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(54) Float for a device air-launched into the sea, in particular for a countermeasure

(57) A float (4), for a device (1) air-launched into the sea, in particular for a countermeasure, has a casing (6) and a bag (24), which is inflatable by two pressurized-gas cylinders (25) and is located, when inflated, at least partly outside the casing (6); inflation by the cylinders (25) is activated by an inertial mass (27) movable in response to deceleration of the casing (6) caused by immersion of the device (1) into the sea.
The float (4) further comprises flight stabilizing members (15) movable between a launch position, in which they are closed against a lateral wall (8) of said casing (6), and a flight position in which they extend outwards from said lateral wall (8).
The float (4) further comprises retaining means (21,22) for retaining a cover (7) closing an opening (10) defined by said lateral wall (8). The retaining means (21,22) are movable from a retaining configuration to a release configuration in response to movement of said flight stabilizing means (15).

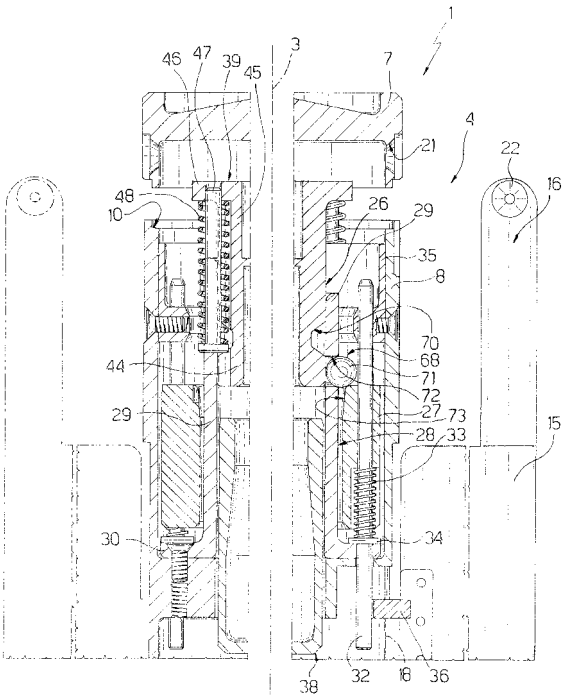

Fig.8

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Description

[0001] The present invention relates to a float for a device air-launched into the sea, in particular for a countermeasure, to which the following description refers purely by way of example.

[0002] As is known, in marine warfare, the defense systems of ships and ports are designed to detect torpedoes launched by enemy vessels, and to air-launch countermeasures into the sea at a given distance. The countermeasures are equipped with electronic devices which, following immersion, attempt to foil the incoming torpedo firing systems by emitting signals simulating the presence of a ship, i.e. a decoy, to lure the torpedo off course.

[0003] In known solutions, the countermeasure comprises a rocket for propelling it to a predetermined immersion position; and a parachute which opens during flight, close to the predetermined immersion position, in response to an electromechanical command. Following immersion, the parachute slows down descent of the countermeasure to allow the electronic devices to emit the signals at a predetermined depth and long enough to lure the torpedo off course.

[0004] Known solutions of the type described above have several drawbacks. In particular, flight time of the countermeasure is relatively prolonged, on account of the relatively slow descent of the countermeasure into the sea after the parachute opens. Moreover, during descent, the parachute is affected by wind, so that the countermeasure may enter the sea at some distance from the target point, thus impairing the effectiveness of the decoy.

[0005] Other drawbacks include the high cost and time required for routine maintenance of the countermeasure; the safety precautions involved in storing the explosive material of the countermeasure rocket; and the high cost and unreliability of the electromechanical parachute opening control.

[0006] US-A-5341718 discloses a float for a device air-launched into the sea, as defined in the preamble of claim 1.

[0007] It is an object of the present invention to provide a float for a device air-launched into the sea, in particular for a countermeasure, designed to provide a straightforward, low-cost solution to the above problems, and which, preferably, is highly reliable and has no electric or explosive components.

- According to the present invention, there is provided a float for a device air-launched into the sea, as claimed in claim 1.

[0008] A preferred, non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a side view of a preferred embodiment of a float for a device air-launched into the sea, in particular for a countermeasure, in accordance with the present invention;

Figure 2 shows a larger-scale, schematic rear view of the Figure 1 float;

Figure 3 is similar to Figure 1, and shows, with parts removed for clarity, the float following immersion into the sea;

Figure 4 shows a larger-scale section in perspective of a detail of the Figure 3 float;

Figure 5 shows a larger-scale cross section, along line V-V in Figure 1, of an internal detail of the float;

Figures 6 and 7 show longitudinal sections of the Figure 1 float along respective lines VI-VI and VII-VII in Figure 5;

Figure 8 is similar to Figure 7, and shows, with parts removed for clarity, the float during immersion into the sea.

[0009] Number 1 in Figure 1 indicates a countermeasure, which comprises a fore portion 2 housing electronic devices (not shown) which, in use, emit signals simulating the presence of a decoy in the sea to lure torpedoes, launched against a ship or port, off course. Countermeasure 1 has no propulsion systems, and is air-launched by known launch systems, not described in detail, on said ship or at said port. More specifically, countermeasure 1 is launched by a compressed-air system from a launch tube (not shown) which guides countermeasure 1 along an axis 3 over the initial portion of its flight path.

