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(12) # EUROPEAN PATENT APPLICATION

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(54) **Pneumatic double acting piston and cylinder device.**

(57) A double-acting operating cylinder is disclosed, particularly useful for ventilating devices. The cylinder is of the positive-lock type with pneumatically operated piston locks at each end of the stroke.
The locking device is designed in such a way that the working pressure is applied to the piston only after it has been unlocked.

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LIFTING CYLINDER WHICH CAN BE ACTUATED BY PRESSURE FLUID, PREFERABLY FOR VENTILATING DEVICES

The invention relates to a lifting cylinder which can be actuated by pressure fluid for opening and closing ventilating devices in particular, such as ventilation flaps and the like, having a double-sided working piston which is disposed on the surface of a longitudinally movable lifting rod and the working pressure chambers of which can each be acted upon by the pressure fluid through a pressure-fluid connection for the stroke movement of the lifting rod, and having detent recesses at the lifting-rod side as well as locking members associated with each working pressure chamber and provided perpendicular to the longitudinal axis of the lifting rod to lock the lifting rod, each of which locking members is disposed for longitudinal movement and in a spring-loaded manner in an unlocking pressure chamber and can be acted upon by the pressure fluid through the pressure-fluid connection of the particular associated working pressure chamber in order to unlock the lifting rod.

In a lifting cylinder of this type known from the DE-AS 20 36 716, the supply of compressed air to the working pressure chambers is effected through pressure conduits extending along the lifting rod at the cylinder housing side. The particular compressed air supplies to the unlocking pressure chambers are connected to these pressure conduits. In order to unlock the lifting rod, the locking member is acted upon by compressed air through the particular compressed-air connection, the pressure conduit of the working pressure chamber and its compressed-air supply to the unlocking pressure chamber leading into the pressure conduit. In this case, the compressed air supplied through the pressure conduit also reaches the working pressure chamber of the working piston at the same time. As a result of the pressure produced at the working piston in the direction of movement of the lifting rod, the locking member of pin-like form is pressed against the lateral boundary wall of its detent recess during the unlocking phase. As a result, the unlocking process is made more difficult, requires great pressure and can only be effected with intensive wear and noise. In addition, a non-tilting longitudinal guiding of the lifting rod is not ensured by the pressure conduits extending laterally along the lifting rod, as a result of which the sealing surface of the working piston in particular is also loaded in a wear-intensive manner.

It is the object of the invention to provide a lifting cylinder which can be actuated by pressure fluid for opening and closing ventilation devices in particular, of the type mentioned at the beginning wherein a low-noise unlocking of the lifting rod is possible with only slight pressure in a manner which protects the material.

In order to solve this problem, the lifting cylinder according to the invention is characterised primarily in that the supply of pressure fluid to a working pressure chamber of the working piston can be closed when its locking member is in the locking position and freed when this locking member reaches the unlocking position. With regard to further advantageous developments of the invention, reference should be made to claims 2 to 11.

In the lifting cylinder according to the invention, if a working movement of the lifting rod is desired, the pressure fluid is at first supplied only to the surface of the locking member adapted for the application of pressure, in order to unlock the lifting rod. As soon as the unlocking operation is terminated, the supply of pressure fluid to the working pressure chamber of the double-sided working piston responsible for the necessary opening or closing movement is released. Thus the unlocking operation can be completed without hindrance, free of any forces produced at the working piston, with only little pressure. The pressures per unit of area occurring altogether at the locking member, lifting rod or other components are considerably reduced in a manner protecting the material. The unlocking of the lifting rod does not produce any loud unlocking pop but is effected with little noise. Despite a considerably improved service life, the lifting cylinder as a whole is simple and cheap to manufacture and can be equipped not only with a preferably pneumatic unlocking means but also with an additional possibility for manual unlocking. Construction and operation of the lifting cylinder according to the invention will now be explained in more detail with reference to the drawing. In the drawing:

FIG. 1 shows one example of embodiment according to the invention in a diagrammatic cross-sectional illustration;

FIG. 2 shows an enlarged detail of the right-hand locking member shown in Figure 1.

