(CONVENTION. By one or more persons and/or a Company.) Form 4

608679

COMMONWEALTH OF AUSTRALIA

Patents Act 1952-1969

CONVENTION APPLICATION FOR A PATENT

(1) Here insert (in full) Name or Names of Applicant or Applicants, followed by Address (es).

I/We (1) SANTONI S.R.L., a company organized under law of the Italian Republic of Via Gerolamo Savoldo, 16 - Brescia, Italy.

(2) Here insert Title of Invention.

hereby apply for the grant of a Patent for an invention entitled: (2) "ELECTROMAGNETIC ACTUATOR DEVICE, IN PARTICULAR FOR THE SELECTION OF THE NEEDLES ON A KNITTING MACHINE"

(3) Here insert number(s) of basic application(s)

which is described in the accompanying complete specification. This application is a Convention application and is based on the application numbered (3) 20 415 B/88

(4) Here insert Name of basic Country or Countries, and basic date or dates

for a patent or similar protection made in (4) Italy Filed: 11th January, 1988.

APPLICATION ACCEPTED AND AMENDMENTS ALLOWED 7-1-91

My/Our address for service is Messrs. Edwd. Waters & Sons, Patent Attorneys, 50 Queen Street, Melbourne, Victoria, Australia.

DATED this 9th day of January, 1989.

SANTONI S.R.L.

(5) Signature (s) of Applicant (s) or Seal of Company and Signatures of its Officers as prescribed by its Articles of Association.

(5)

By:

L. J. DYSON,

1005 11/01/89

COMMONWEALTH OF AUSTRALIA

Patents Act

DECLARATION FOR A PATENT APPLICATION

▼ **INSTRUCTIONS**

(a) Insert "Convention" if applicable

(b) Insert FULL name(s) of applicant(s)

In support of the (a) Convention application made by (b)

SANTONI S.r.l.

(c) Insert "of addition" if applicable

(d) Insert TITLE of invention

(hereinafter called "applicant(s)") for a patent (c) for an invention entitled (d)

ELECTROMAGNETIC ACTUATOR DEVICE, IN PARTICULAR FOR THE SELECTION OF THE NEEDLES ON A KNITTING MACHINE

(e) Insert FULL name(s) AND address(es) of declarant(s) (See headnote*)

I/~~We~~ (e) TIBERIO LONATI

of Via Gerolamo Savoldo, 16 - Brescia, Italy

do solemnly and sincerely declare as follows:

~~1. I am/We are the applicant(s).~~

~~*(or, in the case of an application by a body corporate)*~~

1. I am/We are authorized to make this declaration on behalf of the applicant(s).

~~2. I am/We are the actual inventor(s) of the invention.~~

~~*(or, where the applicant(s) is/are not the actual inventor(s))*~~

(f) Insert FULL name(s) AND address(es) of actual inventor(s)

2. (f) LEONE DONINI, Via Ambaraga 27, Brescia, Italy

(g) Recite how applicant(s) derive(s) title from actual inventor(s) (See headnote**)

is/~~are~~ the actual inventor(s) of the invention and the facts upon which the applicant(s) is/~~are~~ entitled to make the application are as follows:

(g)

The Applicant is the assignee of the said actual inventor

*(**Note:** Paragraphs 3 and 4 apply **only** to Convention applications)*

(h) Insert country, filing date, and basic applicant(s) for the/or EACH basic application

3. The basic application(s) for patent or similar protection on which the application is based is/~~are~~ identified by ***country, filing date, and basic applicant(s)*** as follows:

(h)

Italy 11th January 1988 by SANTONI & C. S.p.A.

4. The basic application(s) referred to in paragraph 3 hereof ~~was/were~~ the first application(s) made in a Convention country in respect of the invention the subject of the application.

(k) Insert PLACE of signing

(l) Insert DATE of signing

Declared at (k) Brescia, Italy

Dated (l) 20th December, 1988

(m) Signature(s) of declarant(s)

(m) SANTONI S.r.l.
Via Gerolamo Savoldo, 16
25124 BRESCIA - Italia

Note: No legalization or other witness required

To: The Commissioner of Patents

(12) PATENT ABRIDGMENT (11) Document No. AU-B-28365/89
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 608679

(54) Title
KNITTING NEEDLE ELECTROMAGNETIC ACTUATOR

International Patent Classification(s)
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(21) Application No. : **28365/89** (22) Application Date : **11.01.89**

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20415 /88	**11.01.88**	**IT ITALY**