[0010] Countermeasure 1 comprises an aft portion defined by a float 4, which keeps portion 2 at a given depth once countermeasure 1 is immersed into the sea. Float 4 comprises a casing 6, in turn comprising a rear cover 7, and a substantially cylindrical lateral wall 8, which is coaxial with portion 2 along axis 3, is fixed to portion 2 in known manner not shown, and defines a rear opening 10 (Figure 8) closed by cover 7.

[0011] With reference to Figures 2 and 4, casing 6 supports a number of flight stabilizing members or so-called flaps 15, which have respective surfaces 16 complementary to the contour of wall 8, and are movable between a launch position, in which they are enclosed by the launch tube and flush with portion 2, with respective surfaces 16 facing or resting on wall 8, and a flight position (shown by the dash line in Figure 2), in which they are open and project from wall 8. Flaps 15 are preferably hinged to wall 8 about respective axes 18 parallel to axis 3, and, on leaving the launch tube, are preferably opened automatically into the flight position by respective torsion springs 19 preloaded and wound about axes 18.

[0012] With reference to Figures 4 and 7, during launching, cover 7 is held onto the rear edge of wall 8 by a retaining device 20, which comprises a number of seats 21 formed in cover 7, and, for each seat 21, a respective appendix 22 which is movable to engage/release seat 21. Appendixes 22 are held in the engaged position by flaps 15, and are automatically released from seats 21 as flaps 15 open into the flight position. More specifically,

appendixes 22 are carried directly, in a fixed position, on surfaces 16.

[0013] With reference to Figure 7, casing 6 defines a cavity 23 housing an inflatable bag 24, two pressurized-gas cylinders 25, and an activating or control unit 26 comprising an inertial mass 27. Mass 27 is movable, in response to deceleration of casing 6 caused by immersion of countermeasure 1 into the sea, from an idle position to a work position to commence inflation of bag 24 with the gas from cylinders 25. More specifically, mass 27 is ring-shaped, is coaxial with wall 8, and is housed inside a gap 28 defined radially by wall 8 and by a sleeve 29 terminating with an outer flange 30 fixed to wall 8.

[0014] With reference to Figures 4, 7 and 8, as it slides between the idle and work positions, mass 27 is guided by a number of rods 32, which are parallel to axis 3, are supported by wall 8 in angularly fixed positions, extend through mass 27, and are wound with respective coil springs 33.

[0015] Springs 33 act at one end on mass 27, and at the other end on respective shoulders 34 housed inside gap 28 and supported in fixed positions by rods 32. Gap 28 is bounded axially by flange 30 and by a ring 35 fixed to wall 8. Flange 30 and ring 35 guide rods 32, in directions parallel to axis 3, between a retaining position (Figure 7), in which shoulders 34 are adjacent to mass 27 to retain mass 27 in the idle position during launching, and a release position (Figure 4), in which shoulders 34 are spaced apart from mass 27 to reduce compression on springs 33 during flight and immersion. Rods 32 are preferably maintained in the retaining position by respective shoulders 36, which rotate with flaps 15 about axes 18. Rods 32 translate automatically into the release position when flaps 15 open into the flight position, by virtue of shoulders 36 moving laterally with respect to the path along which rods 32 are pushed by springs 33.

[0016] Bag 24 is housed inside a chamber 37 defined by two bodies 38, 39 coaxial with each other along axis 3. Body 38 is cup-shaped, and comprises a bottom wall 40 perpendicular to axis 3, facing portion 2, and connected to bag 24 by a flexible, extensible cable 41. Body 39, on the other hand, comprises a flat wall 43 perpendicular to axis 3 and supporting bag 24; and a substantially cylindrical wall 44 which slides axially inside sleeve 29. Body 39 also comprises two appendixes 45, which form an extension of wall 44 towards cover 7, are diametrically opposite with respect to axis 3, and terminate with respective outer flanges 46.

[0017] Flanges 46 are guided by rods 47, which are parallel to axis 3, are supported in fixed positions by sleeve 29, extend through flanges 46, and are wound with respective coil springs 48. Springs 48 act on flanges 46, and are preloaded to push body 39 from a rest position towards opening 10 when mass 27 translates from the idle position to the work position.

[0018] Appendixes 45 and wall 43 define a seat 49 (Figure 7) housing cylinders 25. With reference to Figures 5 and 6, cylinders 25 are fixed to a support 50, in turn fixed to wall 43 and supporting two slides 51. Slides 51 are movable between a withdrawn position, in which cylinders 25 are sealed with respect to bag 24, and a forward position, in which cylinders 25 communicate with bag 24 along a passage 52 formed in support 50 and in a fitting 53 extending along axis 3 through wall 43 and support 50. More specifically, one end 54 of fitting 53 is housed inside chamber 37 and fixed in fluidtight manner to bag 24, and a nut 57 is screwed to an opposite end 56 to grip support 50 and wall 43 in fluidtight manner axially between end 54 and nut 57.

