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(54) **Piston-cylinder type actuator**

Zylinder-Kolben-Stelleinrichtung

Vérin à cylindre et piston

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- **PATENT ABSTRACTS OF JAPAN vol. 6, no. 267**
(M-182)(1145) 25 December, 1982; & JP A 57
157863 (SHIYOUWA) 29 September, 1982.

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Description

The invention relates to a piston-cylinder type actuator in which a cylinder tube is fitted with at least one end wall which at least partly is received in the cylinder tube.

Mounting of end walls to cylinder tubes in actuators, usually comprise bolt joints, either short bolts extending through flanges on the cylinder tube and the end walls or tension rods bridging both end walls and the entire length of the cylinder tube. Other common end wall mountings comprise mating threads cut directly on the cylinder tube and on the end walls, or lock rings securing the end walls relative to the cylinder tube.

In all the above related prior art actuators, there is required extra machining of the cylinder tube and/or additional mounting elements, like bolts and nuts, for mounting the end walls to the cylinder tube. There is also required valuable labour time to carry out the assembly work.

A simplified cylinder and end wall design, however, is shown in Japanese Patent Abstract vol.6, No 267 (M-182) (1145). According to this previously known device, a circumferential projection formed by plastic deformation of the cylinder wall engages a circumferential groove on the end wall to thereby lock the latter to the cylinder.

This known device comprises not only a machined weakened portion of the cylinder tube but requires at least two assembling steps.

The main object of the invention is to create an end wall mounting method and a piston-cylinder type actuator by which the end wall and cylinder tube design as well as the assembly work is substantially simplified and, thereby, less costly.

This object is achieved by the method as defined in claim 1 and by the actuator as defined in claim 3. Preferred embodiments are defined in the dependent claims.

A preferred embodiment of the invention is hereinbelow described in detail with reference to the accompanying drawings.

On the drawings:

Fig 1 shows a longitudinal section through a piston-cylinder type actuator according to the invention.

Figs 2a-c illustrate in three steps the end wall mounting method according to the invention.

Fig 3 shows the completed end wall mounting carried through as illustrated in Figs 2a-c.

Fig 4 shows an enlarged fraction of Fig 3.

Fig. 5 shows an end view of the device in Fig 3.

The actuator shown in Fig 1 comprises a cylinder tube 10 with pressure medium communication ports 11, 12 and two end walls 13, 14. One of the end walls 14 has a central opening 16 through which a piston rod 17 extends. The latter has a threaded bore 18 at its outer end for connection to an external load and a threaded inner portion 19 by which a piston 20 is rigidly attached.

The piston 20 carries both a seal ring 22 and guide elements 23 for contact with the cylindrical inner surface 24 of the cylinder tube 10. A seal ring 25 is mounted in the end wall opening 16 to sealingly cooperate with the piston rod 17. A coil spring 27 is inserted between the front end wall 14 and the piston 20 to exert a bias load on the latter towards the rear end wall 13.

The end walls 13, 14 are formed with circumferential grooves 28 and 29, respectively, for supporting seal rings 30, 31. The end walls 13, 14 are also formed with circumferential mounting grooves 33, 34, which are engaged by lock lugs 35, 36 extending radially inwardly from the inner surface 24 of the cylinder tube 10. The lugs 35, 36, which extend throughout the inner circumference of the cylinder tube 10, are formed by plastic deformation of the latter and form together with the grooves 33, 34 a rigid and permanent mounting means for the end walls 13, 14. Thereby, the flat end surfaces 37, 38 of the end walls 13, 14 are flush with the end surfaces of the cylinder tube 10.

As being illustrated in Figs 2a-c, the formation of the lock lug 35 is carried out simultaneously with the introduction of the end wall 13 into the cylinder tube 10.

The end wall mounting is carried out by means of a mounting tool 40 which serves both as an end wall guiding and introduction means and as a cylinder tube upsetting pressing tool. For these purposes, the tool 40 is formed with a flat front surface 41 and an annular ridge 42 of substantially rectangular cross section and protruding in front of the front surface 41. This ridge 42 has an inner diameter to fit the outside surface 37 of the end wall 13, and the axial extent of the ridge 42 is equal to the distance between the outer end surface 37 of the end wall 13 and the mounting groove 33. The width of the ridge 42 is chosen so as to generate a lug 35 of a correct size to match the groove 33 when pressed against and into the end surface of the cylinder tube 10. The deformation ridge 42 engages the end surface portion 43 of the cylinder tube 10 located at the inner circumference of the latter. See Fig 2b.

