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(54) Precision mandrel, particularly suitable for winders.

(57) The wire winding reel (R1) is axially supported by a tail unit structure (13) which is coupled precisely to the head unit (5) which is axially hollow and into which are inserted internal parts (123) of the said tail unit, provided with catches (24) which are brought by a plug (34) from a rest position to an active position in which opposing end hooks (124-224) of the said catches interact with locking parts (22-205) connected with the tail unit and head unit, which in this way become structurally interconnected without the possibility of relative axial displacement. The bearings of the mandrel are thus protected from the axial stresses arising from the thrust of the wire wound on the flanges of the reel and the reel itself is contained in a controlled way between the head unit and the tail unit, enabling precise windings of the parallel-turn type to be made.

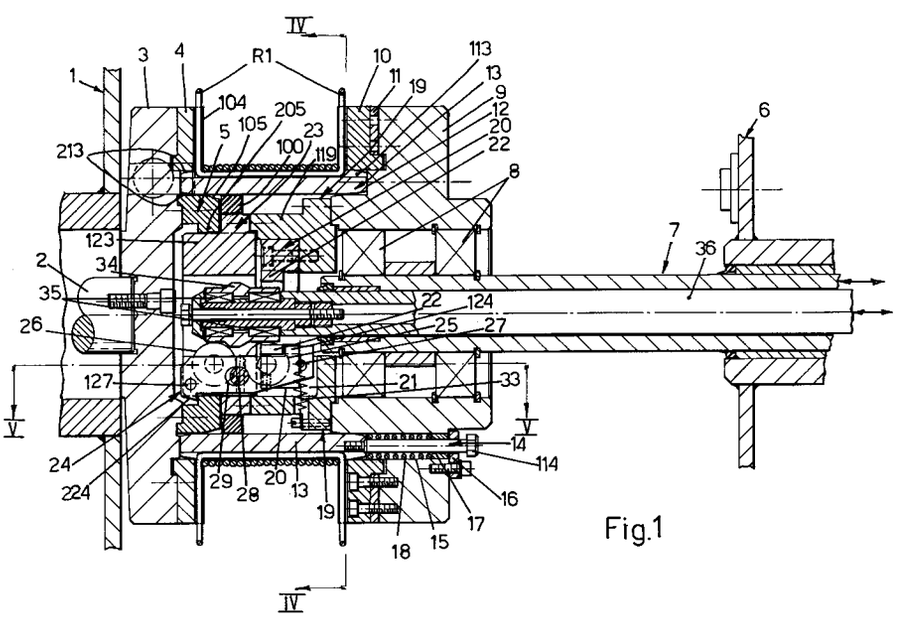

Fig.1

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The invention relates to a precision mandrel, particularly suitable for winders which are required to execute windings of the parallel-turn type, in other words windings in which the turns of each layer are placed exactly side by side and in mutual contact, so that the winding is made to be compact and of regular form.

In particular, the mandrel concerned is very useful in the winding of wires on reels made of welded rods, of the STEIM K 300 type, such as those indicated by R1 in Italian patent No. 1,225,662 in the name of the present applicant, to which the most extensive reference is here made.

Winders of known types use mandrels in which the head unit and tail unit are mounted on and project from the corresponding support structures, the head unit generally being driven and axially fixed, while the tail unit is normally idle but axially movable to approach the head unit at the stage when the empty reel is secured and for the removal of the tail unit at the stage when the reel filled with wire is removed. While the wire is being wound on the reel using mandrels of known winders, the tension of the wire being wound is such as to cause a considerable stress in the axial direction on the tail unit and on the head unit, and this leads to rapid wearing of the bearings of the mandrel. To this disadvantage is frequently added the impossibility of forming precise windings of what is called the parallel-turn type, since the tail unit tends to move away from the head unit under the aforesaid axial stress. This makes it impossible to have a constant winding width during the whole reel filling cycle - an essential prerequisite for forming windings of the parallel-turn type - and may result in the turns of one layer penetrating those of the underlying layer, with consequent disruption of the regularity of the winding.

