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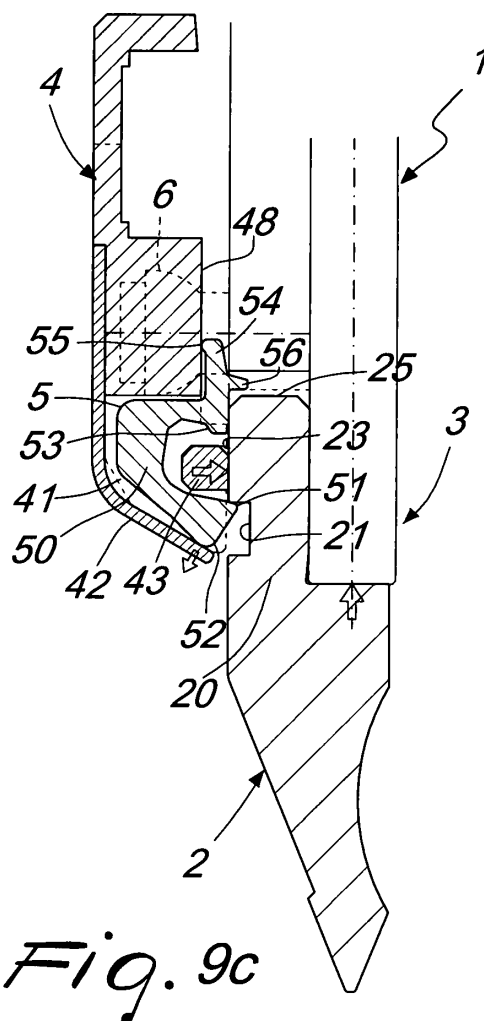
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(54) **Device for locking a tool on a machine tool, particularly a plate bending press**

(57) A device (1) for locking a tool (2) on a machine tool comprising a first jaw (3) and a second jaw (4), which can move toward each other and away from each other, and at least one safety hook (5), which is interposed between the first jaw and the second jaw and is provided with a retention tooth (51) adapted to enter a cavity (21) provided in the shank (20) of a tool (2), characterized in that the second jaw (4) is provided with at least one seat (41) which is open toward the first jaw (3) and with a transverse bar (43) which is accommodated in said seat (41) and is rigidly associated with the second jaw (4), the safety hook (5) being supported so that it can move by the second jaw (4) and having a claw-shaped portion (50) which is directed toward the first jaw (3) and is accommodated in the space of the seat (41) that is delimited by the bar (43) and whose lower end protrudes so as to define the retention tooth (51).



Description

[0001] The present invention relates to a device for locking a tool on a machine tool, particularly a plate bending press.

[0002] Particularly but not exclusively with reference to the field of machine tools for the plastic cold working of metal plates, presses for carrying out bending operations are known.

[0003] Bending presses are constituted by a lower footing, which defines a fixed plate supporting surface and has a bending template, according to the profile of which the metal plate is to be bent. A slider is supported so that it can move with a reciprocating straight-line motion along a direction which is perpendicular to the fixed surface toward and away from it above the footing. A bending tool is rigidly coupled to the slider and is adapted to cooperate with the template provided on the fixed surface. The movement of the slider is generated by a mechanical or hydraulic actuation device, which provides the force required for the deformation operation.

[0004] The tool is constituted by a body in which the lower end is profiled so as to cooperate with the template provided on the fixed surface and the upper end forms a shank for coupling to the slider. The slider is provided with a device for locking the tool, which acts as a clamp on the shank of the tool.

[0005] Moreover, known tools are provided monolithically or are divided, along their length, into a plurality of segments.

[0006] The tools are of the interchangeable type, since their shape, together with the shape of the corresponding template, can vary according to the bending profile to be provided.

[0007] For this reason, the shank of known tools has long had a standardized shape, in order to allow simple and quick changing on any press.

[0008] Such shank has, on at least one side, a seat such as a cavity, slot or channel, which lies transversely to the height of the tool and is for example C-shaped and in which a retention tooth of the locking device engages.

[0009] The presence in the shank of such seat, in which a corresponding retention tooth of the locking device engages, allows to keep the tool temporarily suspended during the tightening and loosening of the locking device, avoiding its fall.

[0010] Known locking devices are of the clamp type and comprise a fixed jaw, which is rigidly coupled to the slider; a movable jaw, which is pivoted to said fixed jaw; and linear actuation means, such as hydraulic cylinders, which are adapted to move closer and space apart the movable jaw with respect to the fixed jaw respectively to lock and release the shank of the tool.

[0011] Tool changing is problematic and difficult especially during the extraction of the tool to be changed and the insertion of the replacement tool.

[0012] These steps are performed manually by assigned operators while the press is temporarily stopped.

[0013] Extraction and insertion of the tools with a standard shank, as described above, occurs either by horizontal sliding or by means of a combined translational and rotary motion on the vertical plane respectively downwardly and vice versa.

[0014] In the first case, the tool, constituted by a single body or divided into a plurality of segments, the distance between two segments being less than their lengths, is made to slide parallel to the horizontal plane along the entire length of the press and is extracted and inserted from the sides of said press.

[0015] A drawback of this extraction by horizontal sliding consists in that it requires large maneuvering spaces at the sides of the press, and such spaces are not easily available.

[0016] Another drawback of this extraction by horizontal sliding consists in that it requires long execution times and therefore prolonged machine downtimes, consequently slowing production.

[0017] Still another drawback of the extraction by horizontal sliding is that in the case of a tool divided into a plurality of segments which are individually longer than the relative distance of one segment with respect to the other, when it is necessary to replace a segment in an intermediate position it is necessary to extract first of all the segments that precede it, and this consequently entails a further increase in replacement times and an onerous slowing of production.

[0018] In the second case, i.e., in the case of extraction and insertion of the tools respectively from the top downwardly and vice versa, between the two jaws of the locking device there is a safety hook, in which there is the retention tooth adapted to enter the C-shaped seat of the shank of the tool in order to keep the tool temporarily suspended during the tightening and loosening of the two jaws, preventing its fall.

[0019] EP 1 244 528 B 1 discloses a locking device of this type, in which the movable jaw is provided, on its face directed toward the fixed jaw, with a plurality of teeth which cooperate with corresponding secondary teeth or receptacles formed in the safety hook.

[0020] The movable jaw is provided with a lower tooth, which acts on a V-shaped spring which is fixed at one end to a protrusion provided on the safety hook; the function of this lower tooth is to apply to the safety hook, by means of the V-shaped spring, the necessary tightening force on the shank of the tool, locking it against the fixed jaw.

[0021] The movable jaw is further provided with an intermediate lug, which is directed upwardly and defines a recess for the insertion of a corresponding pawl which protrudes from the outer curve of the safety hook; the function of this intermediate lug is to keep the safety hook temporarily suspended, when the tool is inserted, during the tightening and loosening of the two jaws.

[0022] Finally, the movable jaw is provided with an upper tab, which cooperates with a corresponding tooth formed on the outer curve of the safety hook; the function

of said tab is to prevent, when the jaws are open and the tool is inserted, the upward sliding of the safety hook.

[0023] The tool is extracted and inserted with a combined translational and rotary motion of the tool on the vertical plane respectively downwardly and vice versa.

[0024] However, such known locking device suffers drawbacks, including the fact that the provision of the teeth, lugs and tabs on the movable jaw and of the corresponding protrusions, pawls and teeth on the safety hook, all of which have calibrated dimensions, requires long, laborious and expensive precision machining.

[0025] Another drawback of this known locking device consists in that it does not ensure adequate safety conditions during the operations for replacing the tools. Keeping the safety hook in suspended conditions and preventing its upward sliding, both during loosening and during tightening of the two jaws between which the shank of the tool is inserted, are in fact entrusted to the mating between the teeth and the tabs, which are very small.

[0026] Therefore, an accidental misalignment, a minimal degree of wear or a tolerance error are sufficient to prevent correct mating between such teeth and such tabs, to the detriment of the safety of the operators assigned to tool changing.

[0027] The aim of the present invention is to provide a device for locking a tool on a machine tool, particularly a plate bending press, which allows to perform tool changing operations simply and easily, in a short time and with limited machine downtimes.

[0028] Another object of the present invention is to provide a device for locking a tool on a machine tool, particularly a plate bending press, which does not require large spaces to perform tool changing operations.

[0029] Another object of the present invention is to provide a device for locking a tool on a machine tool, particularly a plate bending press, of the type which comprises two jaws, between which a safety hook is interposed, which allows to fix the safety hook so that it is suspended both during loosening and during tightening of the two jaws, thus ensuring the necessary safety conditions for the operators assigned to tool changing.

[0030] Another object of the present invention is to provide a device for locking a tool on a machine tool, particularly a plate bending press, which is easy to manufacture and can be provided by means of simple and inexpensive machining operations.

[0031] Another object of the present invention is to provide a device for locking a tool on a machine tool, particularly a plate bending press, which allows to lock a tool stably and safely.

[0032] Within this aim, another object of the present invention is to achieve said aim and objects with a structure which is simple, relatively easy to provide in practice, safe in use, effective in operation, and relatively low in cost.