In the mounting step illustrated in Fig 2b, the end wall 13 is engaged by the tool 40 and is introduced in the cylinder tube 10. An axially directed force F is applied on the tool 40, and in Fig 2c there is illustrated the final mounting step where the end wall 13 is fully introduced in the cylinder tube 10 and a lug 35 is formed by the pressing tool ridge 42. The lug 35 is actually formed into the groove 33 to thereby fill out the latter completely. A positive locking of the end wall 13 relative to the cylinder tube 10 is obtained. In Fig 3, and in Fig 4 in particular, the completed end wall mounting is shown.

It is to be understood that the embodiments of the invention are not limited to the above described example which includes the formation of a single annular lock lug 35 extending over the entire circumference of the cylinder tube 10. Instead, the lock means may comprise a number of shorter lugs distributed over the circumference of the cylinder tube 10, and the mounting groove

33 may as well be replaced by a number of shorter grooves to match the lugs. In such a case, the mounting tool 40 is formed with a number of short ridge portions for producing such lugs.

Claims

1. Method for rigidly mounting an end wall (13, 14) to a cylinder tube (10) of a piston-cylinder type actuator, wherein said end wall (13, 14) is to be received at least partly in said cylinder tube (10) and is formed with one or more peripheral grooves (33, 34), **characterized** by a one-step process in which said end wall (13, 14) is introduced into the cylinder tube (10) simultaneously with the application of a pressing force (F) onto one or more portions (43) at the inner circumference of the respective end surface of said cylinder tube (10) to form by plastic deformation of said one or more portions (43) one or more radially inwardly extending lugs (35, 36) for locking engagement with said peripheral groove or grooves (33, 34) on said end wall (13, 14). 10
2. Method according to claim 1, wherein said end wall (13, 14) is introduced into said cylinder tube (10) by means of a mounting tool (40) which is formed with a deformation means (42) for simultaneous engagement with and deformation of said end surface portions (43). 15
3. Piston-cylinder type actuator, comprising a cylinder tube (10), a piston (20) reciprocally guided in said cylinder tube (10) and at least one end wall (13, 14) which is at least partly received in said cylinder tube (10) and which has one or more peripheral grooves (33, 34), said cylinder tube (10) has one or more radially inwardly extending peripheral lugs (35, 36) arranged to engage said groove or grooves (33, 34) to lock rigidly said end wall (13, 14) relative to said cylinder tube (10), **characterized in** that said one or more peripheral lugs (35, 36) are formed by plastic deformation of one or more portions (43) of the respective end surface of said cylinder tube (10). 20
4. Actuator according to claim 3, wherein said one or more peripheral grooves (33, 34) comprise a single groove extending throughout the circumference of said end wall (13, 14). 25
5. Actuator according to claim 4 wherein said one or more peripheral lugs (35, 36) comprise a single lug extending throughout the inner circumference of said cylinder tube (10). 30