The invention is intended to overcome these and other disadvantages with the following idea for a solution.

The reel is supported on one face and axially by a structure connected with the tail unit (or with the head unit) and the axial supporting part of this structure is precisely coupled to a corresponding axial part of the head unit (or of the tail unit) and locking means are provided to hold together the two coupled axial parts of the head unit and tail unit, in such a way as to provide substantial structural continuity between these parts, thus preventing any relative axial movement.

With this solution the bearings of the mandrels are prevented from being stressed by the high axial loads to which they are subjected with the known solutions, and it is possible to form precise parallel-turn windings, owing to the precise axial containment action of the head unit and tail unit at the stage of engagement of the reel.

Further characteristics of the invention, and the advantages derived therefrom, will be clearly understood from the following description of a preferred embodiment of the invention, illustrated purely by way of example and non-restrictively in the figures on the three sheets of drawings attached, in which

- Fig. 1 shows the mandrel in the engaged position seen from the side in axial section;
- Fig. 2 shows, from the side facing the head unit, the part of the tail unit which supports the locking points for the oscillating catches for axially locking the said tail unit to the head unit;
- Fig. 3 shows, from the side facing the head unit, the part of the tail unit which supports the fulcrums of the oscillating catches for axially locking the said tail unit to the head unit;
- Figs. 4-5 show two details of the tail unit mechanism, viewed in sections taken through the lines IV-IV and V-V respectively in Figure 1.

In Figure 1, the number 1 indicates the fixed structure which supports and permits the rotation of the driven shaft 2 of the mandrel, on which shaft is coaxially fixed the disc 3 which carries on the visible face the coaxial ring 4 with the radial cavities 104 for the containment of the spokes of the wire winding reel R1. The hollow head unit 5, with a conical end 105, is fixed coaxially on the said visible face of the disc 3.

The clamp of a known type, not illustrated in the drawings, which retains the end of the wire at the start of the winding cycle, is mounted on the disc 3 of the head unit.

Also in Figure 1, 6 indicates the fixed tail unit support structure, which supports and permits the axial displacement of the shaft 7 which is aligned with the shaft 2 and which, by means of the bearings 8, supports and permits the free rotation of the disc 9 which carries the ring 10 with radial cavities 110 for containing the spokes of the reel R1.

11 indicates a distance piece which enables the mandrel to be precisely adapted to the width necessary for the diameter of the wire to be wound on the reel.

It will be seen in Figures 1 and 4 that the disc 9 has, on its visible face, within the ring 10, an annular coaxial recess 12 in which is inserted on one end of each of the axially displaceable sector pieces 13, each of which is provided with a pair of rods 14 which pass through through holes 15 in the disc 9 and have their ends 114 disposed outside a ring 16 fixed on the rear face of the disc 9, to cover the holes 15. 17 indicates guide bushes of the rods, housed in the holes 15, while 18 indicates helical cylindrical springs which are housed in the

same holes 15 and are capable of normally keeping the sector pieces 13 extended from the annular guide 12.

The sector pieces 13 are disposed adjacent to each other with a precise clearance and their sides are shaped so as to form the tubular structure of the tail unit, which is provided with longitudinal cavities 113 aligned with the cavities 110, in which are housed the sections of rod which form the core of the reel R1. The reel R1 is positioned on the tail unit formed by the sector pieces 13, whose length is such that they project by a precise amount beyond the reel.

Means of a known type, not illustrated, are provided to keep the head unit and the tail unit in a predetermined angular rest position, so that the radial cavities 104 of the head unit are perfectly aligned with and opposite the cavities 110 of the tail unit. When the tail unit is brought axially nearer to the head unit, as shown in Figure 1, the free end of the tail unit formed by the sector pieces 13, suitably tapered on its inner and outer edges, as indicated by 213, is precisely coupled to the tail unit 5 and the previously free spokes of the reel R1 engage with the radial cavities 104 of the disc 4 of the head unit. At this stage, the tail unit formed by the sector pieces 13 is displaced axially a small distance in opposition to the springs 18 which are suitably stressed.

