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(54) Electrically operated lock, particularly for the hood or tailgate of a motor vehicle.

(57) An electrically operated lock (1) for the hood of a motor vehicle, comprising a latch (14) designed to engage, in a first closed position, a respective locating member (26) on a fixed part of the vehicle; a bolt (35) designed to cooperate with the latch (14) by virtue of elastic means (45) and to maintain the same in the closed position; mechanical means (64) for activating the bolt (35); and a control pin (37) activated by an electrical actuator (58), having an eccentric portion (36) on which the bolt (35) pivots, and designed to move the bolt (35) reversibly in such a manner as to move the latch (14) from a secondary latched position to a fully latched position wherein the load on the hood seals is incremented; the load incrementing stroke being commenced by an electric signal (107) produced by means (105) for detecting the position of the bolt (35).

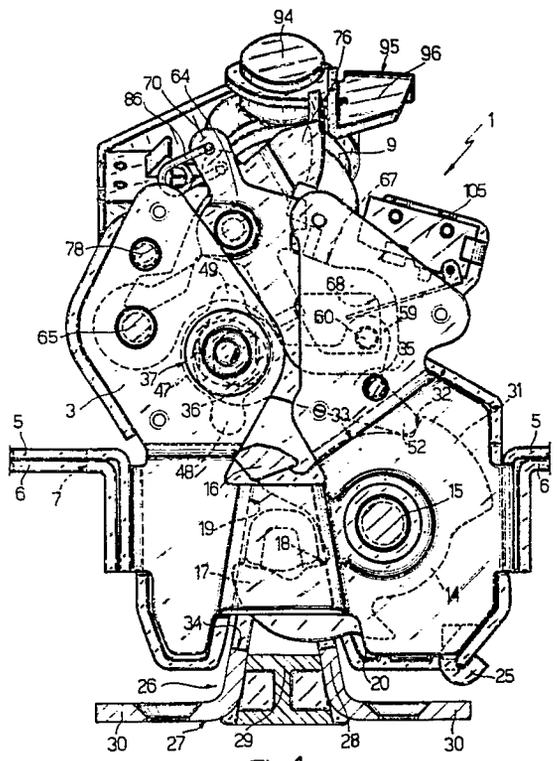

Fig.1

EP 0 393 595 A2

ELECTRICALLY OPERATED LOCK, PARTICULARLY FOR THE HOOD OR TAILGATE OF A MOTOR VEHICLE

The present invention relates to an electrically operated lock, particularly for the hood or tailgate of a motor vehicle.

Motor vehicle hoods or tailgates are usually fitted with manually operated locks closed by slamming the hood or tailgate, the manual effort required being directly proportional to the elastic load of the peripheral seals employed. Similarly, considerable effort is also required for releasing the lock, which is generally performed by means of a key operated button on the outside or a mechanical lever inside the vehicle.

Higher class vehicles often feature electrically operated devices which, while effectively peforming the normal locking function, fail to solve or even attenuate the aforementioned drawbacks. On vehicles of this sort, in fact, and particularly "two-volume" vehicles, particularly high compression loads are required for ensuring maximum comfort (absence of noise or air leakage) inside the passenger compartment.

The aim of the present invention is to provide a lock for the hood or tailgate of a motor vehicle, designed to overcome the drawbacks typically associated with known locks of the aforementioned type.

With this aim in view, according to the present invention, there is provided an electrically operated lock, particularly for the hood or tailgate of a motor vehicle featuring peripheral elastic sealing means designed to cooperate in airtight manner with said hood or tailgate, and comprising:

- a latch pivoting on a pin integral with said hood or tailgate, and designed to move between a first open position and a second closed position wherein it engages a corresponding locating element on the fixed part of said vehicle;
- a bolt designed to cooperate with said latch by virtue of elastic means, and to click into an engaged position wherein it cooperates with respective means for locating said latch, and maintains said latch in said closed position;
- mechanical means for releasing said bolt from said latch;
- electrical actuating means; and
- means for controlling said electrical actuating means; characterised by the fact that it comprises a control pin activated by said electrical actuating means, and having an eccentric portion on which said bolt pivots; said control pin being designed to move said bolt reversibly in such a manner as to further rotate said latch from said second closed position to a third closed position wherein the load on said peripheral sealing means is incremented; said control means comprising a control unit, and means for directly detecting said engaged position of said bolt, and for generating an enabling signal for activating said actuating means.

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

Fig.1 shows a front view of a lock in accordance with the present invention;

Fig.2 shows a top plan view of the Fig.1 lock;

Fig.3 shows a partially sectioned side view of the Fig.1 lock;

Fig.s 5, 6, 7, 8 and 9 show partial views of the Fig.1 lock in various operating positions.

Number 1 in Fig.s 1 to 3 indicates an electrically operated lock for the hood of a motor vehicle luggage compartment (not shown) featuring known elastic seals cooperating with the edge of the hood.

Lock 1 is an integrated type, i.e. comprising a single assembly mounted inside the hood, on a supporting board 2 secured to the same. Board 2 substantially consists of a front and rear half-board 3, 4 arranged facing each other and connected at opposite sides in known manner (not shown) via permanent deformation. Said half-boards 3, 4 define respective pairs of superimposed lateral tabs 5, 6 having slots 7 for assembly to the hood.

Between half-boards 3, 4, there is mounted a plastic supporting element 8 of complex structure, extending upwards and outwards of board 2, and having an inclined bush 9 located on the rear half-board 4 side and housing a known key-operated button 10 for manually opening lock 1.

The bottom portion of board 2 houses a latch 14 pivoting on a pin 15 supported at the ends by half-boards 3, 4 and housed in a through hole on supporting element 8.

Latch 14 presents a pair of teeth 16, 17 defining a U-shaped recess 18 and substantially facing a cavity 19 on supporting element 8 communicating with a bottom opening 20 on board 2. Pin 15 of latch 14 presents a helical spring 24, the ends of which cooperate in known manner with latch 14 and board 2. Said spring 24 provides for forcing latch 14 into an open position wherein the back of tooth 17 cooperates with a stop 25 formed in board 2, and tooth 16 extends obliquely inside cavity 19 of supporting element 8, for intercepting a locating element 26 secured to the bodywork of the luggage compartment.

Substantially opposite tooth 17, latch 14 also presents a projection 31 defined laterally, on the side facing tooth 16, by a flat side face 32. Be-

tween tooth 16 and side 32, fork 14 presents a convex outer surface 33 substantially in the form of an arc of a circle.

Said locating element 26 substantially consists of a shaped metal bracket 27 having a wedge-shaped central portion 28 housing a wedge-shaped plastic insert 29, and two flat end wings 30 with holes for assembly to the vehicle body. Locating element 26 presents a transverse opening 34 engaged by tooth 17 of latch 14 as described later on.

