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(71) Applicant: **Migliori, Luciano**
20124 Milan (IT)

(72) Inventor: **Migliori, Luciano**
20124 Milan (IT)

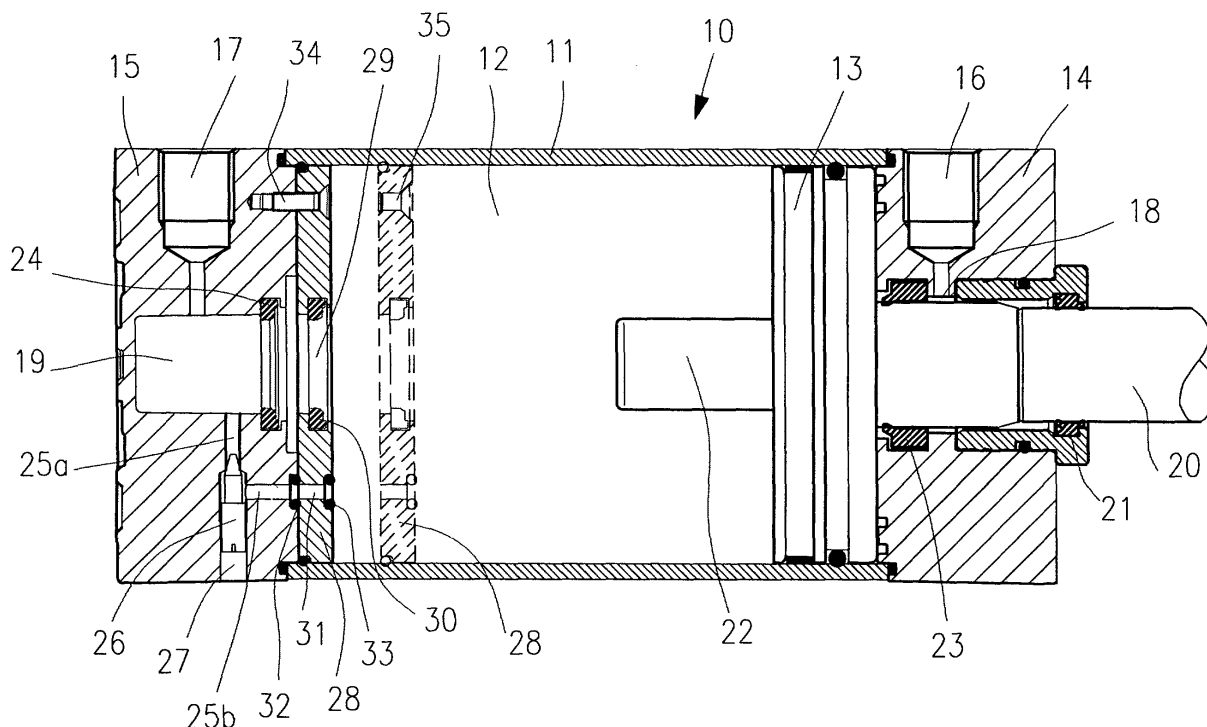
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(74) Representative: **Coloberti, Luigi**
Via E. de Amicis No. 25
20123 Milano (IT)

(54) **Variable-stroke pneumatic cylinder**

(57) A variable-stroke pneumatic cylinder (10); the cylinder (10) comprises a tubular casing (11), having fore and rear heads (14, 15), defining a chamber (12) for reciprocation of a piston member (13) along a working stroke; at least one of the heads (14, 15) is provided with an air inlet/outlet hole (16, 17) connected to a central cavity (18, 19) in the cylinder head (14, 15), which facing towards the piston chamber (12). The rear head (15) is provided with a pneumatic damping device com-

prising a venting path (25a, 25b, 27) provided with a control valve. The pneumatic cylinder (10) also comprises head extension members (28) to change the working stroke; the extension members are in the form of disk-shaped member (28) secured to the cylinder head (15). Each disk member (28) is provided with a central hole (29) axially aligned with the central cavity (19) of the cylinder head (15), and an air venting hole (31) axially aligned with a venting hole (25b) branched off from the air venting path (25a, 27).



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Description

BACKGROUND OF THE INVENTION

[0001] This invention refers to single-acting and double-acting pneumatic cylinders having a piston chamber and a reciprocable piston member, provided with a stroke control system for controlling or varying the working stroke of the piston member in cylinders used, for example, for controlling clamping devices of the lever type, normally used for clamping work pieces or locking the same to a supporting structure, in particular for welding mechanical operations or on parts of a structure or of the body of motor vehicles.