Patentansprüche

1. Verfahren zum starren Befestigen einer Stirnwand (13, 14) an einem Zylinderrohr (10) eines Kolben-Zylinder-Stellgliedes, bei welchem die Stirnwand (13, 14) wenigstens teilweise in dem Zylinderrohr (10) aufgenommen und mit einer oder mehreren Umfangsnuten (33, 34) ausgebildet wird, **gekennzeichnet durch** einen einstufigen Verfahrensschritt, in welchem die Stirnwand (13, 14) unter gleichzeitiger Anwendung einer Druckkraft (F) auf einen oder mehrere Bereiche (43) am inneren Umfang der betreffenden Stirnfläche des Zylinderrohrs (10) in dieses eingeführt wird, um durch plastische Deformation des Bereiches bzw. der Bereiche (43) eine oder mehrere radial nach innen weisende Vorsprünge (35, 36) zum verriegelnden Eingreifen in die Umfangsnut bzw. -nuten (33, 34) in der Stirnwand (13, 14) auszuformen. 5
2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet**, daß die Stirnwand (13, 14) in das Zylinderrohr (10) mittels eines Montagewerkzeuges (40) eingeführt wird, das mit Verformungsmitteln (42) zum gleichzeitigen Angreifen und Verformen der Stirnflächenbereiche (43) ausgebildet ist. 10
3. Kolben-Zylinder-Stellglied mit einem Zylinderrohr (10), einem Kolben (20), der in dem Zylinderrohr (10) hin- und hergehend geführt ist, und wenigstens einer Stirnwand (13, 14), die zumindest teilweise in dem Zylinderrohr (10) aufgenommen ist und eine oder mehrere Umfangsnuten (33, 34) besitzt, wobei das Zylinderrohr (10) einen oder mehrere radial nach innen weisende Umfangsvorsprünge (35, 36) aufweist, die so angeordnet sind, daß sie in die Nut bzw. Nuten (33, 34) eingreifen, um die Stirnwand in Bezug auf das Zylinderrohr (10) starr zu verriegeln, **dadurch gekennzeichnet**, daß der Umfangsvorsprung bzw. die Umfangsvorsprünge (35, 36) im Wege plastischer Deformation eines oder mehrerer Bereiche (43) der betreffenden Stirnfläche des Zylinderrohrs (10) ausgeformt sind. 15
4. Stellglied nach Anspruch 3, **dadurch gekennzeichnet**, daß die eine oder die mehreren Umfangsnuten (33, 34) aus einer einzigen Nut bestehen, die sich durchgehend über den Umfang der Stirnwand (13, 14) erstreckt. 20
5. Stellglied nach Anspruch 4, **dadurch gekennzeichnet**, daß der eine oder die mehreren Umfangsvorsprünge (35, 36) aus einem einzigen Vorsprung bestehen, der sich durchgehend über den inneren Umfang des Zylinderrohrs (10) erstreckt. 25

Revendications

1. Procédé pour monter rigidement une paroi d'extrémité (13, 14) sur un tube de cylindre (10) d'un vérin de type à cylindre et piston, dans lequel la paroi d'extrémité (13, 14) doit être reçue au moins partiellement dans le tube de cylindre (10) et comporte une ou plusieurs rainures périphériques (33, 34),

caractérisé par
un processus en une seule étape dans lequel la paroi d'extrémité (13, 14) est introduite dans le tube de cylindre (10) en même temps qu'on applique une force de pression (F) sur une ou plusieurs parties (43) à l'endroit de la circonférence intérieure de la surface d'extrémité respective du tube de cylindre (10), de manière à former, par déformation plastique de la partie ou des parties (43), un ou plusieurs ergots faisant saillie radialement vers l'intérieur (35, 36) pour produire un engagement de verrouillage avec la rainure ou les rainures périphériques (33, 34) formées dans la paroi d'extrémité (13, 14).

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2. Procédé selon la revendication 1,

caractérisé en ce que la paroi d'extrémité (13, 14) est introduite dans le tube de cylindre (10) au moyen d'un outil de montage (40) qui est muni d'un moyen de déformation (42) destiné simultanément à s'engager sur les parties de surfaces d'extrémités (43) et à déformer ces parties de surfaces d'extrémités.

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3. Vérin de type à cylindre et piston, comprenant un tube de cylindre (10), un piston (20) guidé dans un mouvement de va-et-vient à l'intérieur du tube de cylindre (10), et au moins une paroi d'extrémité (13, 14) venant se loger au moins partiellement dans le tube de cylindre (10) et comportant une ou plusieurs rainures périphériques (33, 34), le tube de cylindre (10) comportant un ou plusieurs ergots périphériques faisant saillie radialement vers l'intérieur (35, 36) et disposés de manière à s'engager dans la rainure ou les rainures (33, 34) pour bloquer rigidement la paroi d'extrémité (13, 14) par rapport au tube de cylindre (10),

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caractérisé en ce que l'ergot ou les ergots périphériques (35, 36) sont formés par déformation plastique d'une ou plusieurs parties (43) de la surface d'extrémité respective du tube de cylindre (10).

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4. Vérin selon la revendication 3,

caractérisé en ce que

la rainure ou les rainures périphériques (33, 34) comprennent une rainure unique s'étendant sur toute la circonférence de la paroi d'extrémité (13, 14).

5. Vérin selon la revendication 4,

caractérisé en ce que

l'ergot ou les ergots périphériques (35, 36) comprennent un ergot unique s'étendant sur toute la circonférence intérieure du tube de cylindre (10).