Lock 1 also comprises a flat bolt 35 lying in the same plane as latch 14, and mounted for rotation on an eccentric intermediate portion 36 of a pin 37 having cylindrical end portions 38, 39 resting on respective bushes 40 secured via permanent deformation to respective half-boards 3, 4.

Between end portion 39 and eccentric portion 36, pin 37 presents a connecting portion 44 about which is fitted a helical spring 45 secured at one end (not shown) to board 2, and the opposite end 46 of which cooperates with bolt 35 so as to maintain the tapered rounded end 52 of the same contacting latch 14.

Pin 37 also presents a flange 47 adjacent to eccentric portion 36, and having two rounded, diametrically opposed projections 48, 49 defining cam control means as explained later on. Bolt 35 is maintained axially contacting flange 47 by a retaining ring 50 mounted in an annular seat on eccentric portion 36 via the interposition of a washer 51. Between flange 47 and end portion 38, pin 37 presents a cylindrical portion 53 having a circular, 90° radial projection 54 defined by flat radial sides 55 (Fig.4) designed to cooperate with respective mechanical locators (not shown) integral With board 2, and so define an angular displacement of 180° of pin 37.

In end portion 38 of pin 37, there is formed an axial seat 56 engaged prismatically by the output shaft 57 of an actuator 58 (shown partially in Fig.3) comprising a d.c. electric motor and a known speed reducer (not shown).

Close to end 52, bolt 35 presents a rounded lateral projection 59 to which is fitted a pin 60 having its axis perpendicular to the bolt 35 plane.

Lock 1 also comprises a release lever 64 of complex design, pivoting on a pin 65 secured to board 2 close to pin 37.

In particular, release lever 64 presents a central portion 66 from which extend, in substantially perpendicular directions, an arm 67 having a substantially trapezoidal through slot 68, and an elongated appendix 69 pivoting at one end on pin 65. From said central portion 66, there also extend a top appendix 70, substantially opposite arm 67, and a lateral projection 71 substantially opposite appendix 69.

Lever 64 is loaded clockwise (as viewed in Fig.5 onwards) by elastic means (not shown) by which it is maintained in the Fig.5 position wherein arm 67 cooperates with a fixed stop pin 82. Lock 1 also comprises a lever 74, herein referred to as a selective connecting lever for reasons which will become clear later on, and pivoting via pin 75 on the central portion 66 of release lever 64.

Said lever 74 comprises a shaped appendix 76 extending upwards in the direction of bush 9 of supporting element 8. Substantially opposite appendix 76, lever 74 comprises a second flat, shaped appendix 77 designed to cooperate with a fixed locating pin 78 carried on board 2 close to and over pin 65. Lever 74 also comprises two lateral projections 79, 80 having respective end teeth 84, 85 bent 90° in opposite directions. In particular, tooth 84 is bent towards release lever 64, and is designed to cooperate with the side of arm 67 of lever 64. so as to define a first angular stop position between levers 64 and 74, or with the end surface of lateral projection 71 of lever 64, so as to define a second angular stop position. Tooth 85 is bent towards flange 47 and designed to cooperate with projection 48 of the same.

Lever 74 is designed to move, in relation to lever 64, between said first and second positions, both of which, shown respectively in Fig.s 7 and 5, are rendered stable by virtue of the action of a helical spring 86 secured at the ends to lever 74 and appendix 70 of lever 64.

A supporting collar 87 (Fig.s 2 and 3) is clicked on to the top portion of bush 9 housing button 10. Said collar 87 comprises, on one side, an integral bracket 88 supporting a microswitch 89, and, on the top front portion, a cylindrical seat 90 having its axis positioned radially in relation to collar 87 and inside which is fitted a pin 94 on which pivots a bell-crank lever 95 having an appendix 96 facing appendix 76 of lever 74.

Bush 9 is also fitted with a sliding control collar 97 activated in known manner by button 10, which may be rendered integral with collar 97 by means of known key-operated mechanisms (not shown) housed inside bush 9. Said bush 9 presents known helical guide means (not shown), so that pressure on button 10 results, not only in axial displacement, but also in proportional rotation of collar 97. Said collar 97 presents, on one side, an appendix 99 designed to cooperate with a button 100 activating microswitch 89; and a substantially tangential arm 104 designed to cooperate with bell-crank lever 95.

Lock 1 also comprises a second microswitch 105 secured to board 2 so that respective blade 103 is activated by projection 59 of bolt 35, as described later on.

Reversible actuator 58 is controlled by a conventional programmable control unit 106 connected

to microswitches 89, 105 and designed to receive from the same respective enabling signals 107, 108 and to supply corresponding signals 109, 110 for enabling supply of actuator 58 in both rotation directions. Control unit 106 features timing means for cutting off said signals when sufficient time has elapsed for enabling angular displacement of pin 37. Microswitches 89 and 105 may be normally-open or -closed types, by accordingly adjusting the programming of control unit 106. By way of example, however, it is assumed that microswitch 89 is normally open and 105 normally closed.

Operation of lock 1 is as follows.

The continuous line in Fig.5 shows the position of latch 14 when lock 1 is open, in which position, bolt 35 cooperates with the end surface of projection 31 of latch 14; projection 59 of bolt 35 cooperates with blade 103 of microswitch 105; and eccentric portion 36 of pin 37 is displaced, in relation to the axis of pin 37, in the opposite direction to end 52 of bolt 35.

When the hood is closed manually, tooth 16 of latch 14 strikes locating element 26, and turns (clockwise in Fig.5) into the so-called secondary latched position shown by the dotted line, wherein tooth 17 engages opening 34 of locating element 26.

By virtue of spring 45, end 52 of bolt 35 engages side 32 of projection 31 of latch 14, which is thus locked in position.

Latch 14 and bolt 35 are so sized and restrained that said position is achieved with minimum compression of the hood seals and, therefore, minimum manual effort, but with the outer contour of the hood practically already flush with the rest of the vehicle body. That is to say, as regards engagement of bolt 35 and latch 14, the hood is practically in the fully latched position, the only difference being the low compression load on the hood seals.

As bolt 35 moves into said secondary latched position, projection 59 of bolt 35 is detached from blade 103 of microswitch 105 thus switching the same; enabling signal 107 is therefore produced, subsequent to which control unit 106 produces signal 109 for supplying actuator 58 and so turning output shaft 57 clockwise.

The eccentric portion 36 of pin 37 turns about the pin axis, taking with it bolt 35, end 52 of which is secured contacting latch 14 by spring 45. Bolt 35 therefore moves more or less linearly to the right in the accompanying drawings, maximum displacement being reached subsequent to 180° rotation of pin 37, at which point, the eccentricity of portion 36 is inverted in relation to the axis of pin 37. Tangential thrust is exerted by bolt 35 (Fig. 6) on latch 14, which rotates further by a limited but sufficient amount to bring the hood and frame closer together and so further compress the seals as required.