STATE OF THE ART

[0002] A conventional pneumatic cylinder, as shown in US-A-3,805,672, US-A-3,440,930, EP-A0 005 407, comprises a tubular casing which defines a piston chamber for a reciprocable piston member, which is closed by a fore and rear cylinder head; the piston member of the cylinder is generally provided with a piston rod which protrudes from and is guided by the fore cylinder head.

[0003] The piston member of conventional pneumatic cylinders usually move along a fixed working stroke and the current tendency is to standardise their dimensions, according to pre-established requirements; consequently it is not possible to vary their working stroke unless to provide the cylinders with particular devices.

[0004] It is sometimes necessary to make use of pneumatic cylinders which have a working stroke shorter than the standard one, or it may be necessary to reduce or vary the working stroke of a cylinder already assembled or already in operation, in order to satisfy specific requirements.

[0005] A solution is shown in DE-A-29 811 901, in which use is made of a disk-shaped member, movable inside the piston chamber by means of an adjusting screw, which can be positioned close to or at a certain distance from the rear cylinder head. This system has the main disadvantage of transmitting all the impact forces caused by the piston, when the latter moves backwards, onto the adjusting screw; moreover, it is a complex system which can present functional problems at mechanical level.

[0006] The pneumatic cylinders are also provided, both in the fore and in the rear heads, with a pneumatic damping system which comprises a suitably set venting path which allows the air to escape in the last portion of the backward or forward working movement of the piston member, so as to reduce its speed and deaden the impact forces. The venting path of a conventional damping device may be provided with a suitable restricted flow passage, or can be provided with a needle valve which can be adjusted in order to vary, as required, the braking speed of the piston in the last portion of its stroke

and, consequently, the impact force.

[0007] In the case of DE-A-29 811 901, the device for controlling or varying the stroke of the piston member has the drawback of not allowing the use of a control valve for adjusting the venting of the air, in that an air space is formed between the disk member and the cylinder head, which would nullify the effect of the control valve.

OBJECTS OF THE INVENTION

[0008] The main object of this invention is to provide a pneumatic cylinder of the type referred to, provided with a system for varying the working stroke of the piston member, which allows the use of a venting device provided with a control valve and which is structurally simple and adaptable to various requirements.

BRIEF DESCRIPTION OF THE INVENTION

[0009] The foregoing can be achieved by means of a pneumatic cylinder according to claim 1; more precisely, according to the invention a pneumatic cylinder has been provided, comprising:

- a tubular casing defining a chamber for a piston member;
- a fore and a rear cylinder head at the ends of the piston chamber, at least the rear one of the cylinder heads being provided with an inlet/outlet hole for feeding and discharging pressurized air, said air inlet/outlet hole opening into a central cavity facing a corresponding side end of the piston chamber;
- a reciprocable piston member movable along a working stroke inside the piston chamber, said piston member having a piston rod which tightly protrudes from the fore cylinder head;

in which at least the rear cylinder head is provided with a pneumatic damping device comprising a venting path; and

in which the piston member comprises a plug member designed to tightly penetrate into the central cavity of said rear cylinder head; and

head extension means for axial extension of the rear cylinder head inside the piston chamber for varying the working stroke of the piston member,

characterized in that said head extension means comprises at least one disk-shaped member removably fastened to the rear cylinder head, inside the piston chamber,

said disk-shaped member having a central hole axially aligned to the central cavity of the rear cylinder head, and a side hole axially aligned with a venting hole branched off from the air venting path.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] These and further features of a pneumatic cylinder according to this invention, will be more clearly evident from the following description with reference to the accompanying drawings, in which the figure shows a longitudinal cross-sectional view of the pneumatic cylinder.

DETAILED DESCRIPTION OF THE INVENTION

[0011] The general features of this invention will be illustrated hereunder by means of a preferential embodiment.

[0012] According to this embodiment, the pneumatic cylinder 10 comprises a central tubular casing 11 which forms a chamber 12 for a reciprocable piston member 13; the piston chamber 12 is closed at both ends by a fore head 14 and by a rear head 15. Each cylinder head 14, 15 presents a respective air inlet/outlet hole 16, 17 for pressurized air, which communicates with the piston chamber 12 through passages in the same cylinder heads; in particular, with regard to the rear head 15, the air inlet/outlet hole 17 communicates with a central cavity 19 in the same head, which opens out towards the piston chamber 12. The piston member 13 reciprocates along a working stroke inside the piston chamber 12 and is provided with a piston rod 20 which protrudes from the fore cylinder head 14, forming a seal on an annular gasket 21; the piston member 13, on the side facing the rear head 15, is provided with a closing member or conical plug 22 designed to tightly penetrate into the central cavity 19 of the rear head 15, to form a seal against an annular gasket 24 and to close an air venting duct 25a in the last portion of the working stroke of the piston 13. The plug member 22 and/or the central cavity 19, once they are coupled together, provide a slightly conical gape to allow the passage of air.

