United States Patent [19]

Persicke

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[54] **FLUID OPERATED JACKS**

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[21] Appl. No.: **59,905**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 739,106, June 21, 1968, abandoned.

[30] **Foreign Application Priority Data**

July 31, 1969 Great Britain 38551/69

[52] **U.S. Cl.** ..... **254/29 A**

[51] **Int. Cl.** **E21b 19/00**

[58] **Field of Search** ..... 254/29 A

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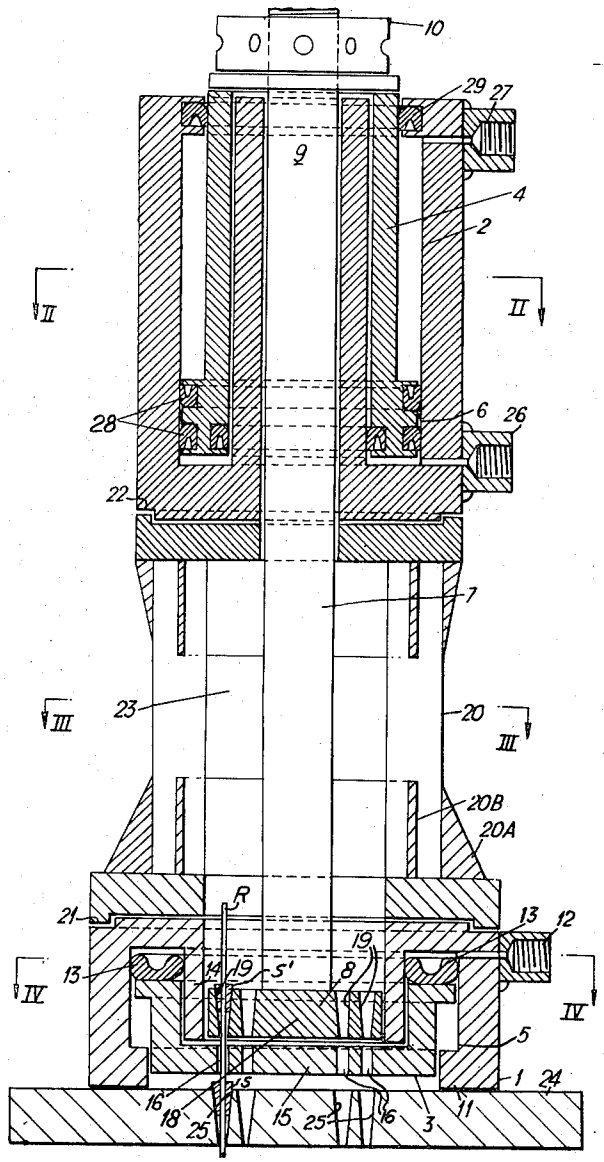
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[57] **ABSTRACT**

A jacking device for stressing or tensioning elongated reinforcing elements in concrete structures comprising an anchor homing jack and a stressing jack assembled in axial alignment, each jack having an annular cylinder surrounding an element to be stressed and an annular piston sliding in the cylinder, a tensioning member extending through both jacks and having means for engagement by the piston of the stressing jack and means associated with the piston of the homing jack to clamp the reinforcement elements after stressing to enable the jacks to be used for further stressing of the elements.

