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(54) Title: **LOAD CYLINDER FOR COMPENSATING UNBALANCED FORCES**

(57) Abstract: Load cylinder for compensating unbalanced forces, which comprises a hollow ring-shaped body (1), a base (2) fixed to a first end (31) of the ring-shaped body (1), and a rod (3) housed partially in the hollow space of said ring-shaped body (1), a chamber (4) being delimited between side walls (13) of said ring-shaped body (1), the rod (3) and the base (2). The rod (3) is housed partially in said chamber (4) and may move in its interior. Said rod (3) comprises a housing (30) on one end (32), and the cylinder (100) comprises a compensation member (5) housed in said housing (30), said compensation member (5) being acted on to cause the movement of said rod (3). The housing (30) comprises a greater width than the width of said compensation member (5), with the result that said compensation member (5) may move inside the housing (30).

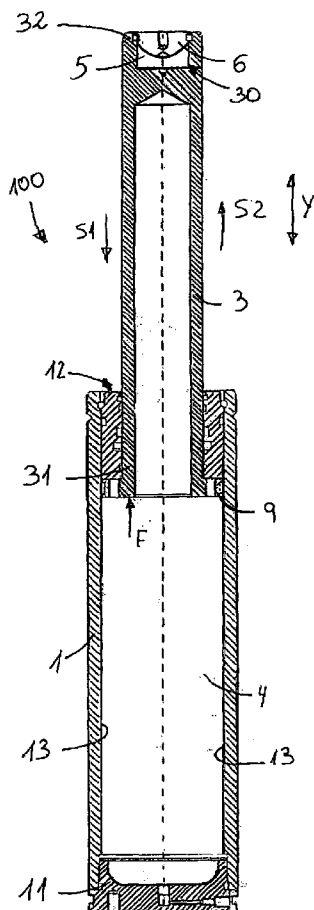


Fig. 1



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DESCRIPTION

“Load cylinder for compensating unbalanced forces”

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TECHNICAL FIELD

The present invention relates to load cylinders, and more specifically to load cylinders adapted for compensating imbalances in the force exerted by the load.

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PRIOR ART

Material-forming installations comprise a press and a die that is arranged in the press. The die comprises a matrix and a male between which is arranged the material for forming, the matrix moving towards the male (or vice versa) in order to form it. Normally, said dies comprise a hold-down board to control the flow of the sheet material, which is moved by the movement of the matrix (or the male). The hold-down board also comprises a window through which the male (or matrix) comes out when said hold-down board moves, the metal sheet being formed as a result. The down force is achieved by applying a force on the hold-down board through cylinders in the press itself, said cylinders increasing their force as they are compressed by the movement of the die.

25 The cylinders comprise a casing and a piston that delimit an internal chamber of the cylinder. The piston moves inside the chamber as a result of the movement of the die, causing the reduction in the volume of the chamber. One of said cylinders is disclosed, for example, in document WO 2009043594.

30 Generally speaking, due to the assembly of the die and/or its use, for example, the movement caused by the die in the piston is not completely vertical and causes said piston to exert unwanted forces against at least one of the internal walls of the casing of the cylinder during its movement. As a result, due to said forces, it is often the case that the piston and/or the casing eventually break, thereby necessitating
35 the replacement of the cylinder with a new one more frequently than is desirable.

Document US7343846B2 discloses a cylinder that solves, at least partially, this drawback, and for this purpose the piston comprises a semi-circular piece which is acted to cause the movement of the piston. This piece is arranged in a substantially

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centred manner in relation to the longitudinal axis of the piston, and can pivot in relation to said longitudinal axis. When the surface of the die is not completely horizontal, this surface and the external surface of the semi-circular piece on which it acts to cause the movement of the piston are not aligned, so that said semi-circular piece pivots in relation to the longitudinal axis, aligning itself with the surface of the die. As a result, the piece rotates in order to adapt itself to the slope of the surface of the die and always exerts a vertical force on the rest of the piston, regardless of said slope, which moves vertically without generating lateral forces on any of the internal walls of the casing of the cylinder as a result of a misalignment between said die and said piston. As a result, said semi-circular piece supports and/or compensates the misalignment between the piston and the die and prevents the cylinder from breaking as a result of this problem.

15 DISCLOSURE OF THE INVENTION

It is an object of the invention to provide a cylinder as described in the claims.