Only the elements of the lifting cylinder necessary for immediate understanding of the invention are illustrated in the drawing and parts having the same effect are provided with the same reference numerals. The lifting cylinder which can be actuated by pressure fluid and which is intended to

serve for the opening and closing of ventilation flaps in installations for the escape of smoke from buildings, halls and the like is designated in general by the numeral 1. In its basic construction, the lifting cylinder 1 consists of a lifting rod 2 which is guided for longitudinal movement in a lifting-cylinder housing 3, 3', 3". Screwed into the free end face 4 of the lifting rod 2 is an articulated eye member 5 for the connection of adjusting members, not illustrated, for opening and closing the ventilation flaps. The lifting rod 2 is constructed with two longitudinal regions having different cross-sectional widths. A double-sided working piston 7 is disposed on the surface of the longitudinally movable lifting rod 2 in the longitudinal region of reduced cross-sectional width 6. The working pressure chambers 8 and 9 of the working piston 7 are constructed inside the housing 3 between the working piston 7 and the end portions 3' and 3" of the housing.

In the example of embodiment shown, two locking members 11 and 12 are provided perpendicular to the longitudinal axis 10 of the lifting rod to lock the lifting rod in the opening or closing position. These locking members 11 and 12 cooperate with detent recesses 13 and 14 provided on the lifting rod 2. The locking members 11 and 12 are disposed in an unlocking pressure chamber 15 or 16 inside the housing 3 and are each loaded by a compression spring 17 or 18. The compression springs 17 and 18 surround an actuating piston 19 screwed into the locking members 11 and 12 and taken to the outside through the peripheral surface of the housing for the manual activation of the locking members 11 and 12 or to enable the lifting rod 2 to be unlocked manually. In order to support and locate the compression springs 17 and 18, the locking members 11 and 12 are each provided with a receiving bore 20 at the top.

In the example of embodiment illustrated, the locking member 11, on the left in Figure 1, with its associated detent recess 13 serves to lock the lifting rod in the retracted position and the locking member 1, on the right in Figure 1, with its associated detent recess 14 serves to lock the lifting rod in the extended position of the lifting rod 2. The retracted end position of the lifting rod 2 is illustrated, in which the locking member 11 engages with its locking extension 21 in the detent recess 13 and locks the lifting rod. The locking member 12 with its locking extension 22 lies, acted upon by compressed air, against the inner wall of the housing shell, being loaded by spring force so that during the outward movement of the lifting rod 2, when the end position is reached, the locking member 12 engages in the detent recess 14 as a result of the force of the compression spring 18.

A pressure-fluid connection 23 is provided on the end housing portion 3' for the admission of pressure fluid to the working pressure chamber 8 and to the unlocking pressure chamber 15 and a pressure-fluid connection 24 is provided for admission to the working pressure chamber 9 and to the unlocking pressure chamber 16. The supply of compressed air to the unlocking pressure chamber 15 is effected from the pressure connection 23 via a pressure conduit 25, the longitudinal guide space 26 of the lifting rod 2 and the transverse bore 27. The supply of pressure fluid to the working pressure chamber 8 is effected via the unlocking pressure chamber 15 through a flow connection 28 which opens into an upper region of the unlocking pressure chamber 15 which is sealed, outside the unlocking position of the locking member 11, by a seal 30 secured to the marginal shoulder 29 of the locking member 11, which can be acted upon by pressure. Thus the locking member 11 with its marginal shoulder 29 carrying the seal 30 forms the closing member controlling the flow connection 28 of the working pressure chamber 8.

The supply of pressure fluid to the unlocking pressure chamber 16 is effected from the pressure-fluid connection 24, through a connecting conduit, not shown, to the supply conduit 31 and through the pressure conduits 32. The locking member 12 associated with the working pressure chamber 9 is also provided at the top with a marginal shoulder 33 which can be acted upon by pressure and which carries a seal 34 guided on the side walls of the unlocking pressure chamber 16. This seal 34 likewise only frees the flow connection 35 to the working pressure chamber 9 during or after unlocking of the lifting rod 2 by the locking member 12.