[0033] This aim and these objects are all achieved by the present device for locking a tool on a machine tool,

particularly a plate bending press, comprising a first jaw and a second jaw, which can move toward each other and away from each other, and at least one safety hook, which is interposed between the first jaw and the second jaw and is provided with a retention tooth adapted to enter a cavity provided in the shank of a tool, characterized in that the second jaw is provided with at least one seat which is open toward the first jaw and with a transverse bar which is accommodated in the seat and is rigidly associated with the second jaw, the safety hook being movably supported by the second jaw and having a claw-shaped portion which is directed toward the first jaw and is accommodated in the space of the seat that is delimited by the bar and whose lower end protrudes so as to define the retention tooth.

[0034] Further characteristics and advantages of the present invention will become better apparent from the detailed description of a preferred but not exclusive embodiment of a device for locking a tool on a machine tool, particularly a plate bending press, according to the invention, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a partially sectional side view of the locking device according to the invention;

Figure 2 is a schematic head-on rear view of the second jaw of the locking device according to the invention, which is shown complete with safety hooks and the transverse bar in the left half and without the safety hooks and the transverse bar in the right half;

Figures 3 and 4 are schematic sectional views of the second jaw of Figure 2, taken respectively along the line III-III and along the line IV-IV;

Figure 5 is a side view of the safety hook of the locking device according to the invention;

Figure 6 is a side view of the first jaw of the locking device according to the invention;

Figure 7 is a schematic side view of a portion of a known type of tool which is adapted to be locked by the locking device according to the invention;

Figures 8a-8f illustrate sequentially the steps for the insertion of a tool between the two jaws of the locking device according to the invention;

Figures 9a-9c illustrate sequentially the steps for tightening the two jaws of the locking device according to the invention in order to lock the tool inserted between them;

Figures 10a-10c illustrate sequentially the steps for the spacing of the two jaws of the locking device according to the invention for the release of the tool inserted between them;

Figures 11a-11f illustrate sequentially the steps for the extraction, by sliding and rotation, of the tool from the locking device according to the invention;

Figures 12a-12c illustrate sequentially the steps for extraction by mere sliding of the tool from the locking device according to the invention.

[0035] With particular reference to the figures, the reference numeral 1 generally designates a device for locking a tool on a machine tool, particularly a plate bending press.

[0036] The device 1 is usable particularly but not exclusively on plate bending presses in order to lock a tool 2 provided as a monolithic body or divided into a plurality of segments.

[0037] A bending press, not shown since it is of the known type, comprises a lower footing, which defines a fixed surface for supporting the metal plate and is provided with a bending template, according to the profile whereof the metal plate is to be bent. A slider is supported so that it can move with a reciprocating rectilinear motion at right angles to the fixed plane toward or away from it above the footing. The movement of the slider is generated by a mechanical or hydraulic actuation device, which provides the force required for the deformation operation.

[0038] A bending tool 2 is rigidly coupled to the slider; the device 1 therefore can be rigidly associated with the slider of a bending press in order to lock thereon a tool 2.

[0039] In the present description, reference is made for the sake of simplicity to a device 1 in the active configuration in which it is rigidly coupled to the slider of a bending press, and the Cartesian system rigidly associated with the press, in which the horizontal plane is constituted by the fixed plate supporting surface and the vertical plane is constituted by the plane on which the slider slides, is taken as a spatial reference system.

[0040] Likewise, the terms "upper" and "lower" are referred to the device 1 in normal configuration for use.

[0041] Moreover, the expressions "substantially perpendicular", "substantially horizontal" or "substantially vertical" indicate directions which are perpendicular, horizontal and vertical except for ordinary tolerances.

[0042] The tool 2, of a conventionally known type, is constituted by a body the lower end whereof is shaped so as to cooperate with the template arranged on the fixed surface of the press and the upper end whereof defines a shank 20 for coupling to the device 1.

[0043] On at least one surface of the shank 20 there is a cavity 21 which has a C-shaped cross-section or the like and, as will become better apparent hereinafter, has a safety function by cooperating with the device 1 in order to keep the tool 2 in a suspended condition during the steps for insertion and extraction.

[0044] The device 1 comprises a first jaw 3 and a second jaw 4, which can move toward and away from each other, and at least one safety hook 5, which is interposed between the first jaw 3 and the second jaw 4.

[0045] The distinction between "first jaw" and "second jaw" has no limiting meaning, since it is used merely for the sake of simplicity in description.

[0046] The safety hook 5 comprises a claw-shaped portion 50, the lower end of which is provided with a retention tooth 51, which is adapted to enter the cavity 21 of the shank 20 in order to keep the tool 2 in the suspended configuration at the end of the insertion step and

at the beginning of the step for extracting said tool.

[0047] The first jaw 3 is adapted to be rigidly coupled to the slider of the press and has the shape shown in Figure 6.

5 **[0048]** The first jaw 3 comprises a body 30, which is adapted to be anchored to the slider of a press and is provided with a sliding surface 31, which faces the second jaw 4 and on which the face 22 of the shank 20, which lies opposite the surface 23 at which the cavity 21 is provided, is adapted to slide.

10 **[0049]** A surface 32 for stopping the sliding of the shank 20 is provided below the sliding surface 31, runs substantially perpendicularly to the sliding surface 31, and is adapted to make contact with a corresponding protrusion 24 which protrudes from the face 22 of the shank 20.

15 **[0050]** The second jaw 4 is pivoted in a central position, by means of a joint 6 of a known type, to the first jaw 3.

[0051] Linear actuation means act between the upper ends of the first jaw 3 and of the second jaw 4 and are adapted to move the lower ends of the two jaws toward each other and away from each other respectively to tighten and release the tool 2.

20 **[0052]** In a preferred embodiment, the linear actuation means are constituted by a pneumatic cylinder, not shown, which in the retracted configuration keeps the two jaws open, i.e., keeps their respective lower ends spaced in the release configuration, and which, in the extended configuration, keeps the two jaws closed, i.e., keeps their respective lower ends closer in the tightening configuration.

25 **[0053]** A gasket 7 of the pusher cylinder is further provided between the upper ends of the first jaw 3 and of the second jaw 4.

30 **[0054]** Elastic contrast means 8, adapted to keep the two jaws open, are provided proximate to the lower ends of the first jaw 3 and of the second jaw 4, i.e., below the joint 6.

35 **[0055]** The second jaw 4 has the shape shown in Figures 2 to 4.

40 **[0056]** The second jaw 4 comprises a body 40, in which one or more open seats 41 are provided in which the opening is directed toward the first jaw 3 in the assembled configuration.

45 **[0057]** The seats 41 are closed, on the opposite side with respect to the first jaw 3, by an arc-like wall 42 the concavity whereof is directed toward the first jaw 3 in the assembled configuration.

[0058] The arc-like wall 42 cooperates with the outer curve of the claw-shaped portion 50 of the safety hook 5 during the different steps of the operation of the device 1.

50 **[0059]** In a preferred embodiment, the arc-like wall 42 can be deformed elastically, and this, as will become better apparent hereinafter, allows the full tightening of the two jaws despite the stop abutment of the protrusion 24 of the shank 20 against the stop surface 32 of the first jaw 3.

[0060] The second jaw 4 further comprises a transverse bar 43, which is rigidly coupled thereto and is ac-

commodated in the seats 41 in front of the arc-like wall 42.

[0061] As shown in Figures 2 and 4, each seat 41 is delimited laterally by two sides 44, in which there is a slot 45 for containing a corresponding anchoring portion of the bar 43; means for fixing said anchoring portions to the second jaw 4 are provided.

[0062] In a preferred embodiment, the fixing means comprise screws 46, which can be inserted through corresponding holes 47, which are provided in the bottom of the slot 45 and can be coupled so as to engage threaded holes formed in the bar 43.

[0063] The claw-shaped portions 50 of one or more safety hooks 5 are accommodated within the space formed inside each seat 41 and delimited at the front by the bar 43.

[0064] The safety hooks 5 are thus supported by the second jaw 4 so that they can move with respect to said jaw both by sliding and by rotating on a vertical plane.

[0065] It is noted that each safety hook 5 has a respective claw-shaped portion 50 which is accommodated within the space formed by a seat 41 and delimited at the front by the bar 43, the claw-shaped portion 50 being arranged so as to surround the bar 43 with considerable play.

[0066] Moreover, it is noted that between the second jaw 4 and the safety hook 5 there is no coupling tooth, even just for temporary coupling, for example for hanging the hook from the jaw.

[0067] The second jaw 4 further comprises a surface 48 for the abutment of the safety hook 5 which in the assembly configuration faces the first jaw 3 and lies above the seats 41.

[0068] When the two jaws are closer one another in the tightening configuration (Figure 9c), the abutment surface 48 lies on a substantially vertical plane.

[0069] The bar 43 has a substantially right-angled quadrangular cross-section, with corners which are cut by inclined planes.

[0070] In a preferred embodiment, the bar 43 comprises a front side 430, which in the assembled configuration is directed toward the first jaw 3 and is substantially parallel to the abutment surface 48 and is staggered forward with respect to it; the front side 430 is adapted to make contact with the surface 23 of the shank 20 which lies above the cavity 21 in order to tighten the shank 20 between the two jaws.

[0071] As will become better apparent hereinafter, the front side 430 applies to the shank 20 the tightening force transmitted by the pneumatic cylinder to the two jaws.