With the mandrel engaged, the tail unit formed by the sector pieces 13 thus forms a first precise structural connection with the head unit 5, providing a precise support for the reel R1.

In Figures 1 and 2 it will be seen that the face of the disc 9 nearer the head unit has coaxially fixed to it an annular structure 19 with a collar 119, within which are fixed three identical sector pieces 20 with equal angular spacing, such that they form, with their opposing sides and with corresponding gaps within the structure 19, seats 21, open towards the centre and capable of containing end sections of the oscillating catches mentioned previously. With the said opposing sides, the sector pieces 20 form steps 22 equidistant from the bottoms of the said seats 21 and used for the aforesaid purposes.

On the annular structure 19 there is fixed, frontally and coaxially, another annular structure 23 (see Figures 1 and 3), with an integral group, on the side nearer the head unit, of three identical and equally spaced sector pieces 123, which with their opposing sides and with gaps formed in the said structure 23 form an extension of the seats 21, but not of the aforesaid steps 22.

The structure 23 is externally threaded and has screwed on to it a ring 100 which has the function of preventing the entry of foreign bodies into the cavities between the structures 19, 119 and 23 and the external tail unit structure formed by the sector pieces 13.

In each seat 21 there is mounted a catch 24 illustrated in detail in Figure 5, formed by a pair of equal and parallel levers between which are rotatably mounted rollers 25-26 which project suitably from the side of the catch facing the axis of the tail unit concerned. 27 and 127 indicate end screws which keep the levers forming the catch 24 joined together. 28 indicates aligned pins fixed to the levers of the catch and housed in slots 29 which pass orthogonally through the structure 23 and which are orientated with their length parallel to the axis of the tail unit. In the sector pieces 123 of the structure 23 there are formed seats 30 which are perpendicular to the pins 28 and which house springs 31 caused by means of screws 32 to bear on the said pins 28 to keep them normally in contact with the ends of the slots 29 nearer the tail unit.

The levers constituting each catch 24 are shaped at their ends so that they form opposing hooks 124 and 224, of which the hooks 124 nearer the tail unit are orientated towards the centre of the said tail unit, while the others are orientated towards the outside.

By means of a spring 33 which acts on the screw 27 of the catch 24, the catch is normally kept with the hooks 224 held together towards the centre of the tail unit, so that when the tail unit is engaged with the head unit as in Figure 1, while the sector pieces 123 of the structure 23 are inserted precisely into the annular collar 205 fitted coaxially on the hollow head unit 5, the said hooks 224 do not interfere with the said collar and pass conveniently through it.

When the tail unit has been engaged with the head unit, a suitably shaped plug 34, disposed coaxially in the tail unit and supported rotatably by bearings 35 on a stem 36 which is axially movable in the hollow shaft 7 and connected to suitable means of axial movement which are not illustrated, comes into operation. During the engagement of the tail unit with the head unit, the stem 36 moves in synchronism with the shaft 7, but when the engagement is complete the stem 7 continues to advance against the head unit so that the plug 34 causes a self-centring displacement of the rollers 26 towards the outside and the consequent oscillation of the catches 24 as in Figure 1. The hooks 224 of the catches interact with the annular collar 205 of the head unit 5, while the hooks 124 of the said catches interact with the steps 22 of the sector pieces 20 connected with the tail unit.

On completion of the operation of the plug 34, both the rollers 25 and 26 of the catches bear on cylindrical circular-section parts of the said plug, so that the position of the said catches is stable and

precise.

When the movement of the tail unit to engage with the head unit is interrupted, after the operation of the plug 34, the same device which has caused the mandrel to become engaged makes a return movement, causing the hooks 124 and 224 of the catches to bear fully on the steps 22 and on the annular collar 205, preventing any further relative axial displacement between the head unit and tail unit, which thus become structurally interconnected in such a way as to overcome the disadvantages mentioned in the introduction to the present description.

