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(54) Locking system.

(57) To enable or disable the latch opening the hood over a car engine, axial rod 4 is coupled to or decoupled from, axial rod 6, according to whether a finger 7 enters the small-diameter annulus 11 of a body 3.

If finger 7 does not lie in space 11, pulling rod 4 leftwards will leave cylinder 2 and hence rod 6 in position. Finger 7 is attached to a diaphragm 16 which is moved by vacuum applied to conduit 19A. The vacuum source is the engine manifold.

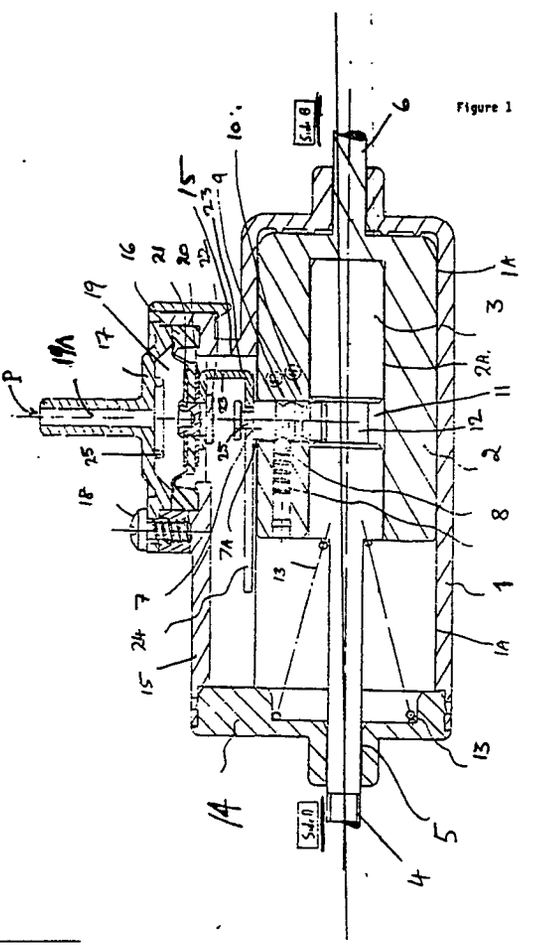

Figure 1

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LOCKING SYSTEM

The present invention relates to a system or method for selecting locked or unlocked condition between two bodies, eg using a a pneumatic and/or reduced pressure source, without undue complication or bulk.

It is often necessary to be able to disengage two connected-together parts, for instance to select a condition where a release trigger can only be moved ineffectively. Remote mechanical controls often use link lines which can stretch or wear, and hence need frequent re-adjustment or replacement. Such problems increase if a strong return bias and/or a long link line form part, and are desirably obviated. With a combustion engine, there is always a sub-atmospheric pressure source provided by the intake manifold.

Accordingly, the invention provides that the two bodies are pistons with oppositely directed rods, one piston sliding inside the other which in turn slides in a housing, the axes of sliding being parallel or concident, one rod of the two being the conditionally locked axially directed output, whereby the other can then be designed as an axially directed manual or other control input, the inner piston having an intermediate region of reduced cross-section, such as a recess or waist, for receiving a transversely, preferably radially, withdrawable locking finger, the outer piston having a cooperating transverse through-hole for passage of the locking finger, means outside the housing such as a transverse extension of said piston housing providing control for transverse driving of the finger, wherein this means may be such that

said finger is transversely driven through a coupling rigid or firm in the transverse direction by means of a lateral flexible diaphragm exposed to a fluid inlet (for connection to a fluid over- or under-pressure source), flexing of the diaphragm providing said transverse driving of the finger; and wherein

said transversely firm coupling comprises a slot parallel to the axes of the pistons, e.g. a common axis, which slot may be between bifurcated limbs and which slot allows freedom of movement of the finger with the axial movements of the outer piston while maintaining said transversely firm coupling.

The transverse coupling may be radial by means of a J-shaped bracket eg with two 90° bends. the short leg being connected to the diaphragm and the long leg being slotted eg forked to engage the locking finger. The inner piston may have an intermediate length of reduced cross-section to conditionally receive the locking finger for said union of the two pistons. Minimum space is occupied by the internally sliding parts, ie the inner piston and the locking finger.