[0072] A surface 431 for supporting the safety hook protrudes from the upper edge of the front side 430; said supporting surface 431 is inclined in the opposite direction with respect to the first jaw 3, i.e., seen from the front as in the accompanying figures from the bottom upwardly and from right to left, by an angle ranging from 30° to 60°.

[0073] In a preferred embodiment, the supporting surface 431 is inclined by an angle of substantially 45°, i.e., equal to 45° minus usual tolerances.

[0074] The safety hook 5 has the shape shown in Figure 5.

[0075] The safety hook 5 has a claw-shaped portion 50 which is provided at the lower end of the retention tooth 51 adapted to enter the cavity 21 of the shank 20.

[0076] A guiding profile 52 is formed proximate to the lower end of the claw-shaped portion 50 and to its outer curve and is adapted to facilitate the insertion of the shank 20.

[0077] An abutment surface 53 is formed on the internal curve of the claw-shaped portion 50 and proximate to the upper end thereof and duplicates the inclined supporting surface 431 on which it is meant to rest by sliding at the end of the step for the insertion of the shank 20 (Figure 8f).

[0078] A stem 54 protrudes from the upper end of the claw-shaped portion 50 and is provided with a wing 55 which is directed toward the second jaw 4 and rests so that it can slide freely on the abutment surface 48.

[0079] The wing 55 is beveled or rounded so as to form, when resting on the abutment surface 48, a fulcrum for the relative rotation of the second jaw 4 and of the safety hook 5.

[0080] A protrusion 56 protrudes from the stem 54, on the opposite side with respect to the wing 55, toward the first jaw 3 and defines an abutment for the tip 25 of the shank 20.

[0081] The shank 20 of the tool 2 is shown in Figure 7; it has a surface 23 at which the cavity 21 adapted to cooperate with the retention tooth 51 is provided.

[0082] The shank 20 further has a face 22 which lies opposite the surface 23 and is adapted to make contact, by vertical sliding, with the sliding surface 31 formed on the first jaw 3; a protrusion 24 protrudes from the face 22 substantially at right angles thereto and is adapted to abut against the surface 32 for stopping the sliding of the shank 20 which is provided in the first jaw 3.

[0083] The shank 20 ends in an upward region with a tip 25 which is adapted to make contact with the protrusion 56 of the safety hook 5.

[0084] Operation of the invention is as follows.

[0085] The device 1 allows to insert and extract the tool 2 with a combined vertical translational and rotary motion from the bottom upwardly and vice versa.

[0086] Figures 8a-8f illustrate sequentially the steps for the insertion of the shank 20 of a tool 2 between the two jaws of the device 1.

[0087] The first jaw 3 and the second jaw 4 are kept open, i.e., with their lower ends mutually spaced, by the elastic contrast means 8, the pneumatic cylinder which acts between their upper ends being in the retracted configuration.

[0088] The tool 2 is inserted manually by applying thereto a vertical thrust from the bottom upwardly, as indicated by the arrow of Figure 8a.

[0089] The tip 25 of the shank 20 makes contact with the guiding profile 52, beyond which the surface 23 slides in contact with the retention tooth 51, while the outer

curve of the claw-shaped portion 50 makes contact with the lower end of the arc-like wall 42 (Figure 8b).

[0090] By continuing to push the tool 2 upwardly, the tip 25 makes contact with the protrusion 56 and applies an upward thrust thereto, lifting and turning the safety hook 5 (Figure 8d), the retention tooth 51 whereof enters the cavity 21.

[0091] When the protrusion 24 makes contact with the stop surface 32, the tool 2 is released and slides downwardly for a preset stroke. During this stroke, the safety hook 5 is moved downwardly until an equilibrium configuration is reached in which the safety hook 5 keeps the tool 2 suspended, the jaws being still open (Figure 8f).

[0092] In this configuration, the outer curve of the claw-shaped portion 50 of the safety hook 5 rests on the lower end of the arc-like wall 42, the abutment surface 53 rests against the supporting surface 431 of the bar 43, the surface 23 makes contact with the stem 54, and the retention tooth 51 makes contact with the upper edge of the cavity 21.

[0093] Figures 9a-9c illustrate sequentially the steps for tightening the two jaws.

[0094] The pneumatic cylinder is in the extended configuration, applying to the upper ends of the two jaws a force which contrasts the reaction of the elastic means 8.

[0095] The second jaw 4 rotates about the fulcrum formed by the joint 6 and transmits, by means of the safety hook 5, an upward thrust to the tool 2, which slides along the sliding surface 31.

[0096] During the rotation of the second jaw 4 about the joint 6, the safety hook 5 slides upwardly and the bar 43, rigidly coupled to the second jaw 4, moves toward the shank 20 until the front side 430 thereof makes contact with the surface 23 of the shank 20.

[0097] When the protrusion 24 of the shank 20 abuts against the stop surface 32 of the first jaw 3, the tightening of the two jaws is completed by way of the elastic yielding of the arc-like wall 42.

[0098] Figure 9c illustrates the locking configuration of the device 1, in which the tightening force of the two jaws is transferred to the shank 20, which is locked between the sliding surface 31 and the front side 430 of the bar 43.

[0099] Figures 10a-10c illustrate sequentially the steps for the spacing of the two jaws to release the tool 2.

[0100] The pneumatic cylinder is returned to the retracted configuration and the second jaw 4, by way of the elastic reaction of the elastic means 8, rotates about the joint 6, moving its lower end away from the first jaw 3.

[0101] When the tightening action ceases, the arc-like wall 42 performs an elastic return.

[0102] During the opening rotation of the two jaws, the tool 2 slides downwardly, entraining the safety hook 5, until an equilibrium configuration is reached in which the tool 2 is kept suspended from the safety hook 5 (Figure 10c).

[0103] In order to extract the tool, as shown in Figures 11a-11f, it is necessary to apply to the tool 2 an upward vertical thrust until the protrusion 24 abuts against the

stop surface 32 and the tip 25 makes contact with the protrusion 56.

[0104] Starting from this position, it is necessary to apply to the tool 2 a rotary action, as indicated in Figures 11b-11d. The tip 25 rests, without sliding, against the stem 54, while the rear edge of the protrusion 24 rests against the stop surface 32, acting as pivoting points for the rotation of the tool 2.

[0105] During this rotation, the retention tooth 51 disengages from the cavity 21, moving into a position in which it does not interfere with said cavity (Figure 11 d). At this point it is sufficient to apply to the tool 2 a downward extraction action in order to extract it from the device 1.

[0106] During this sliding, the retention tooth 51 slides along the surface 23.

[0107] Figures 12a-12c illustrate sequentially the step for the extraction of the tool 2 without rotation.

[0108] In practice it has been found that the described invention achieves the intended aim and objects.

[0109] The locking device according to the invention allows to perform tool replacement operations, both when the tool is constituted by a monolithic body and when it is constituted by a plurality of segments, simply and with easy maneuvers for insertion and extraction with combined sliding and rotation movements on a vertical plane, in a short time and with limited machine downtimes.

[0110] The locking device according to the invention allows to perform insertion and extraction of the tool safely, ensuring that said tool is retained in the momentarily suspended configuration when the jaws are open, by being supported by the safety hook.

[0111] In this regard, it is noted that the safety hook, as well as the jaw that supports it, have no teeth or tabs which are adapted to mate in order to keep the hook suspended.

[0112] The configuration of the seat for accommodating the claw-shaped portion of the safety hook and the presence therein of the transverse bar allow to support the safety hook so that it can move with respect to the jaw and in full safety.

[0113] The elasticity of the arc-like wall that closes in a rear region the seat of the claw-shaped portion of the safety hook allows to apply to the shank of the tool the necessary tightening force, locking it safely and stably.

[0114] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept.

[0115] All the details may further be replaced with other technically equivalent elements.

[0116] In practice, the materials used, as well as the shapes and the dimensions, may be any according to requirements without thereby abandoning the scope of the protection of the appended claims.

[0117] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the

interpretation of each element identified by way of example by such reference signs.

Claims

1. A device for locking a tool on a machine tool, particularly a plate bending press, comprising a first jaw and a second jaw, which can move toward each other and away from each other, and at least one safety hook, which is interposed between said first jaw and said second jaw and is provided with a retention tooth adapted to enter a cavity provided in the shank of a tool, **characterized in that** said second jaw is provided with at least one seat which is open toward said first jaw and with a transverse bar which is accommodated in said seat and is rigidly associated with said second jaw, said safety hook being supported so that it can move by said second jaw and having a claw-shaped portion which is directed toward said first jaw and is accommodated in the space of said seat that is delimited by said bar and whose lower end protrudes so as to define said retention tooth.
2. The device according to claim 1, **characterized in that** said seat is delimited, on the opposite side with respect to said first jaw, by an arc-like wall, the concavity whereof is directed toward said first jaw, said arc-like wall being adapted to cooperate with said claw-shaped portion of the safety hook.
3. The device according to claim 2, **characterized in that** said arc-like wall is elastically deformable.
4. The device according to one or more of the preceding claims, **characterized in that** said seat is delimited laterally by two sides, a slot being formed in at least one of said two sides in order to contain an anchoring portion of said bar, means for fixing said anchoring portion to said second jaw being provided.
5. The device according to one or more of the preceding claims, **characterized in that** said second jaw comprises a surface for the abutment of said safety hook which faces said first jaw and lies above said seat.
6. The device according to claim 5, **characterized in that** said bar comprises a front side which is directed toward said first jaw and is substantially parallel to said abutment surface and is staggered forward with respect to it, said front side being adapted to make contact with the surface of said shank that lies above said cavity.
7. The device according to claim 5 or 6, **characterized in that** said abutment surface lies on a substantially vertical plane when said first jaw and said second

jaw are close to each other in the tightening configuration.