[0019] Slides 51 preferably slide in fluidtight manner inside respective guide seats 58 formed in support 50, are defined by pointed strikers, which pierce respective end sealing walls 59 of cylinders 25 as the slides move into the forward position, and have respective inner channels 60 connecting the inside of cylinders 25 to passage 52 when the slides are in the forward position. Slides 51 translate into the forward position, in opposition to respective springs 62 and in response to mass 27 moving into the work position, via the interposition of a mechanical transmission system 63 (Figure 6), which comprises a cam 64 supported by casing 6, and, for each slide 51, a respective cam follower 65 cooperating with and contacting cam 64. More specifically, cam followers 65 are fixed with respect to slides 51, and project from seats 49 and 58; cam 64 forms part of ring 35; and body 39 forms part of system 63, as body 39 draws cam follower 65 into contact with cam 64 while moving away from the rest position.

[0020] As shown in Figures 7 and 8, body 39 is retained in the rest position, in opposition to springs 48, by a retaining device 68. Device 68 comprises an annular groove 70 formed on the outside of wall 44; and a number of balls 71, which are movable inside respective radial through holes 72 in sleeve 29 : when mass 27 is in the idle position, balls 71 are retained by a truncated-cone-shaped lead-in surface 73 of mass 27 in a locked position (Figure 7) engaging groove 70. On moving into the work position (Figure 8), mass 27 releases balls 71, which are pushed radially out of groove 70 by the axial thrust of body 39 moving away from its rest position.

[0021] In actual use, during flight of countermeasure 1, flaps 15 are pushed open by springs 19, thus releasing device 20 and rods 32. Cover 7 is thus detachable from wall 8, whereas springs 33 continue holding mass 27 in the idle position despite release of rods 32. Mass 27 maintains the locked position of balls 71, which in turn retain body 39 in the rest position, so that slides 51 remain in the withdrawn position detached from cam 64.

[0022] As shown in Figure 8, upon immersion of countermeasure 1 into the sea, casing 6 undergoes deceleration, which moves mass 27 into the work position compressing springs 33. As stated, balls 71, released by mass 27, are pushed out of groove 70 by the axial thrust of body 39 being pushed out of the rest position by springs 48.

[0023] As body 39 withdraws axially, cam followers 65

are brought into contact with cam 64 to move slides 51 into the forward position to pierce walls 59. Pushed by springs 48, body 39 takes with it through opening 10 both cylinders 25 and bag 24, which is inflated with the gas flowing along channels 60 and passage 52 as countermeasure 1 sinks into the sea.

[0024] With reference to Figure 3, once inflated, bag 24 tends to float, whereas countermeasure 1 sinks gradually into the sea. Cable 41 is unwound gradually until it eventually becomes taut to prevent countermeasure 1 from sinking further. At which point, bag 24 and cable 41 sustain the electronic devices at the depth reached, which may be determined beforehand, e.g. by calibrating the length of cable 41.

[0025] Activation takes place, i.e. inflation commences as walls 59 break, a few hundredths of a second from impact of countermeasure 1 with the sea, and portion 2 is stabilized at the predetermined depth in a few seconds.

[0026] Once immersed, the electronic devices of portion 2 are activated to simulate the decoy. This may be achieved, for example, by axial pull of body 38, in turn pulled by cable 41 as it is tautened to sustain countermeasure 1.

[0027] Float 4 therefore provides for positioning portion 2 and the electronic devices at a precise predetermined depth, which remains constant long enough to effectively simulate the decoy.

[0028] Moreover, float 4 having no parachute, and only being activated upon impact with the sea, countermeasure 1 is flown rapidly to the precise immersion point in the sea by exploiting the full maximum range of the launch system.

[0029] Float 4 operates reliably and safely by being fully mechanical: inflation of bag 24 is commanded by energy accumulated in springs 48, and which is only transferred to body 39 and by cam 64 to slides 51 upon mass 27 leaving the idle position.

[0030] Having no explosive or electrical or electronic parts, float 4 requires no additional protection from the outside environment, involves no particular safety precautions for storage, and maintenance is limited to simply replacing the seals in passage 52 and checking bag 24. Moreover, float 4 is much cheaper to produce than known electromechanically activated types.

[0031] In addition, float 4 is designed to withstand acceleration during launching, and is prevented from being activated at the launch stage by device 20 and shoulders 34, 36.

[0032] Clearly, changes may be made to float 4 as described and illustrated herein without, however, departing from the scope of the present invention as defined in the accompanying Claims.

[0033] Float 4 may also be used for devices air-launched into the sea and other than countermeasure 1, e.g. rescue devices, bathythermographic buoys, acoustic monitoring or radiated-noise detection buoys, and depth sonar.

[0034] Provision may be made for resistance by dampers and/or friction in conjunction with or instead of springs 33.

[0035] In conjunction with or instead of springs 19, flaps 15 may be opened aerodynamically or by the launch tube.

[0036] Slides 51 may be defined by movable closing and sealing members, as opposed to piercing members.

[0037] Bag 24 may only come partly out of casing 6 when inflated; and cable 41 may connect portion 2 to float 4, in the event portion 2 is detachable from float 4. At the same time, cylinders 25 may be fixed to casing 6 and communicate by tube with bag 24; and/or mass 27 may produce movement of cam 64, as opposed to movement of body 39 and, hence, cam followers 65 along axis 3.

[0038] Body 39 may be retained in the rest position directly by the inertial mass, as opposed to via the interposition of device 68; and/or the inertial mass may be rotary as opposed to sliding.

[0039] Retention by shoulders 36 may be performed directly on mass 27, to retain mass 27 in the idle position, without moving rods 32 or compressing springs 33; and/or device 20 may be separate from flaps 15.