4 Claims, 8 Drawing Figures

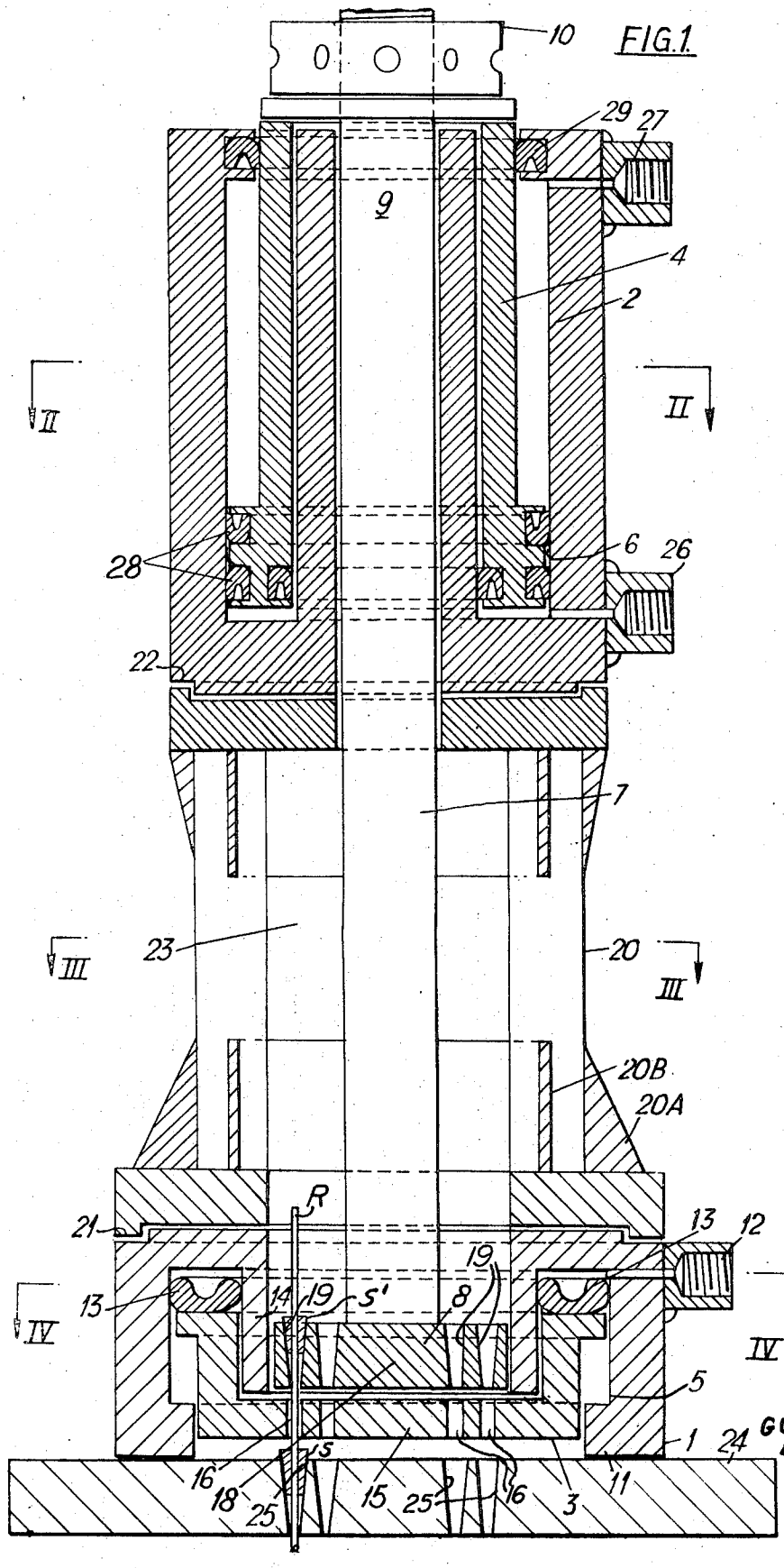


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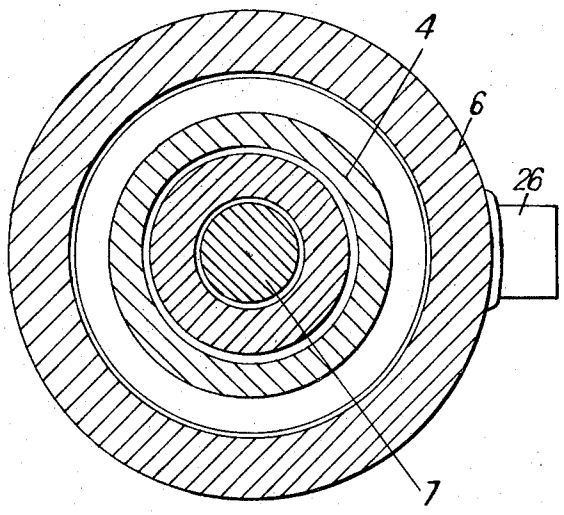
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FIG.1



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FIG.2.



