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(54) **PNEUMATIC MOTOR AND OBJECT CONVEYOR, IN PARTICULAR FOR REMOVING SCRAPS**

(57) A pneumatic motor (1) comprising: an actuator (2) at least partially mobile in an actuation chamber (CA); a first plugging assembly (3) defining a first driving chamber (C1) and a second driving chamber (C2) and comprising a first plug (5) reversibly movable at least between an enabling position and an obstructing position; a second plugging assembly (4) defining a third driving chamber (C3) in fluid communication with the second driving chamber (C2) and an inflow/outflow chamber (CX) in fluid communication with the actuation chamber (CA). In particular, the inflow/outflow chamber (CX) has a first opening (A1) and a second opening (A2) respectively in fluid communication with the inlet opening (I) and the outlet

opening (O) of the motor (1). In addition, the second plugging assembly (4) comprises a second plug (7) reversibly movable at least between an inflow position, in which it allows a fluid communication between the inflow/outflow chamber (CX) and the first opening (A1), and an outflow position, in which it allows a fluid communication between the inflow/outflow chamber (CX) and the second opening (A2). In particular, the first plugging assembly (3) and/or the second plugging assembly (4) have a vent opening (S) adapted to promote a continuous discharge of a fluid from the second driving chamber (C2) and/or from the third driving chamber (C3).

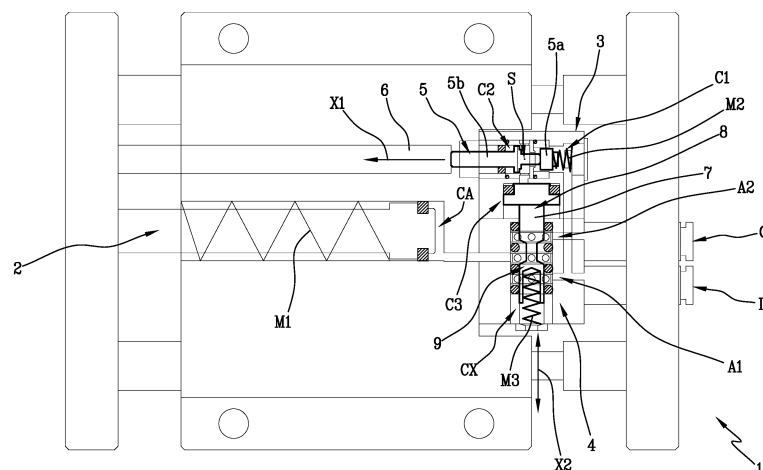


Fig.1

Description

TECHNICAL FIELD

[0001] The present invention relates to a pneumatic motor and an object conveyor, in particular for removing scraps.

[0002] The present invention fits in the technical field of devices for moving objects lying on special collection bodies, for example trays or containers, by imposition of a motion on the collection body itself.

[0003] In particular, the movement of the objects can take place by imposition of a vibratory motion on the collection body, which can define a horizontal or inclined collection plane on which the objects to be moved are intended to be disposed.

[0004] By way of not limiting example, the present invention finds wide application in the devices that allow the movement of objects along one or more paths of a production line, for example the so-called scrap removers.

PRIOR ART

[0005] Nowadays there are many scrap removers on the market.

[0006] Generally, such devices comprise a pneumatic motor adapted to apply an oscillatory, or vibratory, motion to a container so as to promote the advancement of the objects in one of the directions of the oscillatory motion itself.

[0007] In particular, these devices may further comprise springs of different types that allow one of the two steps of the motion to be realized. Disadvantageously, wear on the springs can lead to failures and, therefore, to the need for maintenance interventions.

[0008] Some devices are also capable of giving the container a reciprocating motion thanks to the presence of a pair of pistons, opposed to each other, which therefore allow to overcome the need for the use of elastic springs to achieve one of the two steps of the motion.

[0009] Disadvantageously, this latter type of device requires frequent replacements and/or maintenance interventions.

[0010] In fact, the pneumatic motors that apply the movement to the container can be faced with a "stall condition" (in other words "get jammed") and get blocked, failing to apply the motion to the container in either of the two directions of movement.

[0011] In addition to the material inevitably accumulating on the container, this condition can have serious repercussions on the portion of the production line upstream of the same device. In fact, the accumulation of material leaving a machine, for example a mould, leads to an interference with the operating steps of the machine itself to the point of causing it, in the most serious cases, to faults and/or failures.

SUMMARY

[0012] In this context, the technical task underpinning the present invention is to provide a pneumatic motor and an object conveyor, in particular for removing scraps, which overcome the aforementioned drawbacks.

[0013] In particular, aim of the present invention is to provide a pneumatic motor and an object conveyor, in particular for removing scraps, which are more reliable than the devices of the prior art.

[0014] A further aim of the present invention is to provide a pneumatic motor and an object conveyor, in particular for removing scraps, capable of guaranteeing a high operating flexibility.

[0015] Another aim of the present invention is to provide a pneumatic motor and an object conveyor, in particular for removing scraps, capable of reducing maintenance interventions with respect to the devices of the prior art.

[0016] The stated technical task and the specified aims are substantially achieved by a pneumatic motor and an object conveyor, in particular for removing scraps, comprising the technical characteristics disclosed in one or more of the accompanying claims.

[0017] The dependent claims correspond to possible embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] Further features and advantages of the present invention will become more apparent from the indicative and thus non-limiting description of a preferred but non-exclusive embodiment of a pneumatic motor and an object conveyor, in particular for removing scraps, as illustrated in the accompanying drawings in which:

- figures 1-6 are schematic representations of a plurality of different operating conditions of a pneumatic motor in accordance with a possible embodiment of the present invention;
- figure 7 is a perspective representation of a pneumatic motor in accordance with a possible embodiment of the present invention;
- figure 8 is a perspective representation of an object conveyor, in particular for removing scraps, in accordance with a possible embodiment of the present invention.

[0019] With reference to the figures, a pneumatic motor in accordance with the invention has been indicated as a whole with the numerical reference 1. In the continuation of the present description, the pneumatic motor 1 will also be called simply "motor 1".

[0020] With reference to figure 1, the motor 1 comprises an inlet opening "I" and an outlet opening "O", respectively adapted to permit an inflow of a fluid to the motor 1 and an outflow of a fluid from the motor 1. By way of non-limiting example, the aforementioned fluid may be a

gas, preferably air or nitrogen. The motor 1 further comprises an actuator 2 at least partially mobile in an actuation chamber "CA".

[0021] In accordance with an aspect of the invention, the actuator 2 is reversibly movable inside the actuation chamber "CA" at least between a rearward position (figure 1) and a forward position (figure 5). Advantageously, the actuator 2 can be configured to move from the rearward position to the forward position in accordance with a first translation speed, and to move from the forward position to the rearward position in accordance with a second speed. For example, the first speed may be greater than the second speed. In other words, the motor 1 can be configured to achieve an asymmetrical movement of the actuator 2, being particularly advantageous for applications of the motor 1 to object conveyors and, more particularly, to scrap removers.