8. The device according to claim 6 or 7, **characterized in that** said bar is provided with a surface for supporting said safety hook which runs from the upper edge of said front side and is inclined in the opposite direction with respect to said first jaw.
9. The device according to claim 8, **characterized in that** said supporting surface is inclined by an angle ranging from 30° to 60° with respect to said front side.
10. The device according to claim 9, **characterized in that** said angle is substantially 45°.
11. The device according to one or more of claims 8 to 10, **characterized in that** said safety hook is provided with an abutment surface which replicates said inclined supporting surface and is formed on the inner curve of the upper end of said claw-shaped portion.
12. The device according to one or more of the preceding claims, **characterized in that** said safety hook comprises a stem which protrudes from the upper end of said claw-shaped portion and is provided with a wing which is directed toward said second jaw and is adapted to rest, so that it can slide freely, on said abutment surface.
13. The device according to claim 12, **characterized in that** said wing is beveled so as to form, when it rests on said abutment surface, a fulcrum for the relative rotation of said second jaw and of said safety hook.
14. The device according to one or more of the preceding claims, **characterized in that** said safety hook is provided with a protrusion which is formed proximate to the upper end of said claw-shaped portion which protrudes toward said first jaw, said protrusion forming an abutment for the tip of said shank.
15. The device according to claim 14 and claim 12 or 13, **characterized in that** said protrusion is formed so as to protrude from said stem.
16. The device according to one or more of the preceding claims, **characterized in that** said claw-shaped portion of the safety hook is provided proximate to said lower end thereof, with a guiding profile for the insertion of said shank.
17. The device according to one or more of the preceding claims, **characterized in that** said first jaw can be rigidly associated with a machine tool and **in that** said second jaw is pivoted in a central position to said first jaw, linear actuation means being provided

which act between the upper ends of said first jaw and of said second jaw in contrast with elastic means.

18. The device according to one or more of the preceding claims, **characterized in that** said first jaw comprises a surface, which faces said second jaw, for the sliding of the face of said shank that lies opposite said cavity and a surface for stopping said sliding of the shank which lies substantially at right angles to said sliding surface and is adapted to make contact with a corresponding protrusion formed on the face of said shank that lies opposite said cavity.

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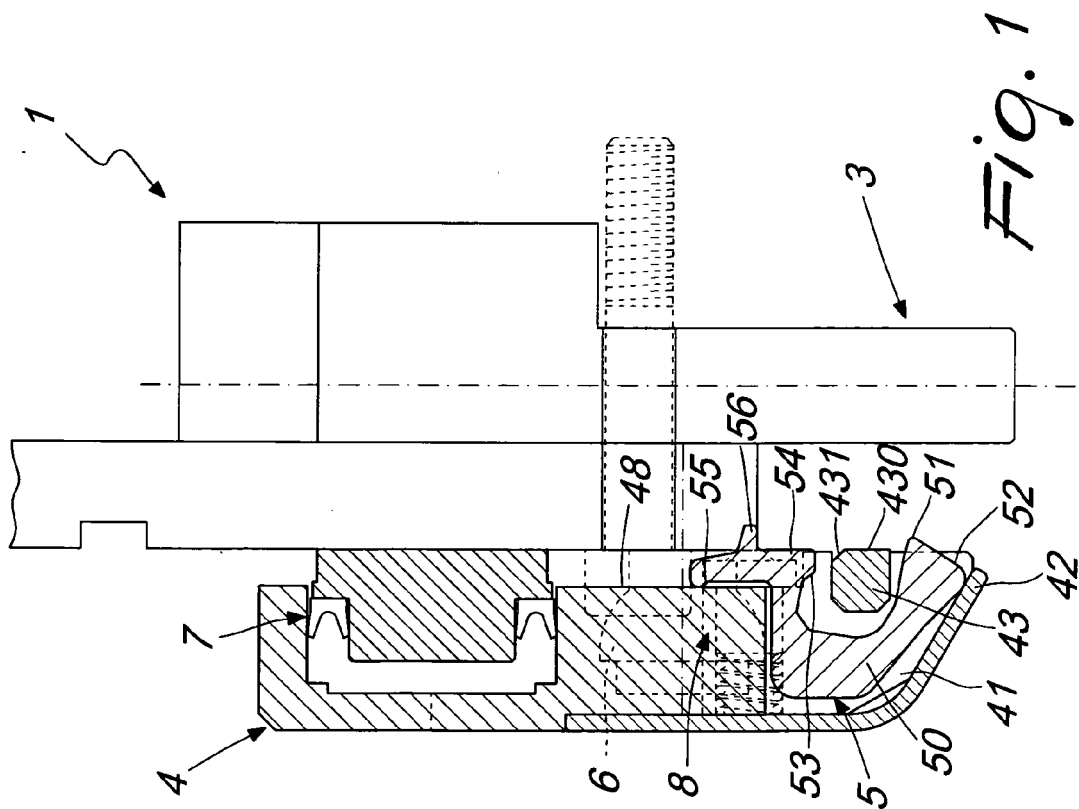


