suction action of said intake means from being negatively affected.

[0118] . Afterwards, the gate returns to the closed configuration, wherein it separates the temporary collecting space 14 from the discharge space 16, whereas the discharge wall 20 moves to the open configuration, thus allowing the sheared parts to be discharged into the external container 22 or delivered to further processing.

[0119] . Innovatively, the device according to the present invention allows collecting semi-finished parts having such a face as to be difficult to be gripped from top.

[0120] . Advantageously, moreover, the device according to the present invention allows moving the sheared burrs away by the gravity action.

[0121] . According to a further advantageous aspect, the device allows considerably increasing the productivity even for semi-finished parts having an asymmetric part body.

[0122] . According to a further advantageous aspect, the apparatus allows quick positioning of the asymmetric parts to prepare them for shearing, both when they are arranged with left and with right face.

[0123] . Advantageously, moreover, said high productivity is achieved with a single workstation, that is, with a single coupling between a punch and relevant matrix die. On the other hand, other solutions of the prior art are complex and expensive, as they are provided with multiple matrix dies, for example arranged onto turntables.

[0124] . Advantageously, moreover, the device allows continuing the process even while the sheared parts are discharged into the external container.

[0125] . It is clear that a man skilled in the art can make several changes and adjustments to the device described above in order to meet specific needs, all falling within the scope of protection defined in the following claims.

[0126] . For example, in an embodiment variation, the matrix die and the punch are aligned along an axis which is tilted relative to the vertical of the ground plane.

[0127] . In a further embodiment variation, said punch actuating means are electrical means.

[0128] . Also such variations are to be deemed as comprised within the scope of protection as defined by the following claims.

Claims

1. A device (1) for shearing burrs of a semi-finished part for obtaining a sheared part, said device being arrangeable on a ground plane (T-T), wherein said semi-finished part comprises a part body (P) and burrs (B) to be sheared, said device comprising:

- a fixed matrix die (2) having a seating cavity (2a) which exhibits an access opening, said cavity being suitable for seating at least partly said semi-finished part (S), leaving said burrs outside said access opening;

- a shearing punch (4) comprising an end (6) suitable for influencing said semi-finished part, when seated into said matrix die, for shearing said burrs, said punch being movable from a bottom limit position, wherein said end (6) is at a bottom limit height relative to said ground plane, and a top limit position, wherein said end (6) is at a top limit height relative to said ground plane, said bottom limit height being lower than said top limit height;

said device being **characterised in that** in said top limit position said punch (4) is suitable for influencing said semi-finished part (S) for carrying out the shearing.

2. A device according to claim 1, wherein said end (6) exhibits a seating suitable for seating at least partly said semi-finished part (S).

3. A device according to claim 2, wherein said seating cavity of the matrix die (2) and said seating cavity of the punch (4) are suitable for enclosing the part body (P) of an asymmetric semi-finished part.

4. A device according to any one of the previous claims, wherein said matrix die (2) and said punch (4) are aligned along a vertical axis perpendicular to said ground plane.

5. A device according to any one of the previous claims, wherein said matrix die (2) and said punch (4) are aligned along an axis tilted relative to said ground plane.

6. A device according to any one of the previous claims, further comprising holding means suitable for holding said semi-finished part (S) into said seating cavity (2a) of said matrix die (2).

7. A device according to claim 6, wherein said holding means are suitable for influencing said semi-finished part (S) with an action that at least overcomes the gravity action acting on said semi-finished part.
8. A device according to claim 6 or 7, wherein said holding means comprise intake means suitable for providing an air flow flowing through the access opening of said matrix die (2).
9. A device according to claim 8, wherein said intake means comprise an intake duct (3) in fluid communication with said seating cavity (2a) of the matrix die (2).
10. A device according to any one of the previous claims, further comprising collecting means suitable for collecting said sheared parts, said collecting means being in fluid communication with said seating cavity (2a) of the matrix die (2).
11. A device according to claim 10, wherein said collecting means comprise a collecting box (12) divided into two spaces (14,16) separated by separating means (20) suitable for changing from a closed configuration to an open configuration for discharging the sheared parts from the temporary collecting space (14) to the discharge space (16).
12. A device according to claim 11, wherein said discharge space (16) comprises a closing wall (20) suitable for changing from a closed configuration to an open configuration suitable for discharging the parts collected from the discharge space (16) to an external container.
13. A device according to any one of the previous claims, comprising actuating means suitable for moving the punch (4) for carrying out an approach stroke and a shearing stroke at different movement speeds.
14. A device according to any one of the previous claims, further comprising discharge means suitable for discharging said semi-finished part if incorrectly loaded.
15. A device according to any one of the previous claims, further comprising detecting means suitable for detecting the correct or incorrect position of the semi-finished part into said matrix die.
16. A device according to claim 15, wherein said detecting means are suitable for detecting the height reached by said punch in abutment with said semi-finished part seated into said matrix die for detecting the correct or incorrect position of the semi-finished part.
17. A shearing apparatus (30) comprising:
- a shearing device (1) constructed according to any one of the previous claims;
 - gripping means suitable for collecting said semi-finished part (S) from a loading plane and for loading it onto said device for carrying out the shearing.
18. An apparatus according to claim 17, wherein said gripping means comprise a robot arm (32) suitable for upturning or rotating said collected semi-finished part, for allowing loading onto said matrix die or onto said shearing head.
19. An apparatus according to claim 17 or 18, further comprising recognition means suitable for recognising the arrangement of the semi-finished part onto said loading plane, for controlling the upturning of the semi-finished part (S) for loading onto said matrix die.
20. A method for loading a semi-finished part (S) into a device for shearing said semi-finished part, wherein said semi-finished part comprises a part body (P) that forms a sheared part and burrs to be sheared (B), and wherein said device comprises:
- a fixed matrix die (2) comprising a seating cavity (2a) having an access opening;
 - a moving punch having a seating;
- wherein said seating cavity and said seating are suitable for enclosing, when coupled, said part body (P) of the semi-finished part (S);
wherein said method comprises:
- a step of detecting the arrangement of the part body of the semi-finished part laying on a loading plane;
 - a step of collecting said semi-finished part from the loading plane through gripping means;
 - a step of moving said gripping means for loading the semi-finished part into the seating cavity of the matrix die or into the seating of the punch based on the detected arrangement of the part body.
21. A method according to claim 20, wherein said moving step comprises a step of upturning said semi-finished part for loading the semi-finished part (S) into the seating cavity (2a) of the matrix die (2).
22. A method according to claim 20 or 21, further comprising the step of sucking said semi-finished part for holding it into the seating cavity (2a) of the matrix die.
23. A method according to any one of claims from 20 to

22, further comprising the step of shearing the semi-finished part.

