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(54) Locking device for pneumatic cylinders.

(57) A fluid actuated locking device for a pneumatic cylinder of the type comprising a first cylinder portion (10) and a second cylinder portion (11) pneumatically reciprocable in respect to the first one. The device comprises a pneumatically actuated U-shaped jaw member (17) connected to one portion (10) of the cylinder and a rod member (12) connected to the other portion (11) of the cylinder, to lock the reciprocation; the jaw (17) is positioned between a thrust member (21) and a reaction member (20) provided with slanted centering surfaces (22) for said jaw (17).

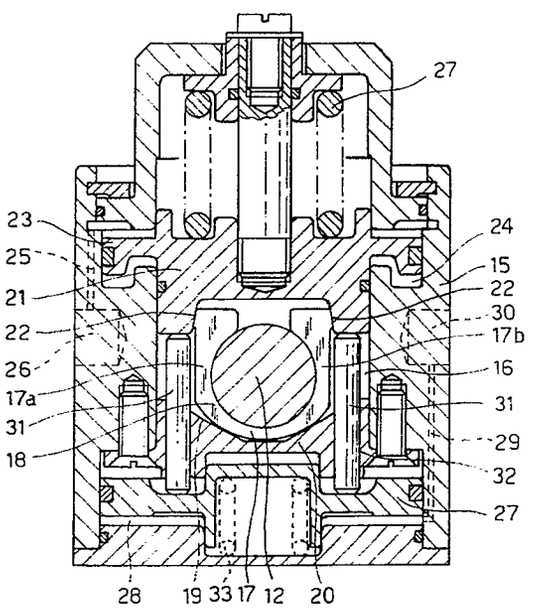

Fig. 2

EP 0 446 694 A1

The present invention relates to a pneumatically actuated locking device for stoping the reciprocation movement in rod and rodless types of pneumatic cylinders, by means of which it is possible to exert a considerable instantaneous force so as to lock any moving member connected to the cylinder.

At present locking devices for pneumatic cylinders are available, which make use of eccentric or tiltable lock elements which are pushed pneumatically or by the action of spring means against the rod of the cylinder.

Also known are locking devices for pneumatic cylinders which make use of an annular locking element elastically deformed by a set of levers operated by 15. axially movable cam members, to engage a rod.

Such locking devices must operate each time an anomalous working condition occurs in the compressed-air supply network, in order to block the movement of the movable portion of the cylinder or of mechanical parts connected thereto, or in order to perform given functions during an operative cycle.

The locking devices of the type referred above have only a limited number of applications owing to their excessively large overall dimensions, and a limited degree of operational reliability, furthermore they are unable to operate in both movement directions of the 10. cylinder and tend to exert excessively high specific locking pressure forces, which compromise the sealing and the proper operation of the cylinder.

A scope of present invention is to provide a locking device for pneumatic cylinders in order to solve the problems arising from previously known locking devices, in particular to reduce the overall dimensions, increase the locking forces while maintaining the specific pressures at sufficiently low levels, and at the same time allowing application of the device to any pneumatic cylinder, with or without a rod, while maintaining a high degree of efficiency in both operative directions.

According to the invention, therefore, a locking device for pneumatic cylinders has been provided, in which the cylinder comprises: a first cylinder portion and a second cylinder portion which is reciprocable in respect to the former one, said device comprising a housing defining an open chamber at both ends, a locking rod passing through said open chamber, said rod being operationally connected to one of said first and second cylinder portions, and locking means in said chamber interacting with said rod, said locking means comprising a U-shaped jaw member peripherally arranged around said rod, and pneumatically actuated control means to lock said jaw member against said rod, said control means comprising a thrust piston member and a reaction member opposite located and contacting said jaw, said thrust member and said reaction member comprising slanted surfaces to contact said locking jaw.

A particular embodiment of the invention will be described hereinbelow with reference to the example shown in the accompanying drawing, in which:

Fig. 1 is a top view of a pneumatic rod-type cylinder provided with a locking device according to the invention;

Fig. 2 is a cross-sectional view along the line 2-2 of Figure 1.