[0022] With reference to figure 1, the actuation chamber "CA" may be in fluid communication with the inlet opening "I" and/or the outlet opening "O" so as to promote a movement of the actuator 2 between the rearward position and the forward position, and vice versa. In particular, the motor 1 can comprise an actuation spring "M1" active on the actuator 2 so as to promote a movement from the forward position to the backward position.

[0023] The motor 1 further comprises driving means having at least one driving chamber adapted to receive a fluid in order to drive the actuator 2 between the rearward position and the forward position and vice versa. Advantageously, the driving means may comprise a first plugging assembly 3 and a second plugging assembly 4 operatively connected to permit a movement of the actuator 2. In particular, the first plugging assembly 3 defines a first driving chamber "C1" and a second driving chamber "C2". With particular reference to figure 4, the first driving chamber "C1" and the second driving chamber "C2" are respectively in fluid communication with the inlet opening "I" and the second plugging assembly 4.

[0024] As better visible in figure 1, the first plugging assembly 3 comprises a first plug 5. Preferably, the first plug 5 comprises a primary body 5a and a secondary body 5b which are kinematically connected and/or connectable. In accordance with an aspect of the invention, the primary body 5a may be at least partially disposed in the first driving chamber "C1" and the secondary body 5b may be at least partially disposed in the second driving chamber "C2".

[0025] According to one aspect of the invention, the first plug 5 is reversibly movable at least between an enabling position (figure 1), in which it permits a fluid communication between the first driving chamber "C1" and the second driving chamber "C2", and an obstructing position (figure 5), wherein it prevents a fluid communication between the first driving chamber "C1" and the second driving chamber "C2".

[0026] Preferably, the first plugging assembly 3 may comprise a return spring "M2" and a limit stop element 6. In particular, the return spring "M2" is active on the first

plug 5 so as to promote a movement from the enabling position to the obstructing position. In addition, the limit stop element 6 is activable on the first plug 5 so as to prevent a movement thereof from the enabling position to the obstructing position and/or to promote a movement from the obstructing position to the enabling position.

[0027] In accordance with an aspect of the invention better visible in figures 1-3 and figures 4-5, the limit stop element 6 can be reversibly movable between an active position (figures 1-3), in which it acts on the first plug 5, and a rest position (figures 4-5), in which it does not act on the first plug 5.

[0028] In accordance with a possible embodiment and as illustrated in the accompanying figures, the limit stop element 6 is kinematically connected to the actuator 2, so that a passage of the actuator 2 from the rearward position to the forward position determines a passage of the limit stop element 6 from the active position to the rest position, and vice versa. Advantageously, the second plugging assembly 4 defines a third driving chamber "C3" and an inflow/outflow chamber "CX".

[0029] With particular reference to figure 1, the third driving chamber "C3" and the inflow/outflow chamber "CX" are respectively in fluid communication with the second driving chamber "C2" and the actuation chamber "CA". In accordance with a further aspect of the invention, the driving chamber "C3" and the inflow/outflow chamber "CX" are not in fluid communication. In addition, the inflow/outflow chamber "CX" has a first opening "A1" and a second opening "A2", respectively in fluid communication with the inlet opening "I" and the outlet opening "O".

[0030] In accordance with a further aspect of the invention, the second plugging assembly 4 comprises a second plug 7. In particular, the second plug 7 has an activation portion 8, disposed at least partially in the third driving chamber "C3" and activable by a fluid present in the third driving chamber "C3", so as to move the second plug 7. In addition, the second plug 7 has a plugging portion 9, disposed at least partially in the inflow/outflow chamber "CX". In other words, the second plug 7 has an activation portion 8 adapted to promote the movement thereof and a plugging portion 9 adapted to define an at least partial obstruction of the aforementioned first opening "A1" and second opening "A2".

[0031] With particular reference to figures 3, 4 and 5, the second plug 7 is reversibly movable at least between an inflow position (figures 3-4), in which it permits a fluid communication between the inflow/outflow chamber "CX" and the first opening "A1" while preventing a fluid communication between the inflow/outflow chamber and the second opening "A2", and an outflow position (figure 5), in which it permits a fluid communication between the inflow/outflow chamber "CX" and the second opening "A2" while preventing a fluid communication between the inflow/outflow chamber "CX" and the first opening "A1".

[0032] In accordance with another aspect of the invention, the second plugging assembly 4 comprises an elastic return element "M3" which is active on the second

plug 7 so as to promote a passage thereof from the inflow position to the outflow position.

[0033] With particular reference to figure 1, the first plug 5 can define a first movement path "X1" and the second plug 7 can define a second movement path "X2". In particular, the first movement path "X1" can be transversal, preferably perpendicular, to the second movement path "X2". In this way, the first plug 5 and the second plug 7 minimize the overall dimensions induced by the motor 1.

[0034] Advantageously, the first plugging assembly 3 and/or the second plugging assembly 4 have a vent opening "S" adapted to promote a continuous discharge of a fluid from the second chamber "C2" and/or from the third chamber "C3".

[0035] In the present disclosure, the term "vent opening" refers to an opening adapted to allow the discharge of a fluid from a duct and/or from a pressurized chamber towards the external environment.

[0036] In particular, the vent opening "S" can be adapted to promote a continuous discharge of fluid from the second driving chamber "C2" and/or from the third driving chamber "C3" at least in conjunction with a positioning of the first plug 5 in the enabling position and/or a positioning of the first plug 5 in the obstructing position.

[0037] As illustrated in the accompanying figures, the vent opening "S" is in fluid communication with an environment external to the first plugging assembly 3 and to the second plugging assembly 4 allowing an outflow of fluid from the second driving chamber "C2" and/or from the third driving chamber "C3" towards the external environment.

[0038] In other words, the vent opening "S" is in fluid communication with an environment external to the motor 1.

[0039] The difference between the pressure inside the driving chambers "C2", "C3" and the pressure of the external environment, generally equal to the atmospheric pressure, results in a continuous outflow of fluid from the second driving chamber "C2" and/or from the third driving chamber "C3" towards the external environment.

[0040] In this way, the vent opening "S" contributes to overcoming the problem related to the occurrence of "stall conditions" and/or "jams" of the plugs and/or of the actuator which, in the devices according to the prior art, lead to the blocking of the motor and, often, can lead to serious damage in the systems that cooperate with the motor itself.

[0041] In fact, the vent opening "S" makes it possible to reduce the pressure internal to the second driving chamber "C2" and/or to the third driving chamber "C3" up to values close to those of the pressure of the external environment, preferably atmospheric pressure, maximizing the driving force, for example exerted by the return spring "M2" and/or by the elastic return element "M3", on the first plug 5 and/or on the second plug 7 which sets in motion the first plug 5 and/or the second plug 7 overcoming the "stall condition".

[0042] In accordance with a preferred and non-limiting embodiment, the vent opening "S" is obtained in the first plugging assembly 3. In accordance with further possible embodiments not illustrated, the first plugging assembly 3 and/or the second plugging assembly 4 may have a plurality of vent openings "S", without the inventive concept underlying the present invention being altered.