[0040] Finally, cylinders 25 may be replaced with gas generators which, when activated, generate pressurized gas by chemical reaction or combustion; and/or an explosive charge or other activatable means may be provided to connect cylinders 25 to bag 24 upon immersion.

Claims

1. A float (4) for a device (1) air-launched into the sea, in particular for a countermeasure; the float comprising:

a casing (6);
an inflatable bag (24) located, when inflated, at least partly outside said casing (6);
inflation means (25, 52) activated to inflate said bag (24); and
activating means (26) comprising an inertial mass (27) movable, in response to deceleration of said casing (6) caused, in use, by immersion of the device (1) into the sea, from an idle position to a work position to activate inflation;
said casing (6) comprising a lateral wall (8) defining an exit opening (10) for said bag (24), and a cover (7) closing said opening (10);
said float (4) being **characterized by** further comprising:
flight stabilizing members (15) movable between a launch position, in which they are closed against said lateral wall (8), and a flight position, in which they extend outwards from said lateral wall (8); and
retaining means (20) movable between a retaining configuration and a release configuration of

said cover (7) in response to movement of said flight stabilizing members (15).

2. A float as claimed in Claim 1, **characterized in that** said activating means (26) comprise elastic means (48) preloaded to accumulate mechanical energy which is released when said inertial mass (27) leaves the idle position.

3. A float as claimed in Claim 2, **characterized in that** said activating means comprise a supporting body (39, 50) movable from a rest position in response to the trust of said elastic means (48) to activate inflation; said inertial mass (27), when in the idle position, retaining said supporting body (39, 50) in the rest position in opposition to the thrust of said elastic means, and, when in the work position, allowing said supporting body (39, 50) to withdraw from said rest position.

4. A float as claimed in Claim 3, **characterized by** comprising retaining balls (71) movable between a locked position, in which they are retained by said inertial mass (27), in the idle position, and in turn retain said supporting body (39, 50) in the rest position, and a release position, in which they are released by said inertial mass (27) to release said supporting body (39, 50).

5. A float as claimed in any one of the foregoing Claims, **characterized in that** said inflation means comprise at least one pressurized-gas cylinder (25); and **in that** said activating means (26) comprise an activating member (51) movable between a withdrawn position, in which said cylinder (25) is sealed with respect to said bag (24), and a forward position, in which said cylinder (25) communicates with said bag (24).

6. A float as claimed in Claim 5, **characterized by** comprising a cam (64) supported by said casing (6); and a cam follower (65) supported by said activating member (51) and which contacts and cooperates with said cam (64) to move said activating member (51) into the forward position when said inertial mass (27) leaves the idle position.

7. A float as claimed in Claims 6 and 4, **characterized in that** said cam (64) is fixed with respect to said casing (6); and **in that** said supporting body (39, 50) supports said activating member (51) so as to cause said cam follower (65) to contact and cooperate with said cam (64) as said supporting body (39, 50) withdraws from the rest position.

8. A float as claimed in Claim 3, 4 or 7, **characterized in that** said supporting body (39, 50) supports said cylinder (25) and said bag (24).

9. A float as claimed in Claim 5, 6 or 7, **characterized in that** said activating member is defined by a piercing member (51) for piercing an end sealing wall (59) of said cylinder (25).

10. A float as claimed in Claim 9, **characterized in that** said piercing member (51) has an inner channel (60) for gas flow from said cylinder (25) to said bag (24).

11. A float as claimed in any one of the foregoing Claims, **characterized in that** said bag (24) is connected to said casing (6) by a flexible cable (41).

12. A float as claimed in anyone of the foregoing Claims, **characterized in that** said retaining means (20) comprise a number of appendixes (22) supported by said flight stabilizing members (15).

13. A float as claimed in any one of the foregoing Claims, **characterized by** comprising additional retaining means (32, 36), which retain the inertial mass (27) in the idle position when launching said device (1), and which are released automatically after said device (1) is launched.

14. A float as claimed in Claim 13, **characterized in that** said additional retaining means (32, 36) comprise shoulders (36) movable together with said flight stabilizing members (15).