24. A method according to claim 23, wherein said shearing step comprises a step of moving the punch towards said matrix die (2). 5

25. A method according to claim 24, wherein said moving step comprises a step of lifting the punch towards said matrix die (2). 10

26. A method according to any one of claims from 20 to 25, further comprising a step of discharging the semi-finished part if incorrectly loaded. 15

27. A method according to any one of claims from 20 to 26, further comprising a step of sucking the sheared part towards a collecting box (12). 20

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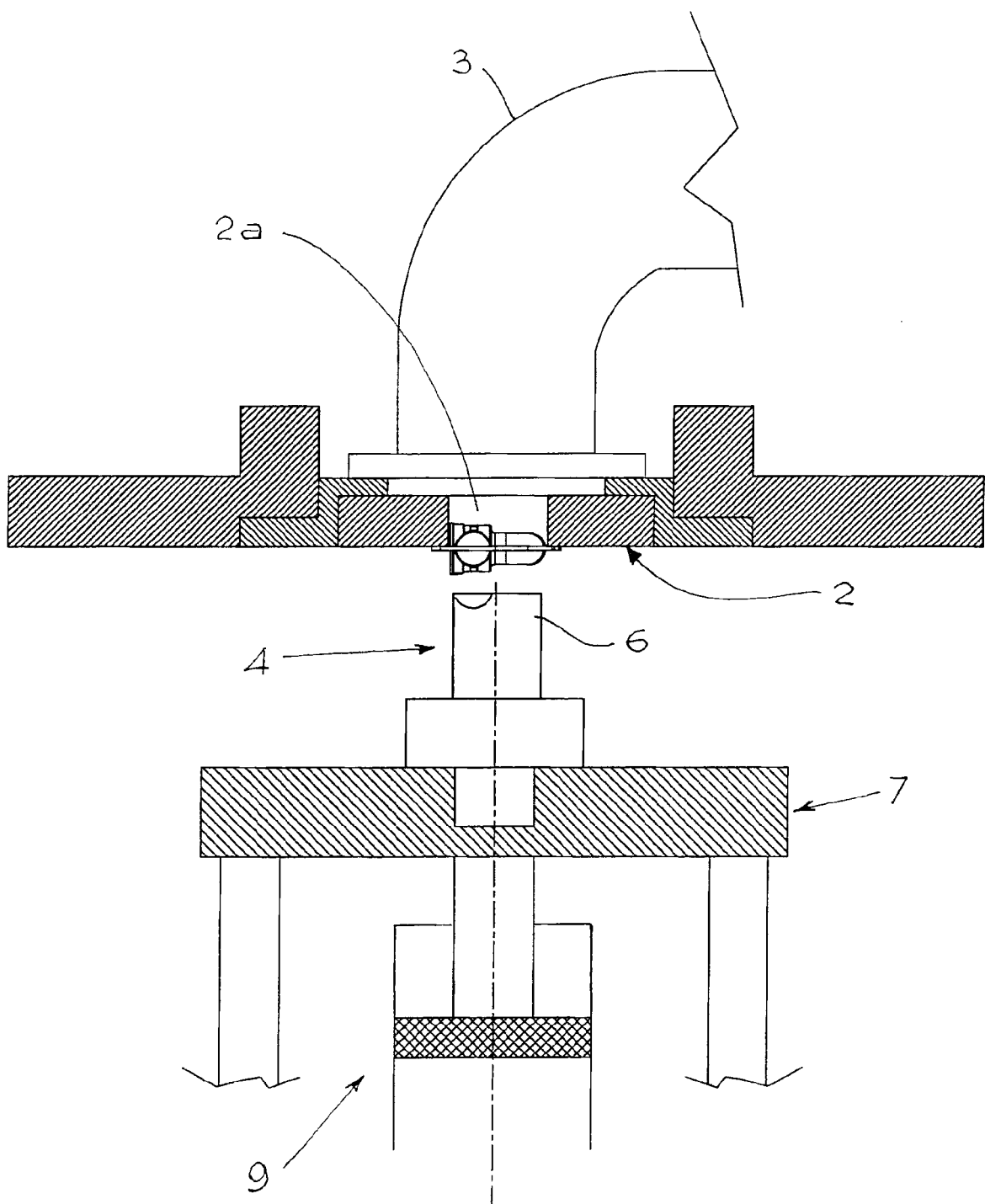
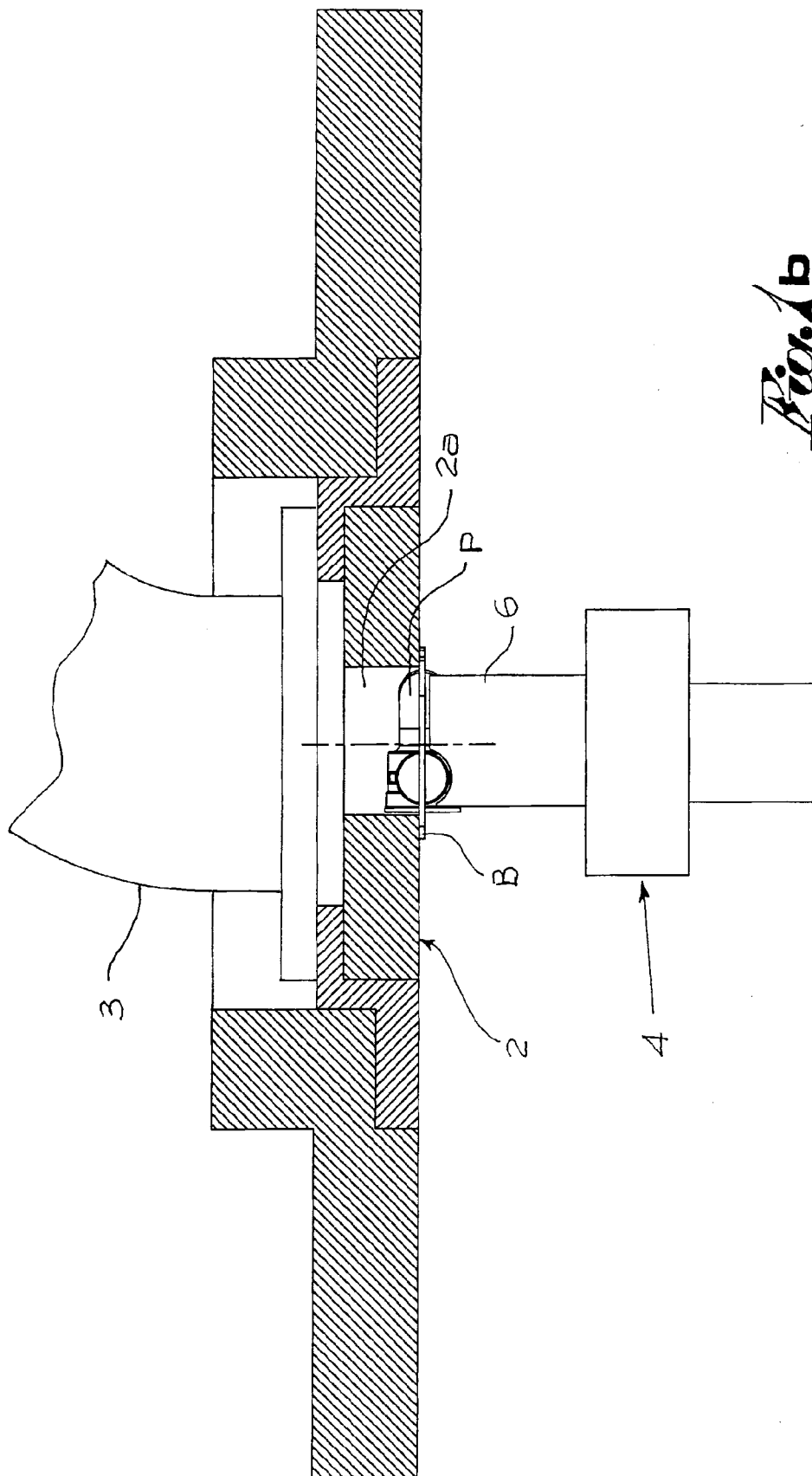
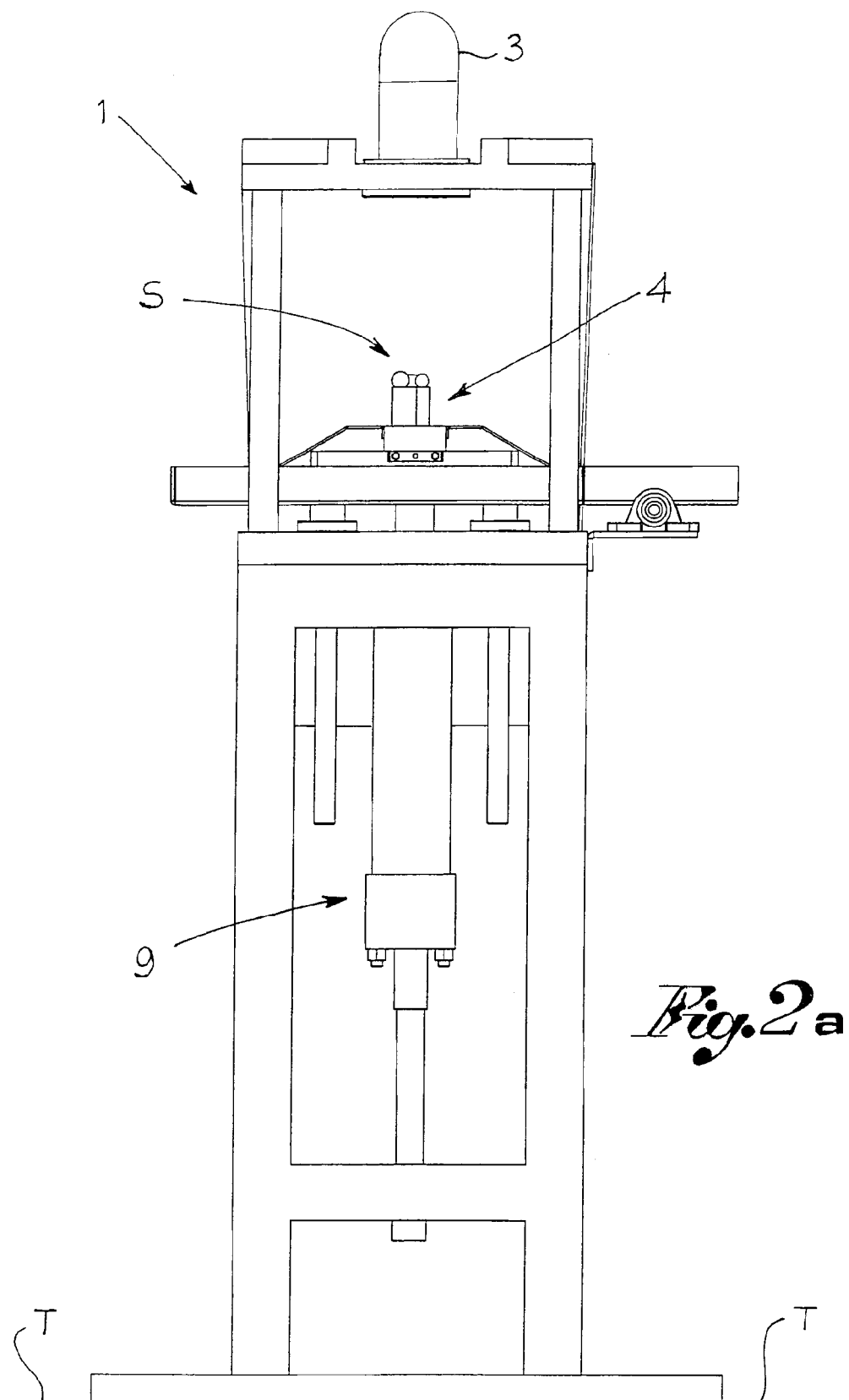
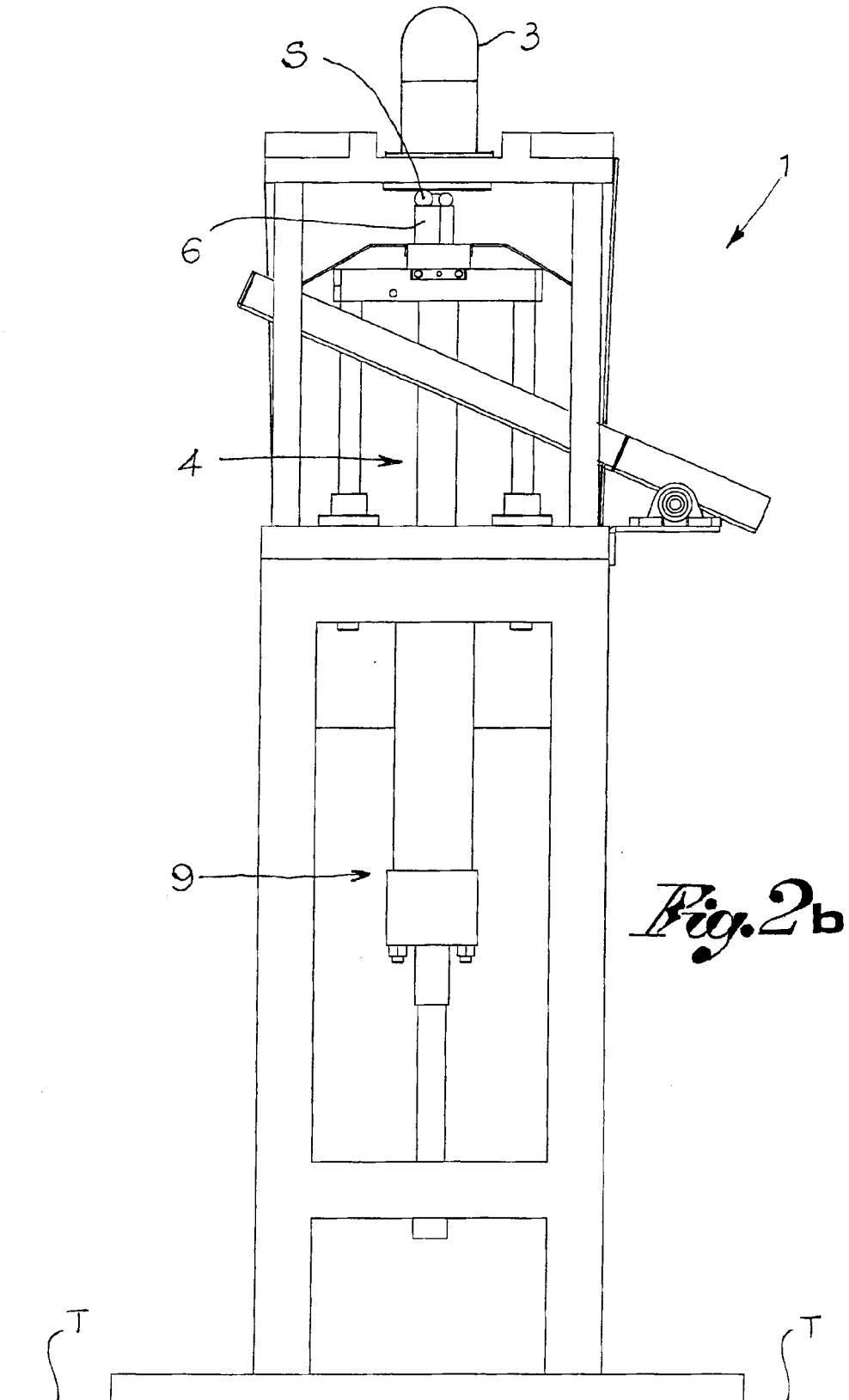
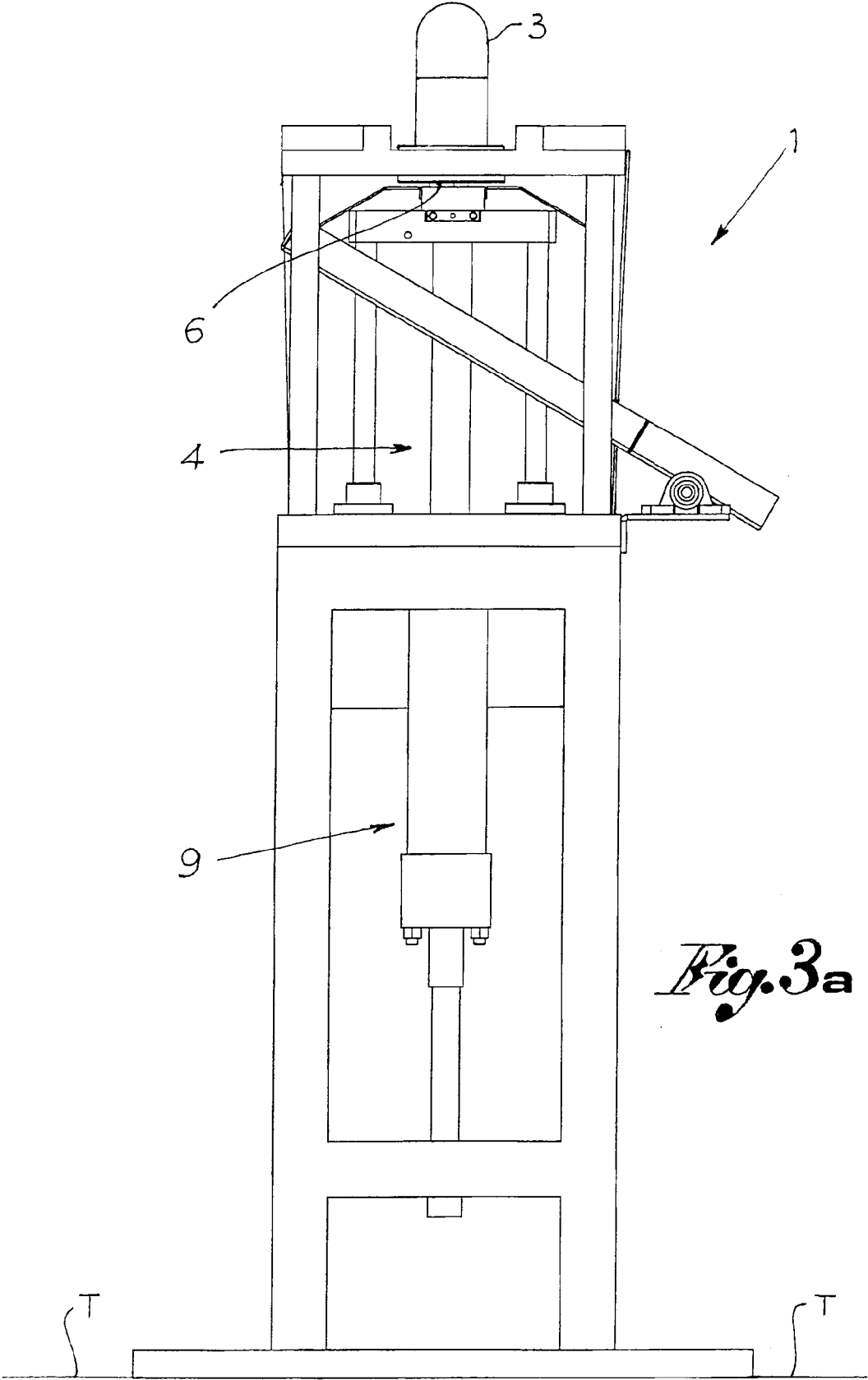