[0043] Preferably, the first plug 5, when in the enabling position, determines the inflow of a flow of driving fluid to the third driving chamber "C3". Advantageously, the flow of the driving fluid may be greater than a flow of fluid being discharged from the vent opening "S" so as to increase the pressure of the fluid inside the third driving chamber "C3" and thus move the second plug 7.

[0044] In other words, the movement of the first plug 5 from the obstructing position to the enabling position determines the inflow of a flow of driving fluid to the third driving chamber "C3" and the difference between the flow of driving fluid and a flow of venting fluid being discharged from the venting opening "S" is greater than zero, during a movement of the second plug 7 from the outflow position to the inflow position.

[0045] In particular, the vent opening "S" can be sized as a function of the speeds that are intended to be applied on the actuator 2.

[0046] According to further possible embodiments of the present invention, the values of the flows of the driving fluid and/or of the flow of the venting fluid may be different, without the inventive concept underlying the present invention being altered.

[0047] In accordance with a possible configuration of use of the present invention, the actuator 2 is initially disposed in a rearward position and the first plug 5 and the second plug 7 are respectively disposed in the enabling and outflow positions (figure 1). The fluid passing through the inlet opening "I" can reach the third driving chamber "C3" in which it exerts a pressure on the activation portion 8 of the second plug 7, promoting a movement thereof from the outflow position towards the inflow position (figure 2). When the second plug 7 reaches the inflow position, the first opening "A1" of the inflow/outflow chamber "CX" enters into fluid communication with the inlet opening "I", allowing the fluid to enter (figure 3). The fluid entering the inflow/outflow chamber "CX" propagates inside the actuation chamber "CA" causing a movement of the actuator 2 from the rearward position towards the forward position. Consequently, this movement also promotes a movement of the limit stop element 6 from the active position to the rest position, thus allowing a movement of the first plug 5 from the enabling position to the obstructing position due to the effect of the return spring "M2". In this operating condition, the first plug 5 no longer allows an inflow of fluid to the third driving chamber "C3" and the fluid that previously entered into the latter chamber "C3" is discharged from the vent opening "S" (figure 4). This fluid discharge, together with the action of the elastic return element "M3" on the second plug 7, causes a movement of the second plug 7 from the

inflow position towards the outflow position and, therefore, allows the fluid to be discharged from the actuation chamber "CA". The fluid being discharged from the latter chamber "CA" then passes through the inflow/outflow chamber "CX" and finally is discharged from the outlet opening "O" (figure 5). Following the fluid discharge from the chamber "CA", the actuator 2 moves from the forward position to the rearward position and, consequently, the limit stop element 6 moves simultaneously from the rest position to the active position, overcoming the action of the return spring "M2" (figure 6) and returning to the initial condition (figure 1).

[0048] In accordance with a further aspect, the present invention refers to an object conveyor 100, in particular for removing scraps.

[0049] With reference to figure 8, the conveyor 100 comprises a pneumatic motor 1 connected to an external support. Furthermore, the conveyor 100 comprises a transfer body 200 adapted to receive the objects and solidly connected to the actuator 2 of the motor 1. Preferably, the transfer body 200 may be a tray.

[0050] In accordance with an aspect of the invention, the transfer body comprises a first portion 300 and a second portion 400 spaced apart along a direction of movement of the actuator 2 and opposite relative to the motor 1. In particular, the first portion 300 and the second portion 400 may be kinematically constrained during a movement of the actuator between the rearward position and the forward position.

[0051] Advantageously, the conveyor 100 may comprise a plurality of motors 1, for example two, connected to the same transfer body 200 and operatively connected so as to promote a movement of objects disposed on the same transfer body 200.

[0052] It is therefore noted that the present invention achieves the proposed aims by realizing a pneumatic motor and an object conveyor, in particular for removing scraps, having an increased reliability with respect to the devices of the prior art, in particular thanks to the presence of a vent opening adapted to promote a continuous discharge of a fluid from the second driving chamber and/or said third driving chamber, preventing the occurrence of stall and/or jamming conditions.

[0053] Therefore, the present invention makes it possible to reduce the need for maintenance interventions with respect to the devices of the prior art, reducing operating costs and increasing efficiency.

Claims

1. A pneumatic motor (1) comprising:

- an inlet opening (I) and an outlet opening (O) respectively adapted to permit an inflow of a fluid to said pneumatic motor (1) and an outflow of a fluid from said pneumatic motor (1);
- an actuator (2) at least partially mobile in an

actuation chamber (CA), said actuator (2) being reversibly movable inside said actuation chamber (CA) at least between a rearward position and a forward position; and wherein said actuation chamber (CA) is operatively connectible in fluid communication with said inlet opening (I) and/or said outlet opening (O) so as to promote a movement of said actuator (2) between said rearward position and said forward position and vice versa;

- a driving means comprising at least one driving chamber adapted to receive a fluid in order to drive said actuator (2) between said rearward position and said forward position and vice versa;

characterised in that said driving means comprises at least one vent opening (S) configured to promote a continuous discharge of the fluid from said at least one driving chamber, inducing a driving action on said actuator (2) adapted to favour a restarting of said pneumatic motor (1) from a jammed and/or standby condition.

2. The pneumatic motor (1) in accordance with claim 1, wherein said driving means comprises a first plugging assembly (3) and a second plugging assembly (4);

wherein said first plugging assembly (3) defines a first driving chamber (C1), said first driving chamber (C1) being in fluid communication with said inlet opening (I), and a second driving chamber (C2), said second driving chamber (C2) being in fluid communication with said second plugging assembly (4);

wherein said first plugging assembly (3) comprises a first plug (5) reversibly movable at least between an enabling position, in which it permits a fluid communication between said first driving chamber (C1) and said second driving chamber (C2), and an obstructing position, wherein it prevents a fluid communication between said first driving chamber (C1) and said second driving chamber (C2);

wherein said second plugging assembly (4) defines a third driving chamber (C3), said third driving chamber (C3) being in fluid communication with said second driving chamber (C2), and an inflow/outflow chamber (CX), said inflow/outflow chamber (CX) being in fluid communication with said actuation chamber (CA);

wherein said inflow/outflow chamber (CX) has a first opening (A1) and a second opening (A2) respectively in fluid communication with said inlet opening (I) and said outlet opening (O); wherein said second plugging assembly (4) comprises a second plug (7) having an activa-