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(72) Inventor(s)
LEONE DONINI

(74) Attorney or Agent
WATERMARK PATENT & TRADEMARK ATTORNEYS, Locked Bag 5, HAWTHORN VIC 3122

(57) Claim

1. Electromagnetic actuator device, in particular for the selection of the needles in knitting machines, comprising at least one winding in a support structure made from a ferromagnetic material, and an armature also made from a ferromagnetic material, hinged onto the structure, and subject to the action of the magnetic field generated by said at least one winding in order to be moved between two angular positions, with the armature being engageable with a member to be actuated, such as, in particular, a selection lever, or the like, characterized in that two windings are provided, which are positioned on opposite sides relatively to the armature, and that the armature, hinged at one of its ends, which is opposite to the end which is engageable with the member to be actuated, according to an axis substantially perpendicular to the axis of the windings, has a configuration with two transversal portions

.../2

protruding from opposite sides, and penetrating inside the interior of the windings.

COMMONWEALTH OF AUSTRALIA 608679 Form 10

PATENTS ACT 1952-69

COMPLETE SPECIFICATION

(ORIGINAL)

Class Int. Class

Application Number:
Lodged:

This document contains the amendments made under Section 49 and is correct for printing.

Complete Specification Lodged:
Accepted:
Published:

Priority :

Related Art :

Name of Applicant : SANTONI S.R.L.
a company organized under the law of the Italian Republic.

Address of Applicant : Via Gerolamo Savoldo, 16 - Brescia, Italy.

Actual Inventor: LEONE DONINI

Address for Service : EDWD. WATERS & SONS,
50 QUEEN STREET, MELBOURNE, AUSTRALIA, 3000.

Complete Specification for the invention entitled:

" ELECTROMAGNETIC ACTUATOR DEVICE, IN PARTICULAR FOR THE SELECTION OF THE NEEDLES ON A KNITTING MACHINE "

The following statement is a full description of this invention, including the best method of performing it known to : me

"ELECTROMAGNETIC ACTUATOR DEVICE, IN PARTICULAR FOR THE SELECTION OF THE NEEDLES ON A KNITTING MACHINE"

The present invention relates to an electromagnetic actuator device, in particular for the selection of the needles in a knitting machine.

Devices for the selection of the needles in knitting machines are known, which comprise a plurality of needle selection levers positioned superimposed to one another on a plurality of levels, and selectively swinging around respective parallel, horizontal axes between a resting position, in which position an end of the same levers is at an intermediate level between levels of selection butts of needle selection members, and does not interfere with them; and a working position, in which such an end is at the level of a corresponding level of needle butts, and engages the selection butts of said level by pushing the relevant selection members into a non-working track, in which they do not lead the corresponding needles to generate the loop.

The orientation of the selection levers is generally carried out by means of electromagnetic actuators, each of which is associated to a respective selection lever, and is selectively excited according to a pre-established program of needle selection.

The actuators may act on the respective selection levers either directly, or through relevant armatures, the swinging movement of which is transmitted to the levers by means of a geometrical coupling between one end of the armature, and one end of the relevant needle-selection rocker lever, e.g., as disclosed in U.K. patent application N. 2,008,157.

These electromagnetic-control selection devices show the advantage that the type of selection can be rapidly modified by simply changing the sequence of the control impulses sent to the various electromagnets by an electronic equipment, which can be programmed from time to time according to the desired sequence.

However, the electromagnetic actuators, which are necessary in a number equal to the number of the selection levers, involve problems of dimensions, because, owing to power reaons, the size of the electromagnets cannot be reduced under certain limits, otherways the action of magnetic attraction will be insufficient for the intended purposes.

The higher and higher speeds of the knitting machines require higher and higher actuation speeds, and, consequently, the moving masses and the frictions to be more and more reduced. The high number of oscillations of the moving members involves continuous impact stresses, and hence a considerable wear of the relevant members, with a loss of precision.

In case a fault occurs to one of the actuators, the operation of replacement of it is mostly complex and difficult, and hence long, with times of inactivity of the selection device, and of the relevant knitting machine, which result in increases in the production costs.

The present invention aims at providing a solution for the above cited problems, by means of an electromagetic actuator device which has small overall dimensions, performs an extremely fast and precise action, and is easy to be installed and/or replaced, and

is capable of operating for long time periods without incurring wear problems.