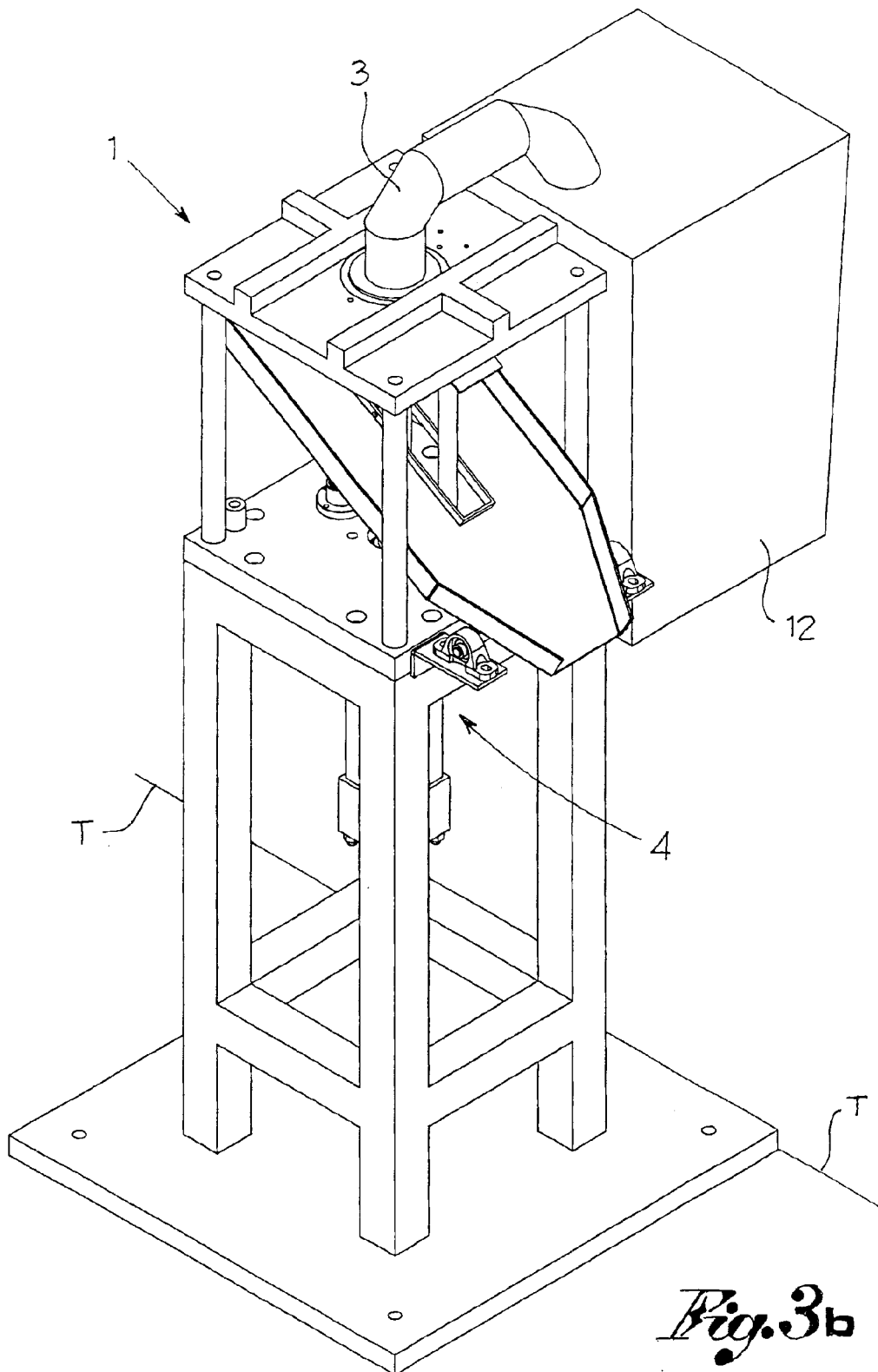
Fig. 1a











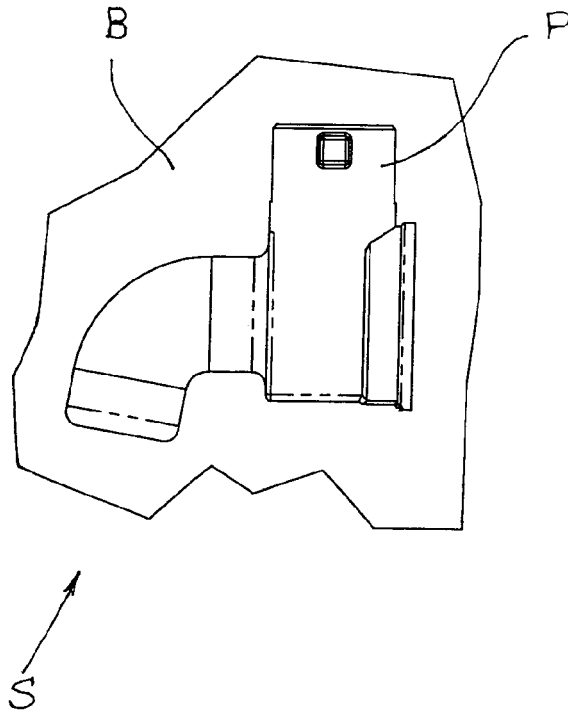


Fig. 4a

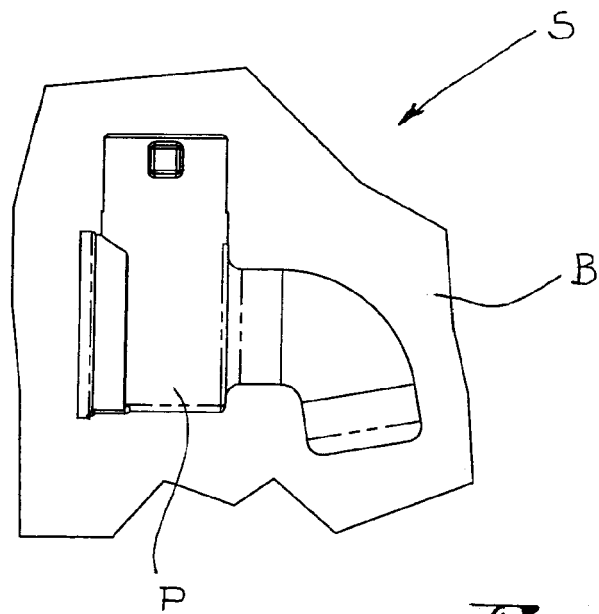


Fig. 4b