[0013] The rear head 15 is also provided with a pneumatic damping device, capable of dampening the speed and the impact forces of the piston member 13; said damping device comprises a venting duct 25a, which on a side opens out indirectly towards the piston chamber 12, through the central cavity 19, and a side hole 27 comprising a flow control valve 26, such as a needle valve adjustable from the outside through the side hole 27, so as to vary the speed and the impact forces of the piston member 13. The damping device comprises a second venting hole 25b, branched from the hole 27, which directly open into the piston chamber 12, on a side of the central cavity 19. A similar damping device may be also provided in the fore head 14 of the cylinder.

[0014] In order to modify, and in particular to shorten the working stroke of the piston member 13, according to the invention use is made of suitable head extension means inside the piston chamber 12, for extension of the rear head 15 of the cylinder; said head extension means comprises one or more disk-shaped members

28, in which each disk-shaped member 28 is provided with a central hole 29 axially aligned to, and constituting an extension of the central cavity 19 of the rear head 15, into which the plug member 22 penetrates, to form a seal on an annular gasket 30, fitted in an appropriate annular seat, as shown; moreover, each disk-shaped member 28 is provided on a side with an air venting hole 31, axially aligned with said air venting hole 25b branched from the main venting path 25a, 27.

[0015] The rear cylinder head 15, at the inner end of the branched off air venting hole 25b, is provided with an annular gasket 32 to form a seal on the facing surface of the disk-shaped member 28 around the venting hole 31 of the latter, so as to allow a sealed connection between the hole 31 and the hole 25b of the venting duct. A further annular gasket 33 is provided on the apposite side of the disk-shaped member 28 at the end of the venting hole 31 facing towards the piston chamber 12, so as to ensure an airtight connection between the venting holes 31 of two or more side by side arranged head extension disks 28. The disks 28 are removably secured to one another and to the rear head 15 by means of at least one fastening screw 34, or by other suitable fastening means, which fits into axially aligned holes 35 in the disk members 30 and into the rear head 15. Since the need may arise, from time to time, to vary the working stroke of the cylinder, according to different values, it is possible to fit more extension disks 28 to extend the rear head 15 and inside the piston chamber 12, in order to achieve greater variability of the stroke, the disks 28 may be of the same thickness or of different thickness.

[0016] What has been described and shown with reference to the accompanying drawings, has been given purely by way of example in order to illustrate the general features of the invention; it being understood however that other modifications to the cylinder and its parts are possible, with the scope of the claims.

Claims

1. A pneumatic cylinder (10), comprising:

- a tubular casing (11) defining a chamber (12) for a piston member (13);
- a fore (14) and a rear (15) cylinder head at the ends of the piston chamber (12), at least the rear one (15) of the cylinder heads (14, 15) being provided with an inlet/outlet hole (17) for feeding and discharging pressurized air, said air inlet/outlet hole (17) opening into a central cavity (19) facing a corresponding side end of the piston chamber (11);
- a reciprocable piston member (13) movable along a working stroke inside the piston chamber (11), said piston member (13) having a piston rod (20) which tightly protrudes from the fore cylinder head (14);

in which at least the rear cylinder head (15) is provided with a pneumatic damping device comprising a venting path (25a, 27); and

in which the piston member (13) comprises a plug member (22) designed to tightly penetrate into the central cavity (19) of said rear cylinder head (15); and 5