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FIG.3

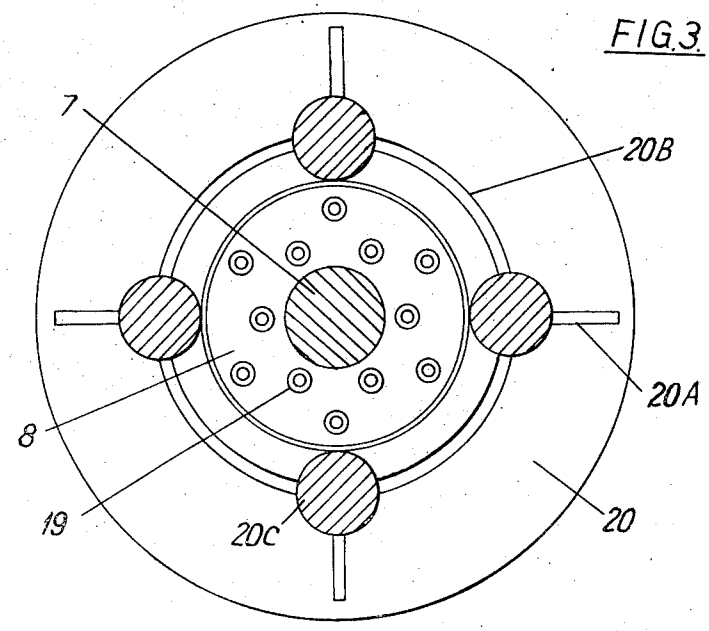
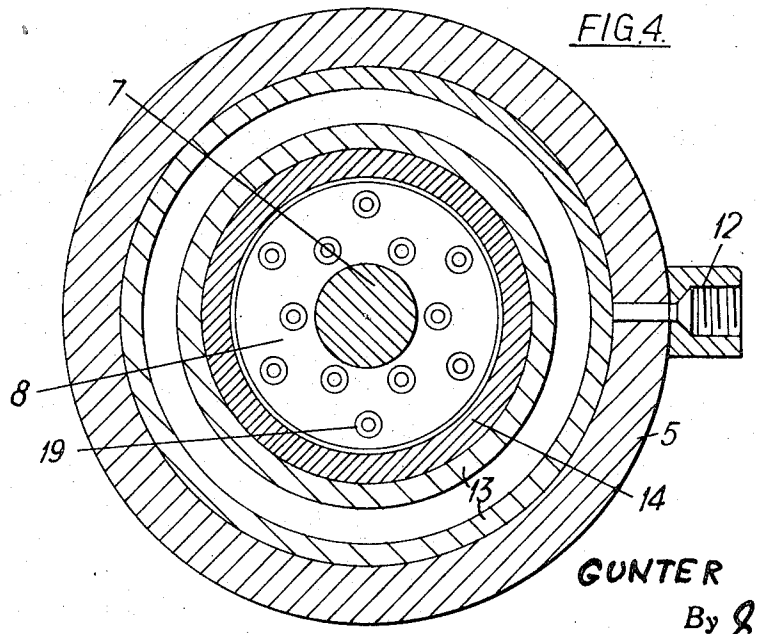