Such an electromagnetic actuator device, in particular for the selection of the needles in knitting machines, comprises at least one winding in a support structure made from a ferromagnetic material and a mobile armature, also made from a ferromagnetic material, hinged onto the structure, and subject to the action of the magnetic field generated by said at least one winding in order to be moved between two angular positions, with the armature being engageable with a member to be actuated, such as a selection lever, or the like, characterized in that two windings are provided, positioned on opposite sides relatively to the armature, and that the armature, hinged at one of its ends, which is opposite to the end which is engageable with the member to be actuated, according to an axis substantially perpendicular to the axis of the windings, has a configuration with two transversal portions protruding from opposite sides, and penetrating inside the interior of the windings.

Advantageously, the armature can be given a substantially cross-like shape. The support structure can be formed by two parts connected to each other with possibility of separation, and with each one of said parts being given a configuration suitable for housing a winding, with the plane along which said parts are connected to each other being substantially perpendicular to the axis of the windings.

Such a kind of actuator device has a compact structure, with not very large overall dimensions, capable of generating an efficacious action of attraction

of the armature thanks to the portions thereof which penetrate inside the interior of the windings. This configuration makes it possible the overall dimensions to be decreased, and the available room to be advantageously exploited. The configuration of the structure as two parts which are connected to each other with possibility of separation, and wherein each one of them houses one winding, facilitates the operations of dismantling and, if necessary, of replacement of the parts. The positioning of two windings on opposite sides relatively to the armature makes it possible a same action to be performed on the armature in both moving directions, and a same stability to be achieved of the position of both armature stroke limits.

Further details of the finding will be better understood from the following disclosure, made by referring to the hereto attached drawings, wherein:

Figure 1 shows a sectional view according to path I-I of Figure 2, through an actuator device according to the present invention, which is a part of a needle selection device of a knitting machine of circular type;

Figure 2 is a partially sectional, top view of the selection device, wherein a plurality of such actuator devices are shown;

Figure 3 shows an exploded perspective view of an actuator according to the present invention, operating on a needle selection lever of the selection device;

Figure 4 shows a detail, on a larger scale, of the mutually engaged ends of the armature and of the selection lever.

Referring to the above figures, an electromagnetic

actuator device 1 according to the present invention, in the depicted exemplifying form of practical embodiment, comprises a support structure 2 made from a ferromagnetic material, in which two windings 3, 4 are provided, and an armature 5 is provided as well, which is made from a ferromagnetic material, is hinged onto the support structure 2 at 6, according to an axis substantially perpendicular to the axis of the windings 3, 4, and is so positioned, as to be subject to the action of the magnetic field generated by either one of both windings 3, 4, in order to swing to the one, or to the other one, of two angular positions defined by suitable stop surfaces.

Taking into consideration the particular case of an actuator device 1 applied to a knitting machine with a needle cylinder 7 and needle selection members 8, e.g., needle selectors with butts 9 positioned inside the grooves 10 provided on the cylinder 7, each actuator 1 with its relevant armature 5 is associated, in a known way, to a selection lever 11, hinged according to a horizontal axis 12, and capable of assuming two angular positions as a consequence of its engagement with the relevant armature 5. Each lever 11 is provided with a relevant engagement portion 13 in order to engage the butts 9 when the lever 11 is in its operating position, in which the engagement portion 13 is at the same level as of the butts 9 of a certain level (i.e., such a position as shown for the middle lever 11 of Figure 1), and pushes the selection members 8, in a known way, towards the bottom of the relevant grooves 10, so that they do not bring the relevant needles to their working

position. When, on the contrary, the lever 11 is moved into its non-operating position, its engagement portion 13 comes to be at an intermediate level between two adjacent levels of butts 9, and does not come into engagement with any butts (i.e., such a position as shown for the other levers 11 of Figure 1), so that the relevant needle selectors 8 bring the corresponding needles to form the loop, in a per_se known way.

The selection levers 11, positioned superimposed to one another, in a number equal to the levels of butts 9, as well as the relevant actuators 1 are borne by a support 14 fastened to the stationary portion of the knitting machine. The levers 11, hinged onto side shoulders 15 of the support 14, are advantageously extended in the direction of the hinging axis 12, so as to make it possible the various actuators 1 to be installed in a staggered arrangement, owing to reasons of overall dimensions, with the various levers 11 being kept equal to one another, as shown in Figures 1 and 2.

In the exemplifying form of practical embodiment herein depicted for exemplifying purposes, the levers 11 have an open central portion 16, and two end portions 17, which definine the seats for the hinging pivot 12. In any cases, for the purposes of the present finding, the shape of the levers 11 is not essential.