The load cylinder of the invention comprises a hollow ring-shaped body with a closed first end and an open second end, a piston housed in the ring-shaped body that delimits a fluid chamber, a rod that is housed at least partially in the ring-shaped body through the open second end and which is fixed to the piston, and which can be moved in a longitudinal direction in one sense or the other, and a compensation member to compensate possible deviations in the movement of the rod, which is attached to said rod and on which it acts to cause said movement of said rod.

The rod comprises, in one end opposite to the piston, a housing where the compensation member is housed. The housing comprises a greater width than the width of said compensation member, so that said compensation member can be moved inside the housing in a compensation direction, in one or another sense, to compensate possible deviations in the movement of the rod.

If an unbalanced force is exerted in a swinging manner on the compensation member, said compensation member can be moved in the compensation direction, in one or another sense, inside the housing in response to said swinging motion, said compensation member absorbing said swinging motion and applying a vertical force on the piston, so that the piston moves vertically without exerting lateral forces on the side walls of the ring-shaped body caused by said swinging motion. As a

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result, the swinging motion of the force that causes the movement of the piston does not affect the cylinder negatively.

These and other advantages and characteristics of the invention will be made
5 evident in the light of the drawings and the detailed description thereof.

DESCRIPTION OF THE DRAWINGS

10 Figure 1 shows an embodiment in cross-section of the cylinder of the invention.

Figure 2 shows, in detail, compensation members of the cylinder of Figure 1.

15 DETAILED DISCLOSURE OF THE INVENTION

Figure 1 shows an embodiment of the cylinder 100 of the invention, which comprises a hollow ring-shaped body 1 with a closed end 11 and an open end 12, a piston 9 housed in the ring-shaped body 1, and a rod 3 which is housed at least
20 partially in the ring-shaped body 1 through the open second end 12, which is fixed to the piston 9, and which can be moved in a longitudinal direction Y in one sense or the other. In the ring-shaped body 1 is delimited a chamber 4 with fluid between the closed end 11 and the piston 9.

25 These types of cylinders 100 are generally used in stamping presses, and when the press performs a stamping action it acts on the rod 3, causing its movement in the direction of movement Y in a first sense S1. The chamber 4 comprises a fluid in its interior, preferably gas, and when the rod 3 moves in said first sense S1 the fluid is compressed as the piston 9 moves in conjunction with said rod 3, exerting a force F
30 on said piston 9 that increases as the rod 3 moves in said first sense S1. When the rod 3 is no longer acted on, due to the force F exerted by the fluid on the piston 9, the rod 3 returns to its initial position moving in a second sense S2 opposite to the first sense S1.

35 In the cylinder 100 of the invention the rod 3 comprises a housing 30 on one end 32 opposite to the end 31 of said rod 3 by means of which it is fixed to the piston 9. The cylinder 100 comprises a compensation member 5 to compensate possible deviations in the movement of the rod 3, which is housed in the housing of said rod 3 and on which acts a load (a die in the press, for example) to cause the movement

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in the first sense S1 of said rod 3. The housing 30 comprises a greater width than the width of said compensation member 5, so that said compensation member 5 can be moved in a compensation direction X, in one or another sense, inside the housing 30.

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The ideal situation occurs when the load acts on the rod 3 with a vertical force. If said force is not vertical, the load is regarded as acting on the rod 3 with unbalanced forces. As a result, with the cylinder 100 of the invention, when the load acts on the rod 3 with a force F1 that originates from the press that causes the
10 movement of said rod 3, and which suffers variations in the compensation direction X in the manner of a swinging motion (an unbalanced force), the compensation member 5 compensates said swinging motion by moving in the compensation direction X. Said compensation member 5 exerts a vertical force on the rod 3 causing it to move in a vertical manner in the first direction S1, said rod 3 not
15 exerting any pressure or force on internal side walls 13 of the ring-shaped body 1. As a result, thanks to the compensation member 5, the risk of the swinging motion of the press affecting the useful life of the cylinder 100 due to the premature breakage of the rod 3 or the ring-shaped body 1 is prevented or reduced.

20 When arranged in the housing 30 of the rod 3, a contact surface 50 of the compensation member 5 is supported on a support surface 33 of the rod 3, with the compensation member 5 sliding on said support surface 33 when it moves in the compensation direction X. For this reason the contact surface 50 is preferably made of a material with a low friction coefficient, such as copper, thereby facilitating said
25 movement. Preferably the compensation member 5 is made entirely of said material with a low friction coefficient.

