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(71) Applicant: **Bordogna S.p.A.**
25036 Palazzolo sull'Oglio (BS) (IT)

(72) Inventor: **Bordogna, Riccardo**
I-25036, Palazzolo sull'Oglio (BRESCIA) (IT)

(74) Representative: **Chimini, Francesco et al**
Jacobacci & Partners S.p.A.
Piazza della Vittoria 11
25122 Brescia (IT)

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(54) **Opening and closing assembly for a safe door**

(57) The invention relates to an opening/closing assembly (1) of a door (2) of a safe (3), comprising a handle assembly (10) fitted with a knob (12), a pinion (16) operatively connected to the command shaft (14) of the handle assembly (10), and at least one tie-rod (20a) pulling the closure pins of the door (2). The tie-rod (20a) has a rack portion (18) engaging in the pinion (16) so as to be moveable from a forward position of the door closed and the rearward position of the door open. The pinion (16) is, in addition, joined to a tang (24) containing an axial seat (26) in which a polygonal portion (14a) of the command shaft (14) is inserted in a shaped coupling. The handle assembly (10) is axially moveable in relation to said tang (24) between a rest position wherein the knob (12) is embedded in its respective seat (4) made in the door (2) and a rearward manoeuvre position wherein the knob (12) is outside the door (2) so as to be rotated.

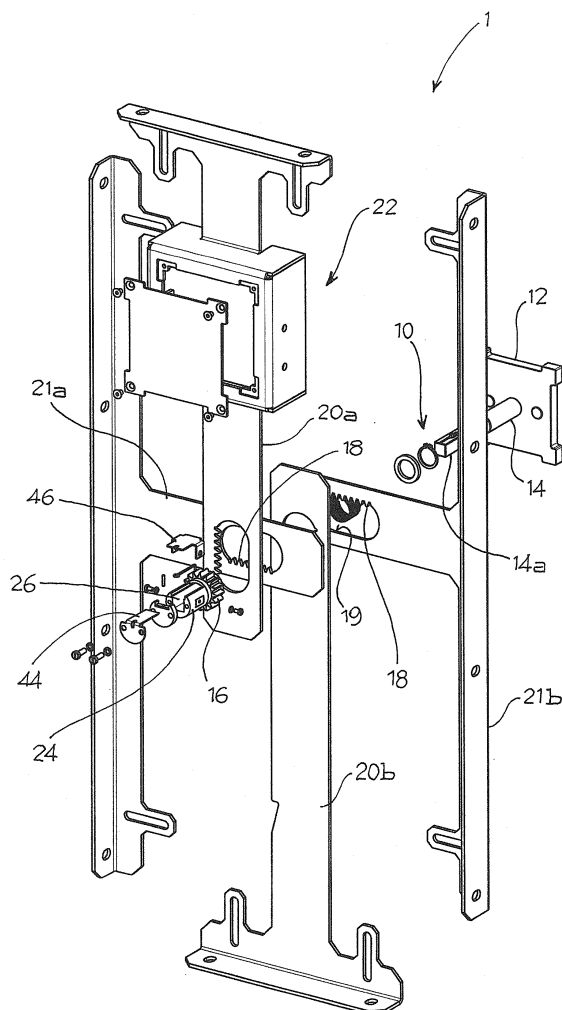


Fig. 1

Description

[0001] The present invention relates to an opening and closing assembly for the door of a safe, safe deposit box or similar container.

[0002] An opening/closing assembly for the door of a safe usually comprises a handle assembly rotating between a position in which the door is closed and a position in which it is open, a pinion being operatively connected to a command shaft of the handle assembly so as to turn between said positions of door open and closed and at least one pulling tie rod of the closure pins of the door, said tie rod having a rack portion engaging in said pinion so as to be movable from a forward position in which the door closed and a rearward position in which the door is open.

[0003] Usually a lock is associated with at least one of the tie rods to allow or prevent it from sliding.

[0004] All the known opening/closing assemblies have a handle or knob to rotate the command shaft. Such handle or knob is always on view and significantly influences the aesthetic appearance of the safe. It should be emphasised that in some cases safes and safe deposit boxes have become out and out design elements to be displayed. So, as well as the obvious function of security, their aesthetic function too is becoming increasingly important and sought after.

[0005] The purpose of the present invention is to create and propose an opening/closing assembly for the door of a safe or safe deposit box which makes it possible to give the door, and thereby the entire container, a clean and linear aesthetic appearance, and specifically not constrained to the shape of the handle or knob.

[0006] Specifically, the task of the present invention is to make available an opening/closing assembly of a door and a door itself, which makes it possible to conceal the knob or handle inside the door when said knob or handle does not need to be manoeuvred.

[0007] Such purpose and such tasks are achieved by an opening/closing assembly according to claim 1 and by a door according to claim 12.

[0008] Further characteristics and advantages of the assembly according to the invention will be evident from the description below, made by way of a non-limiting example, with reference to the attached figures, wherein:

- figure 1 shows an exploded view of an opening/closing assembly of a door according to the invention;
- figure 2 is an exploded view of a part of the assembly according to the invention;
- figure 3 is a cross-section view of the assembled assembly in a rest position;
- figure 4 is a cross-section view of the assembled assembly in a forward release position;
- figure 5 is a cross-section view of the assembled assembly in a rearward manoeuvre position;
- figure 6 is a cross-section view of the assembled assembly during its return to the rest position; and

- figure 7 is a vertical cross-section of the safe with the door according to the invention.