Each lever 11 is engaged, at its end opposite to the working end provided with the engagement portion 13, by a substantially fork-shaped end 18 of the armature 5 of the relevant actuator 1. Advantageously, the surfaces of mutual engagement of the lever 11 and of the armature 5 are given the shape on an involute, i.e., as of the

cooperating surfaces of two teeth of two cylindrical, straight-tooth gear wheels, so as to ensure the absence of any slippings during their relative movement. In this connection, it is also possible to use properly selected materials for the parts under mutual contact; in particular the fork-shaped end 18 of the armature 5 could be a part made from a wear-resistant, self-lubricating plastic material moulded on the body of the armature 5, as shown, and the lever could be made from a light metal alloy, or from a very rigid plastic material, in particular of fiberglass-reinforced, carbon-fibre-reinforced polyamide material. In this way, with the involute-shaped outline, and the wear-resistant material used, a long useful life, as well as a high operating precision is ensured over time.

Each actuator 1 has its two windings 3 and 4 positioned on opposite sides relatively to the armature 5 and this latter, which is hinged at the end opposite to the end engageable with the selection lever 11 - or with any other members to be actuated -, is given a long shape, with two transversal portions 19 and 20, protruding from opposite sides, and penetrating the interior of both windings 3, 4. In particular, the two portions 19 and 20 can be aligned to each other, so that the armature comes to have a substantially cross-shaped configuration, as shown in the figures, with the windings 3, 4 being coaxial to each other. The armature 5 is advantageously made from iron with a low coercive power.

The support structure 2 is formed by two parts 21 and 22, which can be connected to each other with the possibility of being separated, with each one of them

housing a respective winding 3, 4. Both parts 21 and 22 are provided with one or more juncture planes positioned substantially perpendicularly to the axes of the windings 3, 4, and are fastened to each other by means of a screw 23. In order to fasten the whole structure to the support 14, a screw 24 is provided, which is screwed down inside a screw-threaded bore provided in the part 21. In this way, the assemblage of the actuators 1, as well as the possible replacement thereof, is facilitated. Both parts 21 and 22 can be made from low-coercive-power iron.

As it results in particular from Figure 3, each part 21, 22 is provided with a seat 25, 26, of a generally parallelepipedon-shaped configuration, with a central protruding portion 27, 28; said protruding portions extend towards each other in the direction of the transversal portions 19, 20 of the armature, and define the cores of the windings 3, 4. The same windings have the shape of substantially parallelepipedon blocks, which can be installed inside the seats 25, 26, inside which they are retained by the geometrical engagement of the protruding portions 27, 28 inside the central opening 29 of the windings 3, 4. A hollow 30 provided in the part 21 acts as the female element in order to align the underlying part 22, the thickess of which is slightly smaller than of the part 21.

At the side from which the armature 5 comes out, both parts 21 and 22 of the support structure 2 are provided with respective appendices 31, 32, opposite to each other, and each defining a central opening 33, 34, in order to allow the swinging movement of the armature 5 to take place. These appendices, positioned adjacent to

the respective windings 3, 4, are a part of the magnetic loop, and ensure, with a minimum air gap, a particularly high magnetic flux in the magnetic loop, with an efficacious action of the armature 5, also thanks to the penetration of said portions 19, 20 inside the interior of the windings 3, 4.

The armature 5 is hinged onto the part 21, which is provided with a seat 35 for the relevant end of the armature 5, and bores 36 in order to house the pivot 6. Advantageously, on the end of the armature 5, a sleeve 37 of a wear-resistant, self-lubricating plastic material can be moulded, in order to reduce the friction, and increase the useful life of the concerned surfaces.

At it results from the drawings, the overall dimensions of the actuator 1 are very small, thanks to the efficacious exploitment of the spaces.

Advantageously, tne transversal portions 19 and 20 can have a distance from the pivot 6, which is shorter than the distance thereof from the operating end of the armature, on which the fork-shaped, needle-selection-lever engaging end portion 18 is provided. This same end portion, anyway constituted by an amagnetic material, may constitute a stroke-limit, positive-stop element for the armature 5, coming to rest against the respective parts of the seats 33, 34 of the appendices 31, 32 of the structure 2, also securing, in this way, a long useful life of the va·ious elements.