The inventive details will further appear from study of an embodiment illustrated by the diametrical section of Figures 1-4, showing respectively an embodiment locked, locked and manipulated, unlocked (disengaged) and unlocked and ineffectually manipulated.

Referring to the drawings, a housing 1 guides slidably in a bore 1A within it, an outer piston 2, which in turn guides slidably in a bore 2A within it, an inner piston 3. The sliding of the pistons is in the same direction, e.g. axial. A locking arrangement, when in a "locked" condition, ensures that the two pistons slide together in the bore 1A, and when in an "unlocked" condition, allows not only this sliding together but also relative axial movement between the two pistons 2, 3.

The expressions "locked", "unlocked" have no relevance to the possible end uses of the arrangement, indeed a preferred end use may comprise the locked condition to allow the opening of a car bonnet or hood, and the unlocked condition to prevent such opening.

In this arrangement, which is that illustrated, a piston rod 4 extends from one piston, eg the inner piston 3 slidably through the housing 1 at a bearing 5, to a manually accessible side A. The other piston rod, eg the outer piston a transverse e.g. radial through-hole 7A of 2, may have a piston rod 6 similarly extending through the housing to a manually inaccessible side B, where something is required to be conditionally movable from side A.

For unlocking and locking the pistons, a locking finger 7 extends sliding within a transverse e.g. radial through-hole 7A of outer piston 2 between locking and unlocking detent positions determined by at least one spring loaded ball 8 biased axially towards the finger generally within the outer piston. The ball seats on locking or unlocking rest positions determined by the respective annular grooves 9 or 10 in the finger according to whether finger 7 is in its inner locked position (Figure 1 or 2) or in its outer unlocked position (Figures 3 or 4). In its locked position, the finger has engaged a space 11 provided by a reduced diameter portion 12 or other shaping of the inner piston 3. In this embodiment the inner piston can only be thus locked when fully home, rightwards as viewed, in the outer piston. A coil spring 13 acting against an end or lid piece 14 tends to maintain both pistons fully rightward, and hence tends to hold the finger engaging space 11 opposite the finger 7 even when the latter is in its unlocked position. The lid may close the housing, support the spring and provide the bearing 5. Space 11 need not be annular, but can be e.g. just

a recess in one circumferential position of inner piston 3.

In the unlocked conditon, pulling of rod 4 (eg by hand), will also move the outer piston 2 and rod 6 together with the attachment thereto, not shown, at side B, to the left against return spring 13 from the Figure 1 position to that of Figure 2. In the unlocked position of Figure 3, pulling rod 4 will only pull inner piston 3 leftward against spring 13, because the outer piston is not locked to it. The outer piston will be restrained, preferably by the piece to be actuated by piston shaft 6.

Locking finger 7 is moved outward and inward by the following. Housing 1 has a radial extension 15, at one circumferential region, shown upward in Figures 1-4, which is closed by a diaphragm 16 peripherally held by a robust cover 17 by bolts 18 or snap fittings in such manner as to hold a fluid working space 19 on the non-housing side of the diaphragm. Space 19 is fed through a conduit 19A from the outside by a fluid source P of "low pressure" or "vacuum", or usually both may be needed alternately. The diaphragm has central stiffening washers 20 and 21 pierced sealingly by a rivet 22 which communicates the axial movements of the diaphragm to a stiff J-shaped bracket 23. Bracket 23 has bifurcated ends 24 (not visible as bifurcation) defining a slot in which a thinner neck portion25 of the locking finger 7 fits slidably parallel to the axis of housing 1, ie to the direction of movement of shaft 4. The finger is thus constrained to move up and down (as viewed) with the diaphragm but can move leftward whenever outer cylinder 2 does. By "low pressure" is meant a small excess pressure over atmospheric (eg + 0.8 bars). By "vacuum" is meant a small amount of depression, such as -0.8 bars, below atmospheric.

The diaphragm 16 may be self-biased or otherwise biased normally up or normally down by a return spring, or it may be bistable and have to be moved upwardly by vacuum (eg -0.8 bars) and downwardly by low pressure (eg about +0.8 bars). One or more internal projections 25 prevent the diaphragm closing the conduit to P.