[0009] With reference to the aforesaid figures, reference numeral 1 globally denotes, in its entirety, an opening/closing assembly of the door 2 of a safe 3, safe deposit box or similar container, according to the invention.

[0010] According to a general embodiment the assembly 1 comprises a handle assembly 10 which may be rotated manually by a user between a closed position and an open position of the door. Said handle assembly comprises an handling knob 12 and a command shaft 14 which extends from said knob having a portion 14a with a polygonal cross-section, for example, square.

[0011] According to a preferred embodiment, the knob 12 has a flattened shape, so as to be concealable inside the door 2, as will be further described below.

[0012] A pinion 16 is operatively connected to the command shaft 14 so as to rotate between said open and closed positions of the door. The teeth of the pinion engage in a rack portion 18 of at least one pulling tie-rod 20a, 20b, 21a, 21b of the closure pins of the door 2. Each tie-rod is therefore movable by a pinion 16 between a forward position of door closed and a rearward position of door open. In a typical embodiment illustrated in figure 1, the opening/closing assembly comprises an upper tie-rod 20a and a lower tie-rod 20b engaged in the pinion 16 so as to move vertically between a rearward position (of mutual approach), wherein the closure pins, pulled by the tie-rods, disengage from the body of the safe, and a forward position (of mutual distancing), wherein the closure pins engage in the body of the safe. In addition, the assembly 1 comprises a right tie-rod 21a and a left tie-rod 21b moving in the same way as the vertical tie-rods, but in a horizontal direction. Consequently, in this embodiment, the pinion 16 contemporarily engages in four portions of tie-rod shaped like a rack 18. For example, each tie-rod has an aperture 19 which the pinion is inserted in, one side of said aperture having a notching 18.

[0013] According to a preferred embodiment, at least one of the tie-rods has a lock 22 associated with it, for instance an electronic lock, enabling movement of the tie-rod, and therefore of the pinion 16 and with it the entire opening/closing assembly of the door, only when the lock is released by the user, for example, by inserting a code. When the lock is blocked, it is not possible to act on the opening/closing assembly of the door.

[0014] Coming back to the pinion 16, this is joined to a tang 24 with an axial seat 26 which the polygonal portion 14a of the command shaft 14 is inserted in by means of a shaped coupling. In other words, a cylindrical portion 24 extends axially from the pinion 16, for example on the side opposite the control knob 12, having a seat 26 for the polygonal portion 14a of the command shaft. The latter therefore passes through the pinion 16 and is inserted in the tang 24, which is welded, made in one piece with, or in any case joined to the pinion 16, so that rotation of the command shaft 14 causes the contemporary rota-

tion of the pinion 16 and of its tang 24.

[0015] As specified further below, the function of the tang 24 is to form a guidance device for the axial movement of the handle assembly 10 in relation to the other parts of the opening/closing assembly of the door which are, instead, joined to the door itself. Specifically, the handle assembly 10 is axially moveable between a rest position, in which the knob is embedded in its respective seat 4 made in an outer front portion 5 of the door 2 and a rearward manoeuvring position, wherein the knob 12 is extracted from said seat so as to be accessible and therefore manoeuvrable by the user.

[0016] According to one embodiment, an elastic element 28 acts on the handle assembly 10 tending to push the handle assembly into a rearward, manoeuvring position. Said elastic element 28 is countered by releasable retainer means joined to the tang 24 of the pinion and able, when not released, to restrain the handle assembly in a rest position.

[0017] In other words, the handle assembly 10 moves from a rest to a manoeuvring position under the influence of the elastic element 28 only after the retainer means have been released or unlocked.

[0018] According to a preferred embodiment, the elastic element 28 comprises a helical spring placed around the command shaft 14 and restrained on one side by the pinion 16 and, on the opposite side, by a washer 29 joined to the command shaft. For example, said washer 29 is fixed to the shaft 14 by a Seeger 30.

[0019] According to a preferred embodiment, the retainer means may be released by the user, acting directly on the handle assembly, as described below.

[0020] Alternatively, the retainer means may be released automatically by the lock itself. In this second case, the release of the lock would be automatically followed by extraction of the handle assembly to a manoeuvring position.

[0021] Coming back however to the embodiment in which the retainer means are released by the user, regardless of the lock status, according to a preferred embodiment, starting from the rest position, the handle assembly may be manually pushed into a forward position. Following said advancement of the handle assembly the retainer means are released, as will be described now.

[0022] It should be noted that this pushing forward of the handle assembly requires that the seat 4 of the knob 12 is slightly deeper than the thickness of the knob itself. However, the retainer means are able to block the handle assembly in an axial position such that the knob 12 is exactly flush with the surface of the door containing the seat of the knob itself.

[0023] According to a preferred embodiment, on one face of the polygonal portion of the command shaft there is a command track 32 engaging the free end of a restraining bar 34 joined to the tang of the pinion. More specifically, in one embodiment said bar 34 has one end 34a bound to the end of the tang and the opposite end 34b, for example, bent by 90° in relation to its axis, which

engages and slides in the command track 32 between a first position, corresponding to the rest position of the handle assembly, a second position corresponding to the forward position of said assembly, and a third position corresponding to the rearward manoeuvre position.

[0024] Preferably, the command track 32 extends essentially in the axial direction of the command shaft 14 in the shape of a Y facing the knob 12. In said track 32 a first branch 36 for the advancement of the handle assembly 10 from the rest position, a second branch 37 for the rearward movement of the assembly from the advanced position to the rearward manoeuvre position, and a third branch 38 for the return of the assembly from the rearward position to the rest position, passing through the advanced position, may be defined.