15. A countermeasure (1) comprising an aft portion defined by a float (4) as claimed in any one of the foregoing Claims.

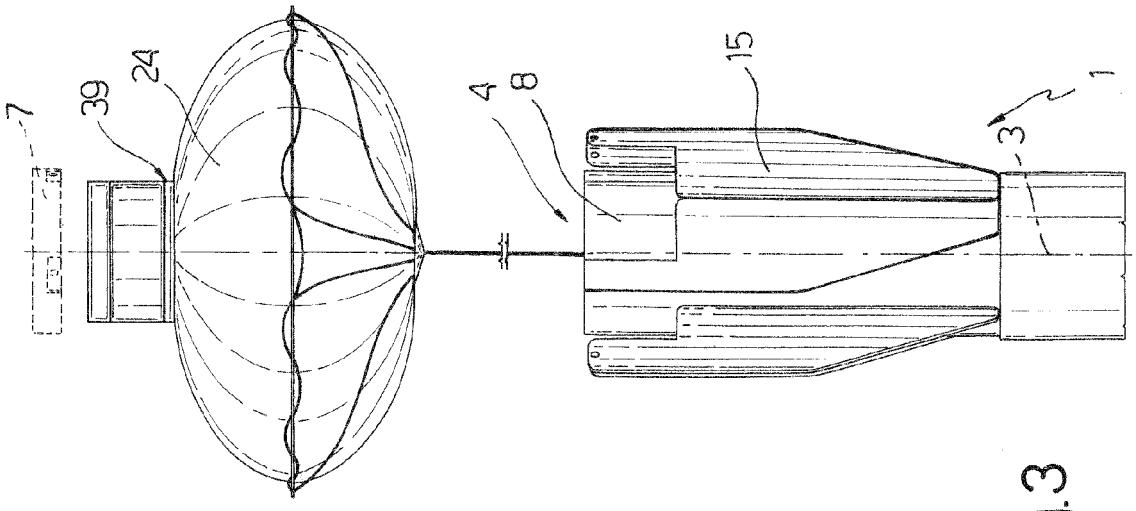

Fig.3

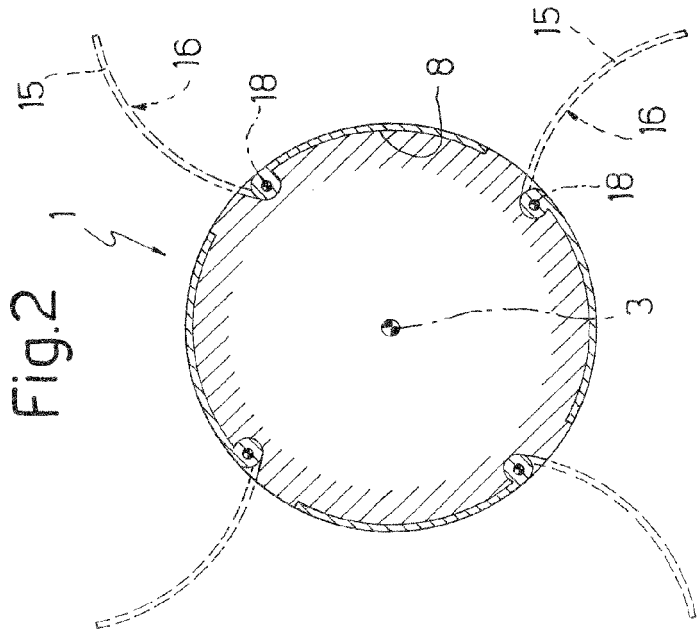

Fig.2

