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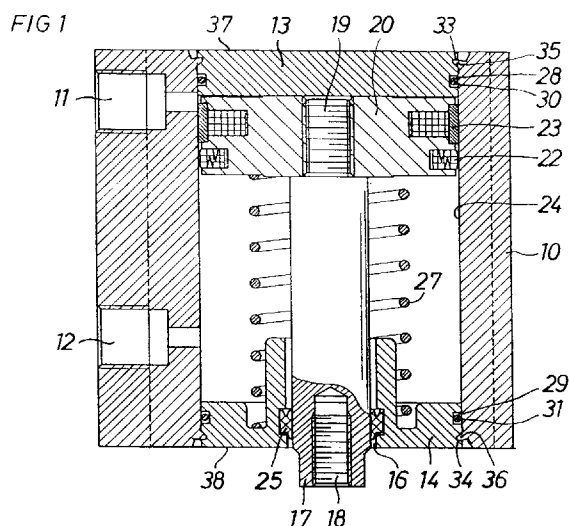
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(54) **Piston-cylinder type actuator.**

(57) In a piston-cylinder type actuator, at least one cylinder end wall (13, 14) is rigidly mounted to the cylinder tube (10) by being at least partly introduced into the cylinder tube (10) and provided with at least one peripheral groove (33, 34) which is engaged by one or more lock lugs (35, 36) formed by plastic deformation of the cylinder tube (10) simultaneously with the introduction of the end wall (13, 14) into the cylinder tube (10).



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.

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

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. 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),

characterized in that each of said end walls (13, 14) has one or more peripheral grooves (33, 34), and that said cylinder tube (10) has one or more radially inwardly extending peripheral lugs (35, 36) formed by plastic deformation of the end surface of said cylinder tube (10) and arranged to engage said groove or grooves (33, 34) to lock rigidly said end wall (13, 14) relative to said cylinder tube (10).

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2. Actuator according to claim 1, wherein said one or more peripheral grooves (33, 34) comprise a single groove extending throughout the circumference of said end wall (13, 14).

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3. Actuator according to claim 2, wherein said one or more peripheral lugs (35, 36) comprise a single lug extending throughout the inner circumference of said cylinder tube (10).

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4. Actuator according to anyone of claims 1-3, wherein said end wall (13, 14) has a flat outer end surface (37, 38) which is located flush with the respective end surface of the cylinder tube (10) as the end wall (13, 14) is mounted in the cylinder tube (10).

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5. Method for rigidly mounting an end wall (13, 14) to a cylinder tube (10) of a piston-cylinder actuator according to anyone of claims 1-4, 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 the end surface of the cylinder tube (10) to form by plastic deformation of the latter 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).