[0025] More specifically, the restraining bar 34 is bound to the tang 24 so as to be free to rotate in the plane parallel to that in which the command track is made. For example, the bar is mounted on a pin 38 which extends from a head plate 39 applied to the end of the tang opposite the pinion.

[0026] The command track 32 is defined by edges acting as cam surfaces guiding the restraining bar 34 when moving along said track following axial shifting of the shaft 14 of the handle assembly.

[0027] Specifically, (figure 3), the rest position of the handle assembly is defined by the support of the free end 34b of the bar 34 against a concave shoulder 40 (in relation to the command shaft axis) of the track edge which coincides with the point of departure of the path towards the first branch 36 and with the point of arrival of the path along the third branch 38 of the track. In other words, the rest position is made in a central position in relation to the first branch 36 and the terminal section of the third branch 38, which extend parallel to the axis of the command shaft, in the direction of the knob.

[0028] Facing the concave shoulder 40, the edge of the command track forms an inclined plane 41 which, when the handle assembly is pressed into the forward position, forces the bar 24 into the first branch 36, as far as the end of it (figure 4). The length of the first branch thereby determines the forward stroke of the handle assembly.

[0029] The second branch 37 has a first portion 37' which extends axially in continuation of the first branch 36, but towards the free end of the command shaft. The second branch 37 then continues with an inclined section 37'' towards the centre of the shaft and ends with an axial section 37''' reaching as far as the end of the command shaft.

[0030] As a result, when the bar 34 is at the end of the first branch, the thrust of the elastic element 28 makes it reverse along the first branch 36 and then all the second branch 37, the bar finding no obstacles along this path.

[0031] When the bar reaches the end of the second branch 37 it causes the handle assembly to stop in a rearward manoeuvre position (figure 5).

[0032] The third branch 38 has a first section which

coincides with the axial section of the second branch, a second inclined section which deviates the bar laterally to the side opposite that of the first branch, and a terminal section parallel to the first branch. The second inclined section is defined by a cam surface 42 which forces the bar to enter said second inclined section when the handle assembly is pressed forward from the rearward manoeuvre position.

[0033] Given that the third branch terminates at the same height as the first branch, when the rod reaches the end of the final section of the third branch, the handle assembly reaches the forward position (figure 6). By releasing the handle assembly, the elastic element 28 joined to it makes the bar reverse along the final section of the third branch 38 bringing it back to abut against the concave shoulder 40, in other words, to the rest position.

[0034] According to a preferred embodiment, the restraining bar 34, obviously except for its free end 34b engaging the track, rests on a lower plate 44 overlaying the command shaft and acting as an oscillation plane for the bar. In addition, the bar 34 is restrained above by an upper blockage plate 46. The two lower 44 and upper 46 plates are attached, for example, by screws to the tang 24 of the pinion.

[0035] According to a preferred embodiment, the command shaft 14 of the handle assembly is inserted so as to slide inside a tube 48 which traverses the thickness of the door and at the end of which, opposite the knob, the pinion 16 with relative tang 24 is joined.

[0036] More specifically, in one embodiment the pinion has a flange 16' which slots into the end of said tube 48 and against which the elastic element 28 joined to the handle assembly 10, leans.

[0037] According to one advantageous embodiment, the pinion and relative tang are assembled to the door by means of an attachment plate 50 which engages the rear side of the teeth of the pinion, that is the side facing the inside of the safe, which is attached to the inside of the door.

[0038] Specifically, in a preferred embodiment, the tube 48 housing the command shaft protrudes from the inner surface of the door 2 in its final section. At the height of the end of the tube an anchorage plate 52 extends parallel to the inside of the door, to which threaded bushes 54 are attached to screw the attachment plate 50 parallel to it, to said anchorage plate. In practice, the pinion 16 is thus placed between the anchorage and attachment plates.

[0039] Starting from a door having a seat for the knob, the housing tube of the command shaft and the anchorage plate, assembly of the opening/closing assembly is very easy and fast.

[0040] In fact, it is sufficient to attach the washer for the spring to the command shaft, for example using a Seeger, and insert the handle assembly in the door, making the command shaft go through the relative housing tube. At this point the elastic element is inserted in the tube and the pinion with relative tang applied to the tube.

[0041] After positioning the tie-rods on the pinion, the attachment plate is screwed to the anchorage plate, thus blocking the pinion and relative tang in position. After which the head plate, lower plate, bar and upper plate are assembled in succession.

[0042] The functioning of the opening/closing assembly according to the invention is clear from the above description.

[0043] Starting from a rest position, wherein the knob of the handle assembly is embedded in its seat, flush with the outer surface of the door, by exerting a slight manual pressure on said knob the handle assembly is thrust into a forward position, releasing the retainer means. In this phase in fact, the restraining bar shifts from its rest position towards the end of the first branch. At this point, the release of pressure on the knob allows the elastic element joined to the command shaft to push the handle assembly into a rearward manoeuvre position. In this position, if the lock is released the handle assembly can be rotated to move the tie-rods and therefore open or close the door.

[0044] By pushing the handle into a forward position the restraining bar is shifted from its limit position in the second branch to the end of the third branch. At this point, when the knob is released the elastic element brings the bar back against the concave shoulder, and thereby the handle assembly to the rest position.