One will understand from the above disclosure that an actuator according to the present finding combines a structure having small overall dimensions, easy to be assembled and to be installed, with a fast and reliable

intervention action, and with a long useful life.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Electromagnetic actuator device, in particular for the selection of the needles in knitting machines, comprising at least one winding in a support structure made from a ferromagnetic material, and an armature also made from a ferromagnetic material, hinged onto the structure, and subject to the action of the magnetic field generated by said at least one winding in order to be moved between two angular positions, with the armature being engageable with a member to be actuated, such as, in particular, a selection lever, or the like, characterized in that two windings are provided, which are positioned on opposite sides relatively to the armature, and that the armature, hinged at one of its ends, which is opposite to the end which is engageable with the member to be actuated, according to an axis substantially perpendicular to the axis of the windings, has a configuration with two transversal portions protruding from opposite sides, and penetrating inside the interior of the windings.

2. Device according to claim 1, characterized in that the armature has a substantially cross-like shape.

3. Device according to claim 1 or 2, characterized in that the support structure is formed by two parts connected to each other with possibility of separation, and with each one of said parts being given a configuration suitable for housing a winding, with the plane, or planes, along which said parts are connected to each other, being substantially perpendicular to the axis of the windings.

4. Device according to claim 1 or 3, characterized

in that the support structure is provided, at one of its ends, with two appendices opposite to each other, and defining a central opening for the swinging movement of the armature to take place, with said appendices being positioned adjacent to the windings, and being a part of the magnetic loop.

5. Device according to one or more of the preceding claims, characterized in that said windings are accomplished as respective blocks having a substantially parallelepipedon shape, positioned inside respective seats of substantially parallelepipedon shape of said structure, said seats being provided with central, mutually opposite protruding portions extending towards each other in correspondence of said two portions of said armature, and defining the cores of the windings.

6. Device according to claim 3, characterized in that one of said parts is provided with a seat for the hinged end of said armature, which is hinged around a pivot housed inside said one of said parts.

7. Device according to claims 2 and 6, characterized in that said two mutually opposite portions are at a distance from said hinge pivot which is shorter than their distance from said end engageable with the member to be actuated.

8. Device according to claims 1 and 4, characterized in that on the end of the armature opposite to the hinged end thereof, a coating of an amagnetic, wear-resistant material is applied, which constitutes a stop element for the armature, limiting the stroke thereof against respective portions of said appendices.

9. Device according to one or more of the preceding

claims, characterized in that the armature is hinged to the relevant pivot, with the interposition of a sleeve made from an amagnetic, wear-resistant material.

10. Device according to one or more of the preceding claims, characterized in that said two windings are placed coaxial to each other.

11. Device according to one or more of the preceding claims, characterized in that the end of said armature, which can be engaged with the member to be actuated, and the member to be actuated have respective engagement surfaces to which an involute-shaped outline is given, like the cooperating surfaces of two teeth of cylindrical, straight-tooth gear wheels.

DATED this 9th Day of January, 1989.

SANTONI S.R.L.

EDWD. WATERS & SONS
PATENT ATTORNEY
50 QUEEN STREET
MELBOURNE VICTORIA 3000.