FIG.4



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FIG.5

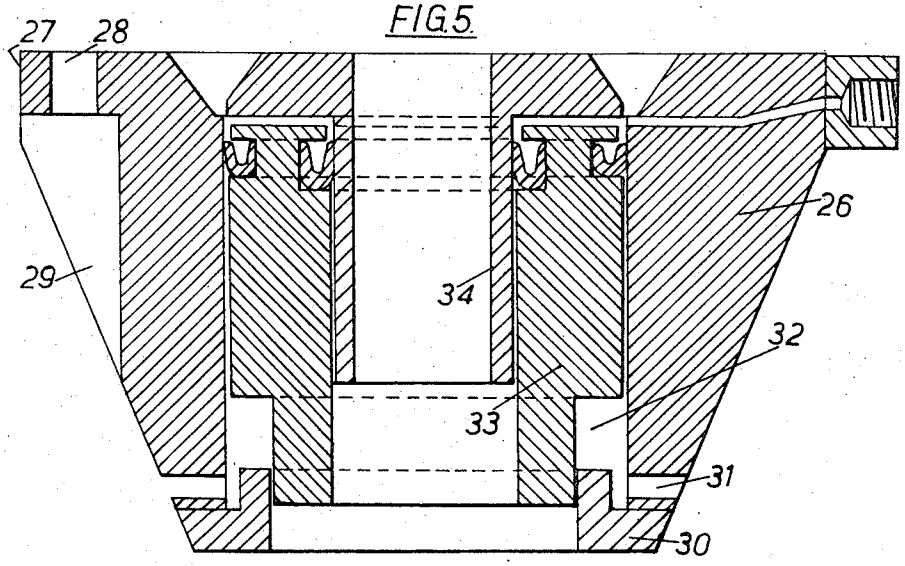
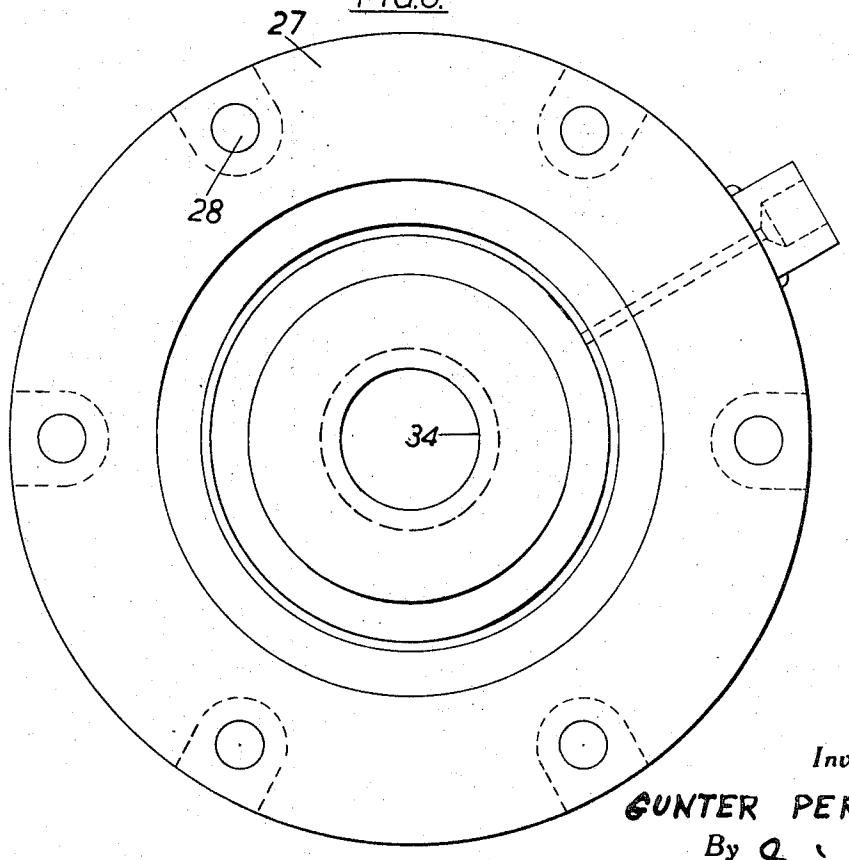
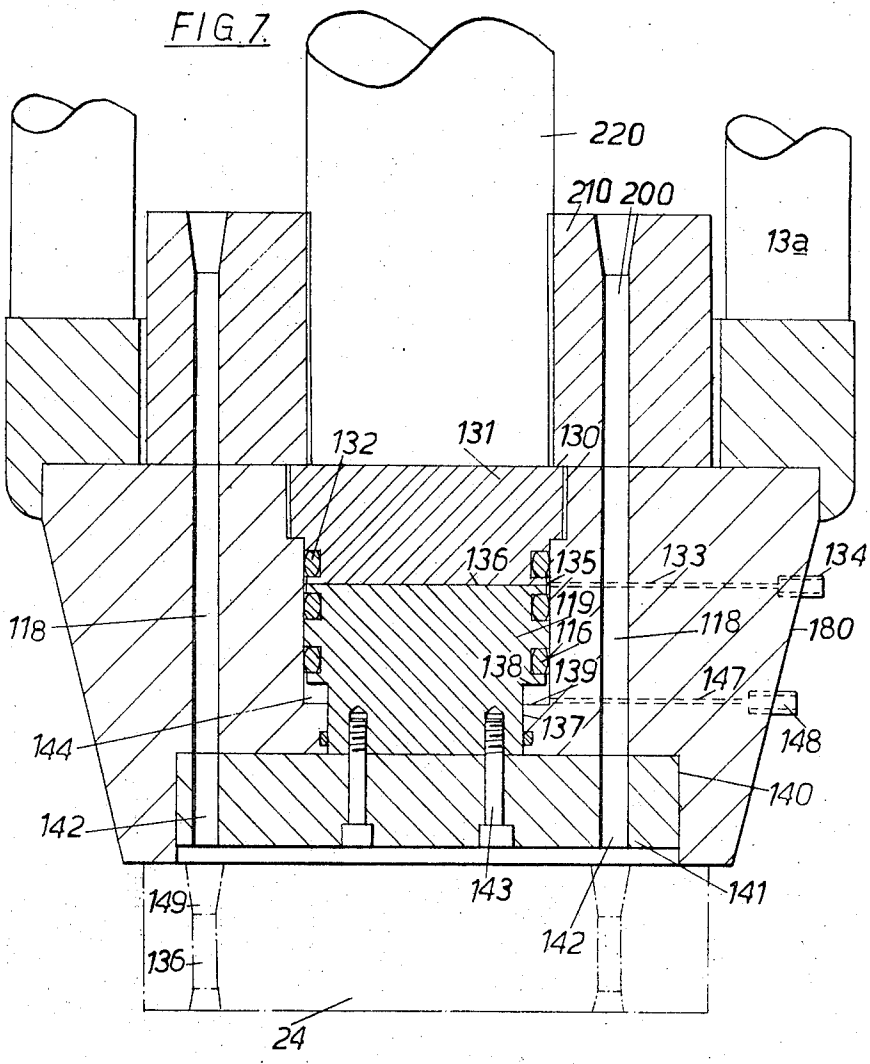