[0045] A person skilled in the art may make modifications, adjustments and replacements of elements with others functionally equivalent to the embodiments of the opening/closing assembly described above so as to satisfy contingent requirements while remaining within the scope of protection of the following claims. Each of the characteristics described as belonging to one possible embodiment may be realised independently of the other embodiments described.

Claims

1. Safe door opening and closing assembly, comprising:

- a handle assembly rotatable between a door closed position and open position, said handle assembly comprising an handling knob and a command shaft extending from said knob and having a polygonal section portion;
- a pinion operatively connected to said command shaft so as to be able to turn between said door open and closed positions;
- at least one door closure pin pulling tie rod, said tie rod having a rack portion engaged in said pinion so as to be able to slide between a forward door closed position and a backward opening position,

characterised by the fact that the pinion is joined

to a tang provided with an axial recess where the polygonal portion of the command shaft is inserted with geometric coupling, and by the fact that said handle assembly is slidable axially in relation to said tang between a rest position in which the knob fits into a respective recess provided in the door and a backward manoeuvring position wherein the knob is on the outside of the door to be rotated.

2. Assembly according to the previous claim, wherein an elastic element that tends to push the handle assembly into a backward position acts on the handle assembly, and wherein the pinion tang is associated to releasable retainer means able to keep the handle assembly in the forward position.
3. Assembly, according to claim 2, wherein, starting from the rest position, the handle assembly is susceptible to being pressed manually into a forward position and wherein said retainer means are released following said pressure on the handle assembly.
4. Assembly according to claim 3, wherein the polygonal portion of the command shaft is provided with a command track and wherein said retainer means comprise a restraint bar having an extremity joined to the tang and the opposite extremity engaging and sliding in said command track between a first position corresponding to the rest position of the handle assembly, a second position corresponding to the forward position of said assembly and a third position corresponding to the backward position.
5. Assembly according to the previous claim, wherein said track extends substantially in an axial direction with a Y-shaped arrangement facing towards the knob and defining a first branch for the progression of the handle assembly from the rest position, a second branch for the retreat of the assembly from the forward to the backward position and a third branch for the return of the assembly from the backward to the rest position, passing through the forward position.
6. Assembly according to the previous claim, wherein the restraint bar is joined to the tang so as to be free to rotate in the plain parallel to that in which the command track is provided.
7. Assembly according to the previous claim, wherein the command track is enclosed by edges acting as cam surfaces which guide the restraint bar in its movements along said edge following the axial shifting handle assembly shaft.
8. Assembly according to any of claims 4-7, wherein the restraint bar is positioned between an upper

blockage plate and a lower plate serving as an oscillation plane, said plates being fixed to the pinion tang.

9. Assembly according to any of the previous claims, wherein the handle assembly command shaft is inserted so as to slide inside a tube which crosses the thickness of the door and which, at the extremity opposite the knob, the pinion with relative tang is associated.
10. Assembly according to claim 9, wherein the pinion comprises a flange that inserts into the extremity of said tube, the elastic element joined to the handle assembly comprising a spring positioned around the command shaft and withheld between said flange and a washer fixed to the command shaft.
11. Assembly according to any of the previous claims, wherein the pinion and tang are assembled to the door by means of a fixing plate that engages the back surface of the pinion teeth and which is attached to the inner side of the door.
12. Door for safe, safety deposit box and the like, comprising an opening/closing assembly according to any of the previous claims, a safety lock able to block/unblock the at least one tie rod of the assembly, and a housing recess of the knob of said assembly, provided in a frontal portion of the door.
13. Safe comprising a door according to claim 12.

