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(12) # EUROPEAN PATENT SPECIFICATION

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(54) **Piston locking device.**

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Description

This invention relates to a pressure fluid actuated piston-cylinder device, comprising a cylinder, a piston rod connected to the piston and extending out of the cylinder through one of the cylinder end walls, and a releasable locking mechanism disposed in said cylinder end wall and including a first wedge means frictionally engageable with the piston rod, a second wedge means axially movable and engageable with said first wedge means, a spring means continuously biassing said second wedge means into engagement with said first wedge means thereby accomplishing a piston rod locking action, and a fluid actuated release piston sealingly guided in a cylinder chamber selectively supplied with pressure fluid and arranged to move said second wedge means in a direction opposite to the direction of the biassing force of said spring means so as to neutralize said biassing force and discontinue said piston rod locking action.

Piston-cylinder devices of the above type find use in applications where safety demands are high as regards avoidance of uncontrolled piston movements at, for instance, hose breakage. By a piston cylinder device having a built-in piston locking mechanism it is also possible to stop and lock the piston and piston rod in predetermined positions. According to a previously known piston rod locking device shown and described in DE—A—2 755 456 conical piston rod engaging friction ring is encircled by an annular activation member which is spring biassed in its friction ring engaging direction and selectively acted upon by pressure fluid in the opposite direction for releasing the piston rod. Accordingly, safety demands are satisfied in that the piston is always locked unless pressure fluid is supplied to release it. The force developed by the pressure fluid has to counteract and exceed the force generated by the spring for relaxing the friction ring. According to this known design concept it would not be possible to obtain an effective enough locking action between the friction element and the piston rod unless increasing the outer dimension of the cylinder or decreasing the cone angle of the friction ring or both. The last mentioned measure, however, would make the locking mechanism much more difficult to release and would also necessitate a longer release stroke. That too would have an undesirable effect upon the outer dimensions of the piston-cylinder device.

Accordingly, it would not be possible to employ a large enough pressurized piston are on the annular activation element without increasing the outer dimension of the piston cylinder device. So, in order to obtain a more effective locking action on the piston rod a larger force has to be applied on the activation member by the spring, and for neutralizing that spring force and releasing the locking device the area of the pressure fluid activated means has to be larger. Then the size of the piston area would be too big not to influence upon the outer dimensions of the piston cyclinder device.

The main object of the invention is to accomplish a piston cyclinder device in which the locking means will generate a powerful enough locking action and in which the locking means does not cause increased outer dimensions of the piston cylinder device.

According to the invention this object is solved in a piston-cylinder device of the kind referred to in the precharacterising part of claim 1 by the characterising features of claim 1.

Other objects and advantages of the invention will appear from the following description and claims.

On the drawings

Fig 1 shows, partly in section, the front end of a piston-cylinder device having a piston locking mechanism according to the invention.

Fig 2 shows a cross section taken along line 2—2 in Fig 1.

The piston-cylinder device shown in the drawing figures comprises a cylinder 10, a piston (not shown) sealingly guided in the cylinder and a piston rod 11 which extends out of the cylinder 10 through the end wall 13 of the cylinder 10. The cylinder end wall 13 comprises an outer section 14 and an inner section 15. In the outer section 14 there is a cylindrical chamber 16 in which there is located a piston rod clamping unit 17. The clamping unit 17 comprises three conical piston rod 11 engaging friction segments 18, an axially displaceable wedge ring 19 surrounding the friction segments 18, and a spring means 20. The latter, which consists of a number of Belleville-type spring washers, acts between the outer cylinder end wall section 14 and the wedge ring 19, thereby biassing the latter in the friction segment engaging direction. Each of the friction segments are provided with a lining 21 for improved frictional engagement with the piston rod 11. Between the segments 18 there are radial clearances 22 for making sure that the radial grip on the piston rod 11 is not jeopardized by contact between the friction segments themselves.

The wedge ring 19 is locked against rotation by means of two axially extending keys 23 mounted diametrically opposite each other in the end wall section 14. Wire inserts 24 are located in axial grooves in the cooperating conical surfaces of the friction segments 18 and the wedge ring 19 in order to prevent the segments to rotate and also to prevent the piston rod 11 from being rotated when locked.