Fig. 1

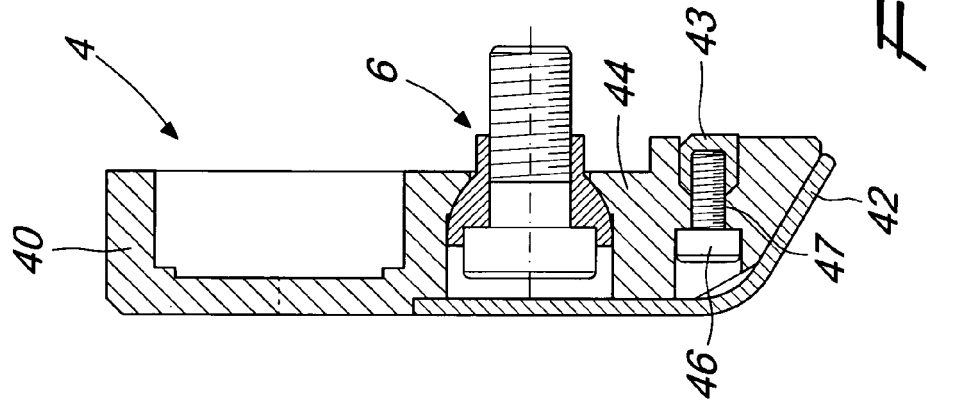


Fig. 3

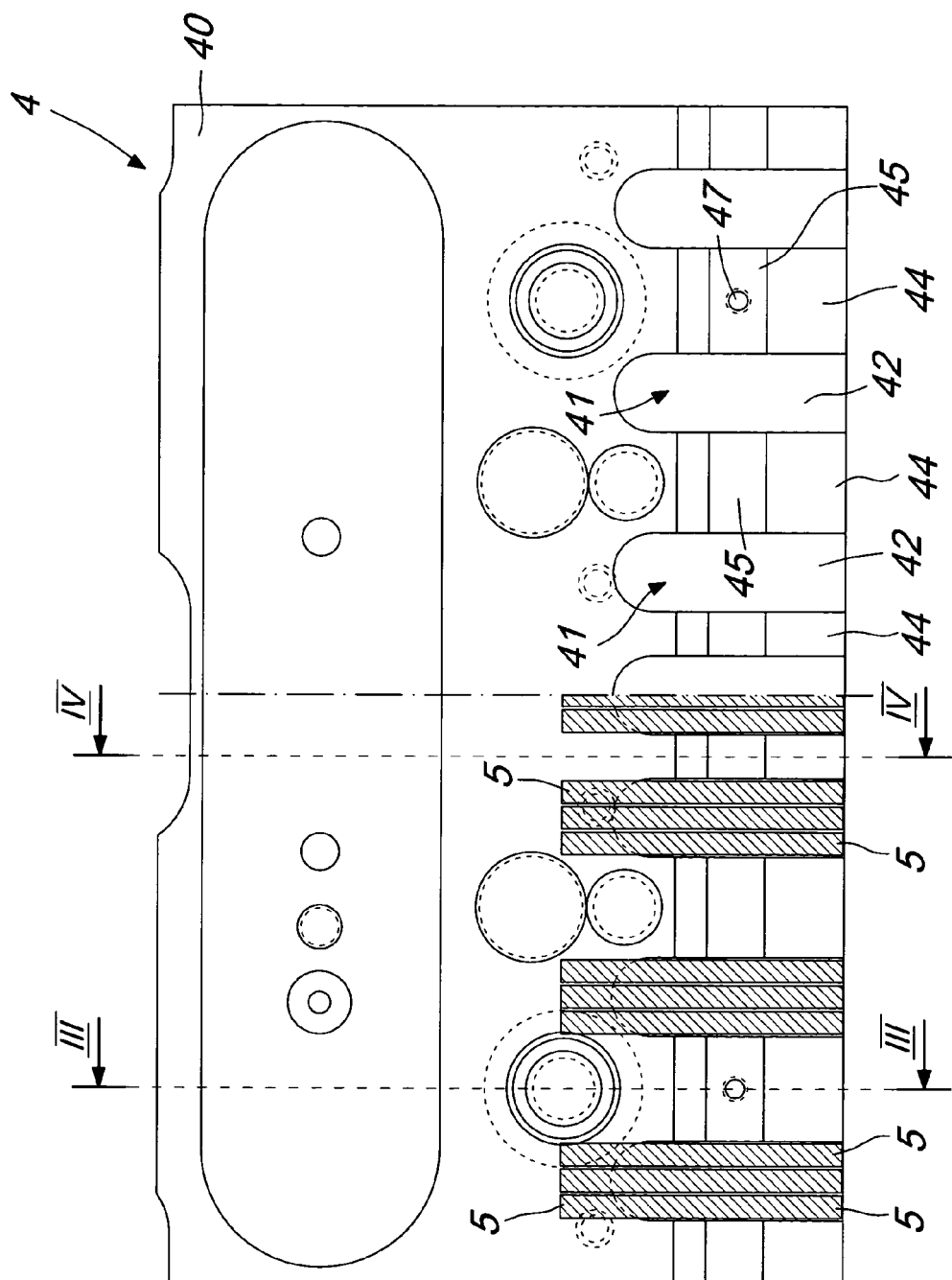
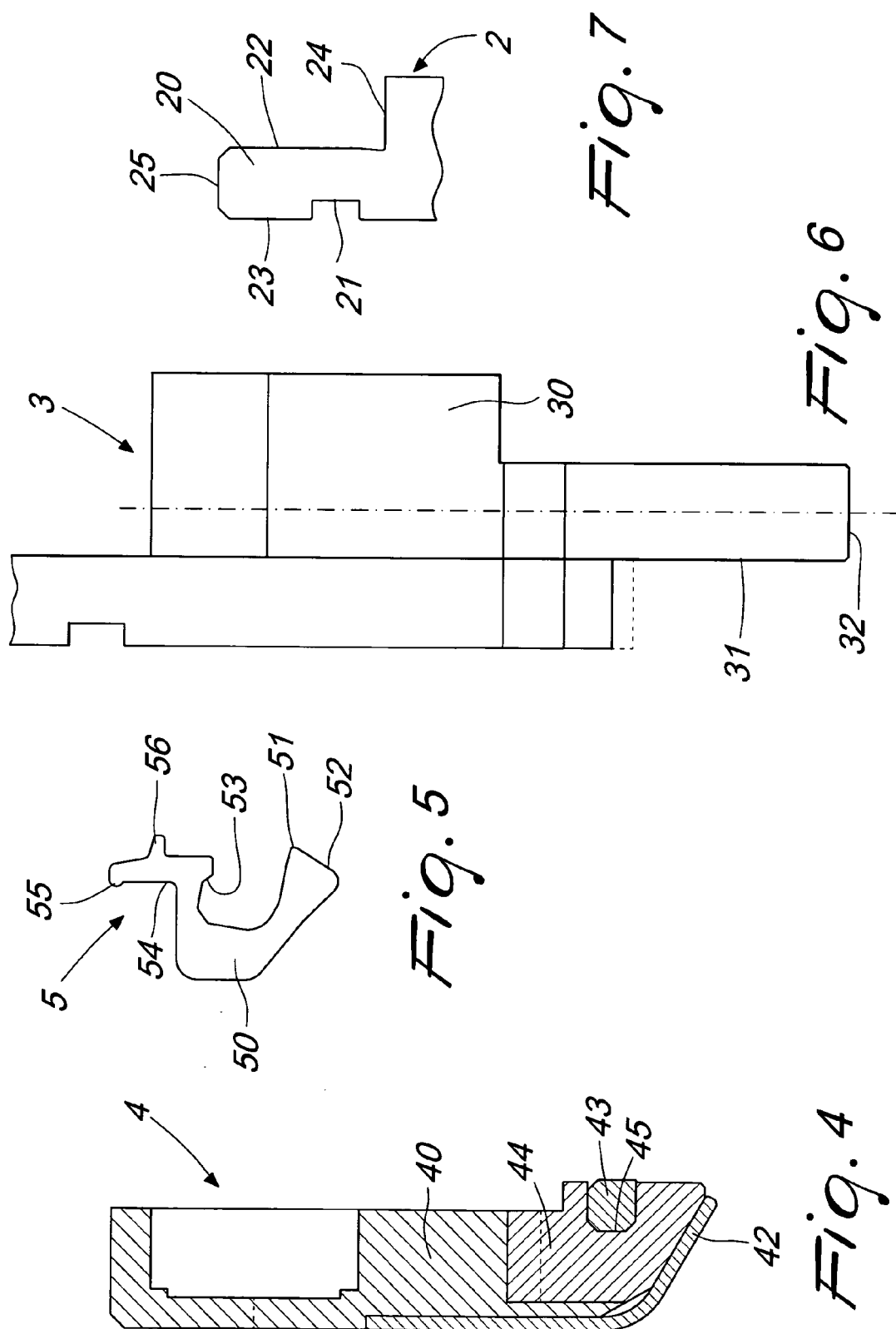
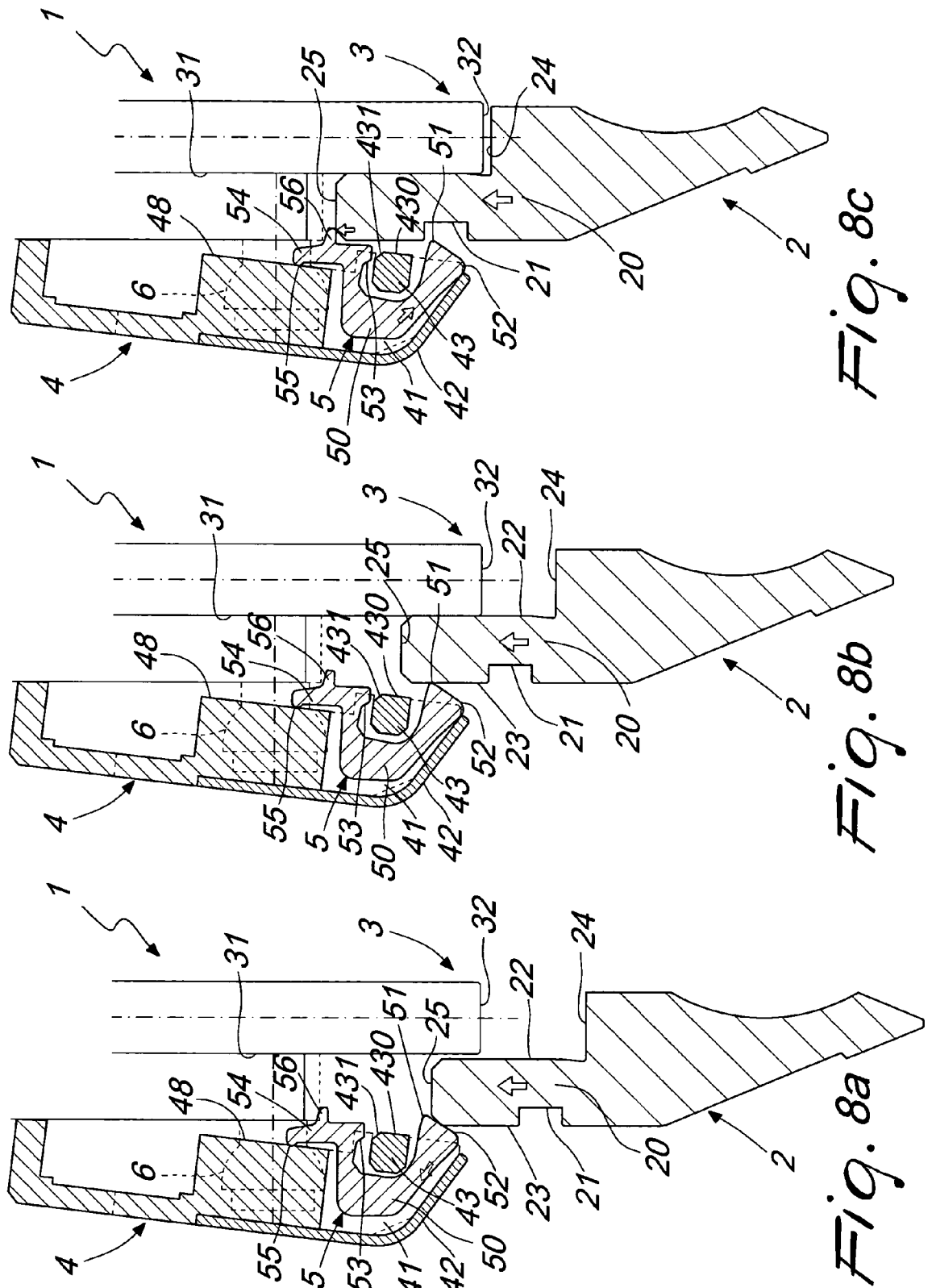
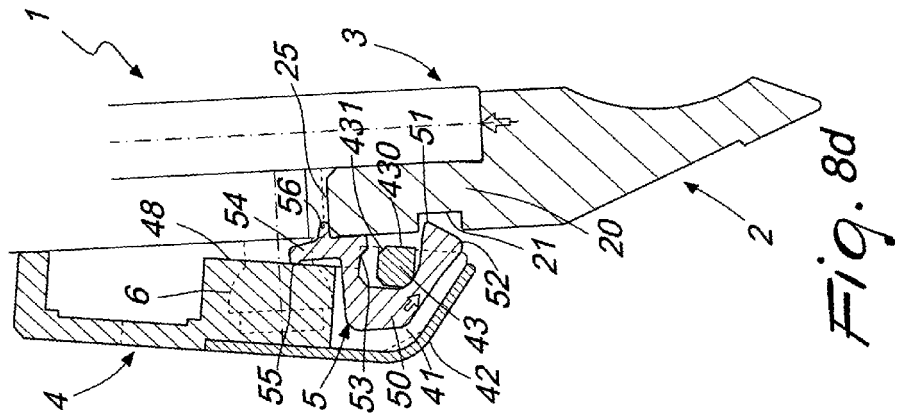