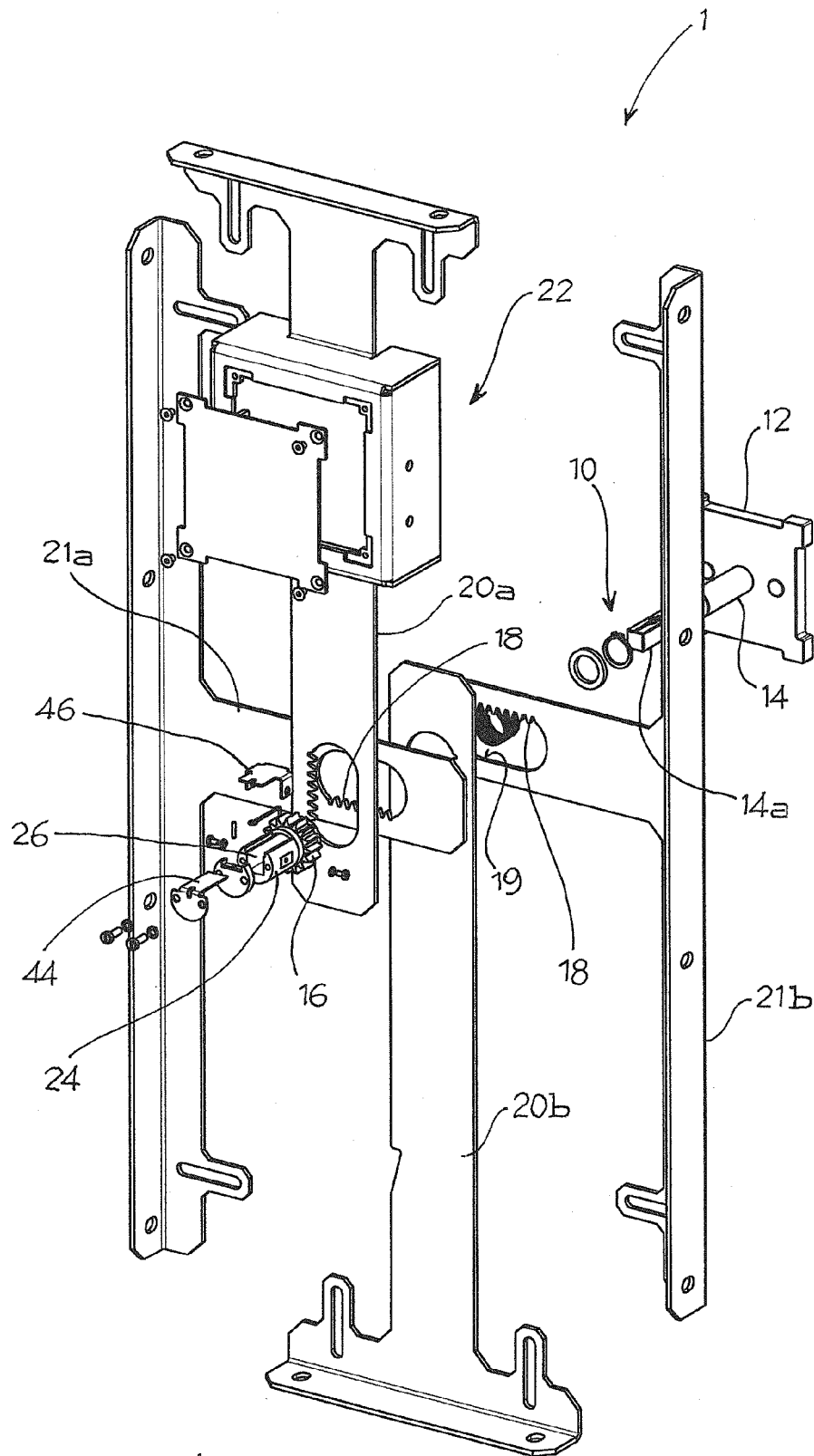


Fig. 1

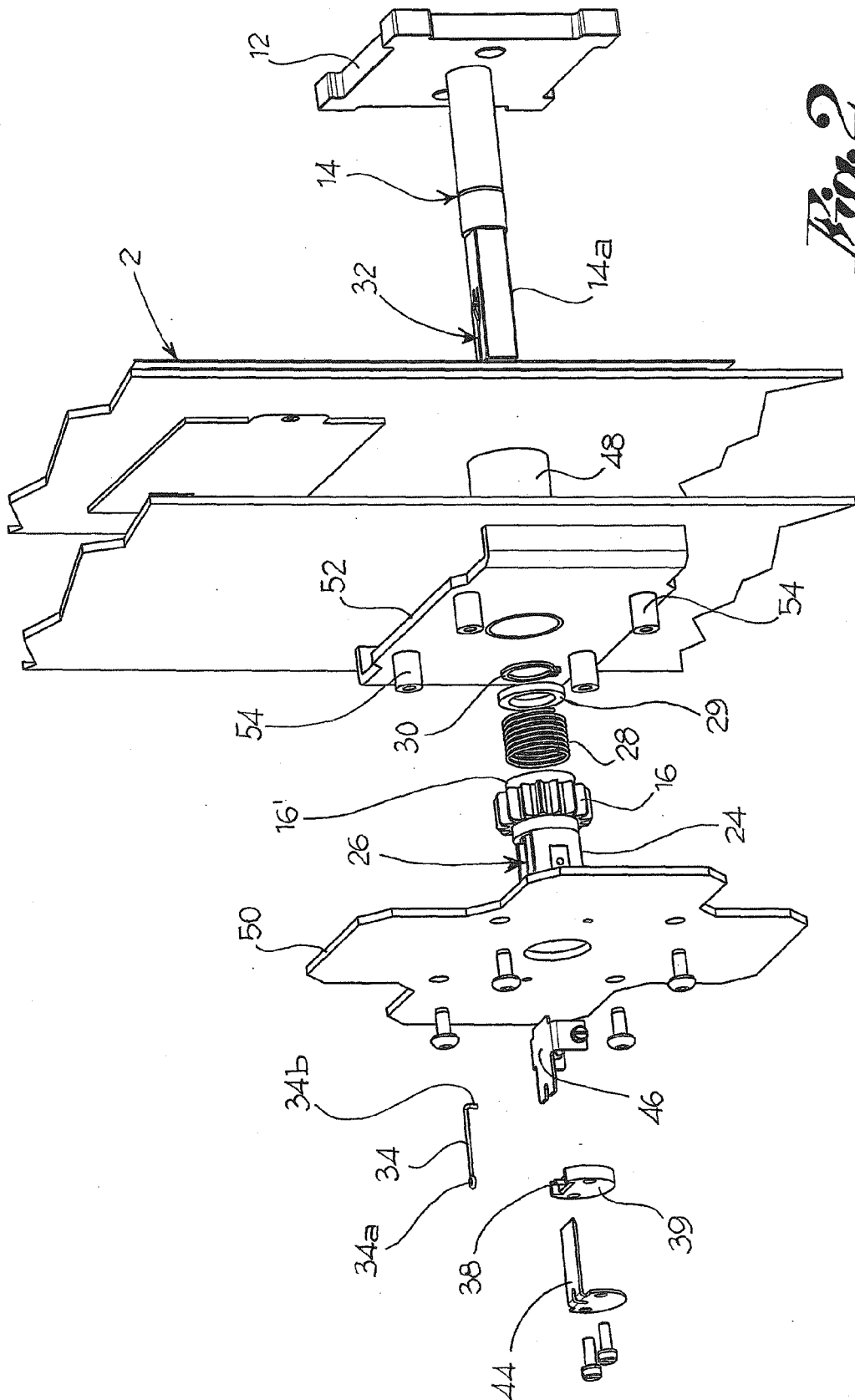