When the reel R1 has been fully wound, the mandrel engagement device is temporarily moved in the direction of engagement to decrease the load on the catches 24, after which the catches are disengaged by the retraction of the plug 34, so that the hooks 124 and 224 of the said catches are made to move away from the corresponding locking parts 22 and 205. At this point, the tail unit is removed from the head unit, the full reel is unloaded from the tail unit, and a new reel is placed on the tail unit for the repetition of the cycle which has been described.

It is to be understood that the description refers to a preferred embodiment of the invention, to which numerous variations and modifications may be made, particularly as regards construction, without departure from the guiding principle of the invention, as described above, as illustrated and as claimed below.

In the following claims, the references in parentheses have the sole purpose of facilitating the reading of the claims and must not, therefore, be interpreted restrictively in any way in relation to the scope of protection of the said claims.

Claims

1. Precision mandrel for winders capable of executing windings of what is called the parallel-turn type, characterised in that it comprises the following means in combination with the head unit and with the tail unit:

- means of precisely supporting the reel on which the wire is to be wound;
- means which pass through the axial aperture of the core of the reel and which, when the tail unit is brought up to and engaged with the head unit, connect the said head unit and tail unit together structurally;
- means of engagement or locking, which act on the structural connection means described in the preceding clause, to prevent relative axial displacements of the head unit and tail unit, the whole in such a way as to provide the following advantages:
  - during the winding of the wire on the reel, the bearings of the winder mandrel are not axially stressed as they are in the known art;
  - it is possible to provide stable and non-deformable support and containment of the reel between the head unit and the tail unit, and it is therefore possible to form precision windings of the parallel-turn type in a perfectly reproducible and reliable way.

2. Mandrel according to Claim 1), characterised in that the head unit (5) is axially hollow, with a frontal collar (205) projecting towards the centre of the said head unit, while the tail unit is provided with a coaxial structure (23) which, when the mandrel is engaged, enters precisely into the said collar of the tail unit, with a part formed by sector pieces (123) which support one or more catches (24) which are spaced at equal angular intervals and oscillate on an intermediate fulcrum (28) which is orthogonal to the axis of the said tail unit, the said catches being shaped at their ends in such a way as to form opposing hooks (124-224), of which those (224) nearer the head unit are orientated towards the outside of the said sector pieces, the said catches being stressed by an elastic means (33) towards a position such that when the tail unit is pushed to engage with the head unit and the structure of sector pieces (123) of the tail unit enters into the frontal collar (205) of the head unit, the said hooks (224) do not interfere with the said collar; a plug (34) being provided axially in the tail unit that may be axially displaced through a control stem (36) disposed in the shaft (7) of the said tail unit and that with the mandrel engaged it acts on the oscillating catches (24) to change their orientation and to fix them in the new position where they have their outer hooks (224) interacting with the frontal collar (205) of the head unit, and their inner hooks (124) interacting with steps (22) of sector pieces (20) fixed with equal angular spacing and coaxially in the tail unit, so that undesirable axial displacements between the head unit and tail unit are prevented.

3. Mandrel according to Claim 2), characterised in that the fulcrums (28) of the oscillating catches (24) connected with the tail unit are mounted in such a way that they can undergo a small displacement in the supporting slots (29), to enable the said catches to undergo a

corresponding small displacement in the longitudinal direction; the said fulcrums being stressed by elastic means (31) towards the ends of the slots nearer the interior of the tail unit, the whole being arranged so that when the mandrel has been engaged and the catches have been brought into the engagement position, the end hooks of the said catches are made to interact with a small clearance and consequently without excessive sliding friction with the corresponding locking stops (205-22), it being provided that when the catches have been operated the inner parts of the tail unit are displaced slightly in the opening direction by any suitable means, so that the end hooks of the said catches interact precisely with the said locking stops.