Between the cylinder end wall sections 14, 15 there is an annular space 26 in which three equally spaced levers 27 are supported. Each of these levers 27 is guided in a radial recess 28 in the inner cylinder wall section 15. A ring piston 29 is sealingly guided in an annular chamber 30 in the inner end wall section 15. The annular chamber 30 is selectively supplied with pressure fluid through a passage 31. The piston 29 is intended to counteract and neutralize the force

developed by the Belleville springs 20 and to move the annular wedge ring 19 off the segments 18, thereby relaxing the clamping unit 17 and permitting movement of the piston rod 11. Each of the levers 27 has a first contact surface 33 engaging two immovable fulcrum forming rings 34, 35, a second contact surface 36 facing the same direction as the first contact surface 33 for engaging the ring piston 29, and a third contact surface 37 located right in between the first and second contact surfaces 33, 36 and facing the opposite direction. The third contact surface 37 abuts against the wedge ring 19. Due to the lever arrangement, the movement of piston 29 is transferred to the wedge ring 19 at half the speed but *twice the power.* This means that a fairly small release piston may be used to neutralize a strong activation spring 20.

In Fig 1, the locking mechanism is shown in its released position. Pressure fluid is suplied to chamber 30 via passage 31, and the piston 29 has moved to its left hand position. The piston movement has been transferred to the annular wedge ring 19 by the levers 27. The force developed by the piston 29 is amplified by 100% by the levers 27.

When the pressure fluid supply to chamber 30 is discontinued the power of Belleville springs 20 immediately returns the levers 27 and piston 29 to their rest positions while the wedge ring 19 reengages and activates the friction segments 18 to lock the piston rod 11.

Claims

1. A pressure fluid actuated piston-cylinder device, comprising a cylinder (10), a piston rod (11) connected to the piston and extending out of the cylinder (10) through one of the cylinder end walls (13), and a releasable locking mechanism disposed in said cylinder end wall (13) and including a first wedge means (18) frictionally engageable with the piston rod (11), a second wedge means (19) axially movable and engageable with said first wedge means (18), a spring means (20) continuously biassing said second wedge means (19) into engagement with said first wedge means (18) thereby accomplishing a piston rod locking action, and a fluid actuated release piston (29) sealingly guided in a cylinder chamber (30) selectively supplied with pressure fluid and arranged to move said second wedge means (19) in a direction opposite to the direction of the biassing force of said spring means (20) so as to neutralize said biassing force and discontinue said piston rod locking action, characterized in that a number of force amplifying levers (27) are arranged to interconnect said release piston (29) and said second wedge means (19).

2. Piston-cylinder device according to claim 1, wherein said release piston (29) is annular and sealingly guided in an annular cylinder chamber (30) which is located in the end wall (13) of the cylinder (10) and concentrically surrounds the piston rod (11).

3. Piston-cylinder device according to claim 1 or 2, wherein each of said force amplifying levers (27) has at one end a first contact surface (33) for engagement with a fulcrum support means (34, 35) fixed in the cylinder end wall (13), a second contact surface (36) located at the opposite end of the lever (27) for engagement with said release piston (29), and a third contact surface (37) located between said first contact surface (33) and said second contact surface (36) for engaging said second wedge means (19).

4. Piston-cylinder device according to claim 3, wherein said levers (27) are three in number and extend radially relative to the geometric axis of the piston rod (11).

5. Piston-cylinder device according to claim 3 or 4, wherein said third contact surface (37) is situated at substantially equal distances from said first and second contact surfaces (33, 36).

6. Piston-cylinder device according to any one of claims 1 to 5, wherein said first wedge means (18) comprises a number of segments, whereas said second wedge means (19) comprises a conical ring element encircling said segments (18).

Patentansprüche

1. Druckmittelbetätigte Kolben -Zylinder -Einrichtung, bestehend aus einem Zylinder (10), einer mit dem Kolben verbundenen und sich aus dem Zylinder (10) durch eine der Zylinderendwände (13) heraus erstreckende Kolbenstange (11) und einer in der genannten Endwand (13) angeordneten lösbaren Verriegelungsvorrichtung mit einem ersten Keilglied (18) für den reibschlüssigen Eingriff mit der Kolbenstange (11), einem axial beweglichen zweiten Keilglied (19) für den Eingriff mit dem ersten Keilglied (18), einem das zweite Keilglied (19) ständig in Eingriff mit dem ersten Keilglied (18) vorspannenden und dadurch die Verriegelung der Kolbenstange herbeiführenden Federmittel (20) und einem druckmittelbetätigten Entriegelungskolben (29), der dichtend in einer selektiv mit Druckmittel versorgbaren Zylinderkammer (30) geführt ist und dazu dient, daß zweite Keilglied (19) in einer Richtung entgegengesetzt zur Richtung der Vorspannkraft des Federmittels (20) zu bewegen, derart, daß die Vorspannkraft aufgehoben und die Verriegelung der Kolbenstange unterbrochen wird, gekennzeichnet durch eine Anzahl kraftverstärkender Hebel (27), welche dazu dienen, den Entriegelungskolben (29) und das zweite Keilglied (19) miteinander zu verbinden.