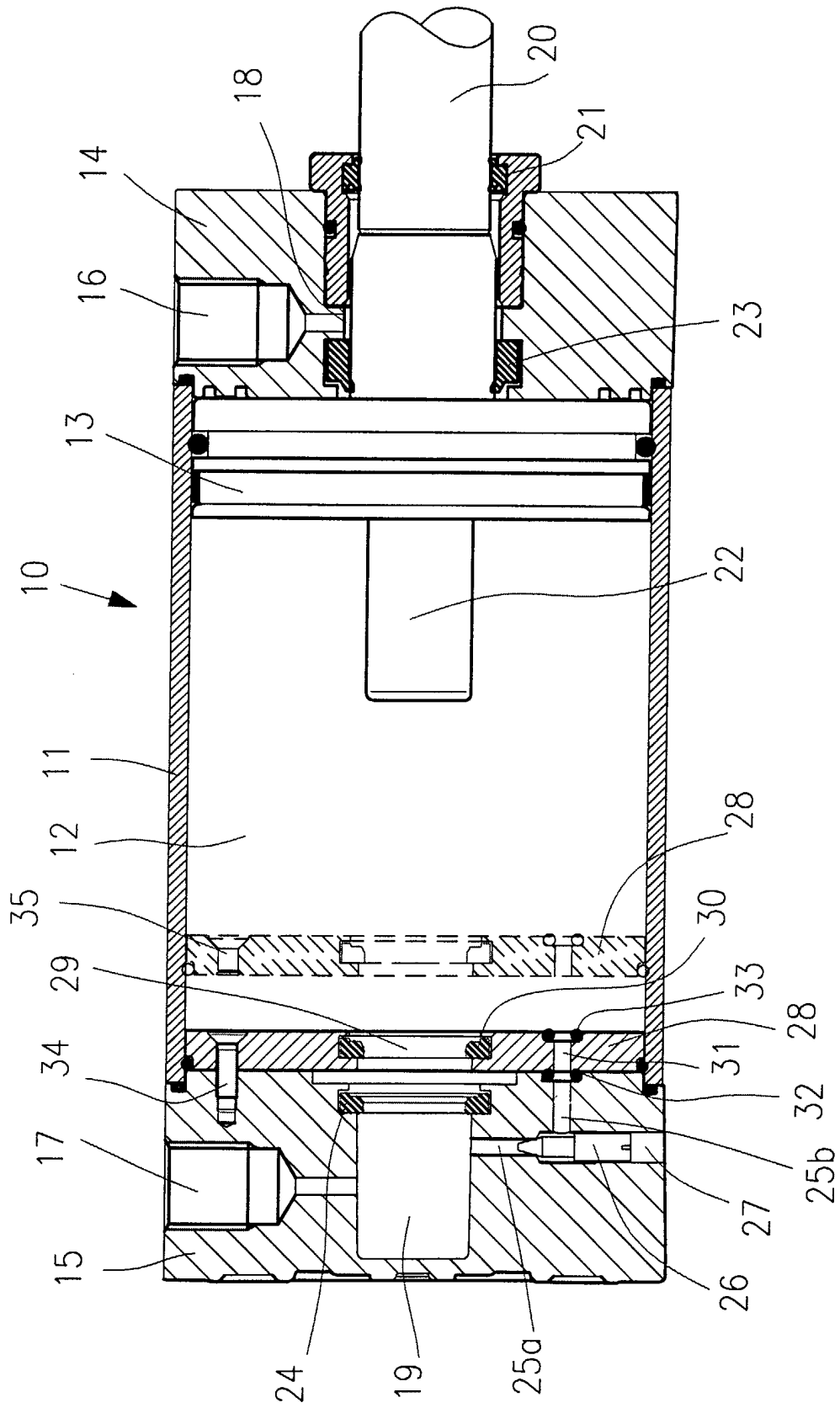
head extension means (28) for axial extension of the rear cylinder head (15) inside the piston chamber (11) for varying the working stroke of the piston member (13), 10

characterized in that said head extension means comprises at least one disk-shaped member (28) removably fastened to the rear cylinder head (15), inside the piston chamber, 15

said disk-shaped member (28) having a central hole (29) axially aligned to the central cavity (19) of the rear cylinder head (15), and a side hole (31) axially aligned with a venting hole (25b) branched off from the air venting path (25a, 27). 20

2. Pneumatic cylinder according to claim 1, **characterised in that** a sealing gasket (32) is provided at the end of the branched off hole (25b) of the air venting path, facing the extension disk member (28) fastened to the rear cylinder head (15). 25
3. Pneumatic cylinder according to claim 1, **characterised in that** each disk-shaped member (28), in correspondence with the central hole (29), is provided with an annular gasket (30) to seal against the plug closing member (22). 30
4. Pneumatic cylinder according to claim 1, **characterised by** comprising a plurality of disk-shaped extension members (28) removably connected to each other and to the rear cylinder head (15). 35
5. Pneumatic cylinder according to claim 4, **characterised by** comprising disk-shaped members (28) of identical thickness. 40
6. Pneumatic cylinder according to claim 4, **characterised by** comprising disk-shaped members (28) of different thickness. 45
7. Pneumatic cylinder according to claim 1, **characterised in that** the venting path (25a, 25b, 27) comprises an adjustable venting valve (26). 50

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EUROPEAN SEARCH REPORT

Application Number
EP 02 02 0943

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.7)
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Y	* page 11, paragraph 2 - page 13, paragraph 1 *	4-6	
Y	--- US 6 220 588 B1 (TUNKERS JOSEF-GERHARD) 24 April 2001 (2001-04-24) * column 10, line 50 - column 10, line 63; figure 2 *	4-6	
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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 24 January 2003	Examiner Toffolo, O
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 02 02 0943

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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