4. Mandrel according to the preceding claims, characterised in that each oscillating catch (24) is provided with a pair of rollers (25-26) disposed behind and before the fulcrum (28), and that when the catches are in the operating position both of the said rollers interact with cylindrical sections of the shaped part of the plug (34) which by means of bearings (35) is rotatably supported by the corresponding axial displacement stem (36).

5. Mandrel according to the preceding claims, characterised in that, if the wire winding reel (R1) is provided with a large axial aperture and is made from metal rods, the said reel is supported by its hollow core on a cylindrical tubular tail unit structure formed by a plurality of sector pieces (13) adjacent to each other, provided with longitudinal grooves (113) to house the core of the reel and mounted on the disc (9) of the tail unit so that they can undergo a small axial displacement, guided and in opposition to elastic means (18), it being provided that when the mandrel is engaged, the tail unit formed by the said sector pieces bears frontally against the disc (3) of the head unit, while with the inner lateral surface of the said free end it interacts precisely or with substantial pressure with the outer surface of the head unit (5), these parts being suitably tapered to facilitate this coupling.

6. Precision mandrel particularly suitable for winders capable of executing windings of the parallel-turn type, made more particularly, wholly or in part, as described, as illustrated in the figures on the three attached sheets of drawings, and for the purposes declared above.