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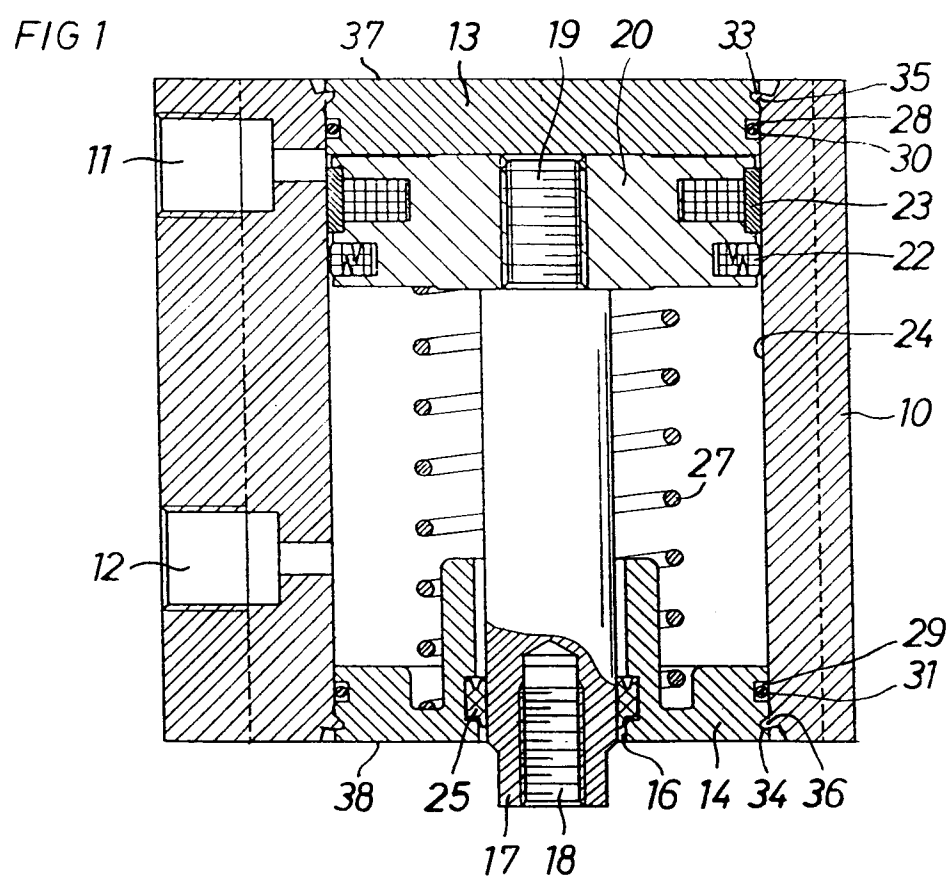
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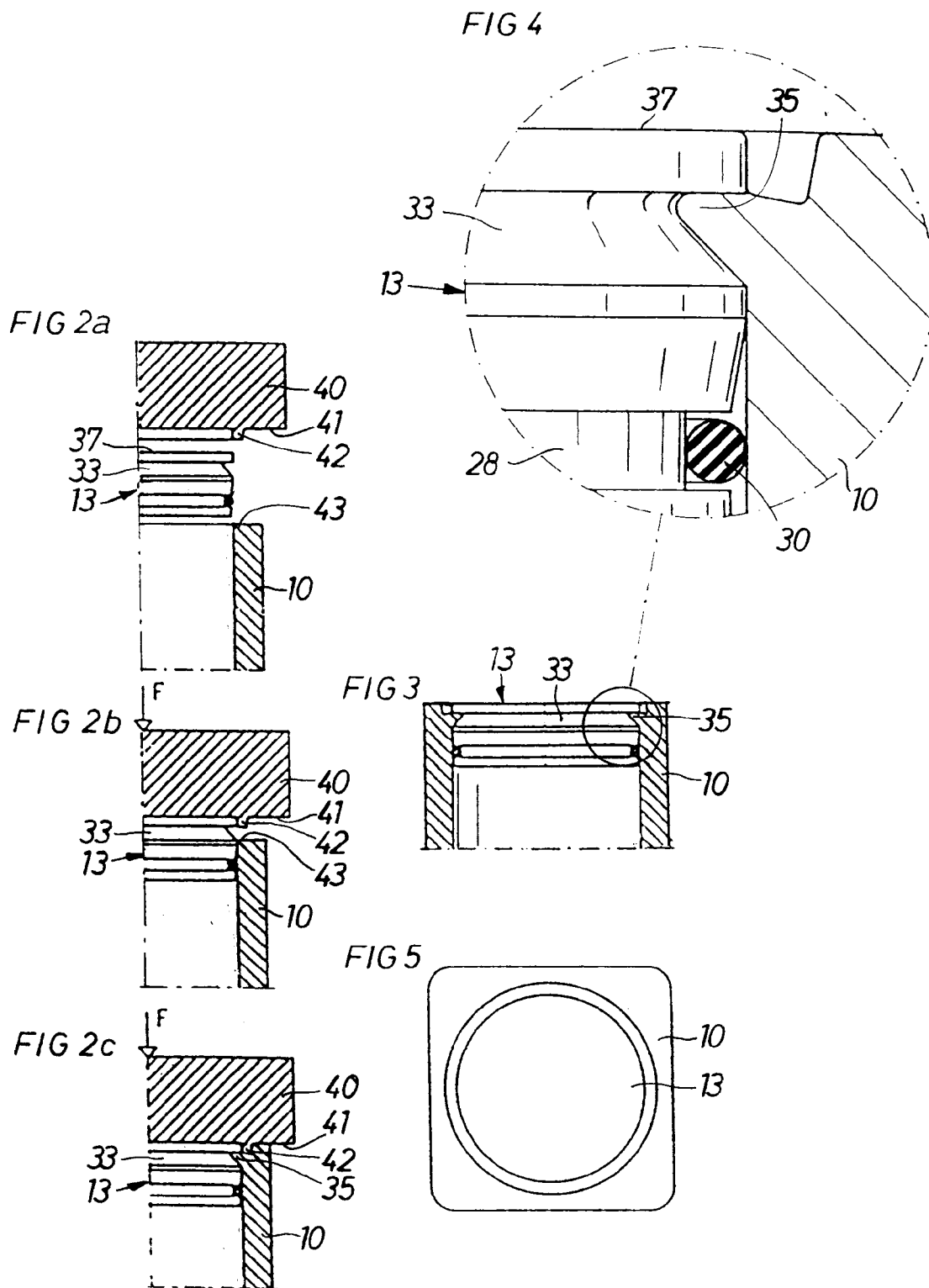
6. Method according to claim 5, wherein said lug or lugs (35, 36) are formed by said pressing force (F) being applied on one or more portions (42) of said cylinder tube end surface, said portions (42) being located at the inner circumference of said end surface.

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7. Method according to claim 5 or 6, wherein said pressing force (F) is exerted simultaneously with the introduction of said end wall (13, 14) into said cylinder tube (10) by means of a mounting tool (40).

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EUROPEAN SEARCH REPORT

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EP 92 85 0083

| 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 | PATENT ABSTRACTS OF JAPAN vol. 6, no. 267 (M-182)(1145) 25 December 1982 & JP-A-57 157 863 (SHIYOMA) 29 September 1982 * abstract * | 1-5 | F16J10/02 F15B15/14 |
| A | DE-A-4 002 558 (KNAPP) --- | | |
| A | DE-A-2 115 053 (KNAPP) --- | | |
| A | CH-A-501 168 (BOSCH) --- | | |
| A | US-A-2 487 512 (BERGER) ----- | | |
| The present search report has been drawn up for all claims | | | TECHNICAL FIELDS SEARCHED (Int. Cl.5) |
| | | | F15B F16J |
| Place of search THE HAGUE | | Date of completion of the search 24 JULY 1992 | Examiner KNOPS J. |
| <p>CATEGORY OF CITED DOCUMENTS</p> <p>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</p> <p>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</p> | | | |

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