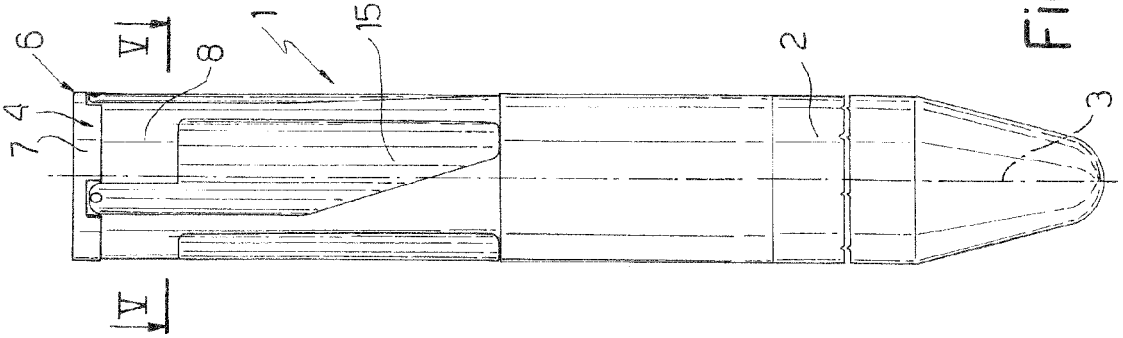

Fig.1

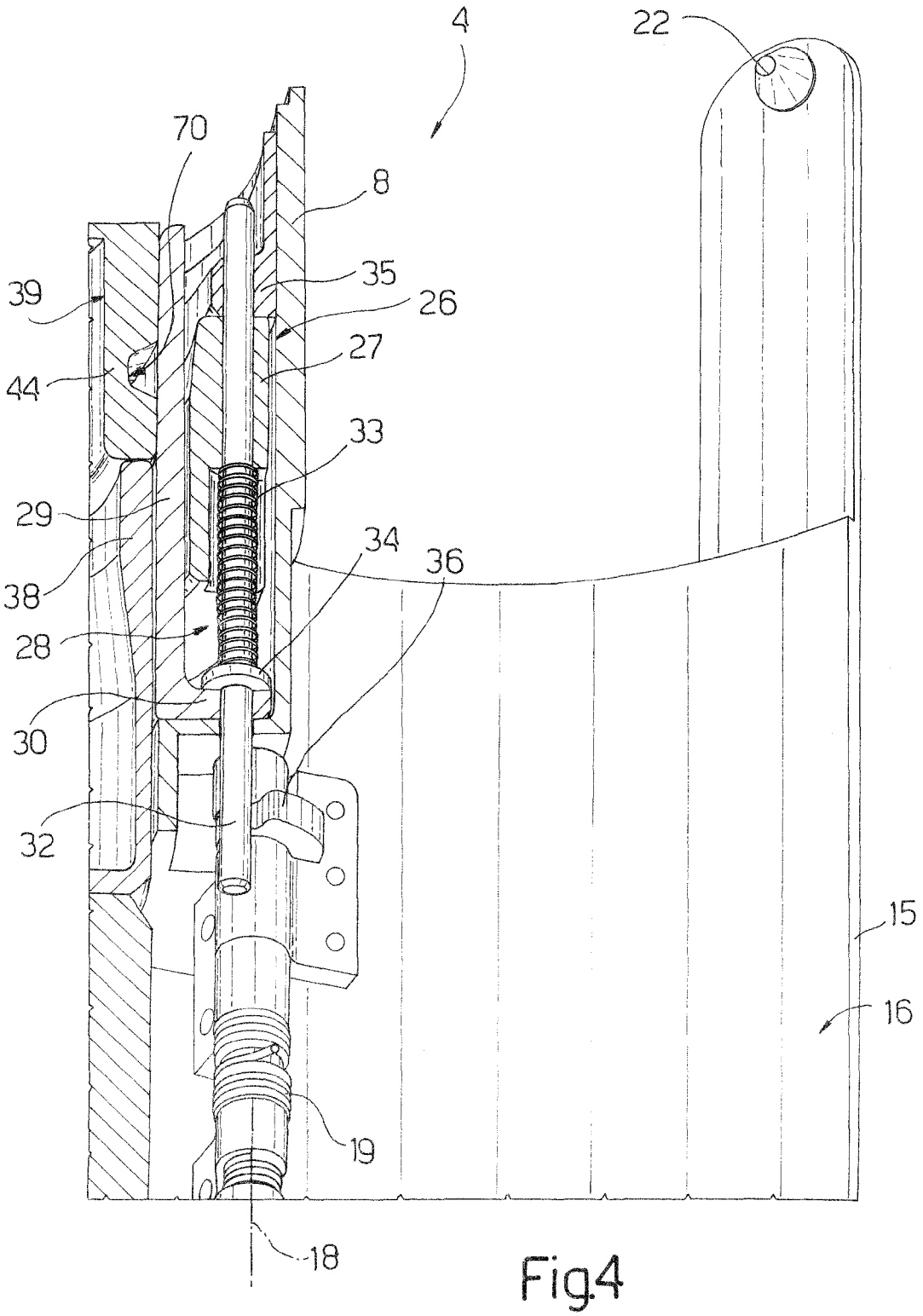

Fig.4

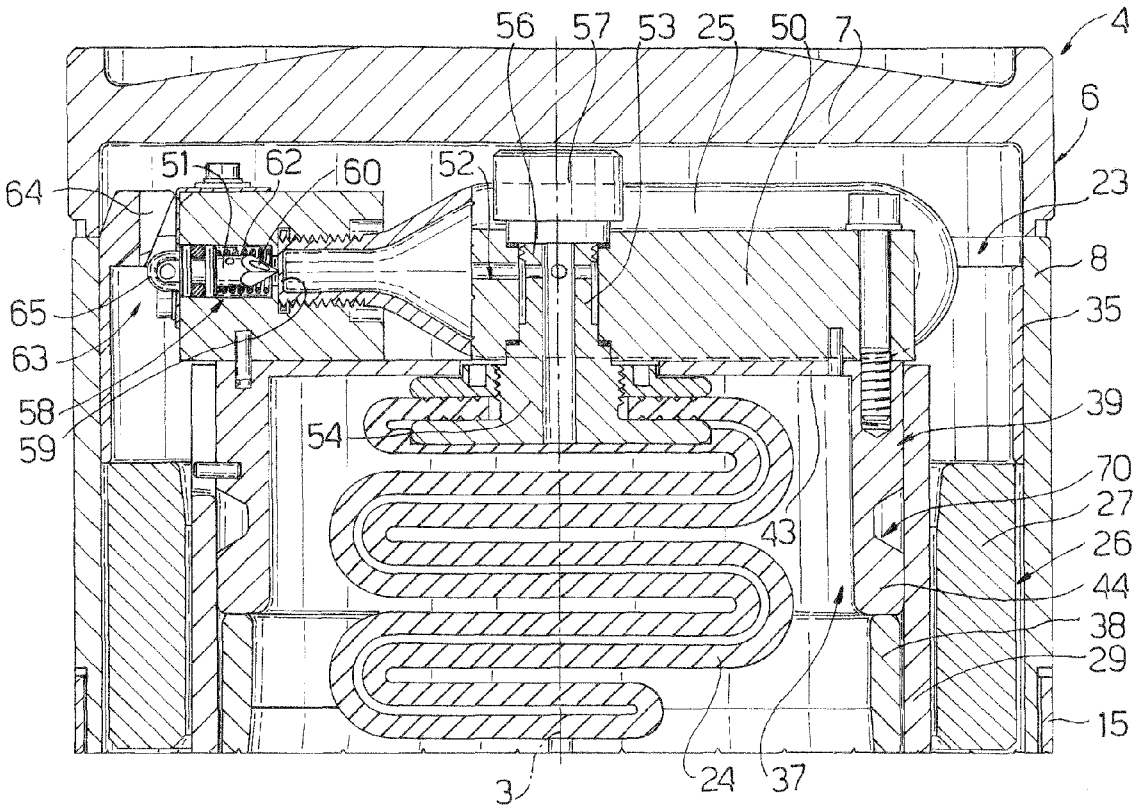
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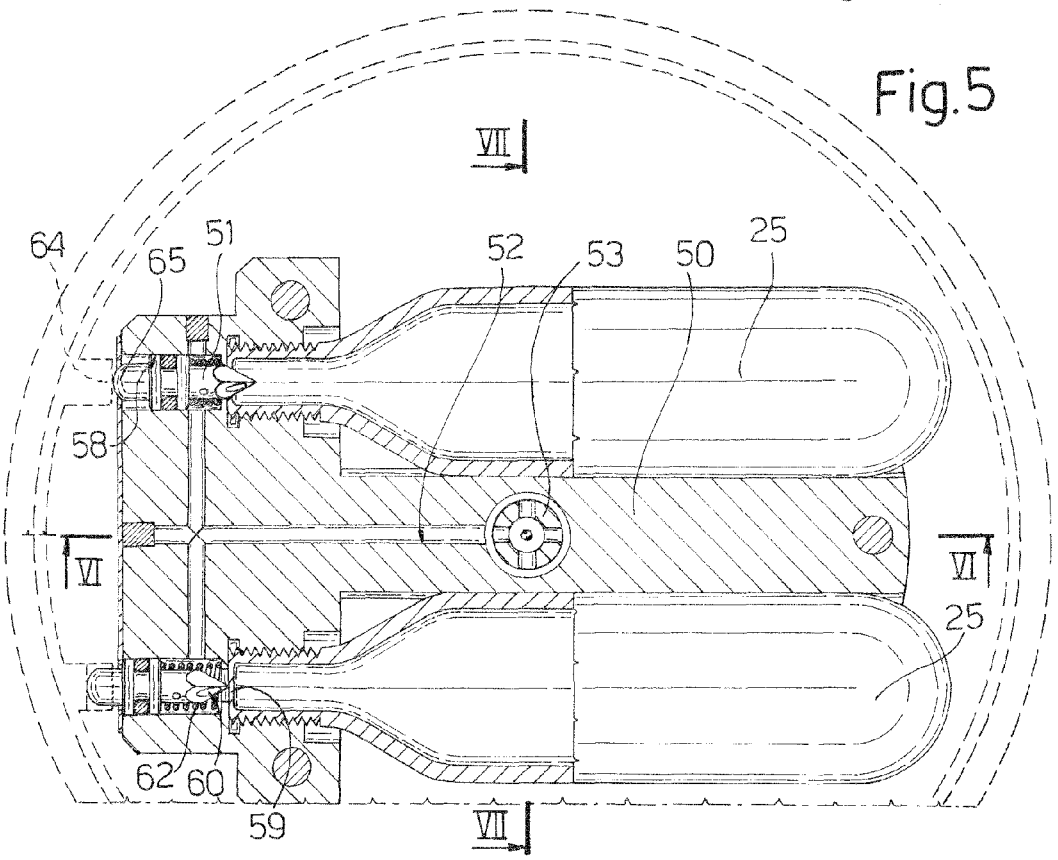
Fig.6