In other words, electrical operation provides, not for locking, which is already provided for mechanically, but for incrementing the locking load in a manner not obtainable manually.

Subsequent to 180° rotation of pin 37, actuator 58 is arrested firstly by side 55 of projection 54 on pin 37 mechanically contacting said locating means on board 2, after which, said timing means disable signal 109 and, consequently, supply to actuator 5B.

To simplify matters, electrical operation of the lock during closure has purposely been omitted at this point, but will be taken up later on.

Lock 1 is released fully automatically by operating button 10 manually from outside, or in any other manner designed to transmit an enabling signal to control unit 106 (e.g. via remote control or a button inside the passenger compartment).

Subsequent to operation and limited axial displacement of button 10, appendix 99 on control collar 97 contacts button 100 of microswitch 89, which therefore switches for supplying control unit 106 with release enabling signal 108.

Via signal 110 from control unit 106, actuator 58 is activated in the opposite direction (anticlockwise in the drawings) so as to turn pin 37.

Rotation of pin 37, and particularly portion 36, about the pin axis moves bolt 35 in the opposite direction to that referred to in connection with the locking operation, thus gradually restoring latch 14 to the secondary latched position and gradually reducing compression of the hood seals.

Flange 47 and projections 48, 49 turn integral with pin 37.

For the first 90°, said rotation provides solely for partly reducing the load on the seals.

After approximately 90° rotation, projection 48 on flange 47 (Fig.8) contacts tooth 85 on projection 80 of selective connecting lever 74 which, as explained later on, is in said first angular position.

Subsequent to such contact and rotation of flange 47, lever 47 and release lever 64 turn integral with each other about pin 65, at first with no relative rotation, by virtue of the contact force line having a substantially zero arm in relation to pin 75.

Rotation of lever 64 brings the bottom edge of slot 68 into contact with pin 60 of bolt 35 (Fig.9), which pin 60 is raised so as to release bolt 35 from latch 14, which is thus restored by spring 24 to the open position.

During operation of bolt 35 as described above, appendix 77 of lever 74 is brought by control member 86 into contact with fixed pin 78, which, simultaneously to release of bolt 35, switches lever 74 from said first position (Fig.9) into said second

position (Fig.5). Consequently, tooth 85 of lever 74 is relieved of the pressure exerted by projection 48, thus enabling bolt 35 and lever 64 to return to the idle position.

Upon completion of the release operation by flange 47 turning 180°, pin 37 is arrested by opposite side 55 of projection 54 contacting said locating means; and supply to actuator 58 is cut off by control unit 106 via said timing means.

Having explained the release function, we may now go on to analyse operation of levers 64, 74 in relation to the position of pin 37 of bolt 35 during the locking phase described previously.

In the final stage of the load incrementation stroke, further inversion of the rotation direction (Fig.6) causes projection 49 of flange 47 to contact appendix 69 of lever 74, which is thus restored to said first position ready for the next release cycle.

In the event of a fault on the electrical system, provision is obviously made for manually performing all the lock 1 functions, regardless of the type of fault or the operating stage in which it occurs.

Mechanical locking is performed as already described. A fault on the electrical system at the locking stage prevents the compression load on the seals from being incremented, and the hood remains in the secondary latched position, which, being tantamount to the fully latched position, poses no problems in terms of passenger safety.

Emergency manual release is performed as follows.

As already described in connection with the electrical release function, pressure on button 10 results in rotation of control collar 97 and appendix 104 integral with the same. In the event of actuator 58 failing to operate, and continued pressure being applied on button 10, appendix 98 contacts and turns lever 95 about pin 94. Appendix 96 of lever 95 acts on appendix 76 of lever 74, so as to turn lever 74 into said second position and then turn levers 64 and 74 integrally about pin 65. The bottom edge of slot 68 of lever 64 raises pin 60 of bolt 35, so as to release bolt 35 from latch 14 as already described in connection with the electrical release function.

It will be noted that, however lock 1 is released, lever 74 is always set to said second position after release. This is essential, in terms of reliable emergency operation, for ensuring that, once lock 1 is released, bolt 35 and lever 64 are restored correctly to the idle position, thus enabling subsequent closure.

The advantages of lock 1 will be clear from the foregoing description.

Firstly, lock 1 may be operated electrically, thus drastically reducing the manual effort required.

Secondly, the electrical locking function is performed subsequent to mechanical locking, by directly detecting the latched position of bolt 35, thus ensuring maximum safety.

Thirdly, electrical release is performed extremely smoothly, by virtue of the seals being practically fully decompressed when bolt 35 is released. Moreover, lever 74 provides for separating electrical and emergency mechanical operation, thus reducing the manual effort required for emergency release, and enabling manual operation at any locking or release stage.

Lastly, lock 1 is of straightforward design, reliable, silent-operating and lightweight.

To those skilled in the art it will be clear that changes may be made to lock 1 as described and illustrated herein without, however, departing from the scope of the present invention.

For example, in place of mechanical stops and timers, the limit positions of pin 37 may be determined using encoders.

Claims

1) - An electrically operated lock, particularly for the hood or tailgate of a motor vehicle featuring peripheral elastic sealing means designed to cooperate in airtight manner with said hood or tailgate, and comprising:
- a latch pivoting on a pin integral with said hood or tailgate, and designed to move between a first open position and a second closed position wherein it engages a corresponding locating element on the fixed part of said vehicle;
- a bolt designed to cooperate with said latch by virtue of elastic means, and to click into an engaged position wherein it cooperates with respective means for locating said latch, and maintains said latch in said closed position;
- mechanical means for releasing said bolt from said latch;
- electrical actuating means; and
- means for controlling said electrical actuating means; characterised by the fact that it comprises a control pin (37) activated by said electrical actuating means (58), and having an eccentric portion (36) on which said bolt pivots (35); said control pin (37) being designed to move said bolt (35) reversibly in such a manner as to further rotate said latch (14) from said second closed position to a third closed position wherein the load on said peripheral sealing means is incremented; said control means comprising a control unit (106), and means (105) for directly detecting said engaged position of said bolt (35), and for generating an enabling signal (107) for activating said actuating means (58).

2) - A lock as claimed in Claim 1, characterised by the fact that it comprises means (74) for selectively connecting said control pin (37) to said me-

chanical actuating means (64).

3) - A lock as claimed in Claim 2, characterised by the fact that said control means comprise cam means (48, 49) designed to cooperate with said selective connecting means (74).

4) - A lock as claimed in any one of the foregoing Claims, characterised by the fact that said mechanical actuating means comprise a release lever (64) pivoting on a fixed pin (65) and designed to cooperate with said bolt (35) for releasing the same from said latch (14); and manually operated means (10, 97, 95) for controlling said release lever (64).