In a preferred embodiment, the compensation member 5 comprises a plurality of grooves 51 in the contact surface 50 which extend along the entire contact surface
30 50 and which are designed to receive lubricant and help said compensation member 5 to slide. The lubricant used may be any known lubricant, oil for example, and its purpose is to aid the movement of the compensation member 5 in the compensation direction X when necessary. The number of grooves 51 depends on the needs of the cylinder 100, and it can be sufficient in some cases to use a single
35 groove 51 (or even no grooves 51). Rather than being arranged in the contact surface 50 of said compensation member 5, the groove 51 (or grooves) can be arranged on the support surface 33 of the housing 30 of the rod 3.

The cylinder 100 of the invention can also comprise an additional compensation

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member 6 arranged on the compensation member 5, as shown in Figures 1 and 2, in contact with said compensation member 5. The load acts directly on the additional compensation member 6, which transmits said action to the compensation member 5, which in turn transmits it to the rod 3, causing the
5 movement of said rod 3 in the first sense S1. A contact surface 52, 60 between both compensation members 5 and 6 is circular, so that if a force F1 exerted by the load on the additional compensation member 6 is not vertical (an unbalanced force) due to a misalignment between the contact surfaces between the rod 3 and the
10 member 6 balances in relation to the compensation member 5 in response to the misalignment, in a balancing direction B in one sense or the other according to what is required, and transmits said force F1 to said compensation member 5 in a substantially vertical manner, causing a vertical movement of the rod 3 in the first sense S1.

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Preferably, the contact surface 60 of the additional compensation member 6 is concave, and the contact surface 52 of the compensation member 5 is convex, although the reverse is also possible: the contact surface 60 of the additional compensation member 6 being convex, and the contact surface 52 of the
20 compensation member 5 being concave.

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CLAIMS

1. Load cylinder for compensating unbalanced forces, comprising
a hollow ring-shaped body (1) with a closed first end (11) and an open
5 second end (12),
a piston (9) housed in the ring-shaped body (1) that delimits a fluid chamber (4),
a rod (3) that is housed at least partially in the ring-shaped body (1) through
the open second end (12) and which is fixed to the piston (9), and which can be
10 moved in a longitudinal direction (Y) in one sense or the other (S1, S2), and
a compensation member (5) to compensate possible deviations in the
movement of the rod (3), which is attached to said rod (3) and on which the load
acts to cause said movement of said rod (3),
characterised in that
15 the rod (3) comprises, in one end (32) opposite to the piston (9), a housing (30) where the compensation member (5) is housed,
the housing (30) comprising a greater width than the width of said
compensation member (5), so that said compensation member (5) can be moved
inside the housing (30) in a compensation direction (X), in one sense or the other,
20 to compensate possible deviations in the movement of the rod (3).
2. Cylinder according to claim 1, wherein the compensation member (5) comprises
a contact surface (50) that is supported on a support surface (33) of the rod (3)
when said compensation member (5) is housed in the housing (30) of said rod (3),
25 said contact surface (50) comprising a friction coefficient that allows the
compensation member (5) to slide on the support surface (33).
3. Cylinder according to claim 2, wherein the compensation member (5) comprises
at least one groove (51) on the contact surface (50).
30
4. Cylinder according to claim 2, wherein the support surface (33) of the rod (3)
comprises at least one groove (51).
5. Cylinder according to any of claims 3 or 4, wherein the groove (51) extends along
35 the entire surface (50; 33) where it is arranged.
6. Cylinder according to any of the preceding claims, comprising an additional
compensation member (6) on which the load acts directly and which is arranged on
the compensation member (5), said additional compensation member (6) acting on

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the compensation member (5) when it is acted on and said compensation member (5) acting on the rod (3) and causing its movement, contact surfaces (52, 60) between both compensation members (5, 6) being circular, so that the additional compensation member (6) can be balanced in relation to the compensation member
5 (5) in response to the misalignment of the load.