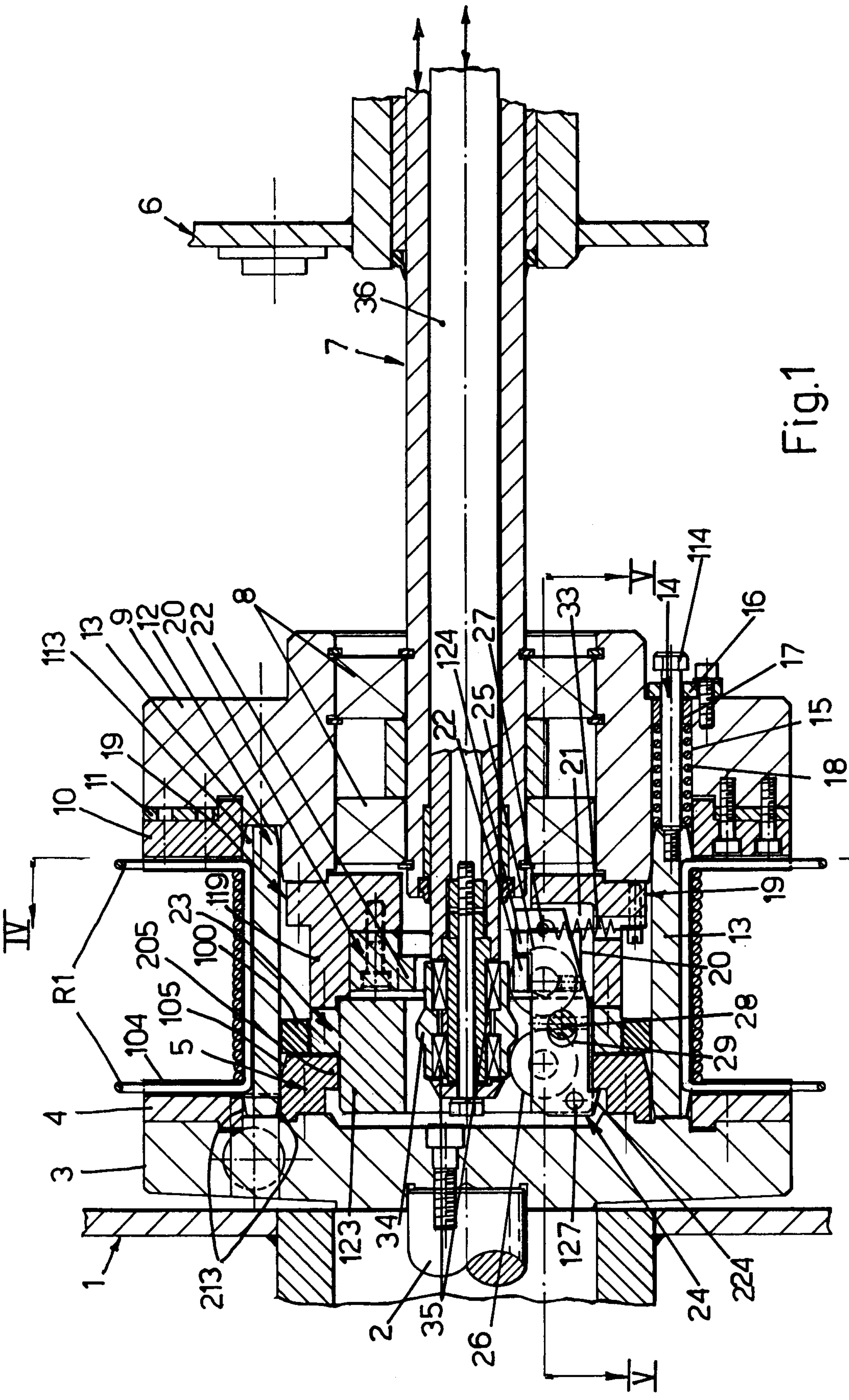

Fig.1

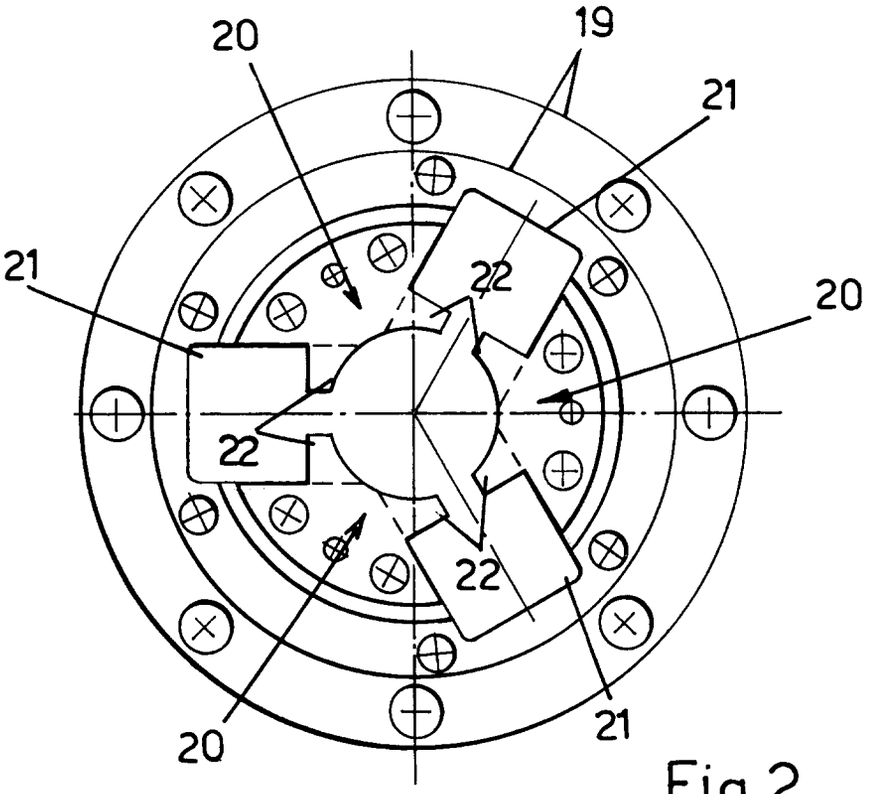
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Fig.2