In the example of embodiment illustrated, when an outward movement of the lifting rod 2 is necessary, compressed air is supplied through the pressure-fluid connection 23 and the pressure conduit 25 to the longitudinal guide space 26. This longitudinal guide space 26 is sealed off from the working pressure chamber 8 through a sliding seal 36 which is likewise provided at the opposite side to seal off the longitudinal guide space 37 of the lifting rod 2. From the longitudinal guide space 26, the compressed air passes through the transverse bore 27 into the lower region of the unlocking pressure chamber and acts on the marginal shoulder 29 of the locking member 11 in the unlocking sense. At first, the working pressure chamber 8 and the flow connection 28 remain sealed off. As a result of the action of pressure, the locking member 11 moves along its longitudinal axis against the force of the compression spring 17 into the upper unlocking position in which the flow connection 28 is first freed. The region of the unlocking pressure chamber 15 formed at the top of the locking mem-

ber 11 is vented through the passage for the actuating piston 19 at the housing side during the longitudinal movement of the locking member 11. Since no forces are produced at the working piston 7 until the lifting rod 2 is completely unlocked, the unlocking operation can be completed without hindrance and with little noise with only little pressure. Moreover, as a result of the non-tilting longitudinal guiding of the lifting rod 2, the sealing sleeve 38 sealing the working pressure chambers 8 and 9 is guided on the inner walls of the housing in a manner which protects the material.

The detent recesses 13 and 14 of the lifting rod 2 are each formed in annular locking members 39 which are pushed, in an interchangeable manner, onto the lifting-rod region 6 having a reduced cross-sectional width. These annular locking members 39 are disposed one at each side of an annular disc 40 forming the double-sided working piston and likewise slid onto the lifting rod 2. Annular disc 40 and annular locking members 39 are braced to the shoulder 43 of the lifting rod 2 through a screw 42 which can be screwed into the end face 41 of the lifting rod 2 so that annular locking members 39, annular disc 40, seals 36, etc. can be exchanged rapidly if necessary.

The locking extensions 21 and 22 of the locking members 11 and 12 engage positively in the detent recesses 13 and 14 so that, because of reduced pressure, the locking components are subjected to only slight wear in comparison with the known pin locking means. In addition, the locking members 11 and 12 are also guided for movement in guide bushes 44 which may appropriately consist of a hardened material. One side wall of each of the detent recesses 13 and 14 is formed by a side-wall ring 46 which can be inserted in an annular groove 45 formed on the locking member 39 at the end and which likewise consists of a hardened material and can, if necessary, be exchanged in a simple manner without renewing the annular locking member 39. Annular grooves 47, which form an end holding means for the exchangeable securing of the sliding seals 36, are likewise formed on the opposite end face of the annular locking member 39 to the annular groove 45 in each case.

Claims

1. A lifting cylinder (1) which can be actuated by pressure fluid preferably to open and close ventilation devices such as ventilation flaps and the like, having a double-sided working piston (7) which is disposed on the peripheral surface of a longitudinally movable lifting rod (2) and to each of the working pressure chambers (8, 9) of which, pressure fluid can be admitted through a pressure-fluid connection (23, 24) for the stroke movement of the lifting rod (2), and having detent recesses (13, 14) at the lifting-rod side as well as locking members (11, 12) each of which is associated with a working pressure chamber (8, 9) and is provided perpendicular to the longitudinal axis (10) of the lifting rod and each of which is adapted for longitudinal movement, being loaded with spring force in an unlocking pressure chamber (15, 16) and can be acted upon by the pressure fluid through the pressure-fluid connection (23, 24) of the particular working pressure chamber (8, 9) associated with it, for the unlocking of the lifting rod, characterised in that the supply of pressure fluid to a working pressure chamber (8, 9) of the working piston (7) can be shut off when its locking member (11, 12) is in the locking position and freed when this locking member (11, 12) reaches the unlocking position.