FIG.6



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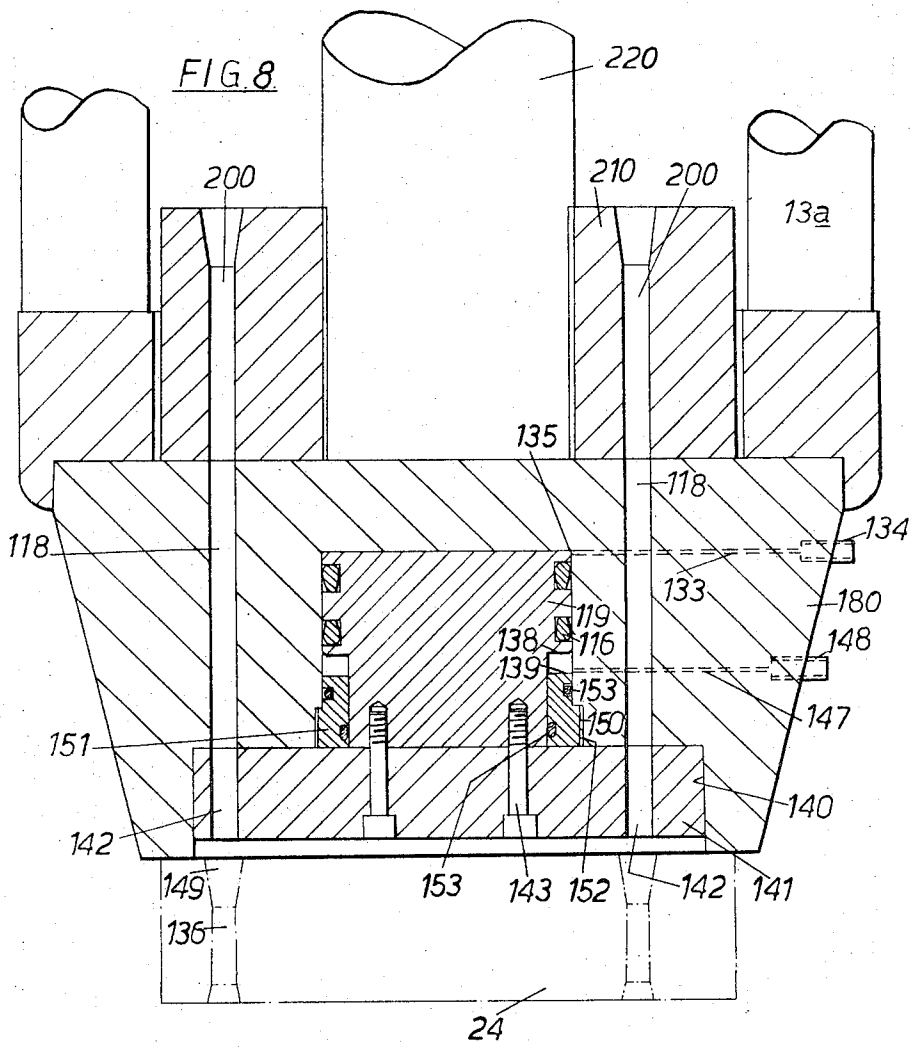
FIG. 7.



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FIG. 8



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FLUID OPERATED JACKS

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a Continuation-in-part of our co-pending application Ser. No. 739,106 filed June 21, 1968 now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to fluid actuated jacks primarily for use in prestressing a plurality of reinforcing cables or rods or like elongated elements in a mould prior to pouring concrete into the moulds in making elongated reinforced concrete structural elements such as piles or panels.

2. Description of the Prior Art

In prestressing such reinforcing elements, the ends of the elements extend beyond the mould by a substantial length, e.g., 4 feet, to give sufficient length on which the tensioning or stressing equipment can be engaged, and when the structural element is completely set, the excess lengths of reinforcing elements are cut off which is a substantial waste of material. Moreover when the reinforcing elements are laid in the mould or through bores in the set concrete elements, an anchor is disposed on the end of the mould or structural element through holes in which the ends of the reinforced elements are passed, and a number of conical segments are disposed round each reinforcing element with their taper ends engaging in the anchor holes which are correspondingly tapered. When the reinforcing elements have been fully stressed and the tensioning load is removed the segments move into the holes and are wedged against the reinforcing elements thereby firmly gripping them in tension. However before the segments fully grip the reinforcing elements some tension or stress in them is lost due to the reinforcing elements running back into the moulds or bores. Also since the segments are located in the holes before the stressing is commenced, they tend during the stressing to move out of the holes and since the jack surrounds the reinforcing elements it is difficult to prevent the segments falling out of the apparatus to replace them if they do.