- tion portion (8), disposed at least partially in said third driving chamber (C3) and activatable by a fluid at least partially present in said third driving chamber (C3) so as to move said second plug (7), and a plugging portion (9), disposed at least partially in said inflow/outflow chamber (CX); and wherein said second plug (7) is reversibly movable at least between an inflow position, in which it permits a fluid communication between said inflow/outflow chamber (CX) and said first opening (A1), preventing a fluid communication between said inflow/outflow chamber (CX) and said second opening (A2), and an outflow position, in which it permits a fluid communication between said inflow/outflow chamber (CX) and said second opening (A2), preventing a fluid communication between said inflow/outflow chamber (CX) and said first opening (A1); and wherein said first plugging assembly (3) and/or said second plugging assembly (4) have said vent opening (S), said vent opening (S) being adapted to promote a continuous discharge of a fluid from said second driving chamber (C2) and/or said third driving chamber (C3).
3. The pneumatic motor in accordance with claim 2, wherein said first plug (5), when it is in the enabling position, determines an outflow of driving fluid to said third driving chamber (C3); and wherein said outflow of driving fluid is greater than a flow of fluid being discharged from said vent opening (S) so as to increase the pressure of the fluid inside the third driving chamber (C3) to move the second plug (7).
 4. The pneumatic motor in accordance with claim 2 or 3, wherein said first plug (5) defines a first movement path (X1) and said second plug (7) defines a second movement path (X2), said first movement path (X1) being transversal, preferably perpendicular, to said second movement path (X2).
 5. The pneumatic motor in accordance with one or more of claims 2-4, wherein said first plugging assembly (3) comprises a return spring (M2) and a limit stop element (6); wherein said return spring (M2) is active on said first plug (5) so as to promote a movement thereof from said enabling position to said obstructing position; wherein said limit stop element (6) is activatable on said first plug (5) so as to prevent a movement thereof from said enabling position to said obstructing position and/or to promote a movement from said obstructing position to said enabling position.
 6. The pneumatic motor in accordance with claim 5, wherein said limit stop element (6) is reversibly movable between an active position, in which it acts on said first plug (5), and a rest position, in which it does not act on said first plug (5).
 7. The pneumatic motor in accordance with claim 6, wherein said limit stop element (6) is kinematically connected to said actuator (2) so that a passage of said actuator (2) from said rearward position to said forward position determines a passage of said limit stop element (6) from the active position to the inactive position and vice versa.
 8. The pneumatic motor in accordance with one or more of claims 2-7, wherein said first plug (5) comprises a primary body and a secondary body which are kinematically connected and/or connectable; wherein said primary body is disposed at least partially in said first driving chamber (C1) and wherein said secondary body is disposed at least partially in said second driving chamber (C2).
 9. The pneumatic motor in accordance with one or more of claims 2-8, wherein said second plugging assembly (4) comprises an elastic return element (M3) active on said second plug (7) so as to promote a passage of said second plug (7) from said inflow position to said outflow position.
 10. The pneumatic motor in accordance with one or more of claims 2-9, wherein said vent opening (S) is adapted to promote a continuous discharge of a fluid from said second driving chamber (C2) and/or said third driving chamber (C3) at least in concomitance with a positioning of said first plug (5) in said enabling position and/or of a positioning of said first plug (5) in said obstructing position.
 11. The pneumatic motor in accordance with one or more of the preceding claims, comprising an actuation spring (M1) active on said actuator (2) so as to promote a movement of said actuator (2) from said forward position to said rearward position.
 12. The pneumatic motor in accordance with one or more of the preceding claims, wherein said actuator (2) is configured to carry out a movement from said rearward position to said forward position according to a first speed and to carry out a movement from said forward position to said rearward position according to a second speed; and wherein said first speed is greater than said second speed.
 13. An object conveyor (100), in particular for removing scraps, comprising:
 - a pneumatic motor in accordance with one or more of the preceding claims and connected to an external support;
 - a transfer body (200) for the objects, solidly connected to the actuator (2) of said pneumatic

motor.

14. The conveyor in accordance with claim 14, wherein said transfer body (200) comprises a first portion (300) and a second portion (400) spaced apart along a direction of movement of the actuator (2) and opposite relative to said pneumatic motor, said first and said second portion (400) being kinematically constrained during a movement of said actuator (2) between said rearward position and said forward position.
15. The conveyor in accordance with claim 13 or 14, wherein said transfer body (200) is a tray.

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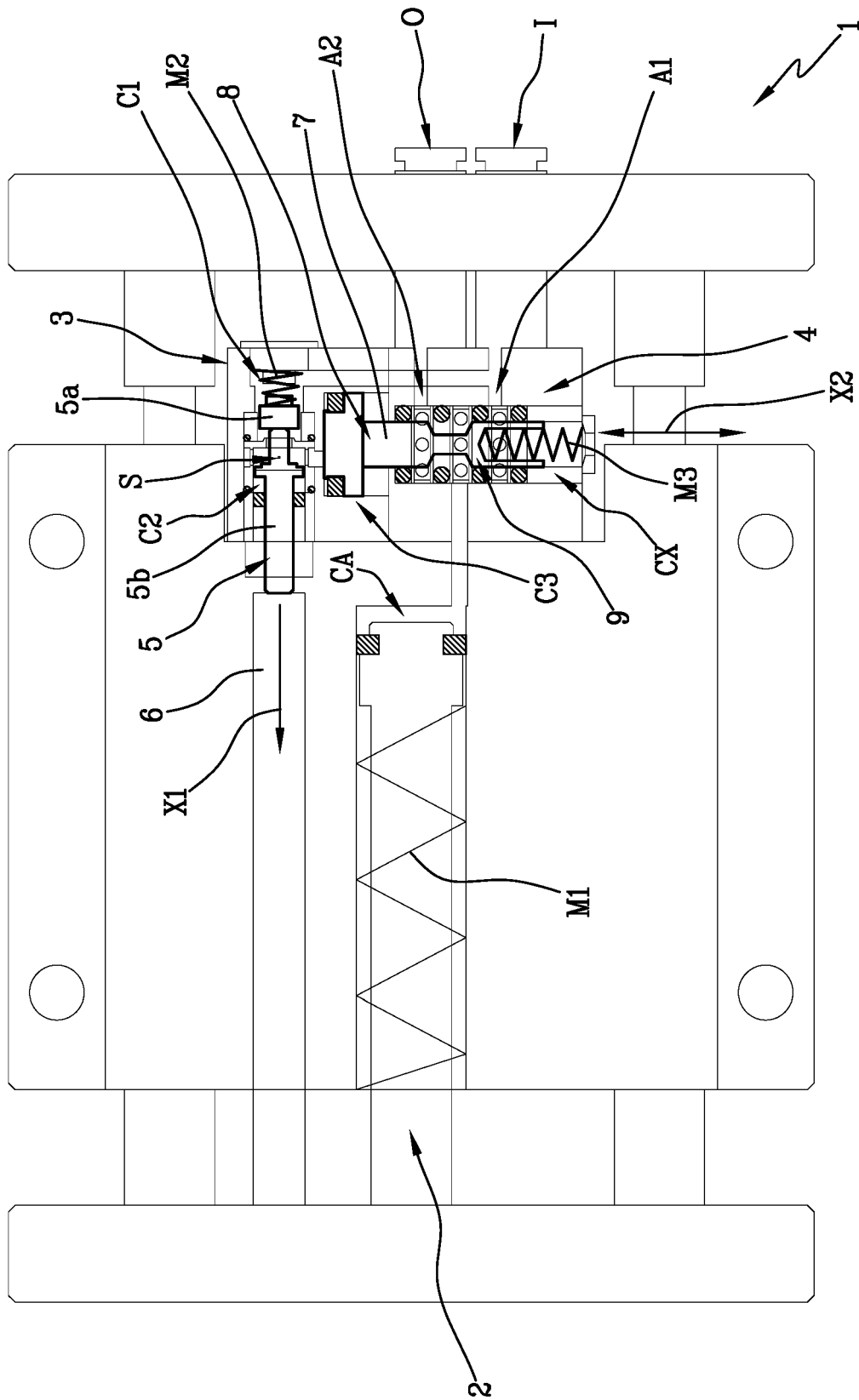