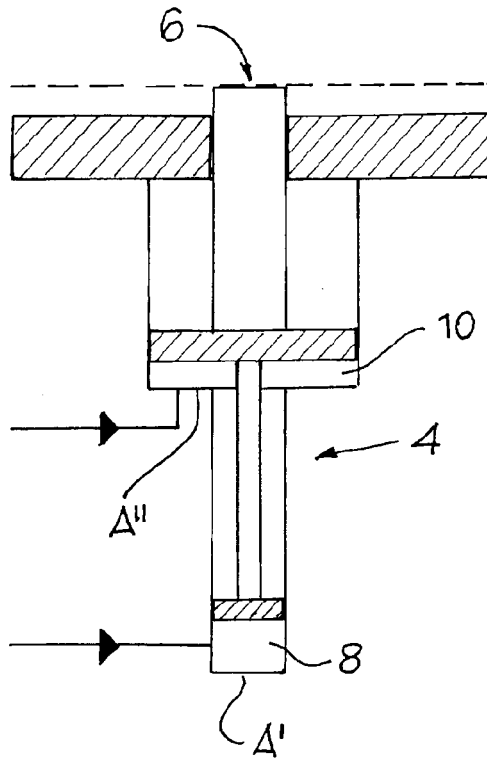


Fig. 5a

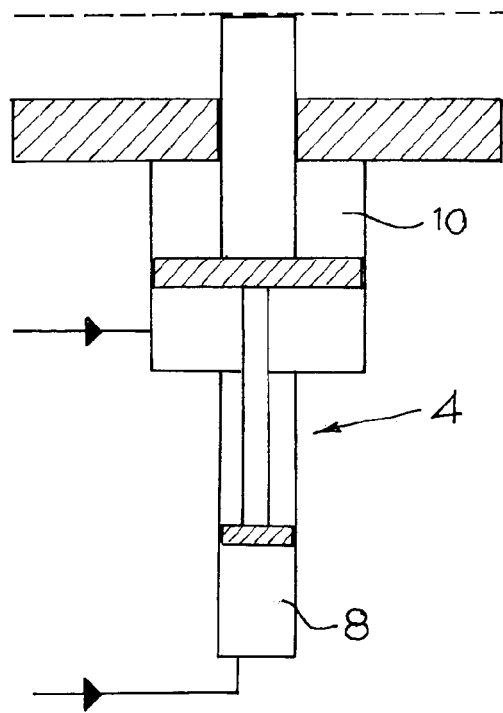


Fig. 5b

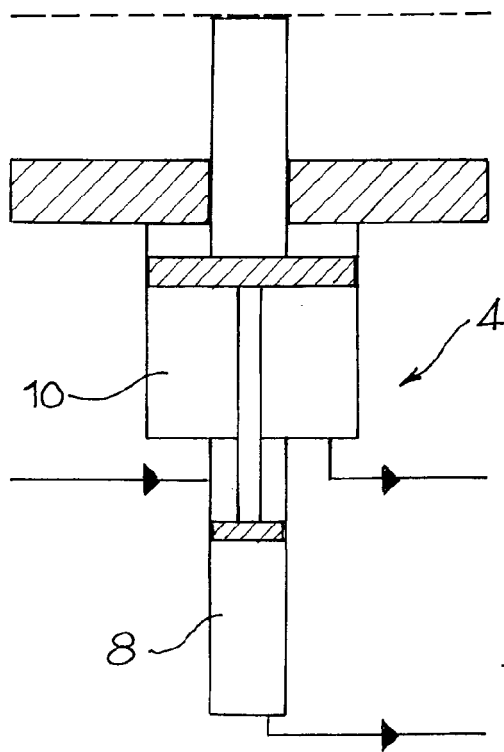


Fig. 5c