2. A lifting cylinder which can be actuated by pressure fluid as claimed in claim 1, characterised in that the supply of pressure fluid to the working pressure chamber (8, 9) is effected in each case through a flow connection (28, 35) opening into the unlocking pressure chamber (15, 16) of the associated locking member (11, 12) which flow connection is controlled by a closing member in operational communication with the locking member (11, 12).

3. A lifting cylinder which can be actuated by pressure fluid as claimed in claim 2, characterised in that the closing member, which is movable with the locking member (11, 12) but not in relation thereto, is guided with a sealing action on the inside walls of the unlocking pressure chamber (15, 16) and the flow connection (28, 35) leads into a region of the unlocking pressure chamber (15, 16) which is sealed by the closing member outside the unlocking position of the locking member (11, 12).

4. A lifting cylinder which can be actuated by pressure fluid as claimed in claim 3, characterised in that the locking member (11, 12) is provided with a marginal shoulder (29, 33) which can be acted upon by pressure and carries a seal (30, 34) and which forms the closing member.

5. A lifting cylinder which can be actuated by pressure fluid as claimed in one of the claims 1 to 5, characterised in that the locking members (11, 12) have locking extensions (21, 22) which engage substantially positively in the detent recesses (13, 14) of the lifting rod (2).

6. A lifting cylinder which can be actuated by pressure fluid as claimed in one of the claims 1 to 5 characterised in that the locking members (11, 12) are guided for movement in guide bushes (44) disposed in the cylinder housing (3', 3").

7. A lifting cylinder which can be actuated by pressure fluid as claimed in one of the claims 1 to 6, characterised in that the lifting rod (2) is provided with a sliding seal (36) between each of its detent recesses (13, 14) and the working piston (7).

8. A lifting cylinder which can be actuated by pressure fluid as claimed in one of the claims 1 to 7, characterised in that the lifting rod (2) is constructed with a shank (6) of smaller cross-sectional width at the cylinder-housing side, on which shank there are secured annular locking members (39) provided with the marginal recesses (13, 14) and an annular disc (40) forming the double-sided working piston (7).

9. A lifting cylinder which can be actuated by pressure fluid as claimed in claim 8, characterised in that one side wall of each of the detent recesses (13, 14) formed in the annular locking members (39) is formed by a hardened side-wall ring (46) which can be inserted in an annular groove (45) provided on the annular locking member (39).

10. A lifting cylinder which can be actuated by pressure fluid as claimed in claim 7 and one of the claims 8 or 9, characterised in that each of the annular locking members (39) is provided with a holding shank (47) at the end for the replaceable arrangement of the sliding seals (36).

11. A lifting cylinder which can be actuated by pressure fluid as claimed in one of the claims 7 to 10, characterised in that the annular locking members (39) and the annular disc (40) forming the working piston (7) are braced to the lifting rod (2) by means of a screw (42) which can be screwed into the end face (41) of the lifting-rod shank (6).