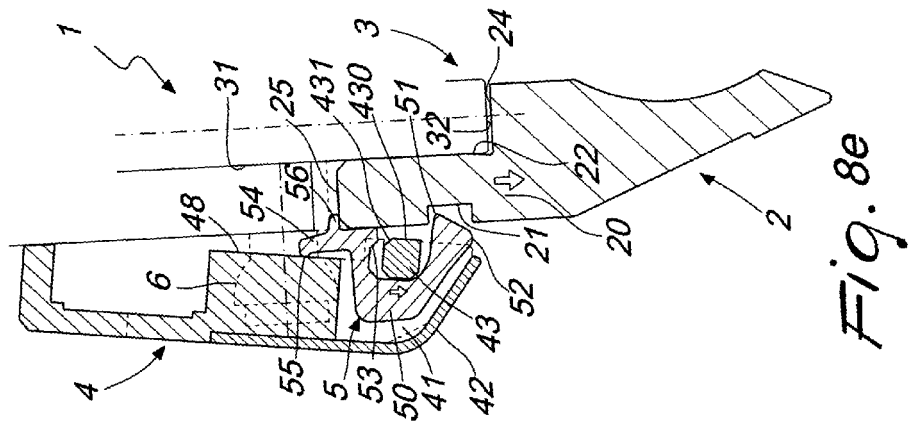
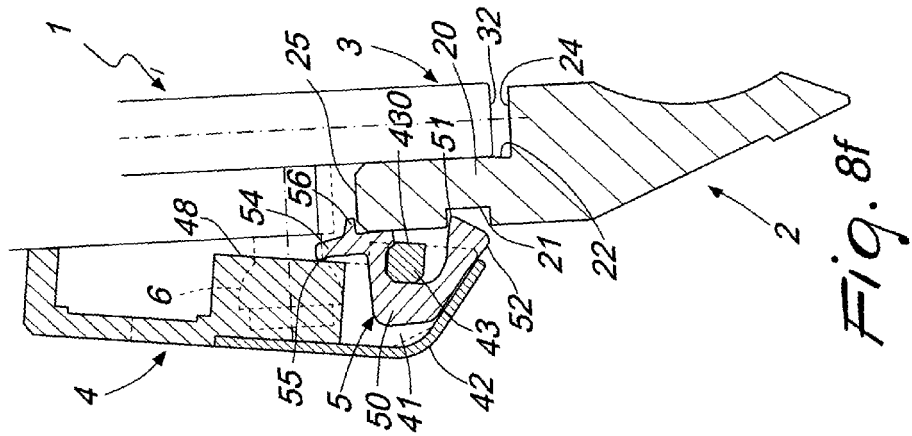
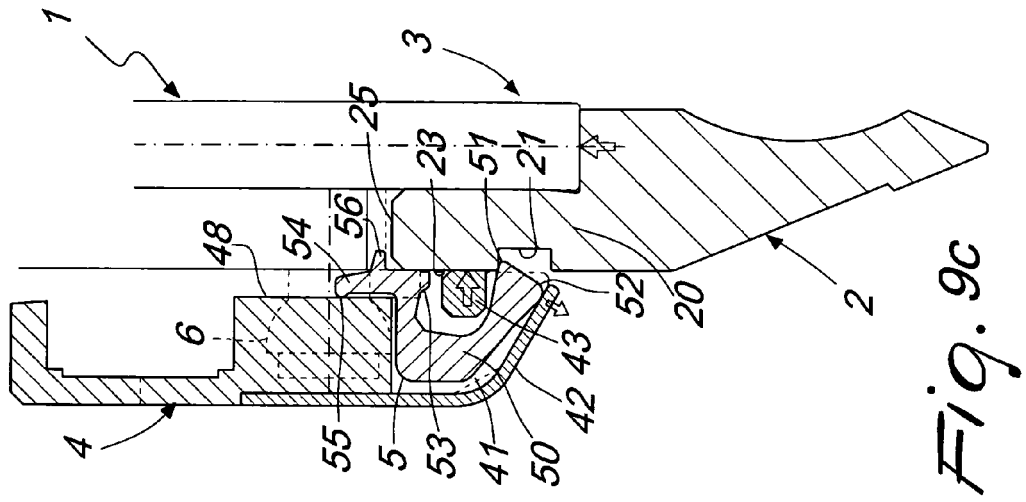
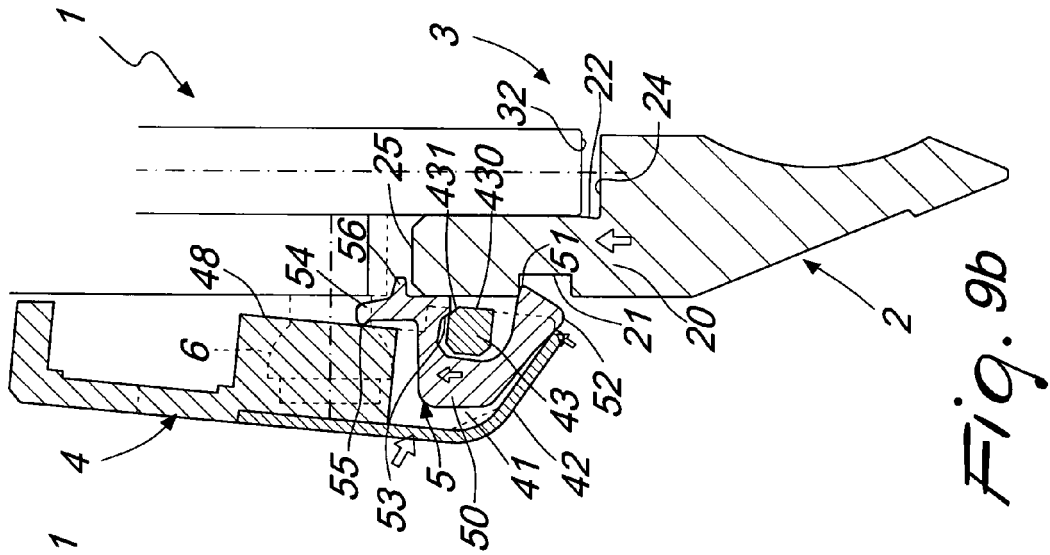
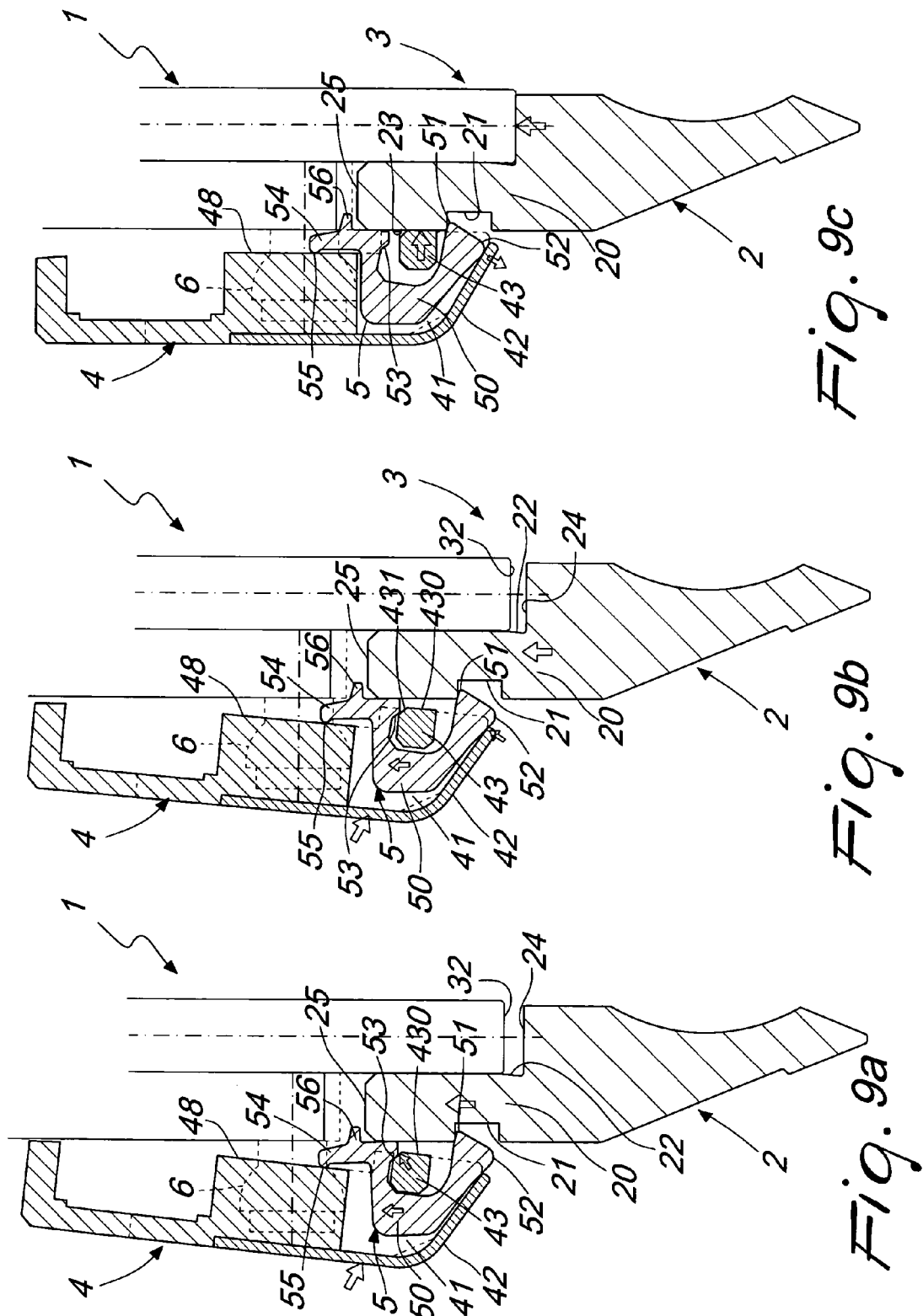