2. Kolben -Zylinder -Einrichtung nach Anspruch 1, worin der Entriegelungskolben (29) ringförmig ausgebildet und dichtend in einer ringförmigen Zylinderkammer (30) geführt ist, welche in der Endwand (13) des Zylinders (10) angeordnet ist und die Kolbenstange (11) konzentrisch umschließt.

3. Kolben -Zylinder -Einrichtung nach Anspruch 1 oder 2, worin ein jeder der kraftverstärkenden Hebel (27) an einem Ende eine erste Berührungsfläche (33) für den Eingriff mit einem

an der Zylinderendwand (13) festen Drehpunkt-Abstützmittel (34, 35), eine am entgegengesetzten Ende des Hebels (27) angeordnete zweite Berührungsfläche (36) zum Eingriff mit dem Entriegelungskolben (29) und eine zwischen der ersten Berührungsfläche (33) und der zweiten Berührungsfläche (36) gelegene dritte Berührungsfläche (37) für den Eingriff des zweiten Keilglieds (19) aufweist.

4. Kolben -Zylinder -Einrichtung nach Anspruch 3, worin die Hebel (27) drei an der Zahl sind und sich radial im Verhältnis zur geometrischen Achse der Kolbenstange (11) erstecken.

5. Kolben -Zylinder -Einrichtung nach Anspruch 3 oder 4, worin die genannte dritte Berührungsfläche (37) in im wesentlichen gleichen Abständen von der ersten und der zweiten Berührungsfläche (33, 36) angeordnet ist.

6. Kolben -Zylinder -Einrichtung nach einem der Ansprüche 1 bis 5, worin das erste Keilglied (18) aus einer Anzahl von Segmenten besteht, während das zweite Keilglied (19) aus einem diese Segmente (18) umschließenden konischen Ringelement besteht.

Revendications

1. Dispositif à piston et cylindre commandés par un fluide sous pression, composé d'un cylindre (10), d'une tige de piston (11) reliée au piston et sortant du cylindre (10) par l'une des parois d'extrémité (13) dy cylindre ainsi qu'un mécanisme de libération de verrouillage placé dans la paroi d'extrémité (13) du cylindre et comprenant un premier moyen (18) en forme de coin coopérant par friction avec la tige de piston (11), un second moyen (19) en forme de coin mobile axialement et coopérant avec le premier moyen en forme de coin (18), un ressort (20) poussant en permanence le second moyen (19) en forme de coin, en contact avec le premier moyen en forme de coin (18) pour réaliser un effet de blocage de la tige de piston, ainsi qu'un piston de libération (29) commendé par du fluide qui est guidé de façon étanche dans une chambre de cylindre (30) alimentée sélectivement en fluide sous pression et destiné à déplacer le second moyen en forme de coin (19) dans une direction opposée à la direction de la force de poussée du moyen à ressort (20) pour neutraliser cette force de poussée et, supprimer l'effet de blocage de la tige de piston, caractérisé par un certain nombre de leviers (27) amplificateurs de force destinés à relier le piston de libération (29) et le second moyen en forme de coin (19).

2. Dispositif à piston et cylindre selon la revendication 1, caractérisé en ce que le piston de livération (29) est un piston annulaire guidé de façon étanche dans une paroi d'extrémité (13) dy cylindre (10) et entourant de façon concentrique la tige de piston (11).

3. Dispositif à piston et cylindre selon la revendication 1 ou 2, caractérisé en ce que chacun des leviers-amplificateurs de force (27) comporte à une extrémité une première surface de contact (33) pour coopérer avec un moyen de support de palier (34, 35) fixé à la paroi d'extrémité (13) du cylindre, une seconde surface de contact (36), située à l'extrémité opposée du levier (27), pour coopérer avec le piston de libération (29) et une troisième surface de contact (37), située entre la première surface de contact (33) et la seconde surface de contact (36), pour coopérer avec le second moyen en forme de coin (19).

4. Dispositif à piston et cylindre selon la revendication 3, caractérisé en ce que les leviers (27) sont au nombre de trois et sont disposés radialement par rapport à l'axe géométrique de la tige de piston (11).

5. Dispositif à piston et cylindre selon la revendication 3 ou 4, caractérisé en ce que la troisième surface de contact (37) est située à une distance sensiblement égale de la première et de la seconde surface de contact (33, 36).