Fig. 1

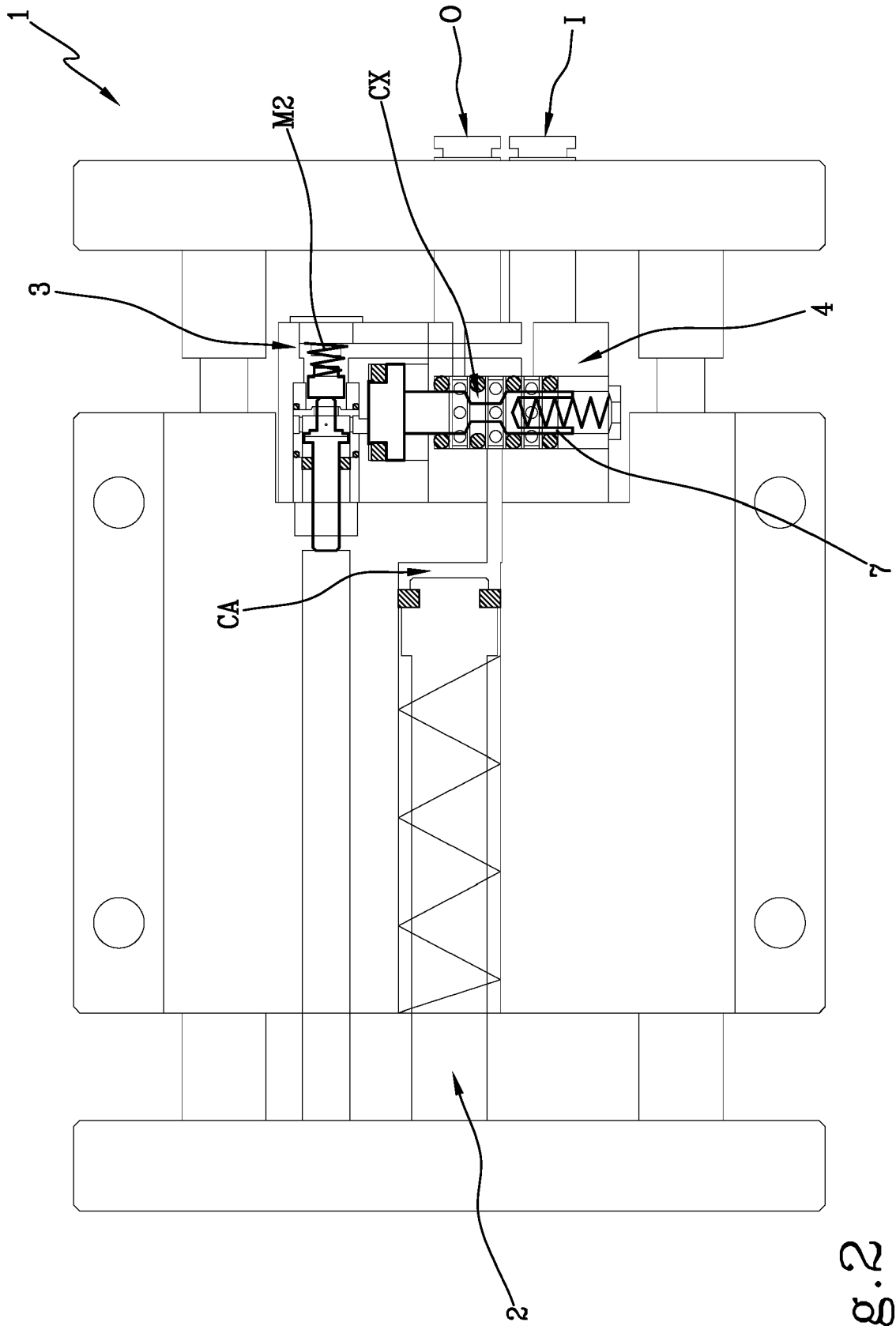


Fig. 2

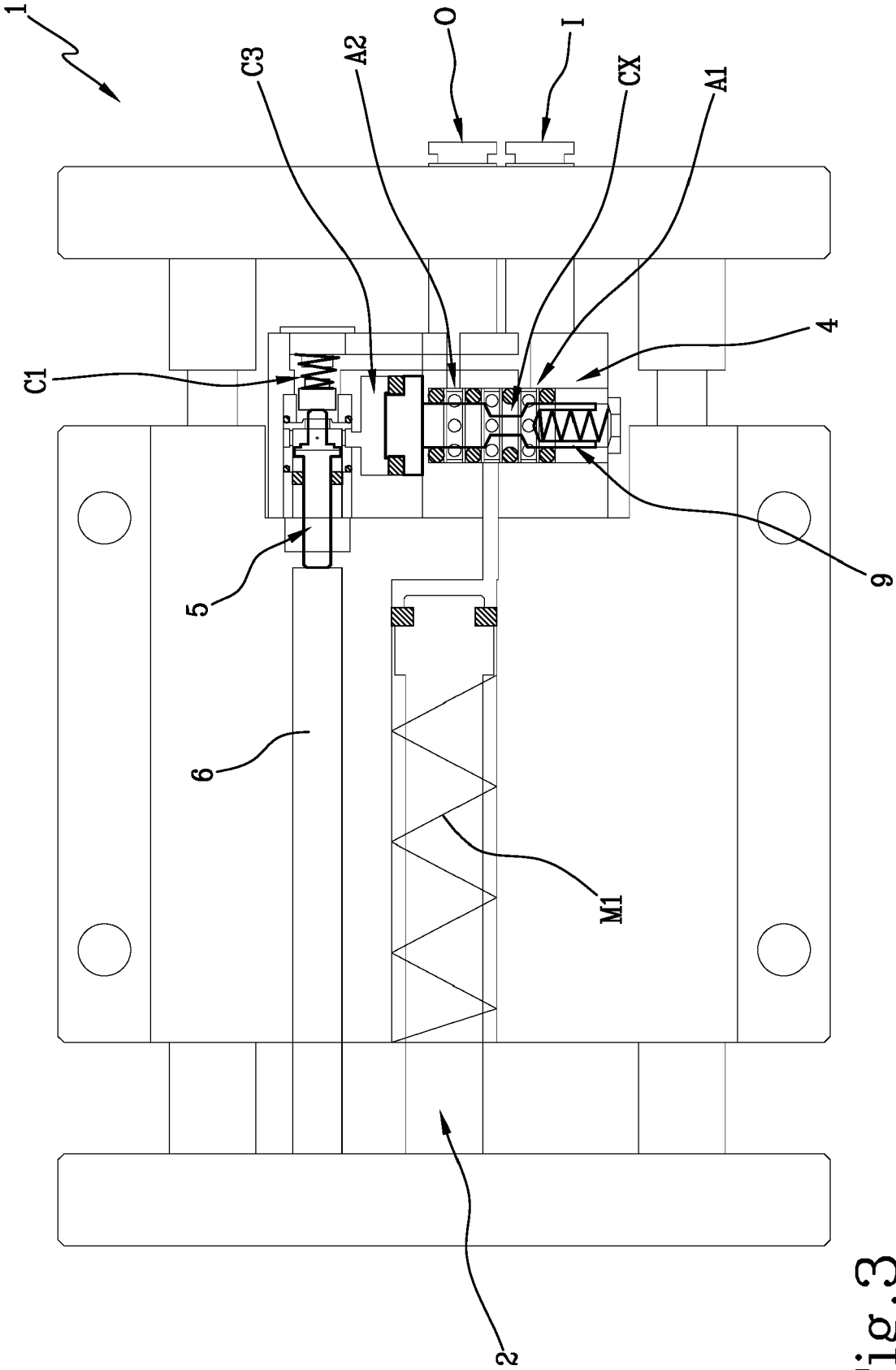


Fig. 3

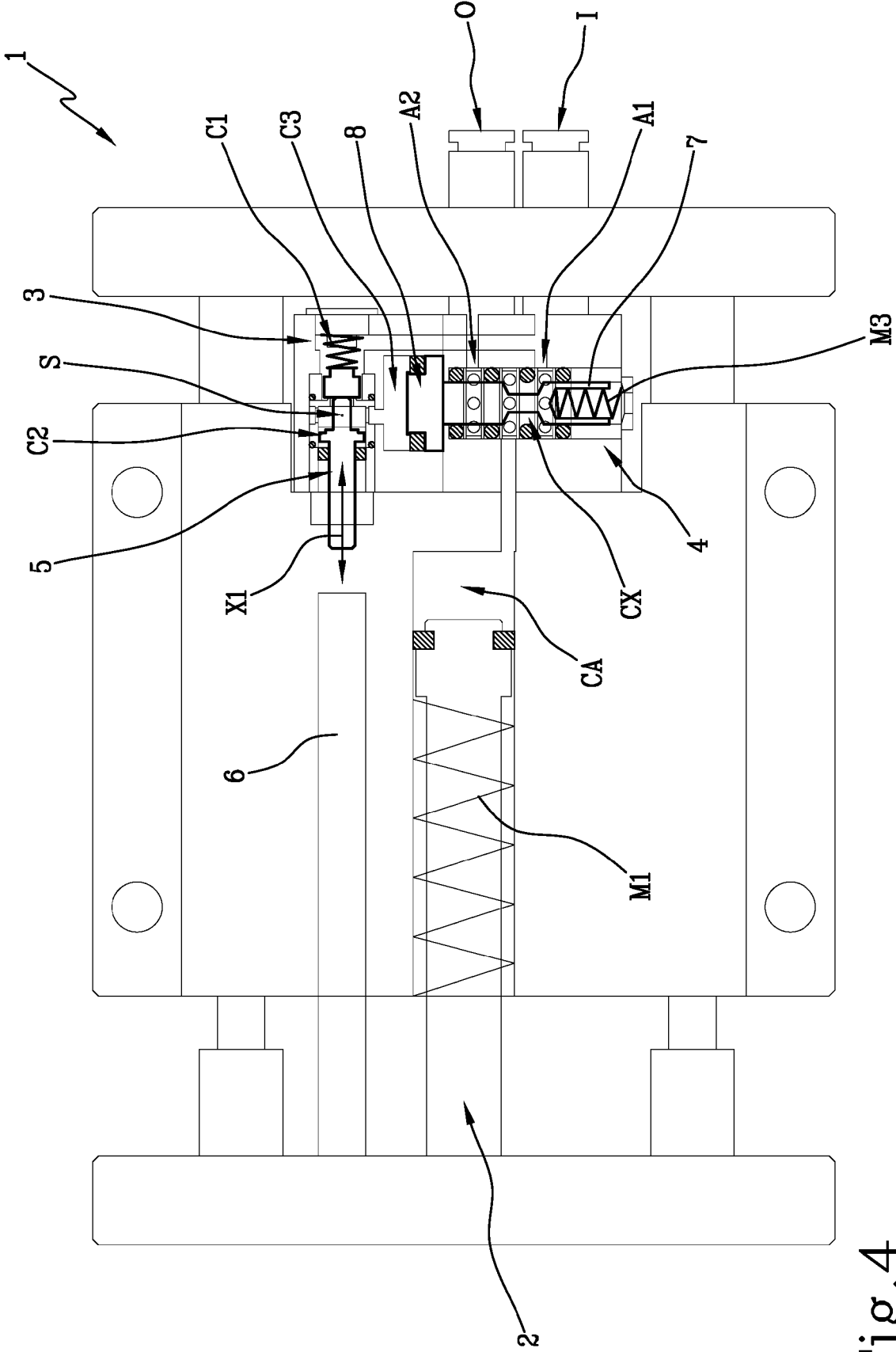


Fig. 4

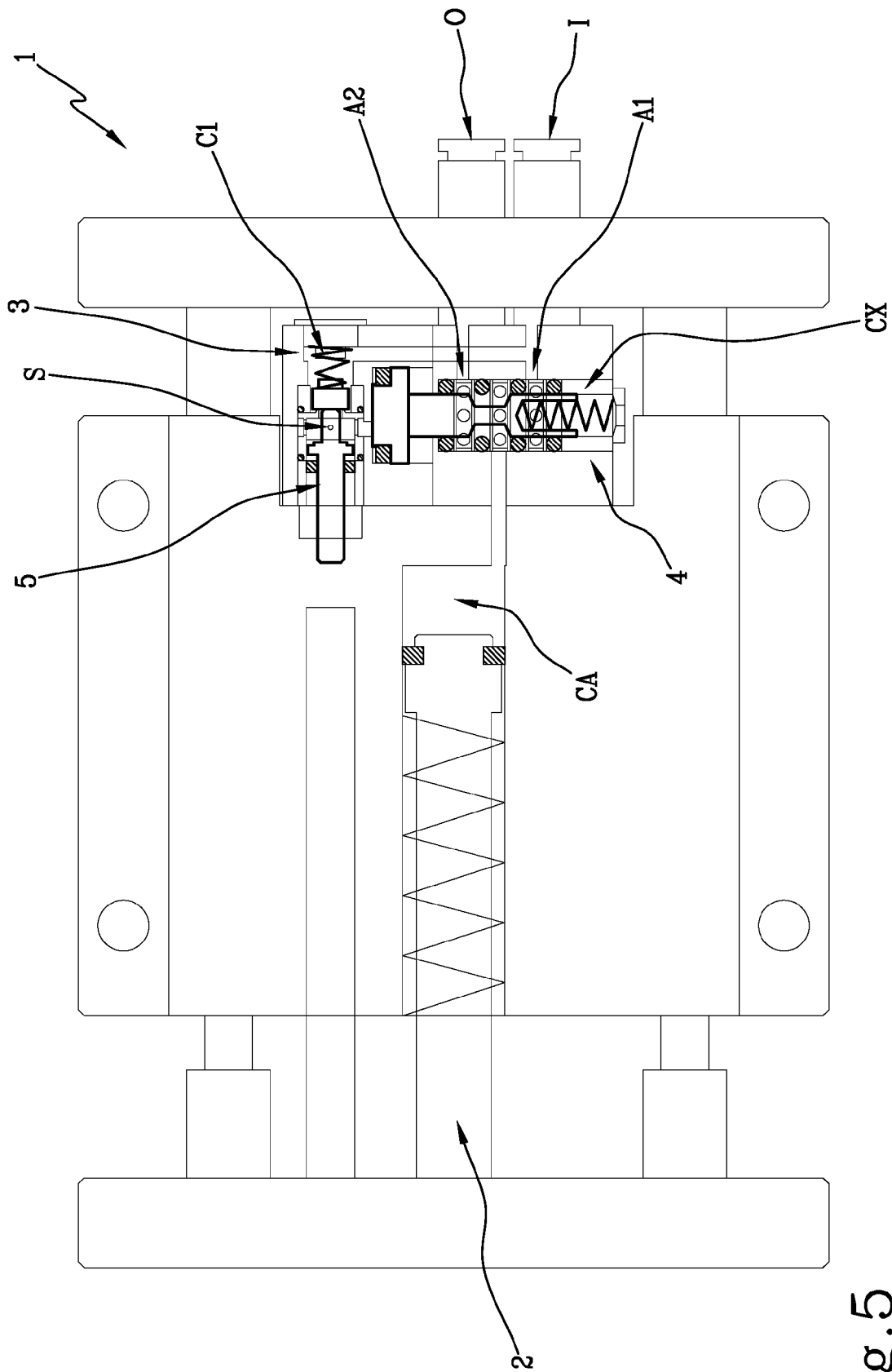


Fig. 5

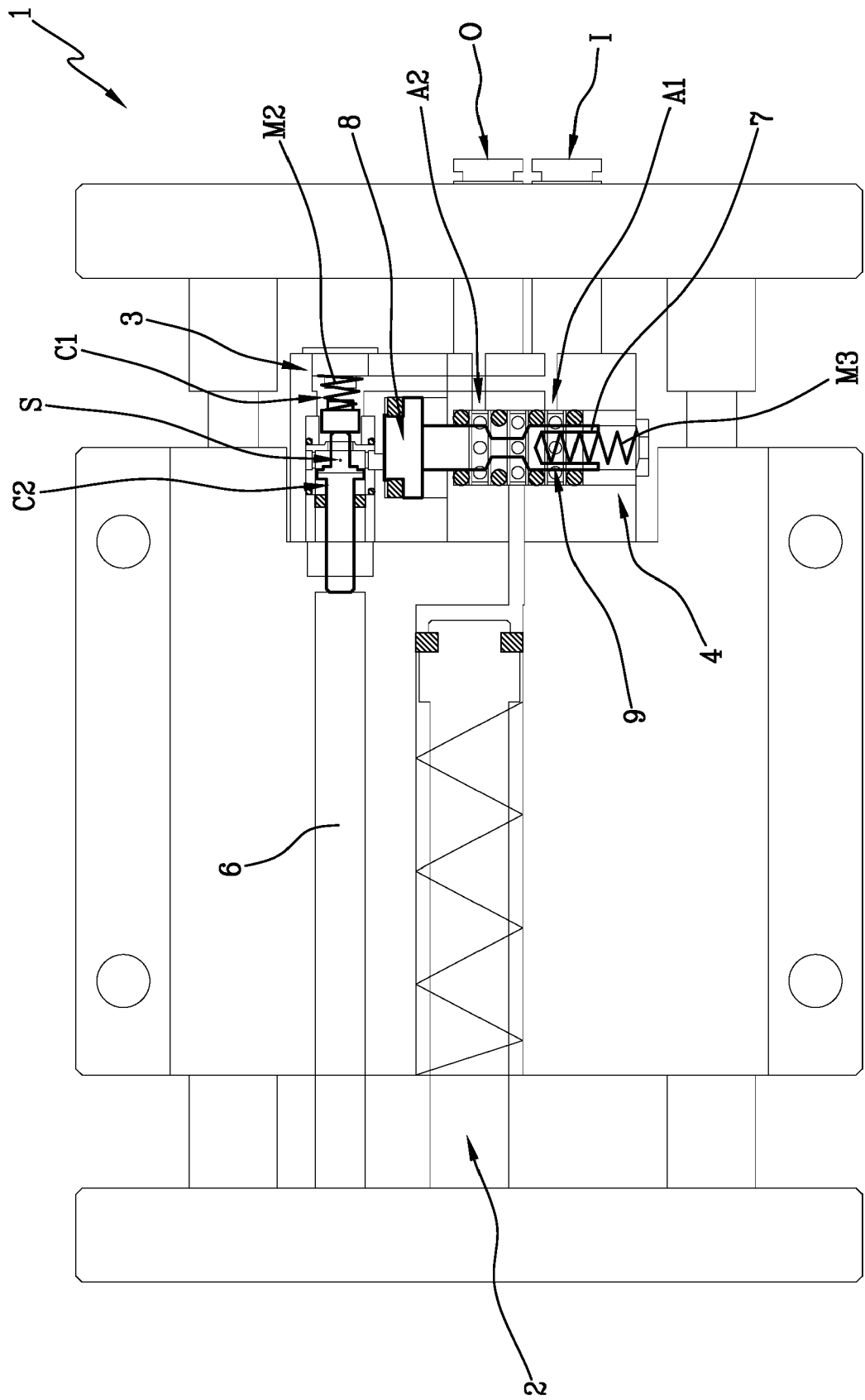