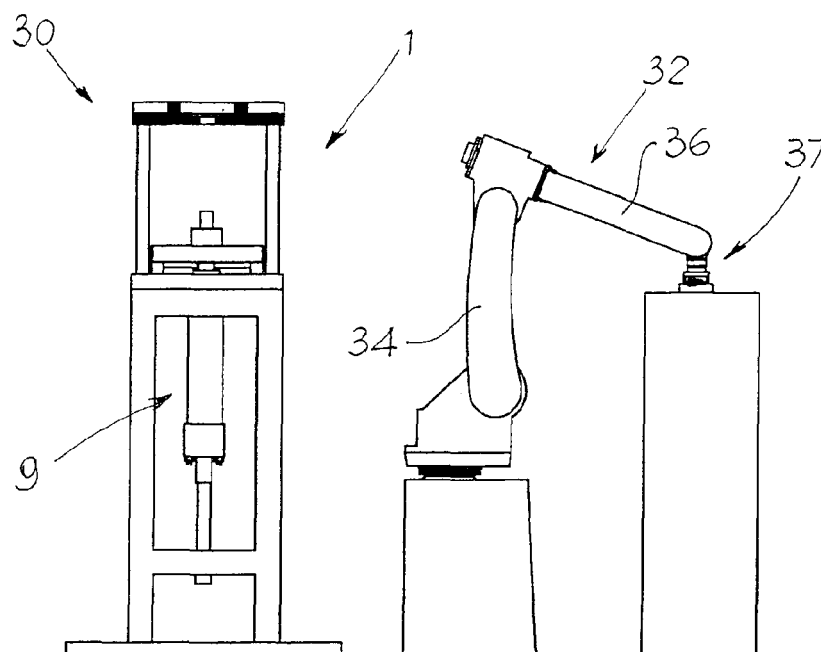


Fig. 6

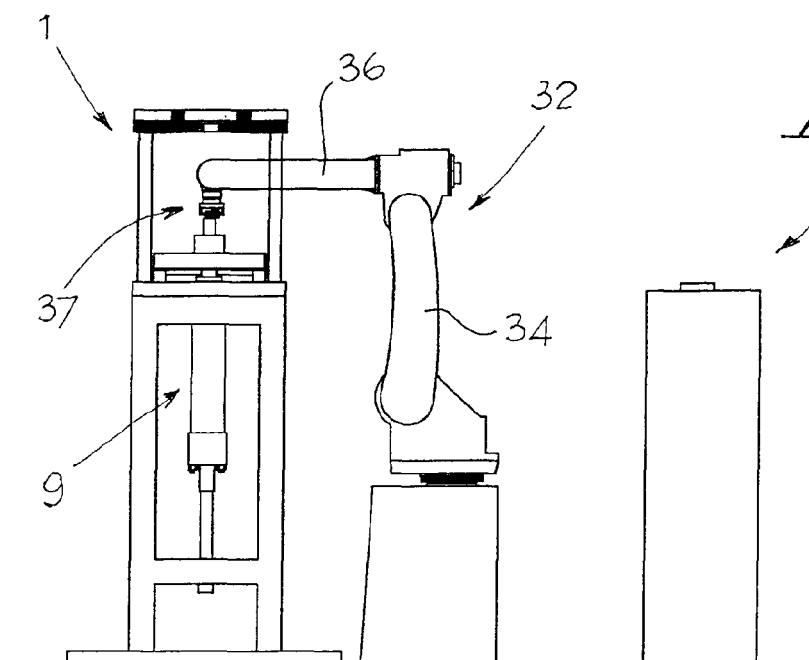


Fig. 7a

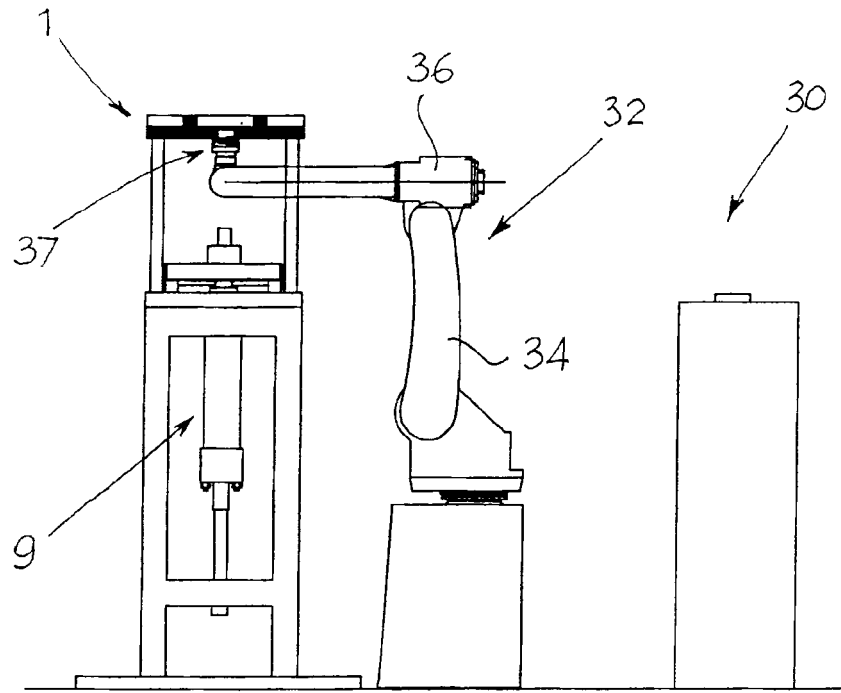


Fig. 7b

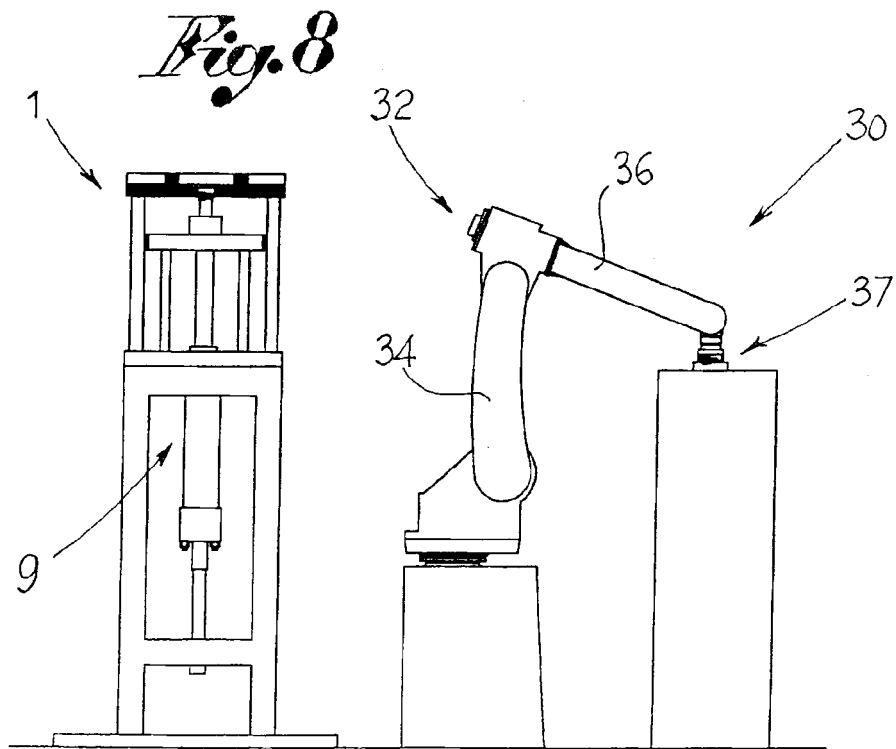