7. Cylinder according to claim 6, wherein the contact surface (60) of the additional compensation member (6) is concave, and the contact surface (52) of the compensation member (5) is convex.
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8. Cylinder according to claim 6, wherein the contact surface (60) of the additional compensation member (6) is convex, and the contact surface (52) of the compensation member (5) is concave.
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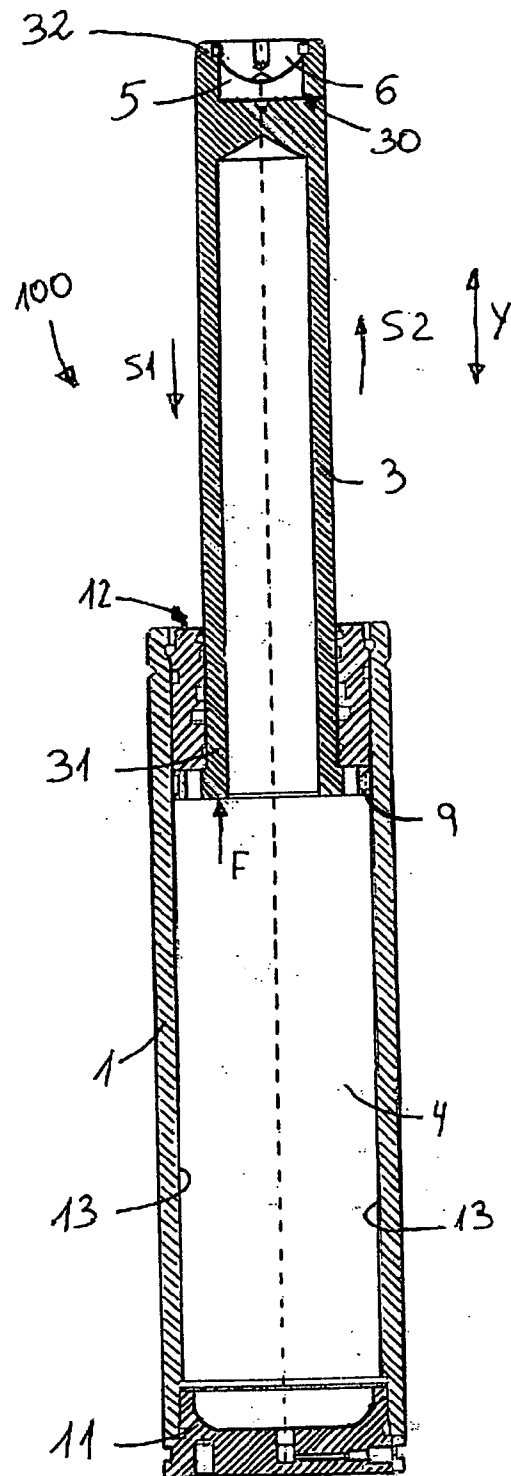


Fig. 1

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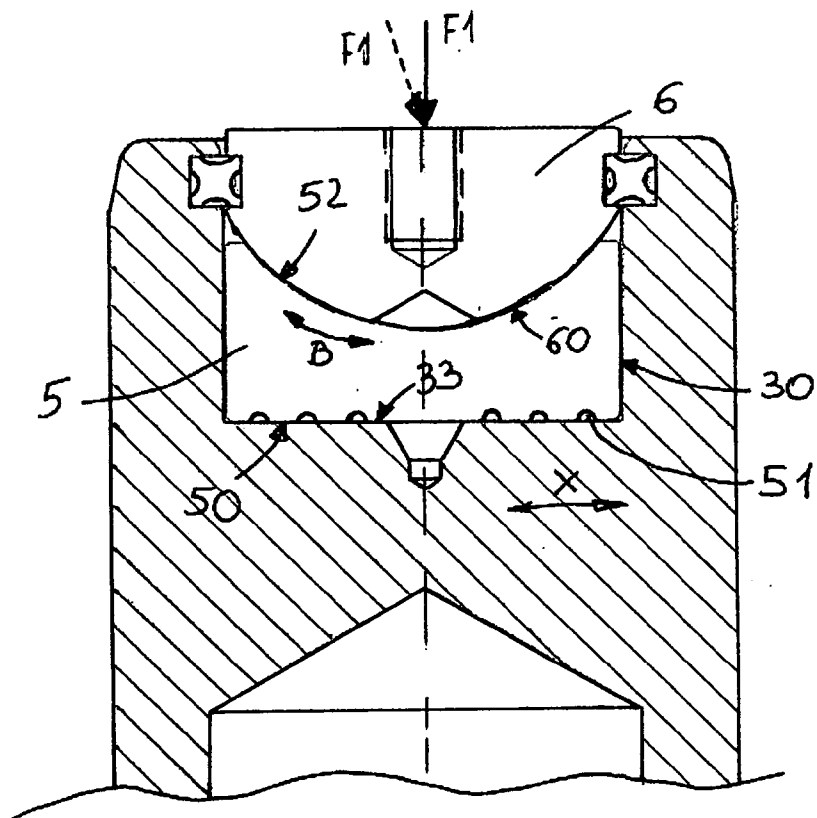


Fig. 2