Fig.5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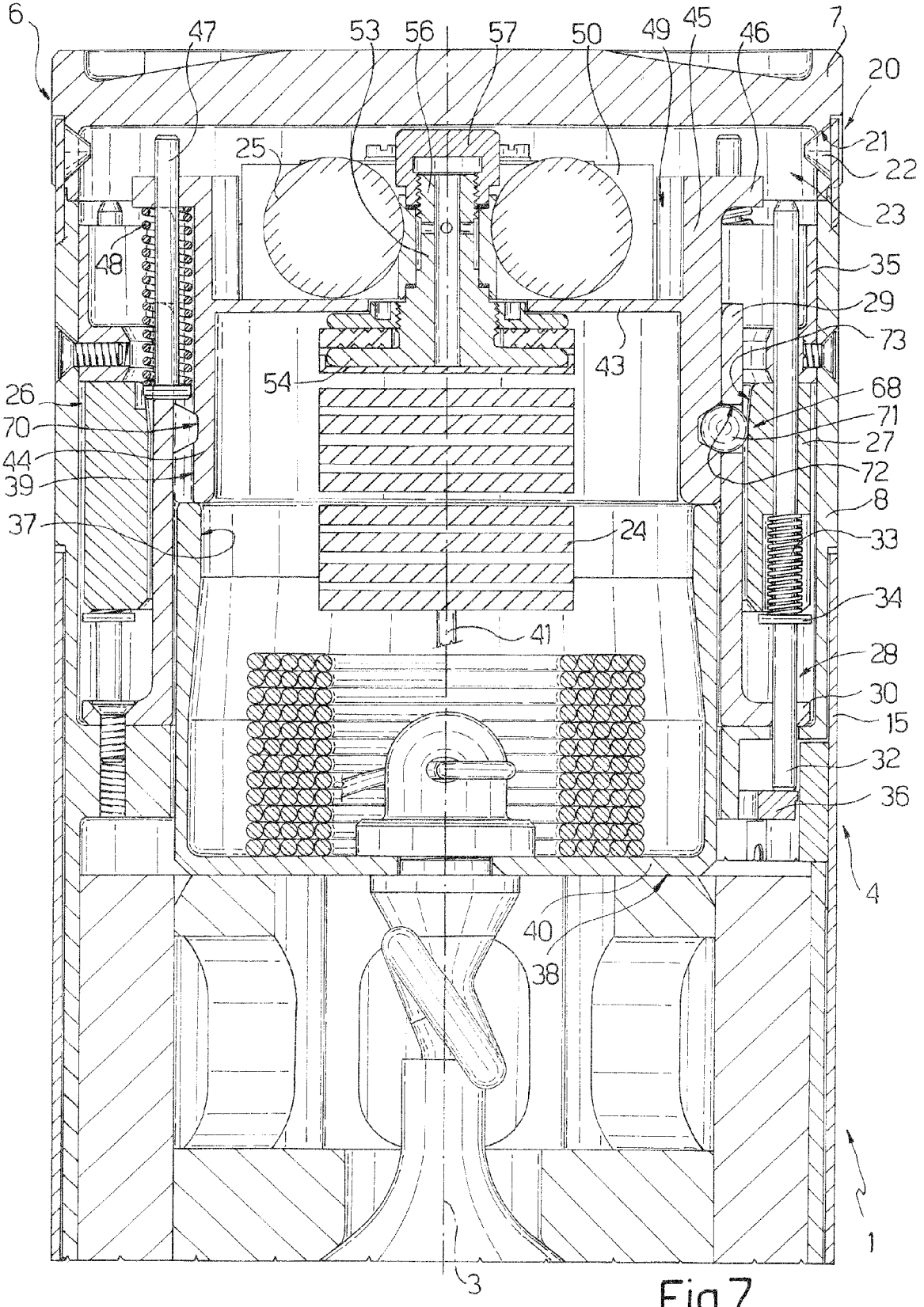
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Fig.7