5) - A lock as claimed in Claim 3 or 4, characterised by the fact that said selective connecting means comprise a lever (74) pivoting on said release lever (64) and designed to move, in relation to the same, between a first position wherein it cooperates with said cam means (48) for transmitting the actuating loads of said cam means (48) to said release lever (64), and a second position wherein said release lever (64) is disconnected from said cam means (48).

6) - A lock as claimed in Claim 5, characterised by the fact that it comprises fixed locating means (78) designed to cooperate with said selective connecting lever (74) during displacement of the same integral with said release lever (64), and to switch said selective connecting lever (74) from said first position into said second position.

7) - A lock as claimed in Claim 7 or 8, characterised by the fact that said cam means comprise a first projection (48) designed to cooperate with a first portion (85) of said selective connecting lever (74) when this is in said first position; and a second projection (49) designed to cooperate with a second portion (77) of said selective connecting lever (74) in said second position, for restoring the same to said first position.

8) - A lock as claimed in Claim 7, characterised by the fact that said first and second projections (48, 49) are formed peripherally on a flange (47) of said control pin (37).

9) - A lock as claimed in Claim 8, characterised by the fact that said projections (48, 49) are diametrically opposite each other.

10) - A lock as claimed in any one of the foregoing Claims from 4 to 9, characterised by the fact that said means for controlling said release lever (64) comprise a manually operated button (10); and means (97, 95) for transmitting the actuating motion of said button (10) to said release lever (64).

11) - A lock as claimed in Claim 10, characterised by the fact that said means controlling said actuating means (58) comprise means (89) for detecting the position of said button (10) and activated by said transmission means (97).

12) - A lock as claimed in Claim 11, characterised by the fact that said electrical actuating means (58) are controlled by said control unit (106) in such a manner as to turn said control pin (37) 180° in one direction, commencing from said engaged position of said bolt (35), at the end of which rotation said latch (14) is set by said bolt (35) into said third closed position, and 180° in the opposite direction, commencing from manual operation of said button (10), during which said bolt (35) enables said latch (14) to return gradually to said second closed position, and is released from the same for enabling it to return to said first open position.

13) - A lock as claimed in Claim 11 or 12, characterised by the fact that said means for detecting said position of said bolt (35) and said button (10) are two microswitches (105, 89).

14) - A lock as claimed in one of the foregoing Claims, characterised by the fact that said control pin (37) comprises mechanical stop means designed to cooperate with respective fixed locating means for defining respective limit angular positions of said pin (37).

15) - A lock as claimed in one of the foregoing Claims, characterised by the fact that said control unit comprises means for timing the signals enabling said electrical actuating means (58).

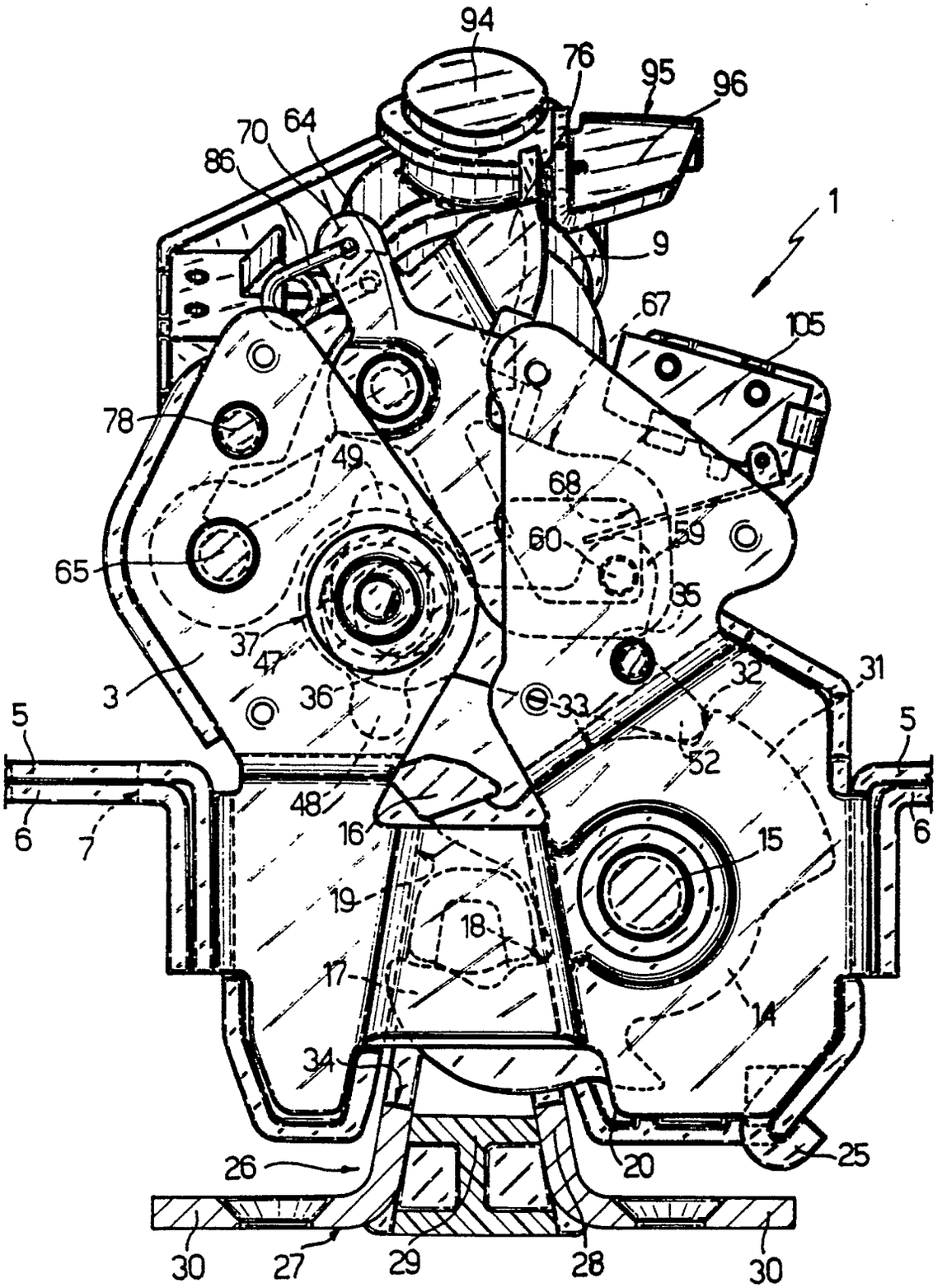
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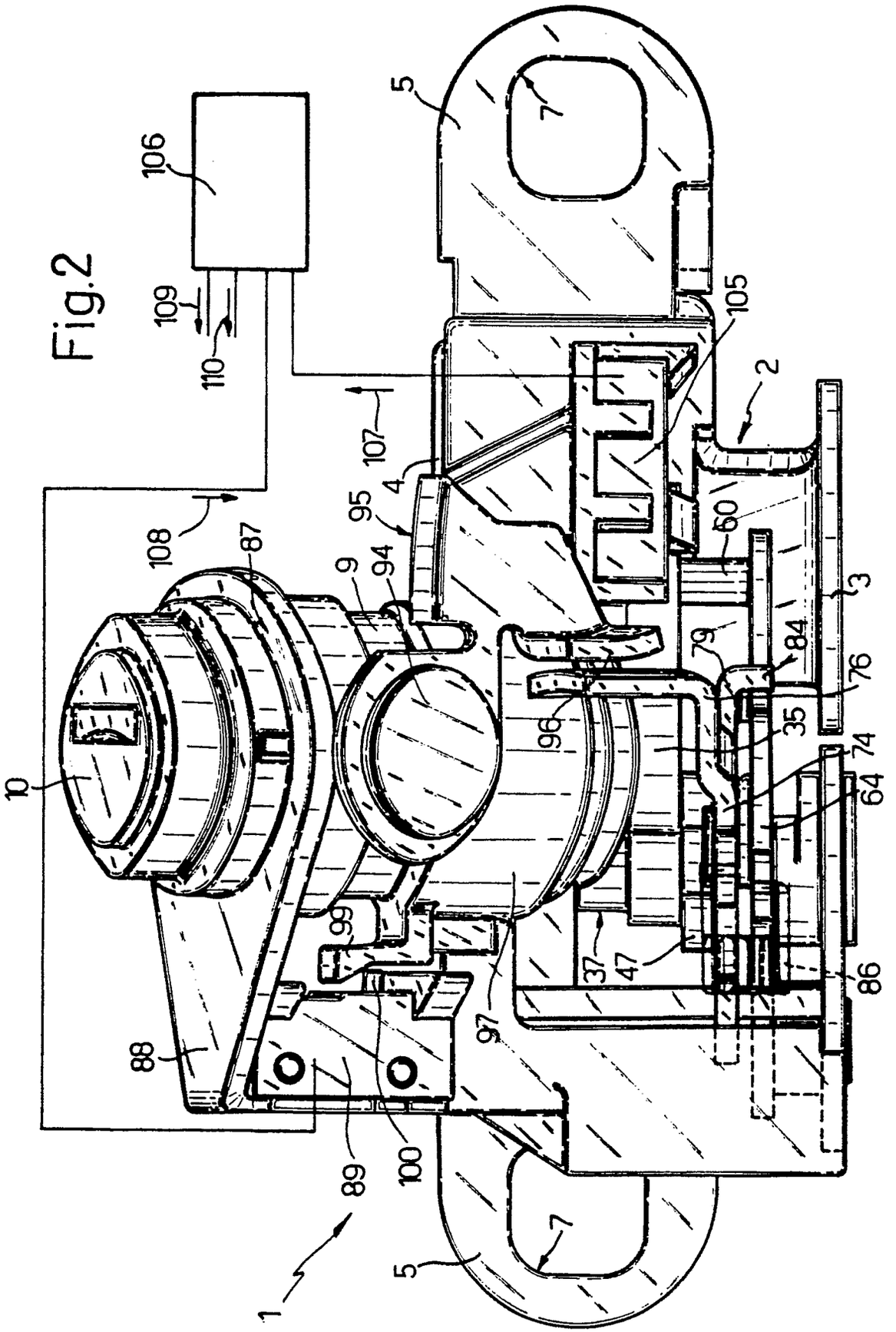
Fig.1