Fig. 6

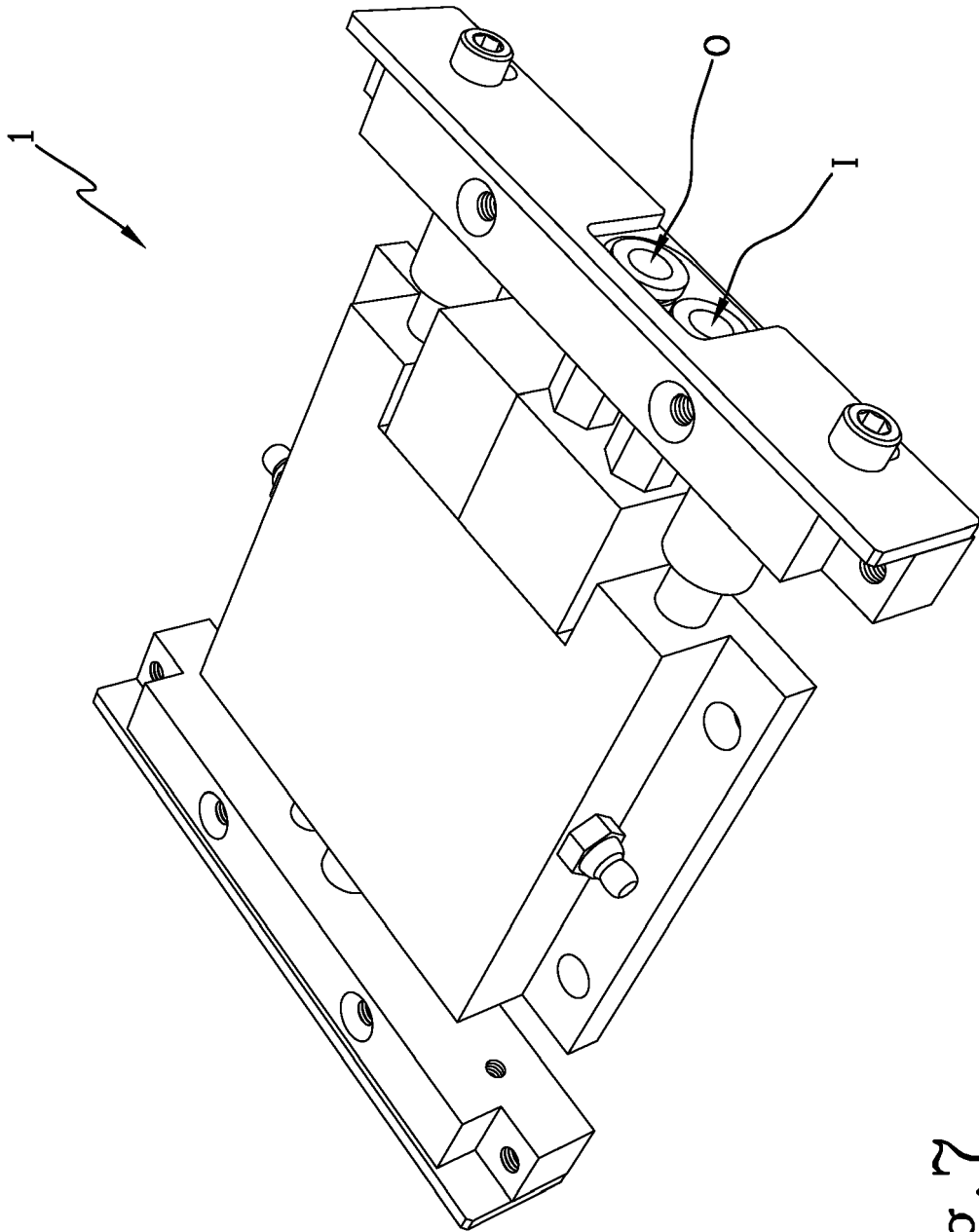


Fig. 7

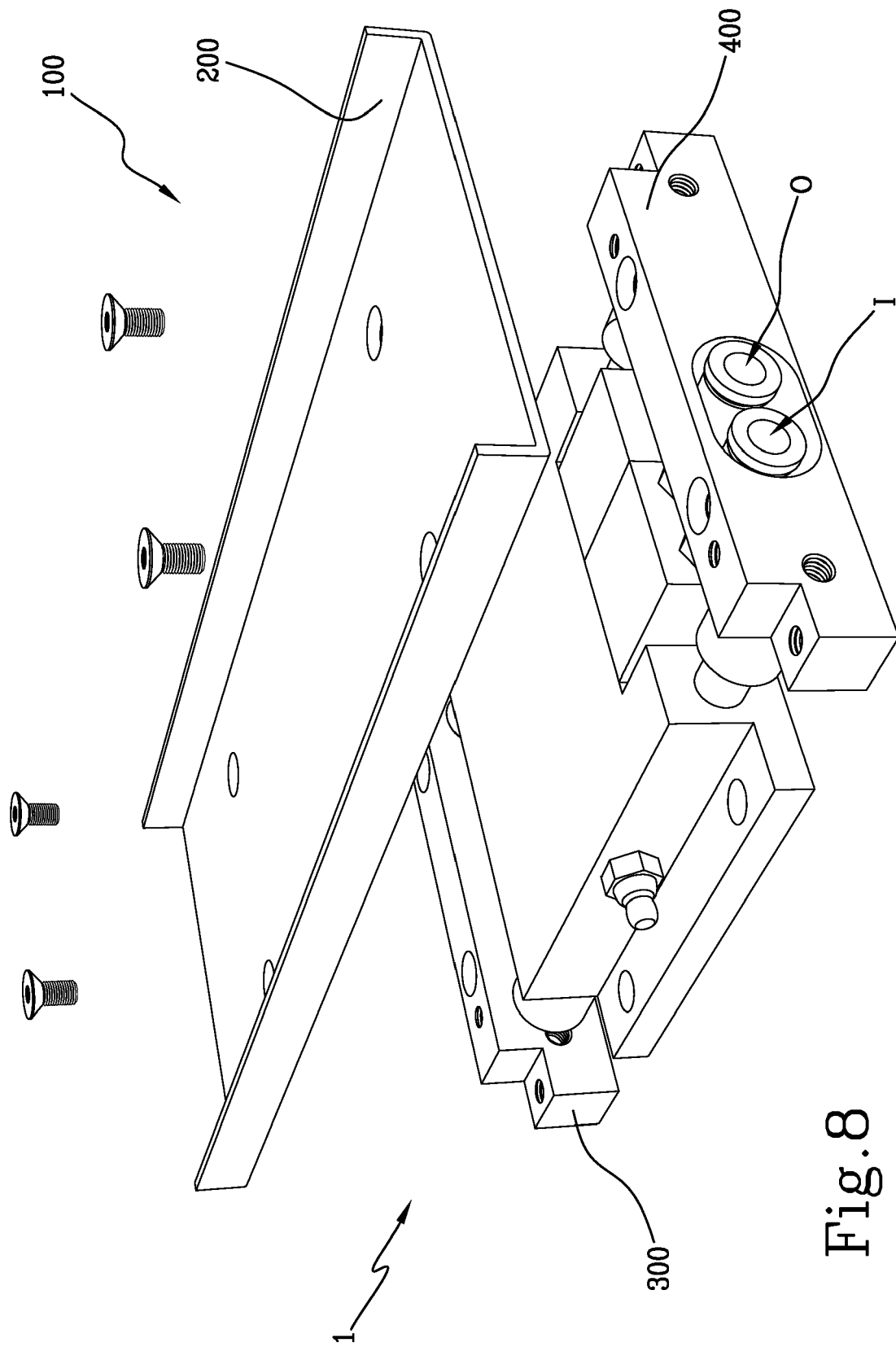


Fig.8



EUROPEAN SEARCH REPORT

Application Number

EP 22 21 0041

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 1 446 590 A (HYDROACOUSTIC INC) 18 August 1976 (1976-08-18) * page 2, lines 118-121 *	1, 11-15	INV. F15B21/12 B06B1/18
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A	-----		
A	EP 1 661 629 A2 (BORDIGNON SILVANO [IT]) 31 May 2006 (2006-05-31) * the whole document *	1, 13-15	

			TECHNICAL FIELDS SEARCHED (IPC)
			F15B B06B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 5 April 2023	Examiner Toffolo, Olivier
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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