Preferably the finger moves radially, but it could move transversely, e.g. along a chord. The housing and pistons need not be round or cylindrical as preferred, but could have any elongated shape. The sliding axes need not be coincident with each other, or with those of the housing or rods, although coincident axes are usually more convenient.

If a car bonnet release or any other normally inaccessible trigger is operated by longitudinal movement of rod 6, it will only be operated through manipulation of rod 4 when the diaphragm and the locking finger 7 are in the downward position of Figures 1 and 2. Obviously the diaphragm must be able to communicate enough fluid or spring bias vertical thrust to be able to overcome the bias of sprung ball 8 and present the alternative seating 9 or 10 to it.

Once the outer cylinder has been unlocked by a reduced pressure, eg car manifold vacuum, being applied at P, the finger 7 will (unless biased downwardly) stay in its unlocking, upward position in stable equilibrium even after the reduced pressure has ceased. The finger must then be positively driven downward by a fluid high pressure source, when it is needed to re-lock the pistons together. In any case it should be arranged that the pressure or depression is cut off or cancelled, or otherwise should cease to be supplied, when finger 7 has been driven to its required positon.

Claims

1. A selectably lockable connection, comprising a housing (1) in a bore (1A) of which an outer piston (2) can slide to and fro, an inner piston (3) slidable within a bore (2A) of the outer piston (2) in the same to and fro direction, respective tie members (4, 6) connected to said pistons and exiting from opposite sides (A and B) of the housing, a through hole (7A) in the side wall of the outer piston (2) through to the bore (2A), a superficial shaping (11,12) of the inner piston (3) which is alignable with said through-hole (7A) for one relative position of sliding between the pistons (2,3), and a transversely movable locking member (7) located in the through-hole of the outer piston, and selectably withdrawable from or engageable with the shaping (11, 12) of the inner piston, whereby the pistons (2,3) are operable, either relatively slidable, or only slidable together in locked condition within the housing (1) and only the latter condition defines a condition of communication between the two sides (A, B).

2. A selectably lockable connection according to Claim 1, comprising first and second alternative stable rest positions (9, 10) shaped on the locking member (7), for a detent (8) which is overridably biased to engage either of the rest positions;
wherein the locking member is so selectably movable from outside the housing as to overcome the bias, in order to be able to engage the detent (8) selectably with either of the rest positions of the locking member (7); and wherein
engagement of one rest position (9) but not the other (10) corresponds to a piston-locking insertion of the locking member into the said superficial shaping (11,12) of the inner piston.

3. A selectably lockable connection according to Claim 1 or 2, comprising a slotted member (23) mounted in the housing such that slot therein is

parallel to said direction of to and fro piston sliding, the locking member (7) being held in said slot accordingly with relative freedom of movement in the to and fro direction, but with constraint to move transversely to the outer cylinder only by virtue of a selectable transverse positionability of the slotted member (23).

4. A selectably lockable connection according to Claim 3 wherein the slotted member is attached to a diaphragm (16) forming a boundary portion of the housing (1), and the exterior face of the diaphragm is exposed to a source (19A) of selectable variations in pressure (P), with consequent selectability of the transverse positions of the slotted member (23) and the locking member (7), such variations (and and bias means or self-bias present) being sufficient to overcome bias of the detent (8) into its alternative resting positions (9, 10).

5. A selectably lockable connection according to Claim 4, where the slotted member (23) is J-shaped, the short limb being attached at a stiffened locality of the diaphragm, the long limb being bifurcated to form the slot.

6. A selectably lockable connection according to any of Claims 1-5, characterised in that the outer piston (3) is closed at one end, and thus provides an end stop for the inner piston (3), and a biasing device (13) acting against a housing part (14) urging the inner piston towards abutment with said closed end of the outer, whereon said through hole (7A) in the outer piston lies adjacent the shaping (11,12) of the inner piston.

7. A selectably lockable connection according to Claim 6, wherein a lid member (14) of the housing provides (A) the part bracing the biasing device (13), (B) a bearing for one (4) of the tie members, and (C) a closure for the housing.