The main object of the present invention is to provide a fluid operated jack in which these disadvantages are minimised or eliminated.

SUMMARY

According to the prevent invention a fluid operated jack for tensioning or stressing reinforcement elements in concrete and like structural members, comprises an anchor homing jack and a tensioning or stressing jack assembled in axial alignment, each jack being fluid operated and formed of an annular piston sliding in an annular cylinder, and a tensioning member having a portion at one end for anchoring to the reinforcing element or elements and at the other end means for engagement by the tensioning or stressing jack to be moved axially thereby and impart a tensile force on each reinforcing element.

In a preferred construction for tensioning or stressing a plurality of spaced reinforcing elements in a single constructional element the interior of both jacks is longitudinally hollow and the tensioning member is located therein with its free end extending beyond the end of the tensioning or stressing jack and having an anchor member engaging the outer end of the extending member of the jack.

An anchor part preferably extends across the inner end of the hollow homing jack, a number of axial holes are spaced round the anchor part through which the ends of the reinforcing elements are passed, and the anchoring portion of the tensioning member has axial holes therein in register with the holes in the anchor part, said axial holes in the anchor part being axially tapered to receive anchoring segments disposed round the reinforcing elements.

The tensioning and homing jacks may be assembled with an axially disposed hollow stool member between them, the stool member and the contiguous jack faces having interengaging profiles to locate the whole assembly together in axial alignment when the reinforcing elements are being tensioned.

In another preferred embodiment the mould end of the block is provided with a number of spaced axial bores spaced from the longitudinal axis of the device, a cylinder coaxial with said axis, a piston slidable axially within said cylinder, and an element fast with the piston at the mould end of the block and having bores therein in register with the bores in the block.

The cylinder which is axially disposed in the block may extend out of the end of the block at the mould end thereof and the piston has a portion extending to the open end of the cylinder with the bored element fast with the piston spanning the end of the block or a recess in the block.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-section through a jack assembly;

FIGS. 2, 3 and 4 are respectively cross-sections on the lines II—II, III—III, and IV—IV of FIG. 1 looking in the direction of the arrows;

FIG. 5 is a cross-section through an alternative construction of homing jack;

FIG. 6 is a plan view of the homing jack of FIG. 5,

FIG. 7 is a cross-section through another construction of the mould engaging jack, and

FIG. 8 is a cross-section similar to FIG. 7 showing an alternative construction.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the drawings the same references are used to designate the same parts.

Referring to the drawings, FIGS. 1 to 4 show a fluid operated jack for tensioning or stressing reinforcement elements in concrete and like structural elements which are not shown in the drawings. The jack comprises a homing jack 1 and a tensioning or stressing jack 2 assembled in axial alignment, the jacks being fluid operated and including annular pistons 3 and 4 sliding in annular cylinders 5 and 6 respectively. Both jacks are formed with a central bore in which is located a portion 8 at one end for anchoring to the reinforcing element or elements R and at the other end 9 having means shown as a nut 10 for engagement with the jack 2 to be moved axially thereby and thus impart a tensile force on each reinforcing element.

The jack 2 is constructed as described in our United Kingdom Letters Patent No. 992,405, while the jack 1 has a cylinder formed with a solid end, which may be

welded on as in Application No. 17319/67, and is provided at its open end with an annular flange **11** through which the tail of the piston **3** slides when the jack is operated. A fluid inlet **12** has a bore extending into the head end of the cylinder and fluid pressure in the bore spreads the sealing ring **13** to engage the cylinder wall and thereby provide a fluid-tight seal between the piston and the cylinder. The cylinder **3** is formed by the external wall **5** and an internal annular boss **14** which provides a hollow centre to the jack. The piston **3** has an integral anchor part **15** extending across the hollow interior pierced with a number of holes **16** for the purpose to be described.

The tensioning member **7** is located within the central bore of the two jacks and its free end **17** extends beyond the end of the jack **2**, the nut **10** being threaded onto the end as described. The other end **8** of the member **7** has a head **18** in which are formed tapered holes **19** in register with the holes in the anchor part **15.**

As shown in the drawings which is a preferred construction the two jacks are separated by a stool member **20** the ends of which have a profile indicated at **21, 22** respectively corresponding to the adjacent profiles of the two jacks so that in use the two jacks and the stool member are maintained in axial alignment.