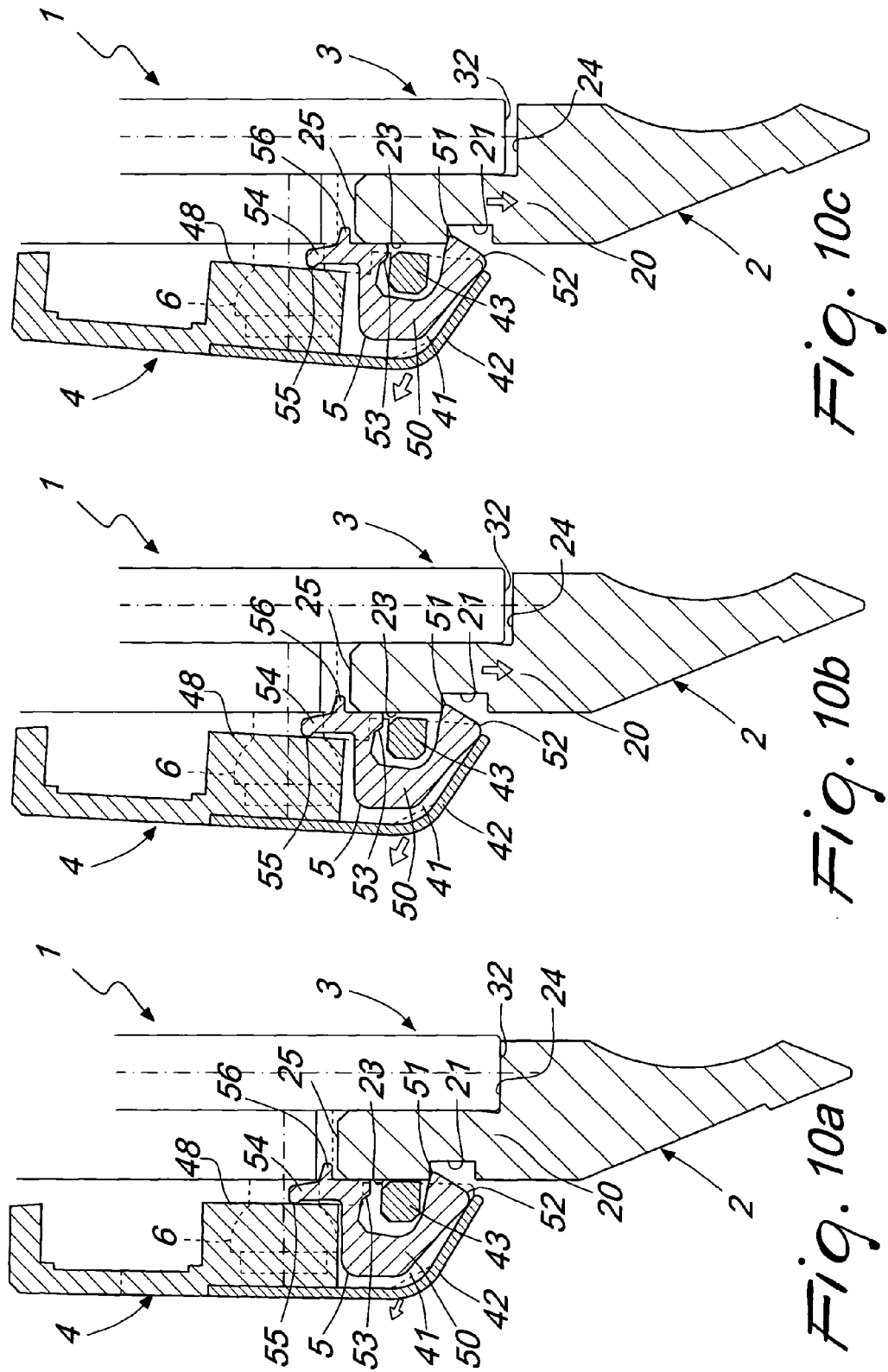
Fig. 2

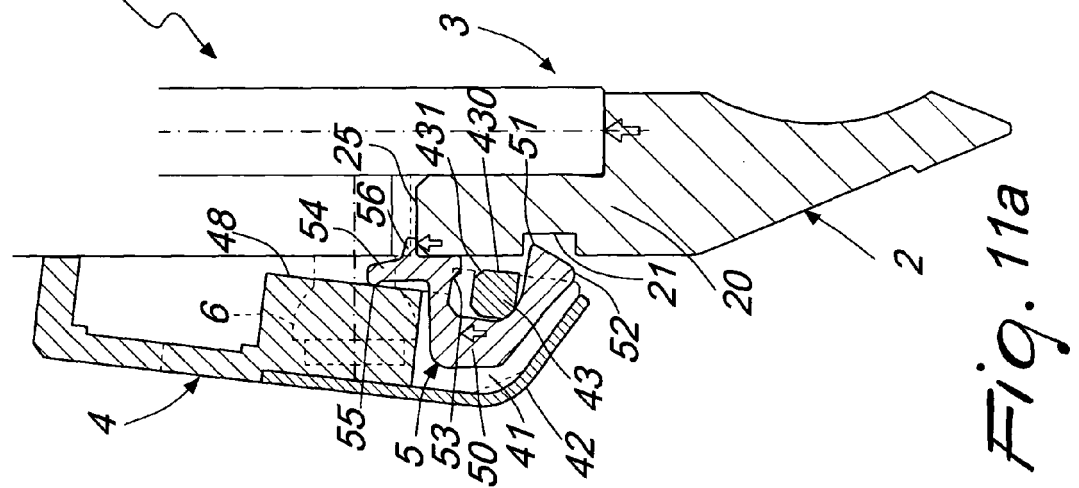
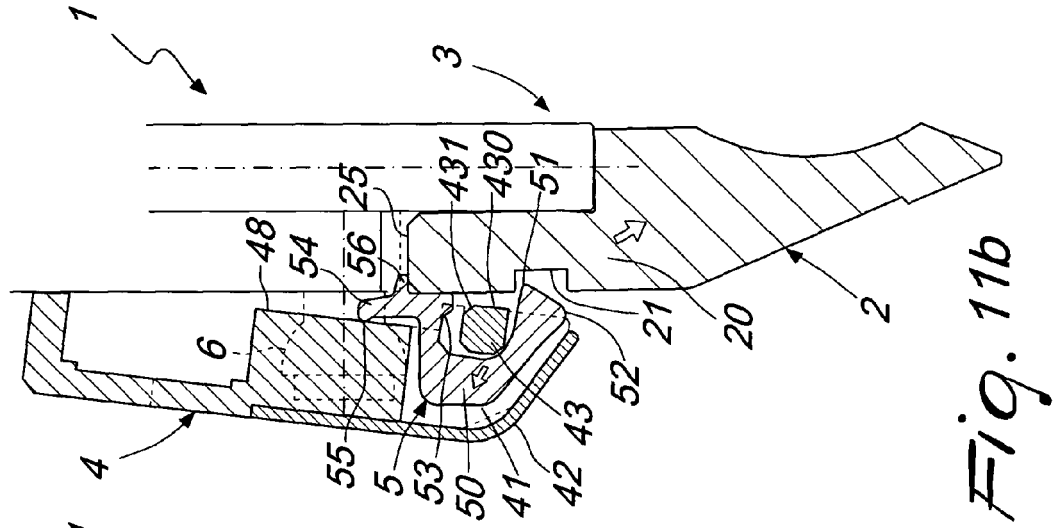
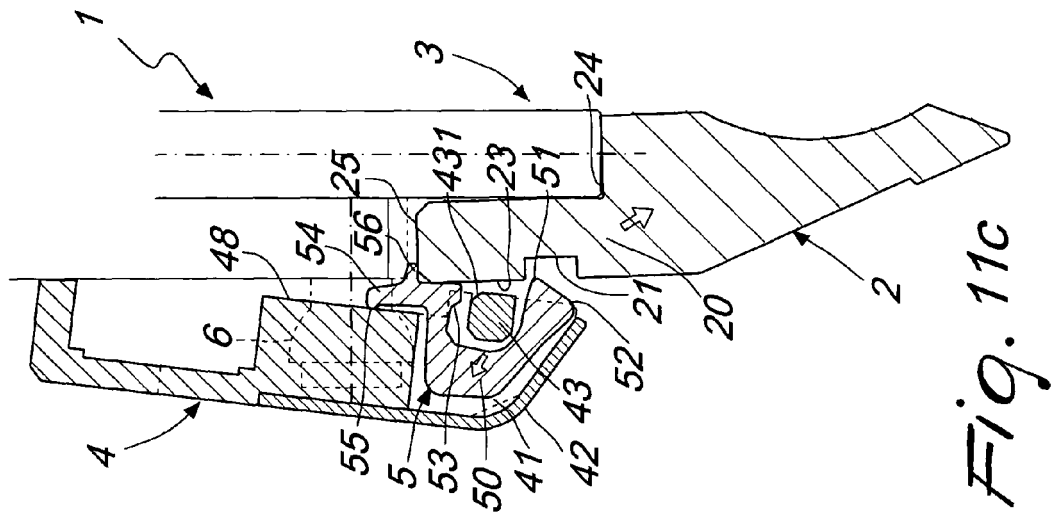