8. A selectable lockable connection, according to any of Claims 1-7 wherein the superficial shaping (11,12) of the inner piston is a waist or recess.

9. A selectably lockable connection, according to Claim 2 wherein the locking member is finger-shaped and the two rest positions thereon are spaced annular grooves (9, 10), said detent (8) being a spring loaded ball.

10. A selectably lockable connection according to any of 1-9 Claims characterised in that one tie member (6) is attached within a vehicle engine compartment (side B) to an internal bonnet or hood release catch, the outer tie member (4) is manually accessible, e.g. open to the environment (side A), and the outside of the diaphragm (16) is exposed to a chamber communicative via a conduit (19A) with an engine manifold and/or another source of pressure (P).

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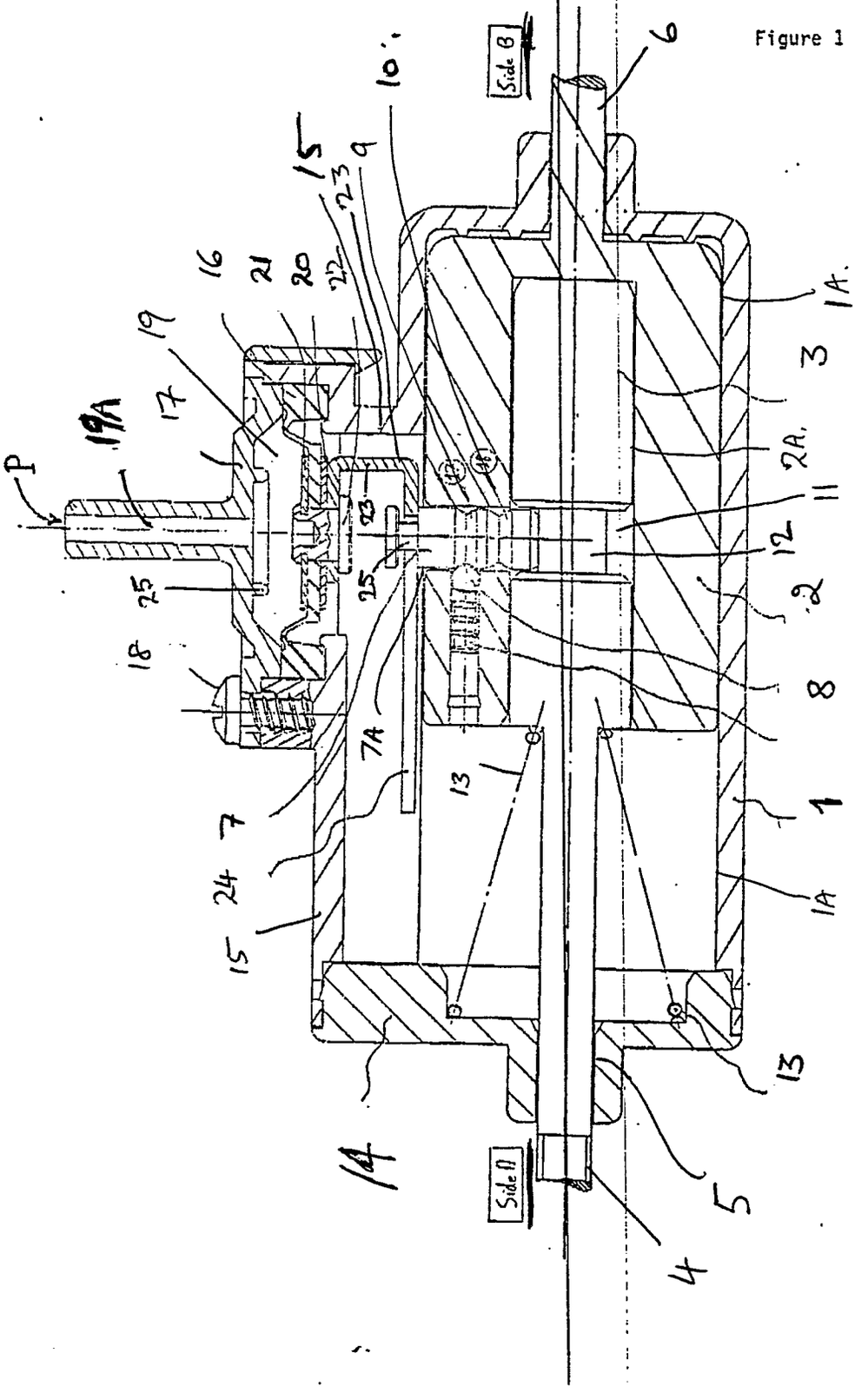
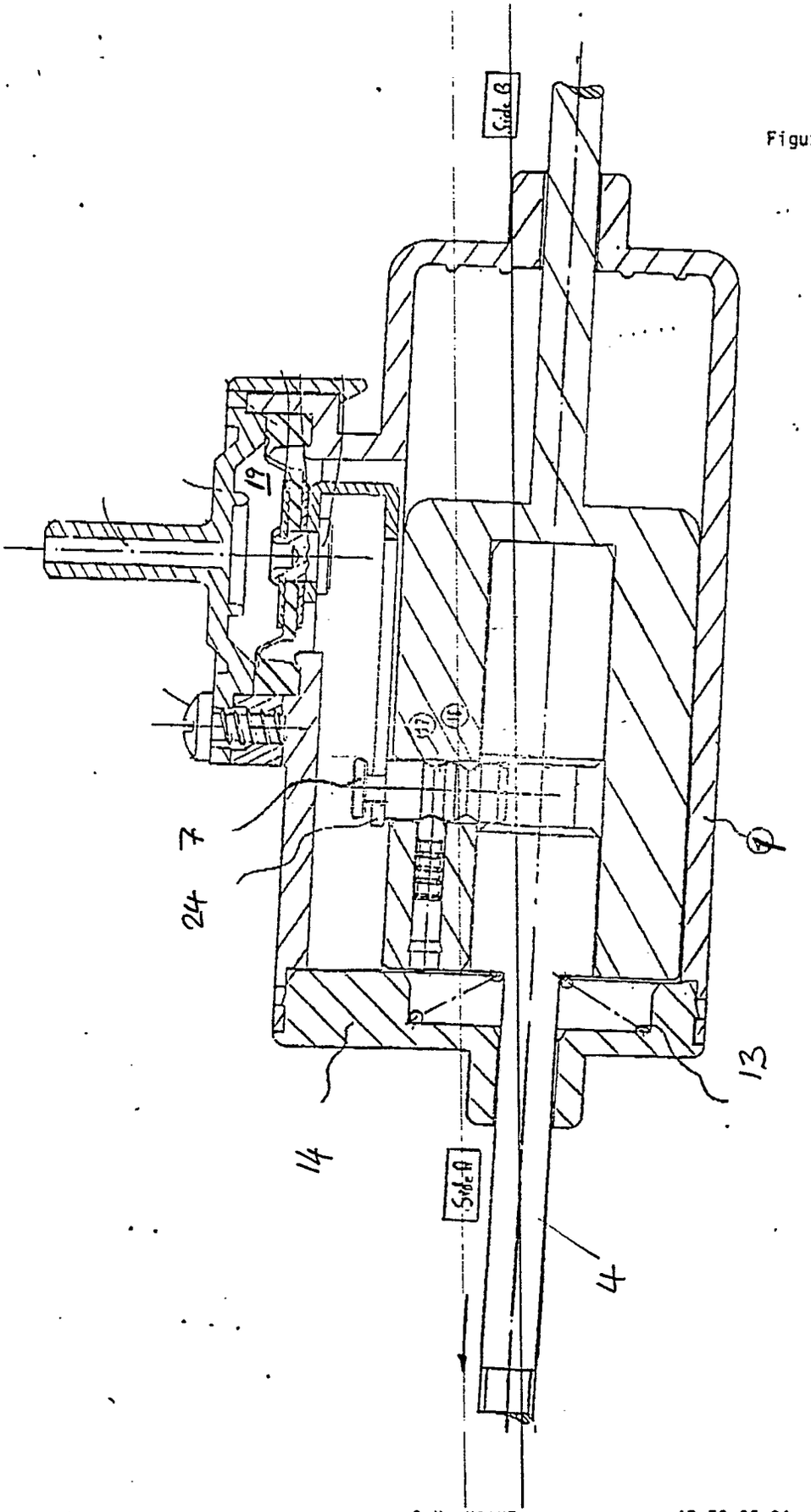