Fig. 2

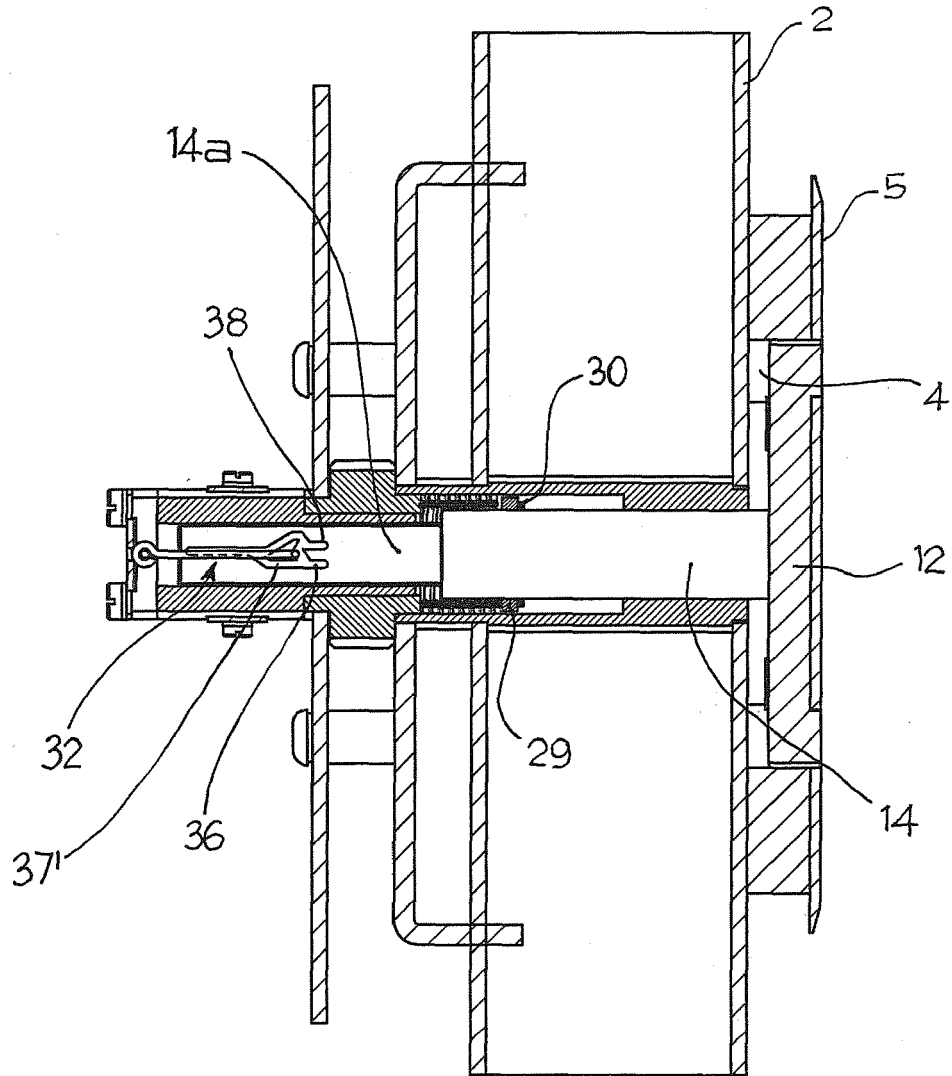