The stool member may be fabricated or formed from a single casting and is provided with windows **23** in its side to allow access to the member **7** if required. This assists in the assembly of the device. round

In use a plate **24** is disposed across the end of the member in which the elements R are to be tensioned. This plate may form the end of a mould or may be a plate engaged with the concrete of the structural element. The reinforcing elements R which are to be stressed may be for example rods or cables and they are passed through the tapered holes **25** in the plate **24.** Tapering segments S are disposed around the reinforcing elements with their ends engaging with the holes **25** and further segments S′ are disposed roun the elements and extend into the apertures **19** in the portion **18.**

When the jack **1** has been assembled with the reinforcing elements R extending through the holes **16,** the stool member **20** is placed in position and the element **7** is then located inside the stool member with the portion **8** inside the centre of the jack **1** with the reinforcing elements extending through the holes **19**; the segments S′ are then inserted into the holes **19** around the reinforcing elements.

The jack **2** is then arranged in position and the nut **10** is screwed down onto the top end of the piston **4** of the jack **2.** A pressure is applied to the interior of the cylinder **6** through the piston **26**; the piston **4** moves upwardly in the cylinder **6** and excess oil flows away from the other side of the piston through the outlet **27.** The pressure of the oil on both sides of the piston **4** expands the sealing rings **28** and the packing ring **29** to provide a fluid-tight seal. The movement of piston **4** in the cylinder **6** against the nut **10** lifts the tensioning member **7** which causes the holes **19** in the element **8** to move over the segments S′ and jam the reinforcing elements R therein; the elements then begin to be tensioned. This action continues until either the reinforcing elements are extended as far as possible, or the end of the reinforcing elements strike the top end of the stool member **20.** During this operation the anchor elements S in the holes **25** have risen slightly to allow the reinforcing elements to pass through them but they are prevented from coming out of the holes **25** by the plate **15.**

At this stage the pressure is maintained in the jack **2** and pressure is then applied through the inlet **12** to the interior of the cylinder **5**; the piston **3** moves downwardly in the cylinder and the portion **15** is forced downwardly towards the plate **24** thereby forcing the anchors S into the holes **25.** This jams the reinforcing elements in the stressed position. It is now possible to dismantle the jack assembly and leave the reinforcing elements completely stressed and anchored within the structural elements.

Referring to FIGS. **5** and **6,** these show an alternative homing jack to that shown in FIG. **1,** the jack of FIGS. **5** and **6** comprising a body portion **26** having an upper flange **27** in which there are apertures **28.** The bottom portion of the body **26** is downwardly and inwardly tapered and beneath the holes **28** there are cut-a-way portions **29.** The end of the body **26** has a member **30** held by which pass through bores **31,** the member forming a closure for the bottom end of the cylinder **32** beneath the piston **33.** As in FIG. **1** the cylinder **32** is annular and its inner wall is formed by a hollow boss **34.** This construction can be used where there are a number of spaced reinforcing elements are to be stressed, these elements being passed through the holes **28** and the cutaway portions **29.** Alternatively, as stated a central tensioning member may be passed through the centre of the hollow cylinder **34.**

FIG. **7** shows an alternative form of homing jack in which the lower end **180** of the jack block is spaced from the stressing jack (not shown) by longitudinal members **13***a*, of which a number are spaced round the block.

The block has a hollow central interior through which passes a tensioning member **220** with a tensioning plate **210** fixed at its lower end. The plate **210** has tapered bores **200** therein in which the free ends of the reinforcing elements (not shown) are anchored by tapered anchoring segments similar to those shown in FIG. **1,** when the jack applies an axial pull on the tensioning member away from the mould, tighten round the reinforcing elements to grip them.

Within the lower hollow block portion **180** are bores **118** parallel to the axis of the central bore and in register with the bores **200** in the plate **210.** The portion **180** has a central axial clyinder within which slides a piston **119** with sealing rings **116** of suitable construction. The upper end of the cylinder has an enlarged portion **130** into which is screwed a plug **131** having sealing rings **132** round the cylinder surface. In its lower-most position the tensioning member **220** abuts at its bottom end against the plug **131.** In its upper position the piston **119** abuts against the lower end of the plug **131** and a fluid inlet duct **133** supplied with fluid from a connector **134** leads into the small annular chamber **135** surrounding the parts of the plug and the piston where they meet at **136** so that pressure fluid introduced into the chamber **135** causes the piston **119** to move down to its lowermost position.

The end of the cylinder has a narrower portion **137** and the piston is shaped with a shoulder **138** which in its lowermost position abuts the ledge **139** between the wider and narrower parts of the cylinder.

Secured to the lower end of the piston and in a recess **140** in the block **180,** is an annular plate **141** having bores **142** therein in register with the bores **118** in the

block 180 and the bores 200 in the plate 210. The plate 141 is secured to the piston by screws 143 and the thickness of the plate 141 is less than the depth of the recess 140 by a distance equal to the height of the chamber 144 defined by the piston 119.