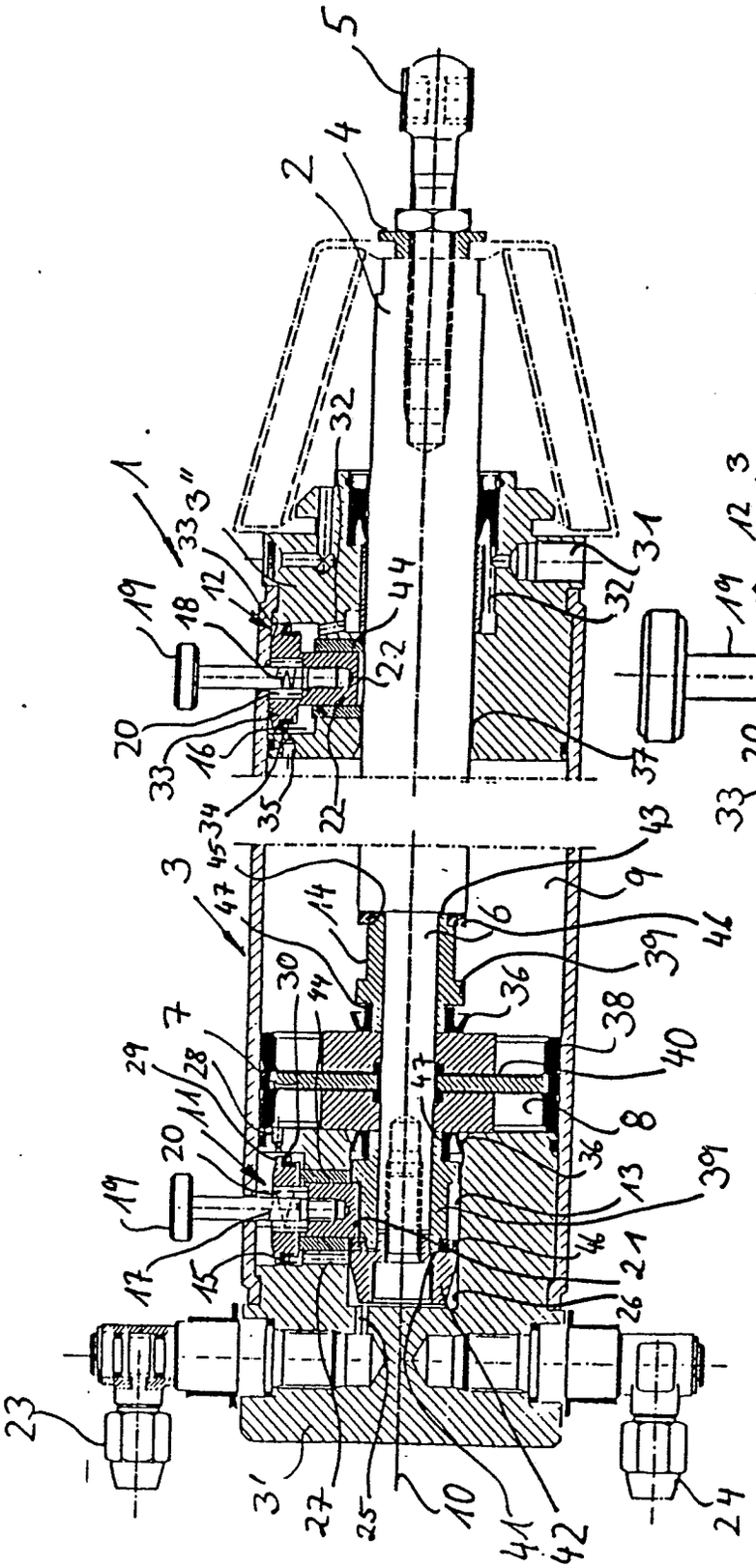

Fig. 1

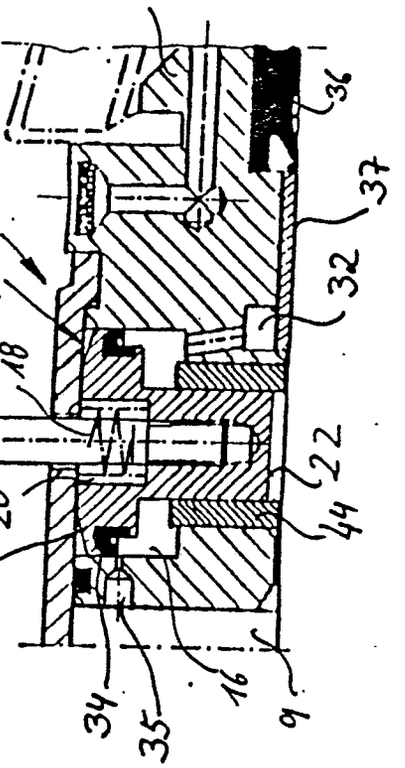

Fig. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 87 30 2404

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.4)
Y,D	DE-A-2 036 716 (GRESCHA) * Whole document *	1-11	A 62 C 3/14 F 15 B 15/26
Y	DE-A-3 018 920 (ANDEXER) * Pages 6,7 *	1-11	
A	US-A-3 889 576 (SHEFFER)		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

A 62 C
F 15 B
B 63 B
E 05 F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16-06-1987	WOHLRAPP R.G.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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