Fig.2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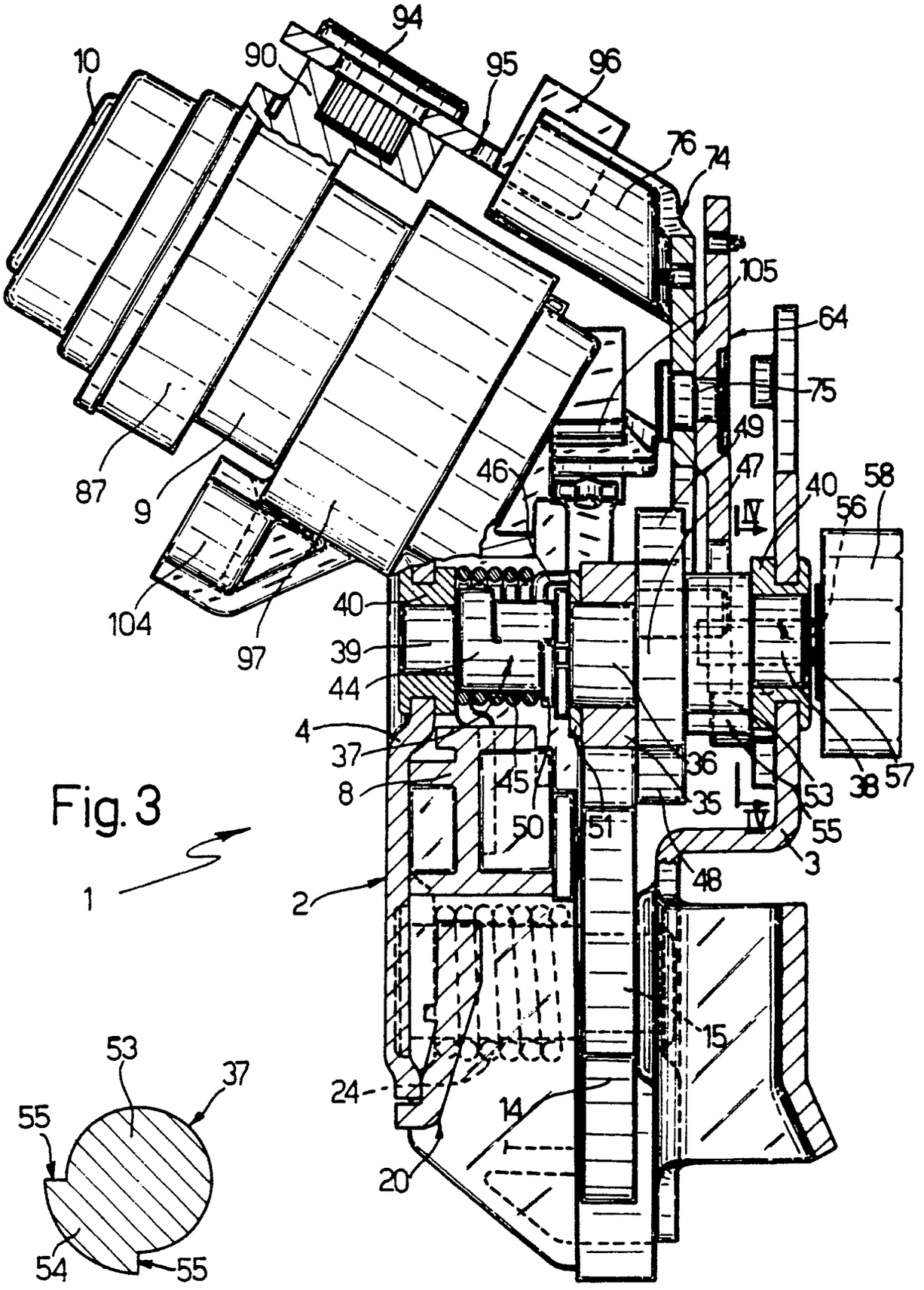
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Fig. 3