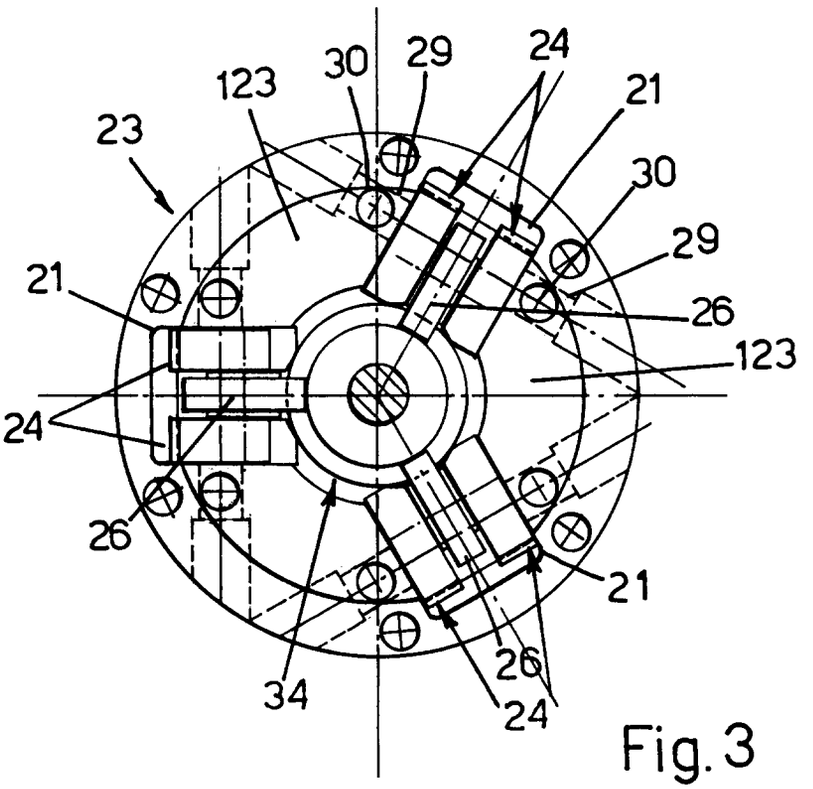
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Fig.3

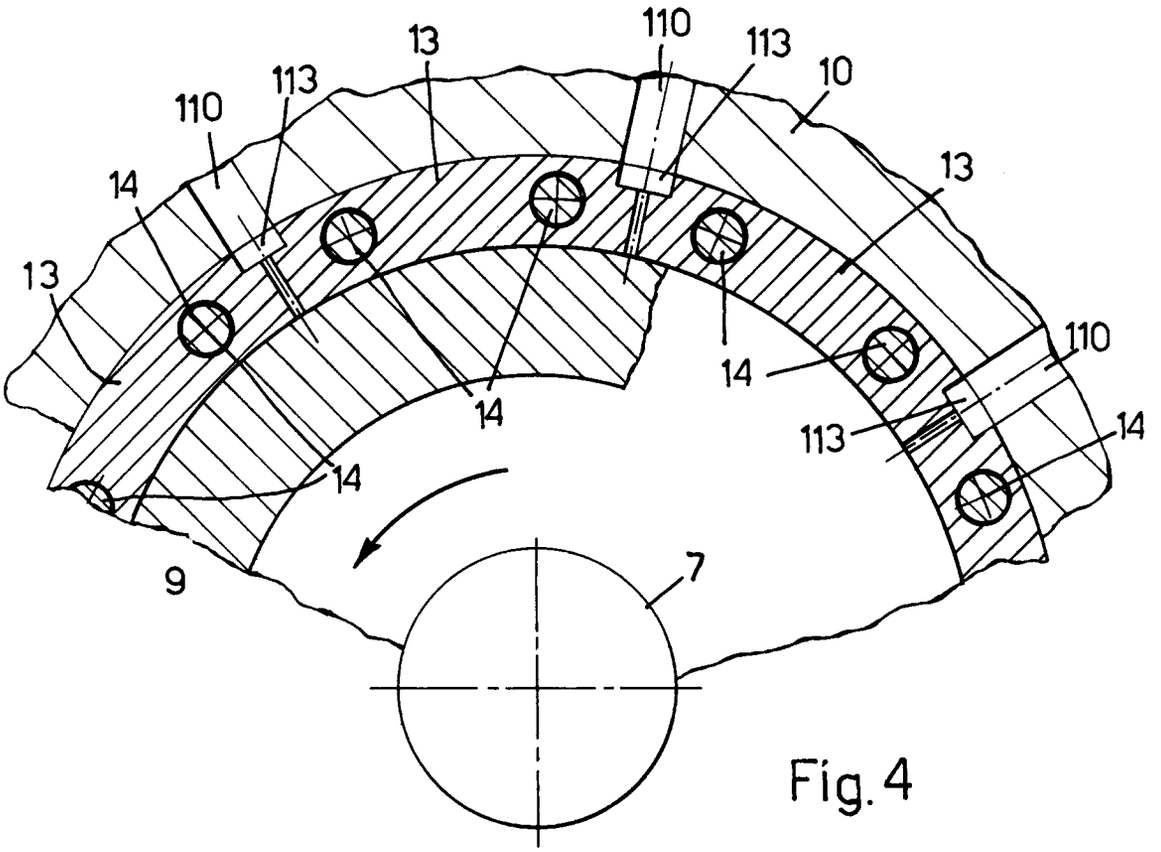
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Fig. 4