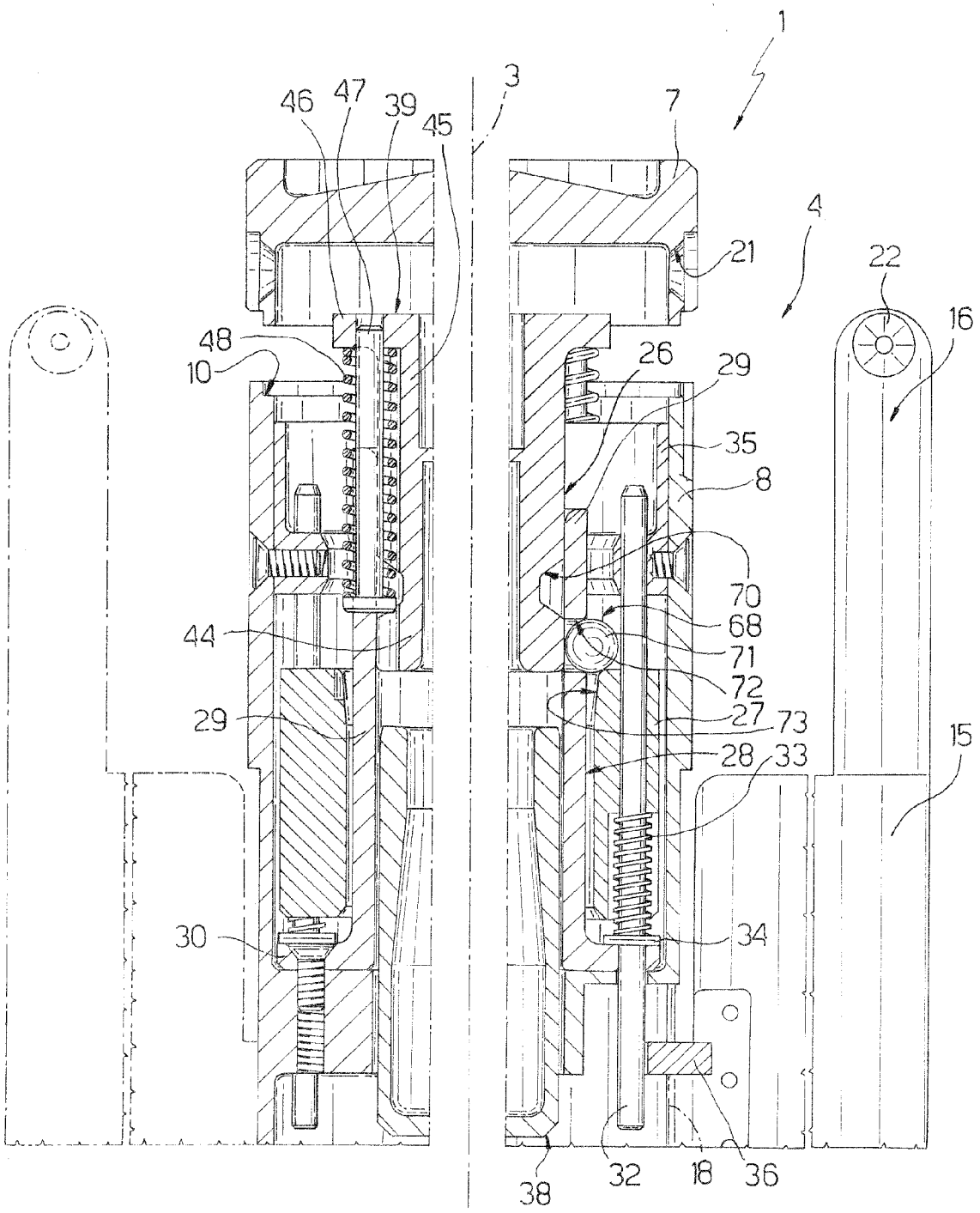
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Fig.8

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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