6. Dispositif à piston et cylindre selon l'une quelconque des revendications 1 à 5, caractérisé en ce que le premier moyen (18) en forme de coin se compose d'un certain nombre de segments et le second moyen (19) en forme de coin comporte un élément annulaire, conique entourant les segments (18).

Fig. 1

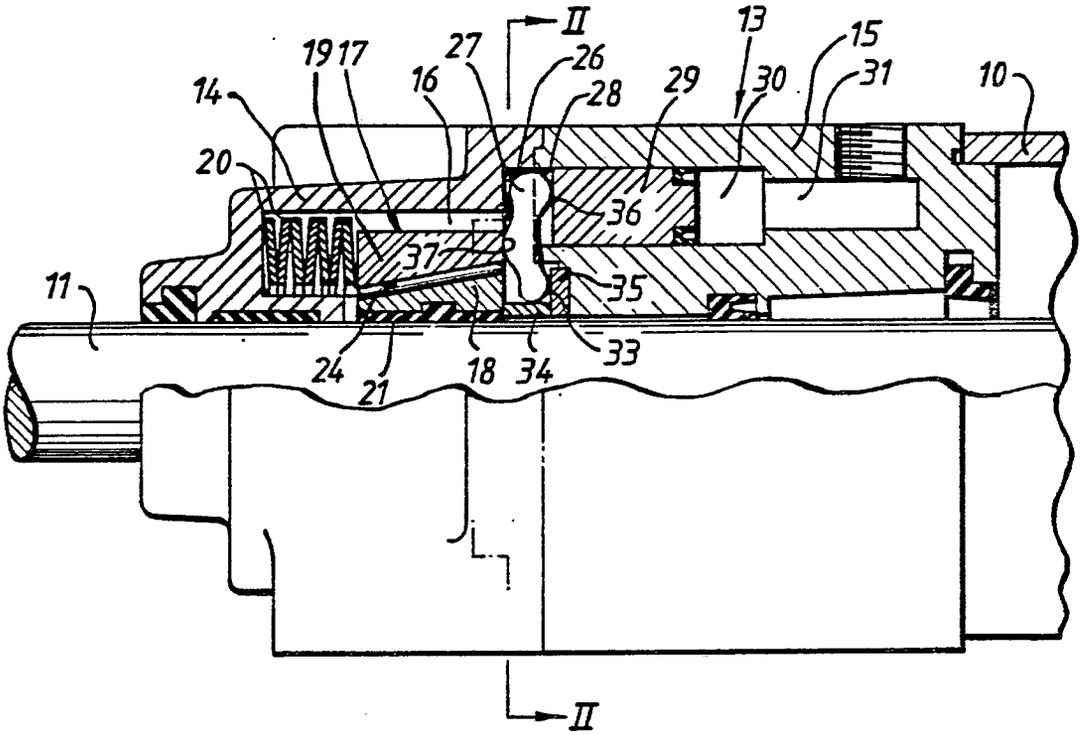
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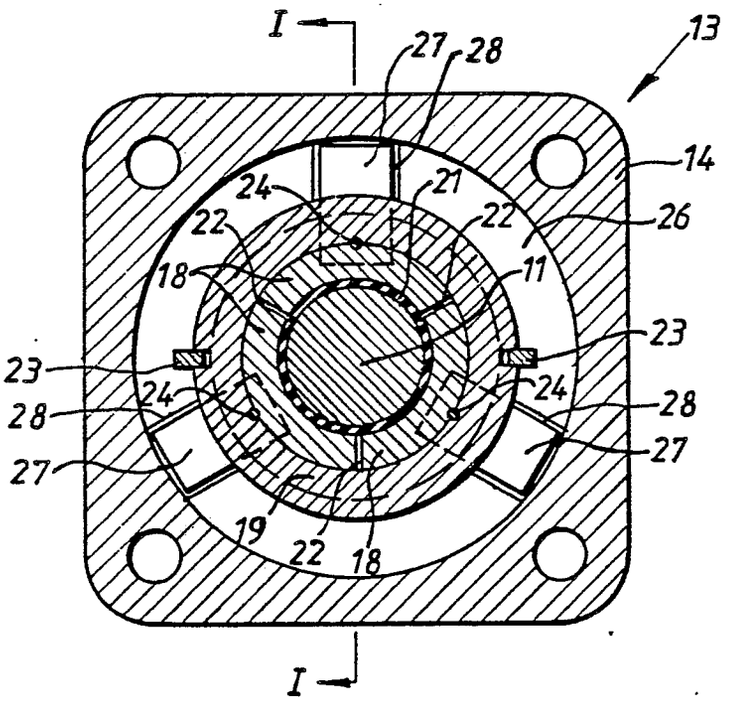
Fig. 2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