Figure 1 shows a pneumatic cylinder comprising a cylinder barrel 10, or first cylinder portion, in which a reciprocable piston member 11 slide; the piston 11 define a second cylinder portion connected to a rod 12 which protrudes in a sealed manner through an head 13 of the cylinder. 14 denotes a locking device for stopping and/or retaining the piston 11, as well as an operative member (not shown) connected to the reciprocable portion of the cylinder, in a fixed position according to the requirements; in the example shown, the locking device 14 is directly connected to the end part 13 of the cylinder. It is obvious, however, that the locking device 14 may be differently arranged and provided also in rodless cylinders, and the like.

As shown in the enlarged cross-sectional view of Figure 2, the locking device 14 comprises a housing or hollow body 15 defining a chamber 16 open at both ends, through which the rod 12 of the cylinder axially slides.

Inside the chamber 16 there is provided a pneumatically actuated locking means comprising an U-shaped locking jaw member 17 peripherally arranged to engage an disengage by arms 17a, 17b against the rod 12 so as to block its movement instantly. The jaw member 17 is positioned between pneumatically actuated control means comprising a thrust piston member 21 and a reaction member 20 provided with centering surfaces and thrust amplifying surfaces means.

In particular, the U-shaped jaw member 17 comprises lateral arms 17a and 17b and an intermediate bottom portion 17c defining an elastically yieldable connecting member for said arms 17a, 17b. Preferably, said arms 17a, 17b and said bottom portion 17c of the jaw define a circular inner surface 18 which slightly fits against most of the circumferential periphery of the rod 12; the bottom portion 17c of the jaw 17 rests against opposing slanted surfaces 19 of the reaction member 20 which diverges towards the rod 12 thus maintaining a self-centring arrangement of the jaw 17.

The bottom portion 17c of the jaw 17 has a reduced thickness so as to allow elastic yielding of the jaw arms 17a, 17b against the rod 12, under

the action of the upper thrust member 21 and reaction member 20; therefore, the arms 17a and 17b of the jaw extend in the direction of and towards the thrust member 21, terminating at their ends with opposite slanted surfaces which fit against corresponding slanted surfaces 22 of the above mentioned thrust member 21, to increase the locking forces of the jaw member 17 acting on the rod 12 by a sliding forward movement of the thrust member 21.

The thrust member 21 is pneumatically operated by a piston 23 reciprocable in an annular chamber 24 inside the body 15. The side of the chamber 24 which is opposite to the thrust member 21 is connected by a duct 25 to an inlet 26 for the compressed air. A biasing means such as spring 27 acting in the same direction of the compressed air, may be provided behind the piston 23 of the thrust member 21, as shown in Figure 2, to force the thrust member 21 forward to lock the rod 12 and/or to maintain said rod 12 locked also in absence of compressed air.

Disengagement of the jaw from the rod 12 may be performed, for example, as shown in Figure 2, by providing pneumatically actuated jaw disengaging means; said means comprises a second piston 27 on the side of the reaction member 20 which is opposite to thrust member 21. The piston 27 is reciprocable inside a chamber 28 which may be supplied with a fluid under pressure, for example compressed air via a duct 29 and an opening 30 on the side of the chamber 28 which is opposite to the reaction member 20, as shown in figure 2. The piston 27 acts on the thrust member 21, upon release of the pneumatic force, for example by means of pins 31, or any suitable or equivalent means, which pins freely pass and slide through holes 32 in the reaction member 20, so as to extend parallelly to the arms 17a, 17b of the locking jaw 17, towards and against the abovementioned thrust member 21.

A biasing spring 33 may be optionally provided between the piston 27 and an end wall portion of housing 15 so as to push the piston 27 and the thrust member 21 in the disengaged condition of the jaw 17.

The operation mode of the locking device is as follows: during normal operation of the cylinder 10, the pressurised air is fed inside the chamber 28 for the piston 27 to deactivate the locking device; in this condition the piston 27 acts, via the pins 31, on the thrust member 21 so as to cause it to move backwards briefly, by an amount sufficient to allow disengagement of the jaw 17 and sliding of the rod 12 of the cylinder.