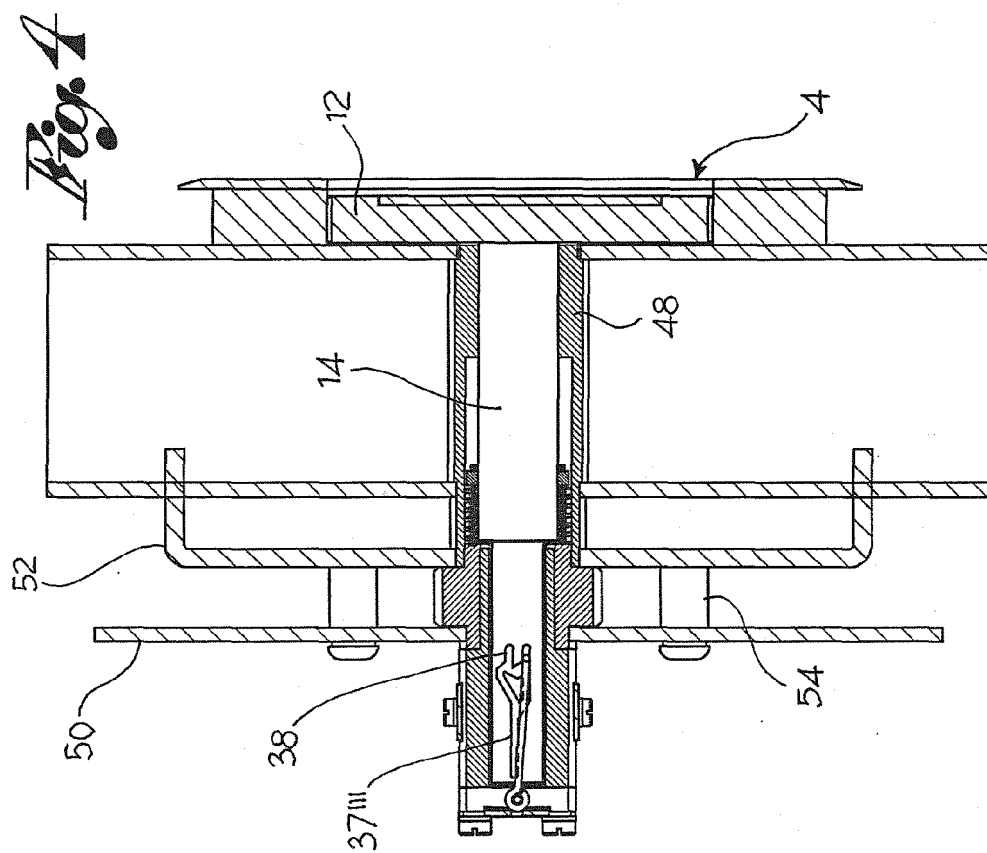
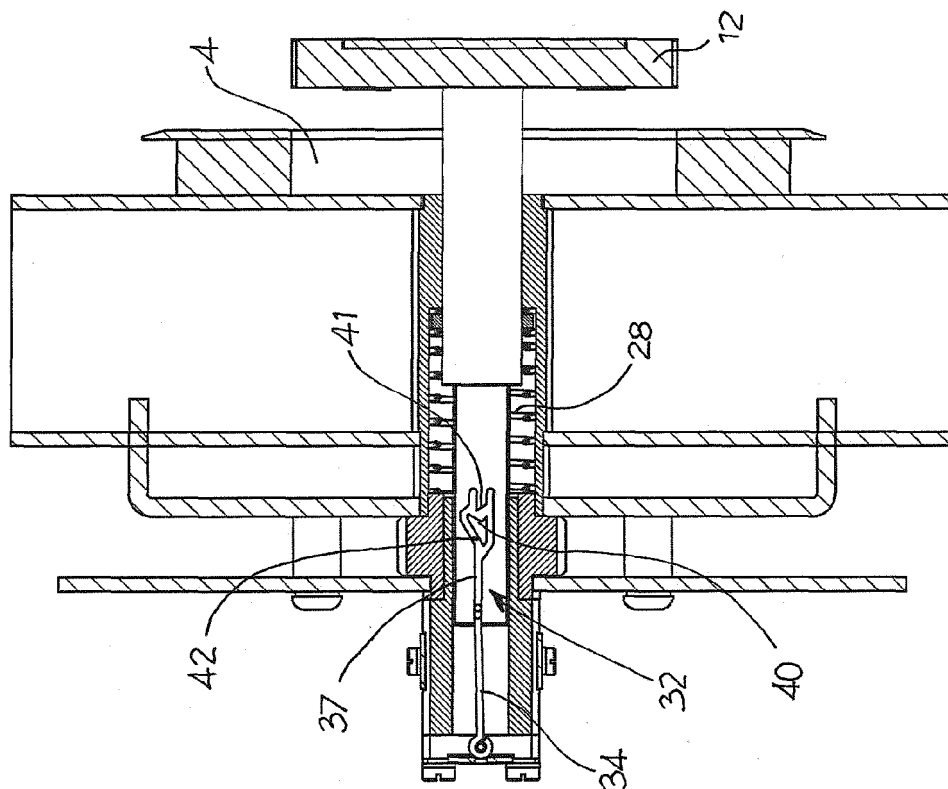