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Fig. 4

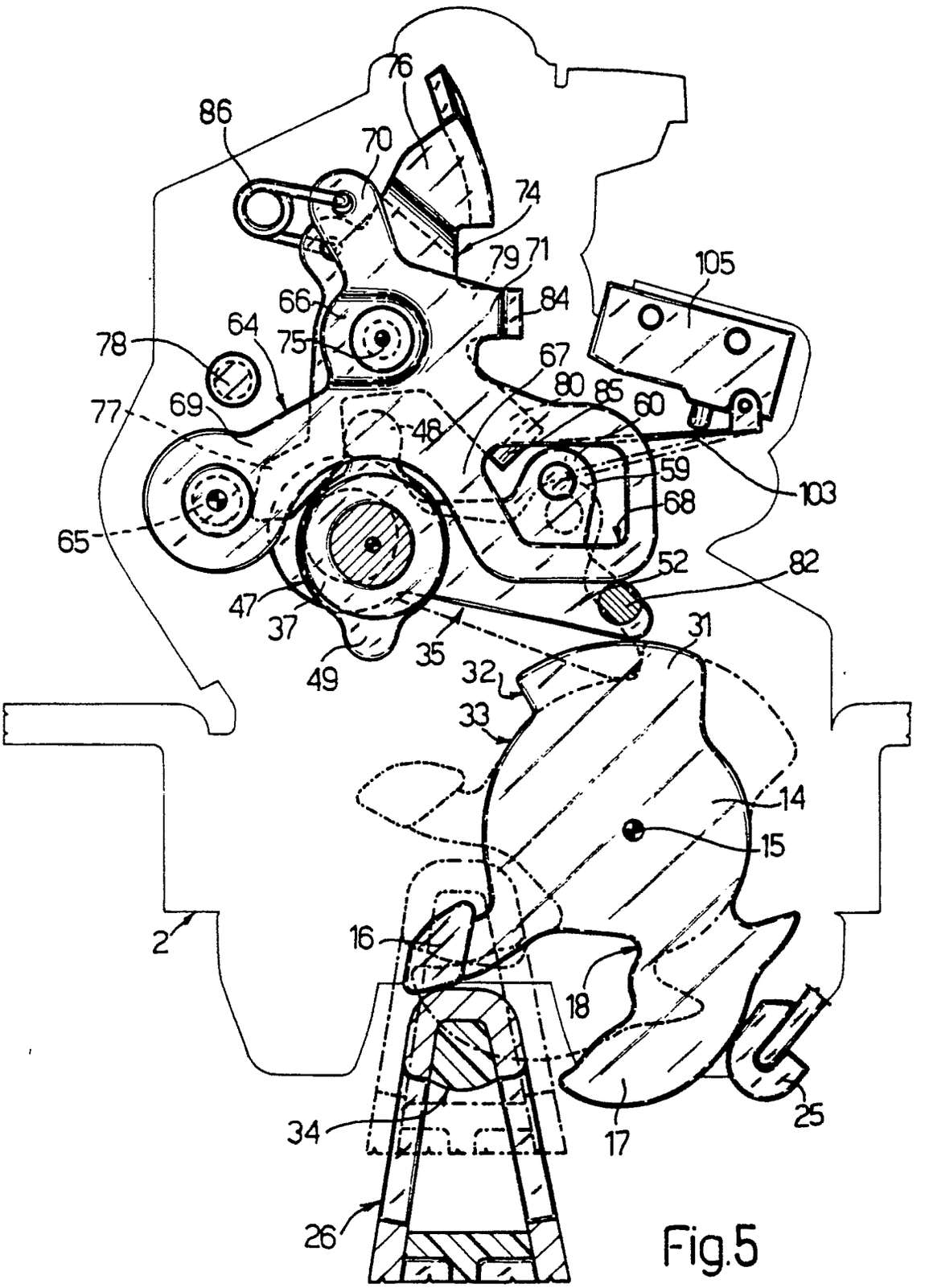
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Fig.5