When the piston 11 of the cylinder or a movable part connected thereto must be stopped, the pressure is released from the chamber 28 and at the same time the pressurised fluid is supplied into the chamber 24 acting against the piston 23 of the thrust member 21 which, overcoming any opposition of the spring 33, the member 21 advances briefly acting with its slanted surfaces 22 against the correspondingly slanted surfaces at the outer sides of the ends of both arms of the jaw 17. Since the jaw 17 rest against the slanted surfaces 19 of the reaction member 20, and since the thrust member 21 acts on the opposite ends of the two arms 17a, 17b of the jaw in positions which are spaced apart from the axis of the rod 12 and from the reaction member, an amplifying lever action thus occurs which presses the arms of the jaw 17 firmly against the rod 12, locking it instantly with a force high enough to overcome the reaction even of large fast moving masses. Obviously, the U-shaped jaw 17 is able to extend axially or parallelly to the rod by an amount sufficient to allow high locking forces, while maintaining low specific pressures so as not to harm or cause any damage to the rod itself.

In the example illustrated, the spring 27, which acts on the thrust member 21 in opposition to the spring 33, is able to exert a greater force such that the device is operationally in a condition where the rod 12 is locked in the absence of pressurised fluid; however, it is obvious that the arrangement could be reversed, with a device operating under normally disengaged conditions.

From the above description and illustration it is obvious that an instantaneous-action locking device for pneumatic cylinders is provided, which is able to exert significant locking forces which are amplified by a lever action of the arms of the jaw 17, as well as by the action of slanted thrusting surfaces of the member 21. It is obvious, however, that the above example and illustration has been given purely by way of a non-limiting example of the principles of the invention which is claimed.

Claims

1. A locking device for a pneumatic cylinder of the type comprising a first cylinder portion (10) and a second cylinder portion (11) which is reciprocable in respect to the former one, said device comprising: a housing (15) defining a chamber (16) open at both ends, a rod (12) passing through an open end of the chamber (16), said rod (12) being operationally connected to one of said first and second cylinder portions (10, 11), and locking means in said chamber 10. interacting with said rod (12), characterised in that said locking means comprises a U-shaped locking member (17) peripherally arranged around and partially encircling said rod (12), and pneumatically actuable

control means (21) to disengageably thrust said U-15. shaped locking member (17) against said locking rod (12).

2. A device according to claim 1, characterised in that said locking means comprises a U-shaped locking member (17) having parallelly arranged arms, said control means comprising a thrust piston member (21) and a reaction member (20) which are opposite located and contac the arms (17a, 17b) of said jaw (17), said thrust member (21) and said reaction member (20) comprising opposite slanted surfaces (22, 19) contacting said locking jaw (17).

3. A device according to claim 2, characterised in that the arms (17a, 17b) of said jaw (17) comprise a circular inner surface (18) fitting against the peripheral surface of the abovementioned rod (12).

4. A device according to claim 2, characterised in that a bottom portion (17c) of said U-shaped jaw (17) rests against slanted surfaces (19) of the reaction member (20).

5. A device according to claim 2, characterised in that the arms (17a, 17b) of said jaw (17) comprise slanted surfaces (22) contacting slanted surfaces of thrust member (21) referred above.

6. A device according to claim 1, characterised in that said control means for actuating the thrust member (21) comprises elastically actuated control means (27).

7. A device according to claim 1, further characterised by comprising second control means (27) opposing to said first control means (23) to disengage the jaw (17) from said rod (12).

8. A device according to claim 7, characterised in that said second control means (27) comprise pneumatically actuated control means.

9. A device according to claim 8, characterised in that said second control means comprise a piston member, and pin means (31) between said piston (27) and the thrust member (21) mentioned above.

10. A device according to claim 9, characterised in that said pins (31) are slidingly arranged through guide holes in the reaction member (20).