Fig. 3



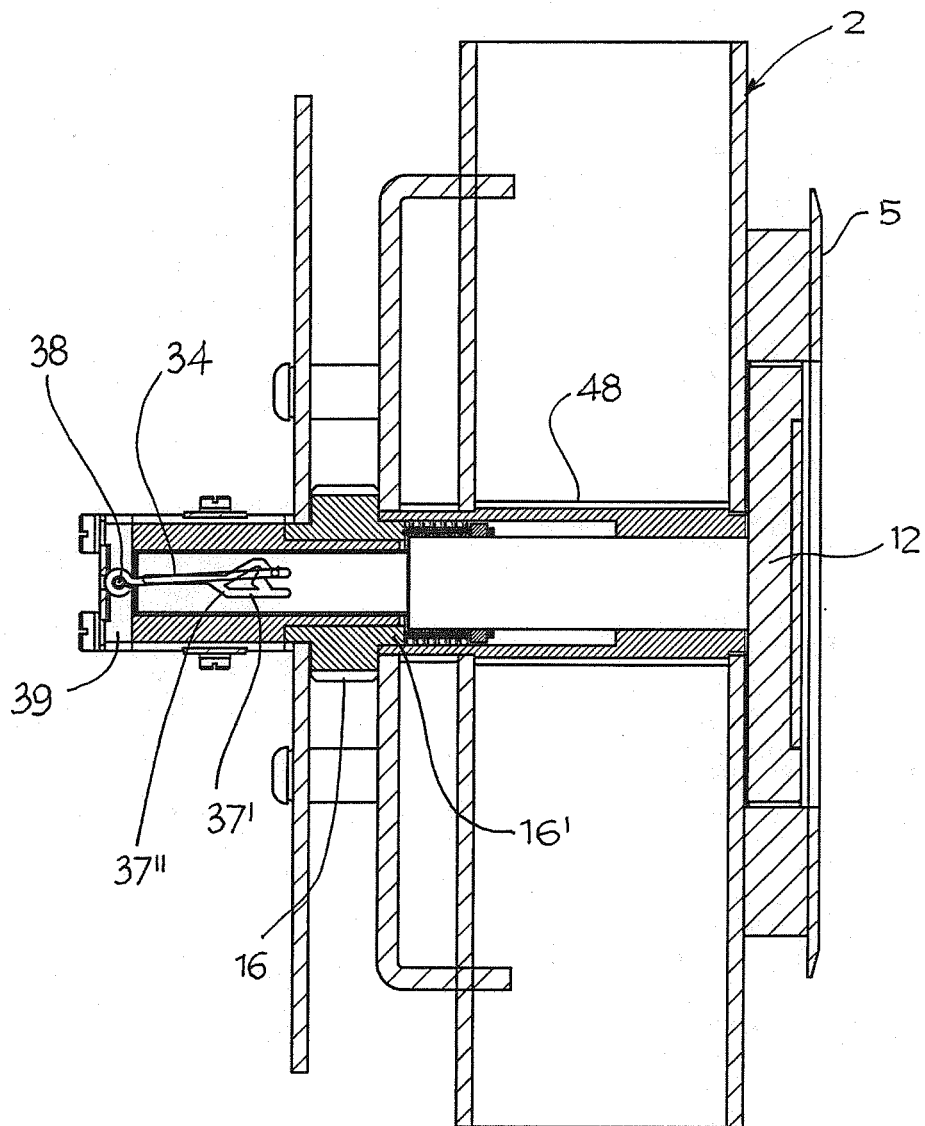


Fig. 6

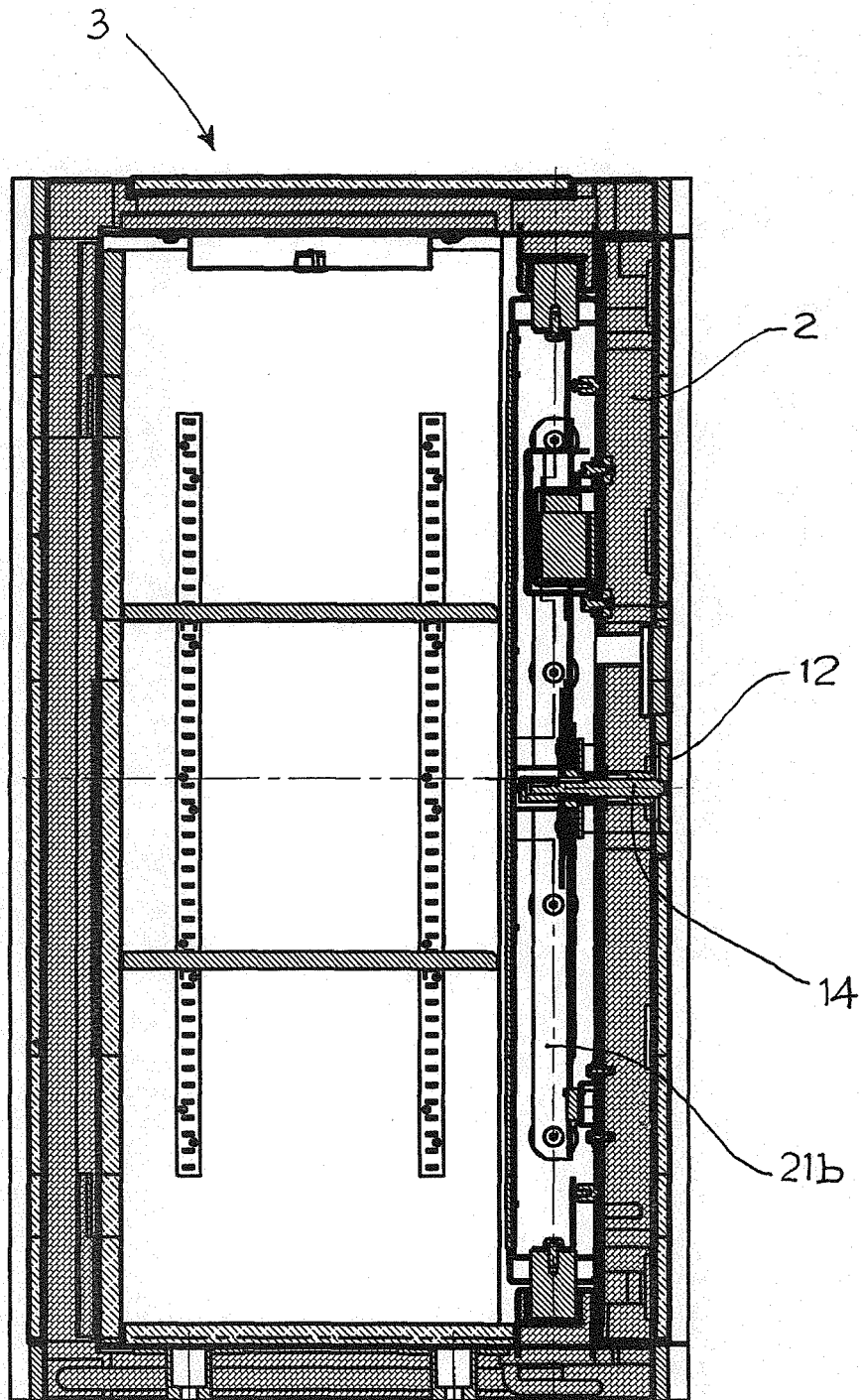


Fig. 7



EUROPEAN SEARCH REPORT

Application Number
EP 09 17 3045

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CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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