Figure 1

Figure 2



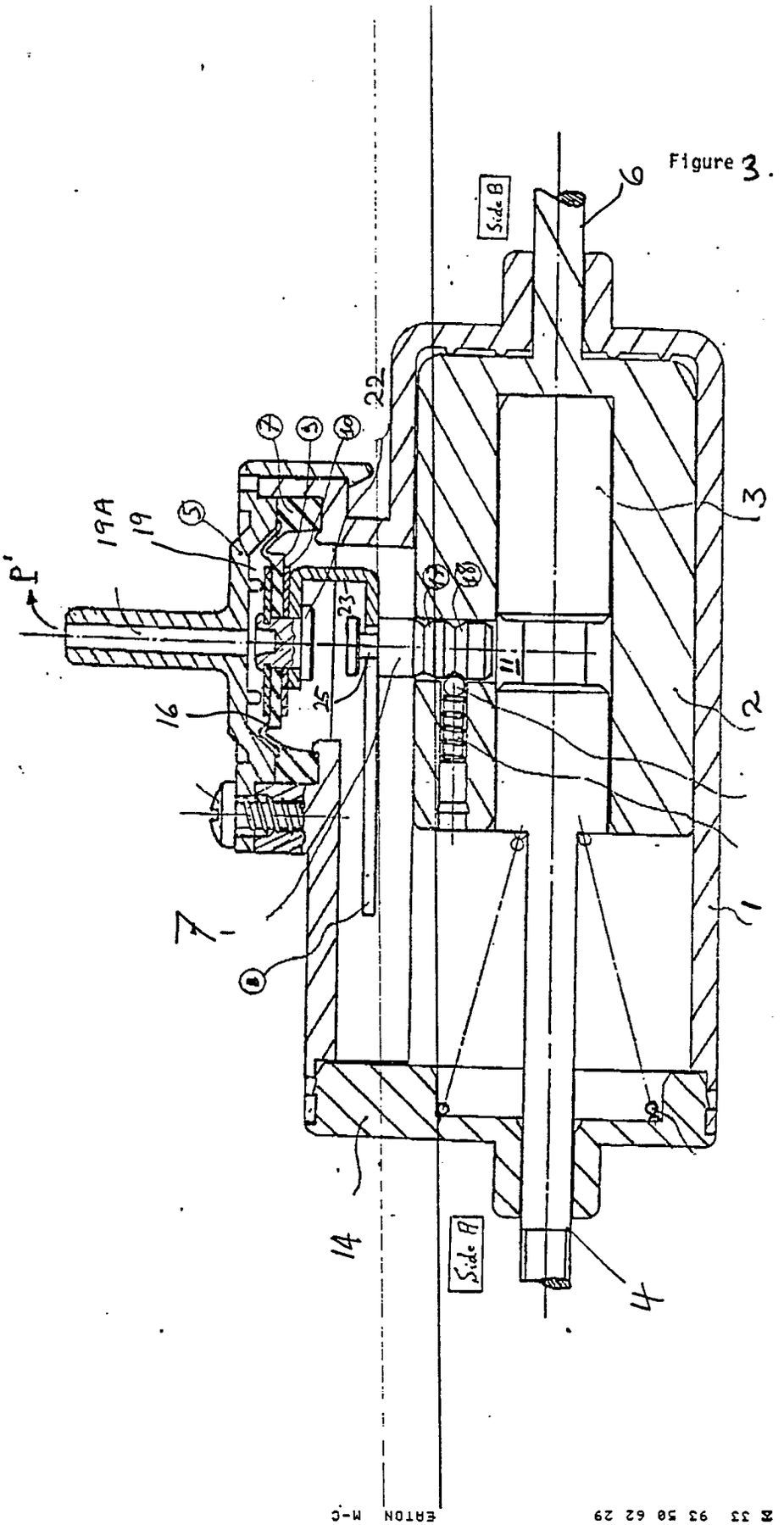


Figure 3.

Figure 4