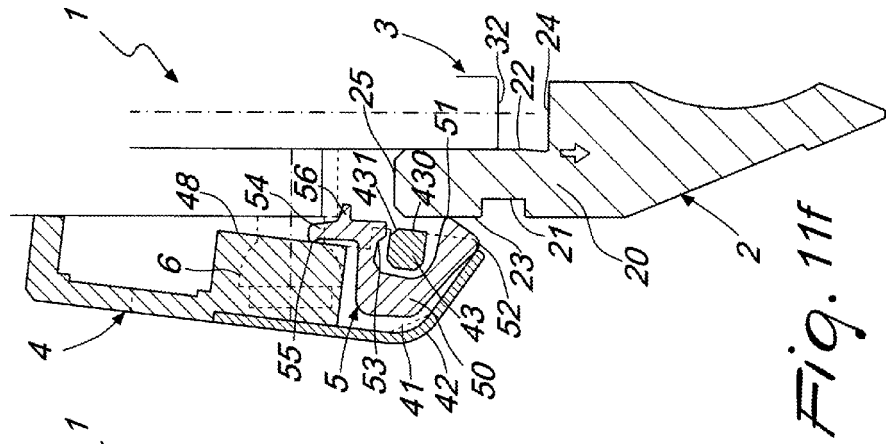


Fig. 11f

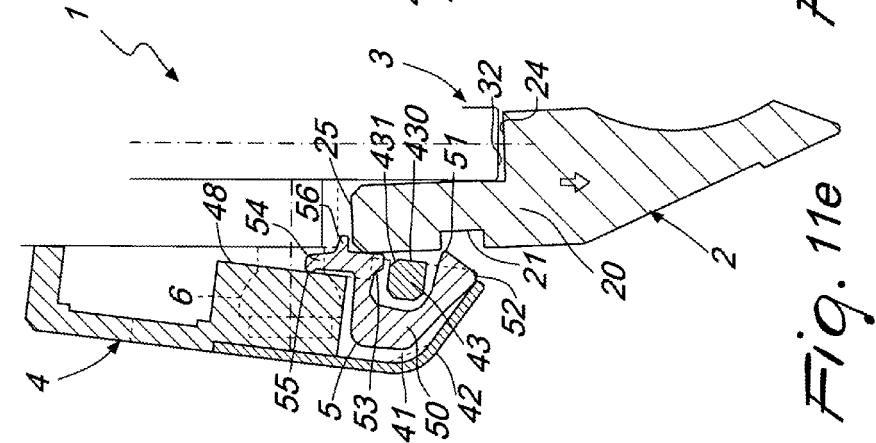


Fig. 11e

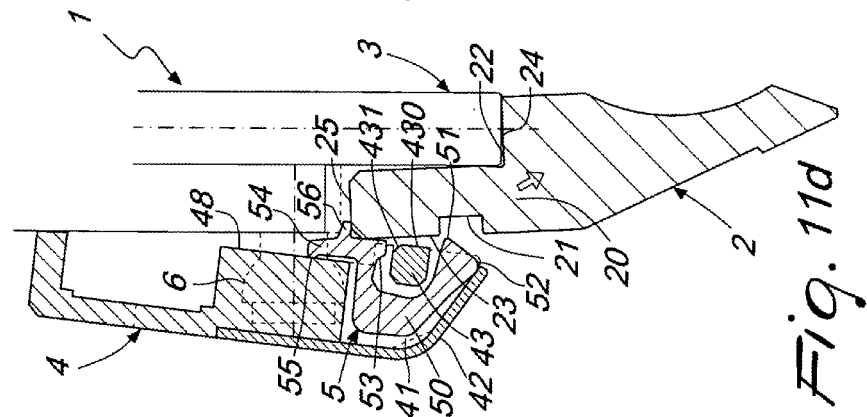
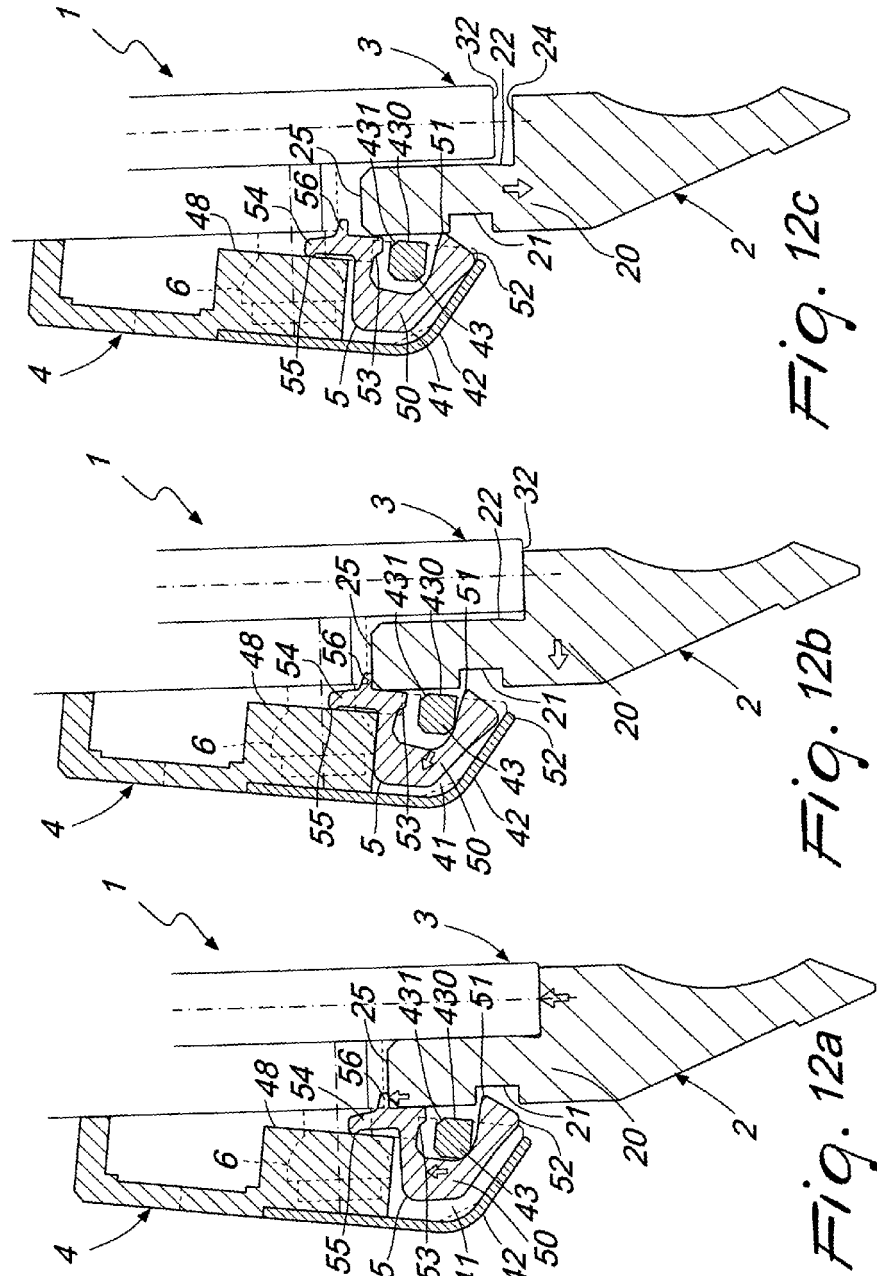


Fig. 11d





European Patent
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EUROPEAN SEARCH REPORT

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Place of search Munich		Date of completion of the search 30 January 2007	Examiner Vinci, Vincenzo
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