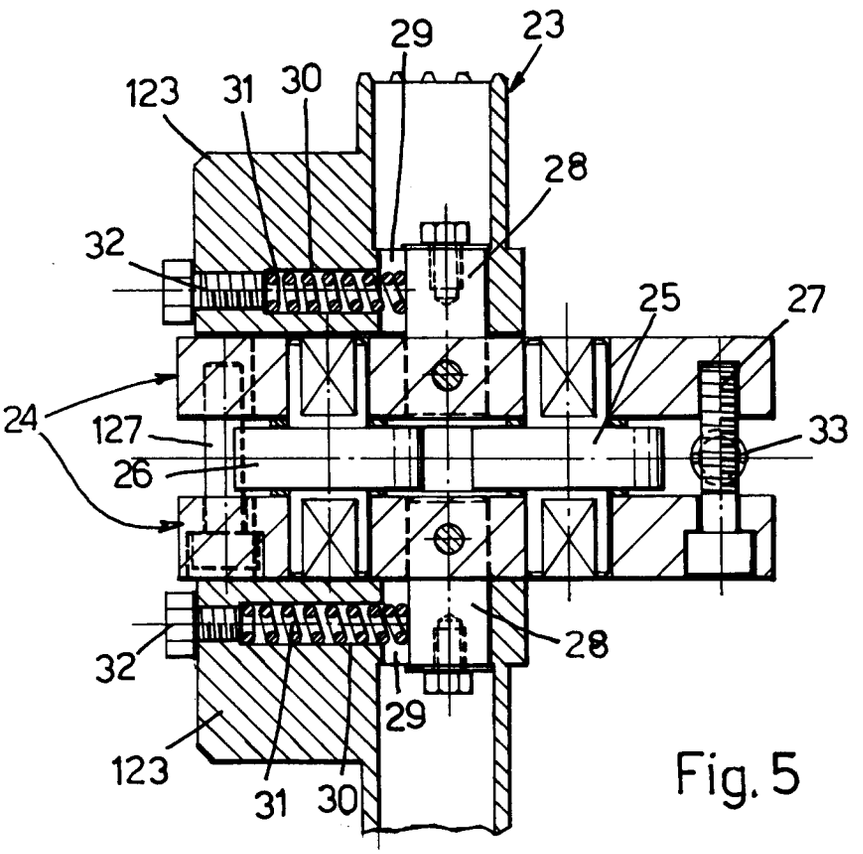
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Fig. 5

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EUROPEAN SEARCH REPORT

Application Number

EP 93 10 3655

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)
A	DE-A-2 133 073 (ROVEMA) * figure 1 * ---	1	B65H75/08 B21C47/28
A	US-A-4 767 077 (KATAOKA) * figure 30 * -----	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B65H
B21C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	07 JULY 1993	RAYBOULD B.D.J.

CATEGORY OF CITED DOCUMENTS

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