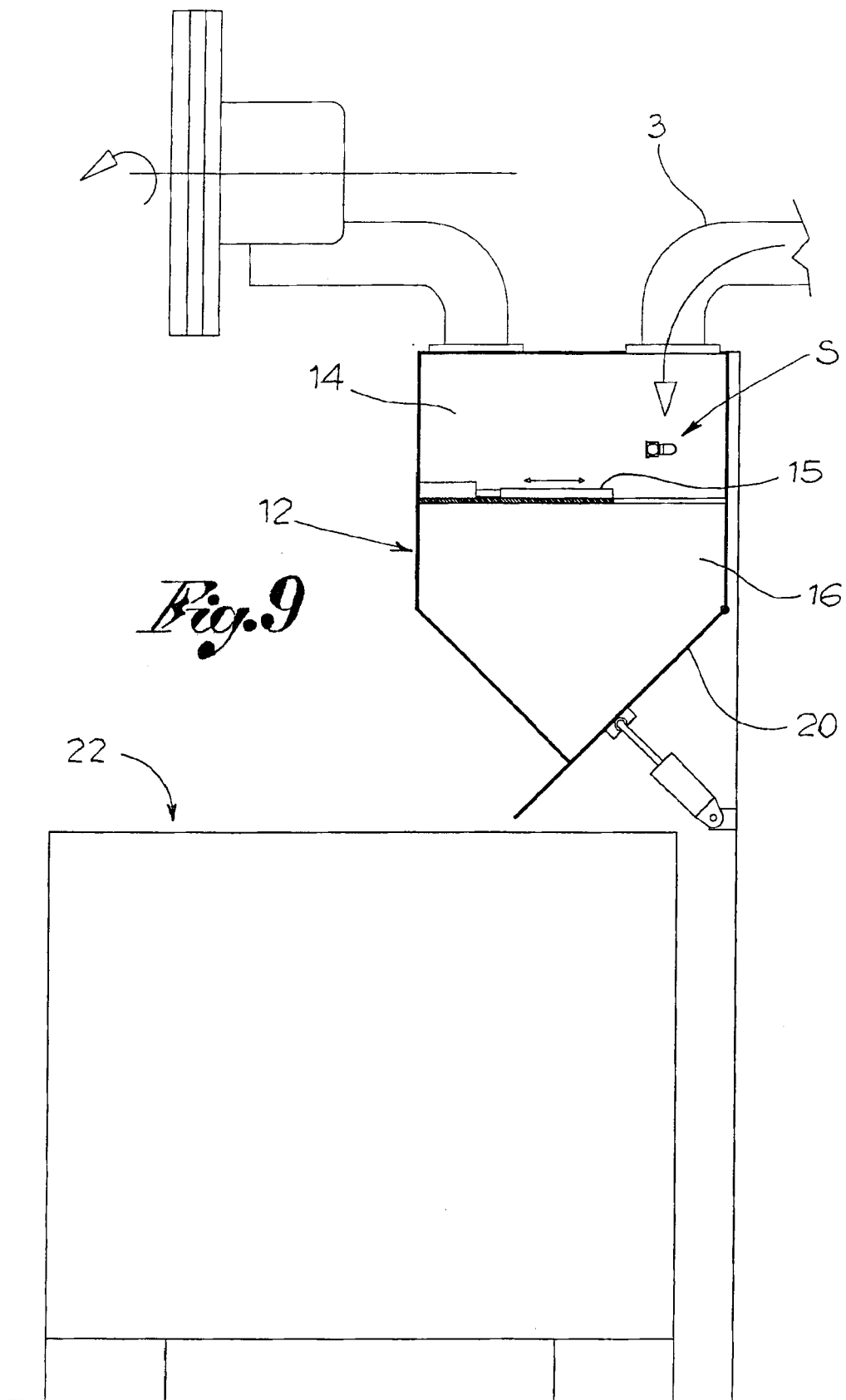


Fig. 8





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
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