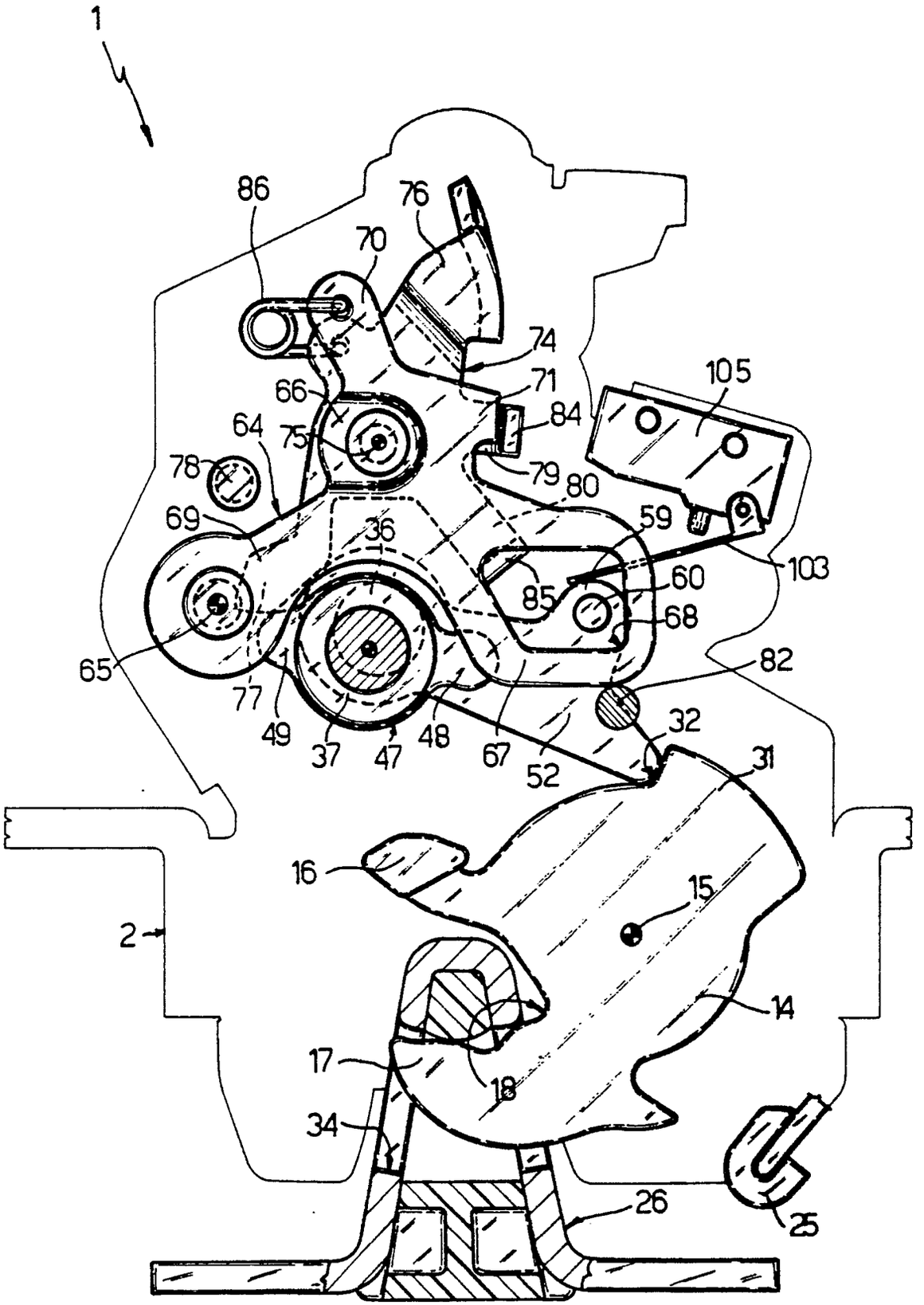
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Fig.6

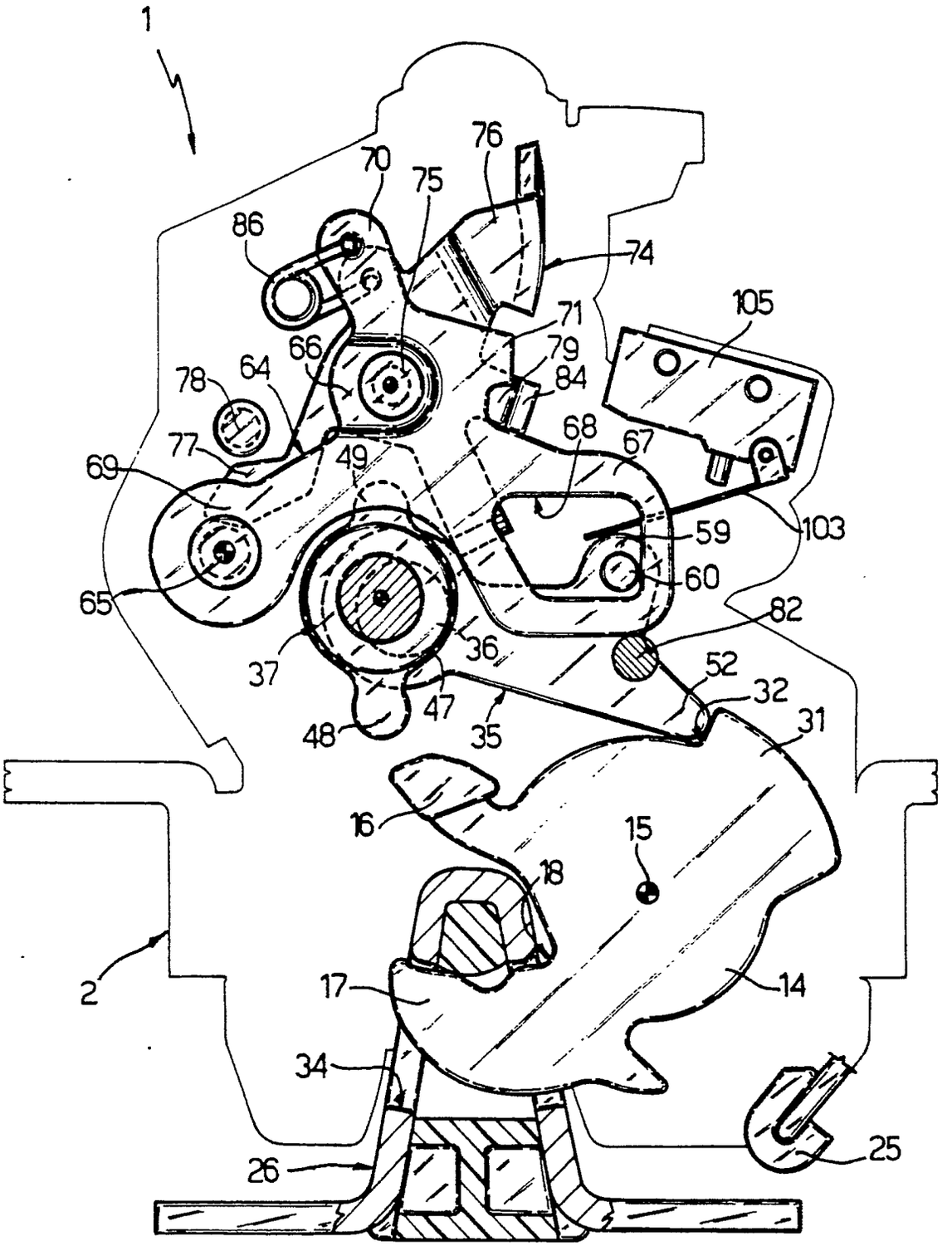
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Fig.7