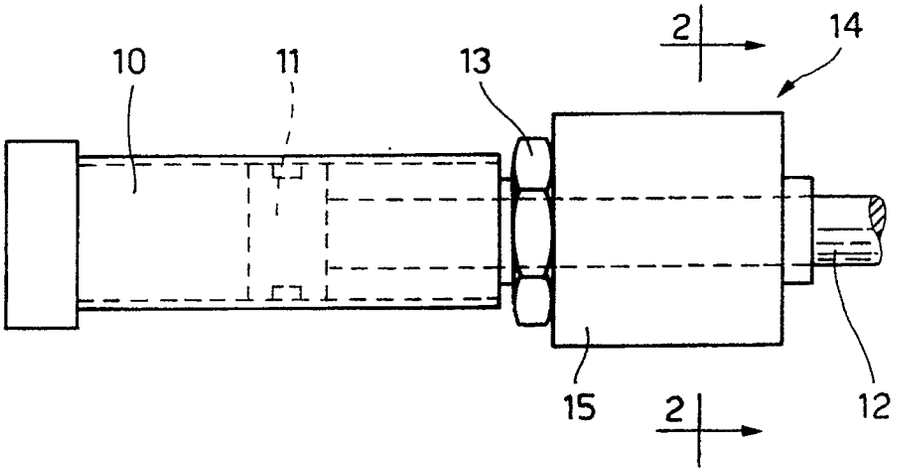
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Fig. 1

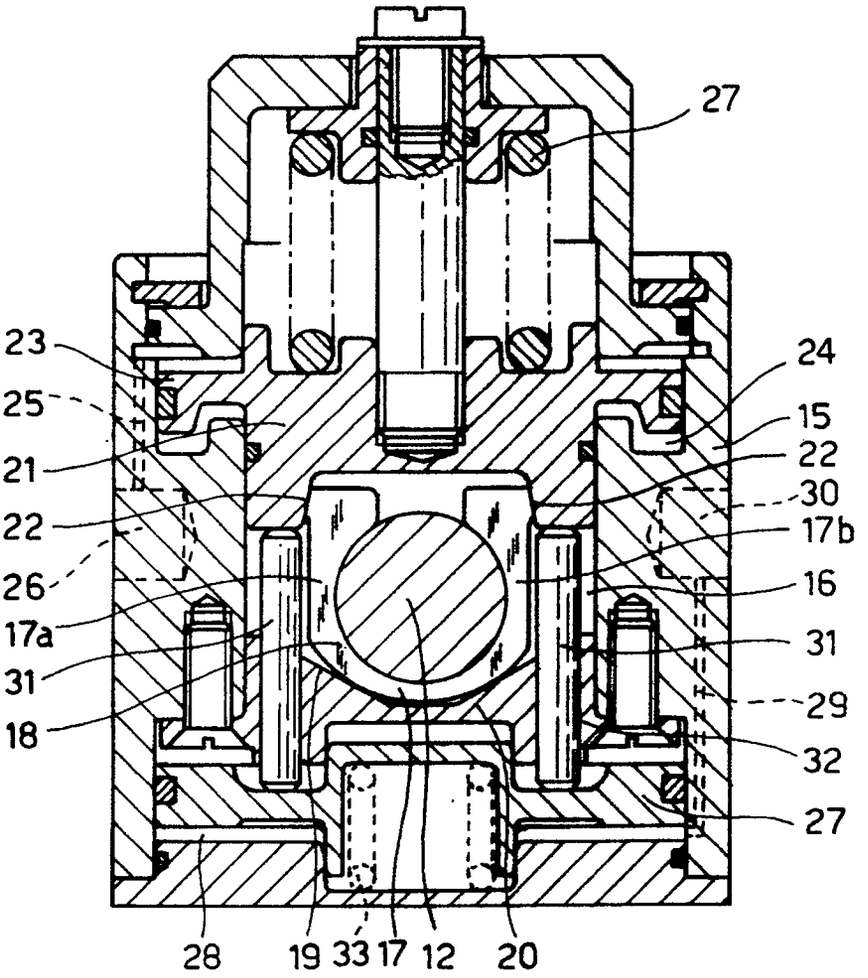
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Fig. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 10 2752

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	DE-A-3 810 388 (KONTEC) * the whole document *	1-3,5-8.	F 15 B 15/26
A	EP-A-0 197 620 (MATSUI)		
A	US-A-4 791 855 (MATSUI)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

F 15 B

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	25 April 91	KNOPS J.

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
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