In operation the device is used to tension the reinforcing elements having their ends extending out of the mould or the end of the concrete element through bores 136 in the plate 24 in which they are held by anchor elements (not shown) in the bores 136.

The device is assembled on the mould by threading the plate 24, the block portion 180 and the plate 210 over the free ends of the reinforcement elements anchored by the taper anchored elements in the upper ends of the bores 136. The free ends of the elements pass right out through the tapered portions of the top of the bores 200 in the plate 210 and anchor elements are placed in those tapered portions.

The stressing jack is then actuated to move the tensioning member 220 axially away from the mould in the manner hereinbefore described so that the plate 210 applies a longitudinal pull on the elongated elements which are thus extended and stressed. During this stressing movement, the plate 141 is held upwardly by fluid pressure in space 144, and this permits the anchor segments in the bores 136 to rise and release the elongated elements, but prevents them from passing out of the tapered portions 149 of the bores.

After stressing movement of the stressing jack, the homing jack in FIG. 7 is actuated by causing fluid under pressure to pass into the chamber 135 so that the piston 119 is forced downwardly, thus moving the plate 141 downwardly and jamming the anchor segments into the tapered portions 149 of the bores 136 to grip the reinforcement elements in the extended position. The operation may then be repeated until the amount of stress required is applied to the elongated elements. The device may then be dismantled from the mould or concrete block being reinforced.

Referring to FIG. 8, this shows a similar homing jack to FIG. 7 but in this embodiment the cylinder in the block portion 180 has an enlarged lower end 150 in which there is located a hollow securing ring 151 held in position by threads 152. Sealing rings 153 are provided around this securing ring. The operation of this device is the same as described with reference to FIG. 7, the upper fluid chamber being locate above the piston 119 and being supplied through the duct 133.

It will be seen that with a jack assembly such as described herein with reference to the drawings in accordance with the invention the spare length of the reinforcing elements which extends beyond the structural elements can be very short at the start of the tensioning operation which is a great saving on the existing forms of construction. Moreover the jack assembly automatically homes the segmental wedges round the reinforcing elements when the homing jack is operated so that dismantling of the jack and leaving the reinforcing elements fully stressed in position is a simple operation.

The jack has a multiple use in that it can be used either as an ordinary jack using in this case the jack 2, or it can be used simply alone or with the stool member 7 for tensioning a reinforcing element which passes right through the hollow portion of the centre of the jack 2, or it can be used as described in the drawings for tensioning multi-cable or multi-rod cores through structural elements.

The jack is simple of construction, light in weight and can be operated by inexpert operatives thereby greatly reducing the cost of tensioning such reinforcing elements.

I claim:

1. A stressing device for stressing elongate reinforcing elements in concrete structures, comprising a base plate adapted to bear with one face against the structure, a plurality of tapered bores in the base plate through which the reinforcements may pass which bores widen outwardly away from the said one face, two or more tapered anchoring segments for disposition in each tapered bore, a homing jack in axial alignment with the base plate, said jack comprising an annular cylinder formed with an open end which bears against the base plate, a piston in the cylinder movable under fluid pressure towards the base plate and openings in the piston and in the cylinder in register with the bores in the base plate for passage of the reinforcements therethrough, and a stressing jack in axial alignment with the homing jack, the stressing jack comprising a cylinder block bearing on the homing jack, a central bore in the cylinder block, an annular cylinder in the end of the cylinder block remote from the homing jack and an annular piston disposed in the cylinder and movable under fluid pressure away from the homing jack, and a tensioning member movable with the annular piston of the stressing jack and having means for gripping the reinforcements, so that when the device is in use and the reinforcements are gripped by the tensioning member, movement of the piston in the stressing jack away from the base plate causes the tensioning member to apply a tensioning force to the reinforcements, and movement of the piston in the homing jack towards the base plate causes the piston to engage the tapered anchoring segments and drive said segments into the tapered bores in the base plate to fix the position of the reinforcements with respect to the base plate.

2. A stressing device according to claim 1, wherein the cylinder block of the stressing jack bears on the homing jack through the intermediary of a hollow cylindrical stool element disposed between the homing jack and the stressing jack and in axial alignment therewith.

3. A stressing device according to claim 2, wherein the contacting faces of the stressing jack, the stool element, and the homing jack are provided with interengaging profiles.

4. A stressing device according to claim 1, wherein in the homing jack, the end of the cylinder is provided with an annular recess and the end of the piston extending out of the cylinder is provided with a plate which spans the end of the cylinder and fits within said recess.

* * * * *