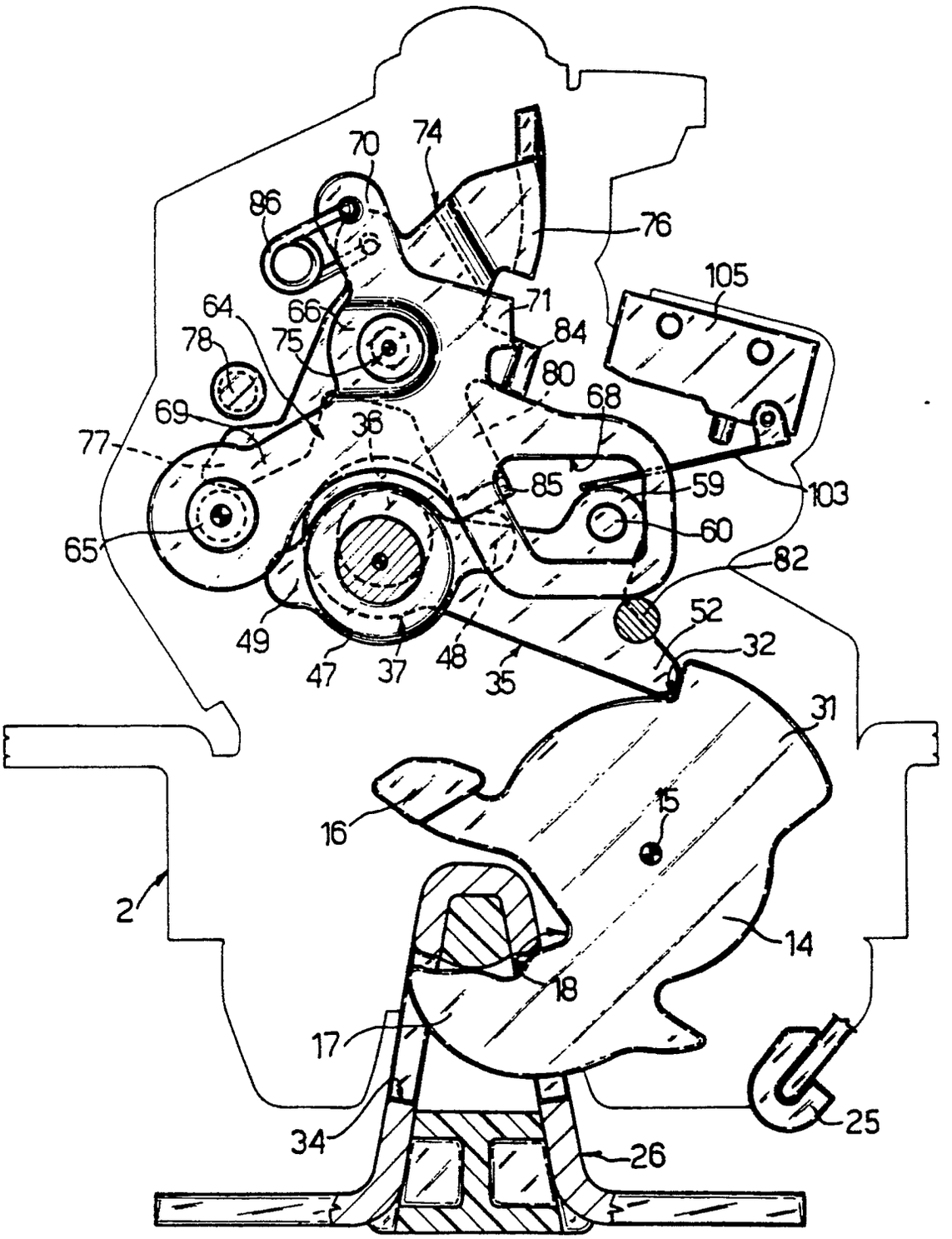
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Fig.8

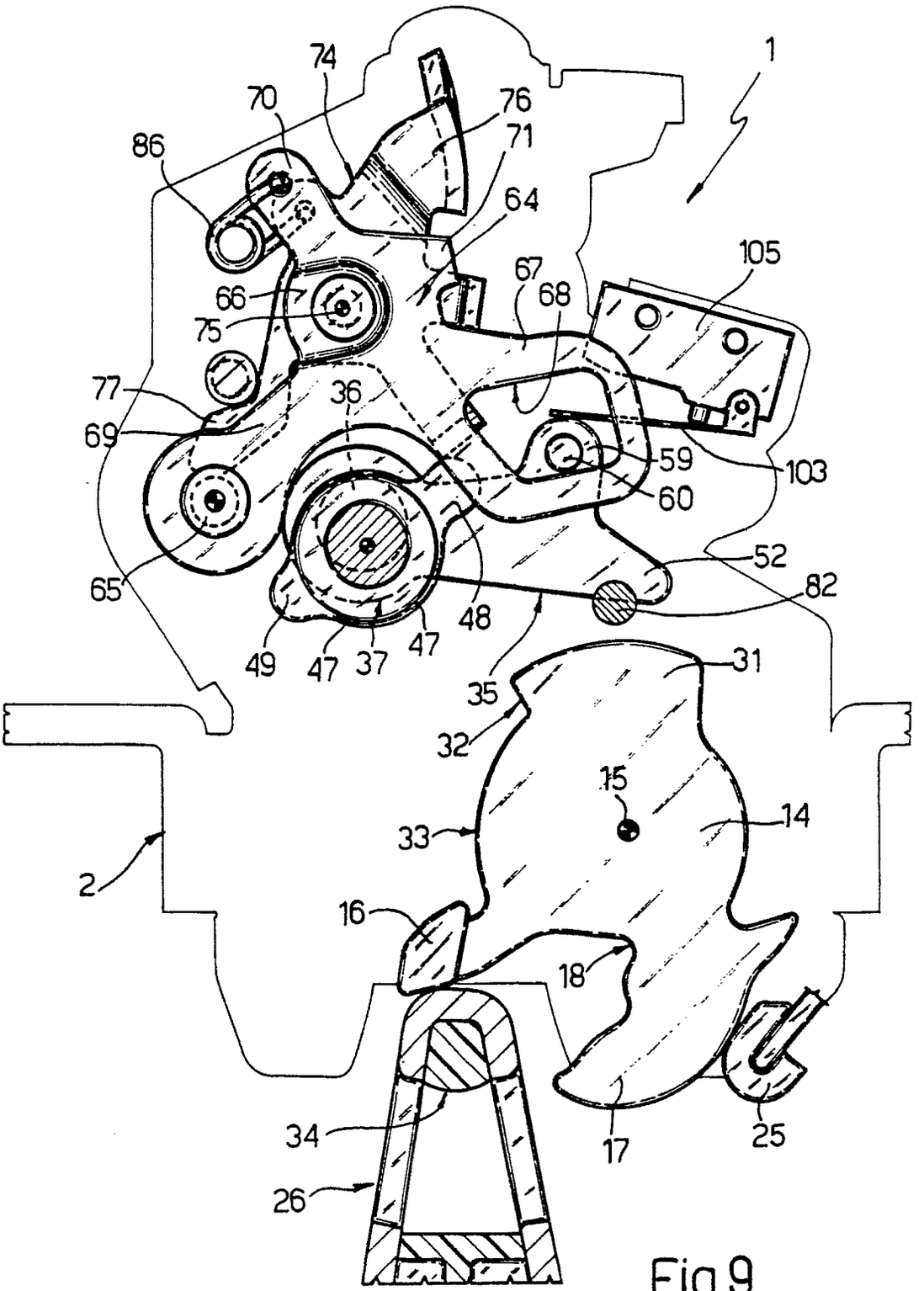
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Fig.9