Fig.1

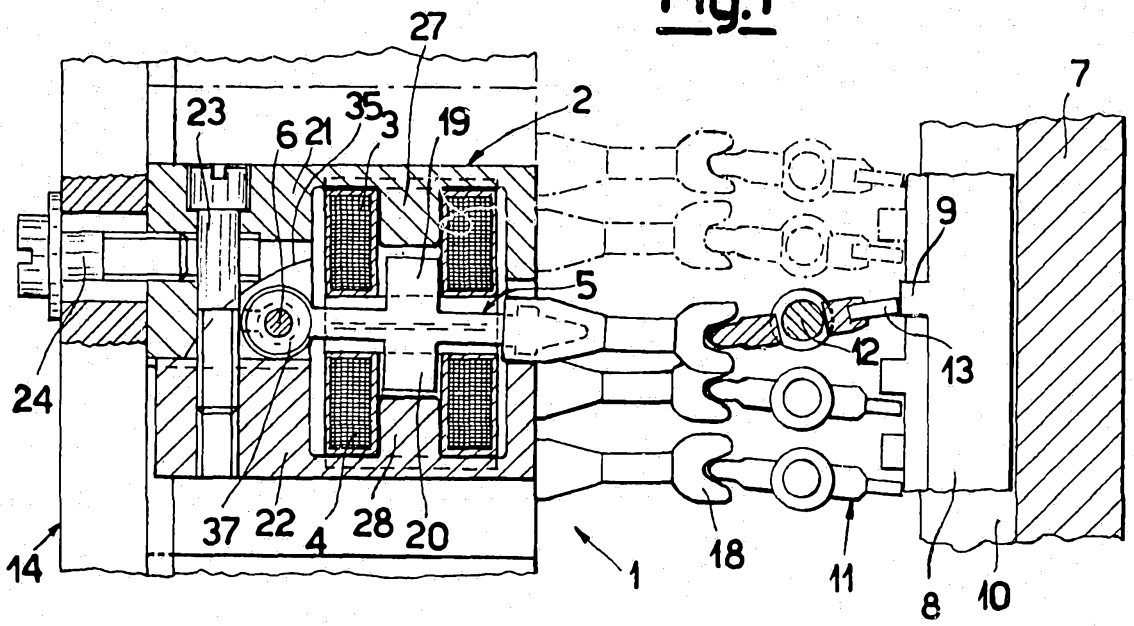
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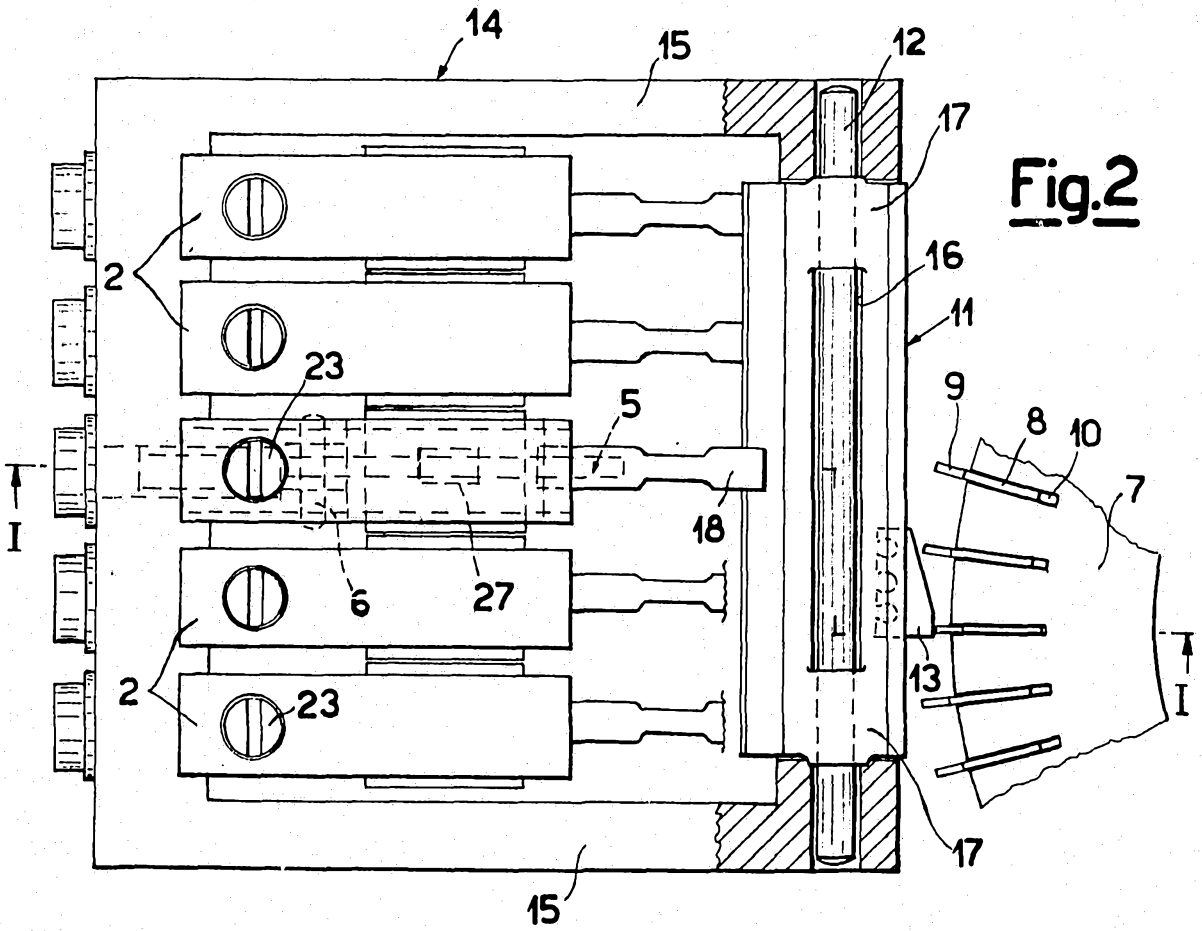
Fig.2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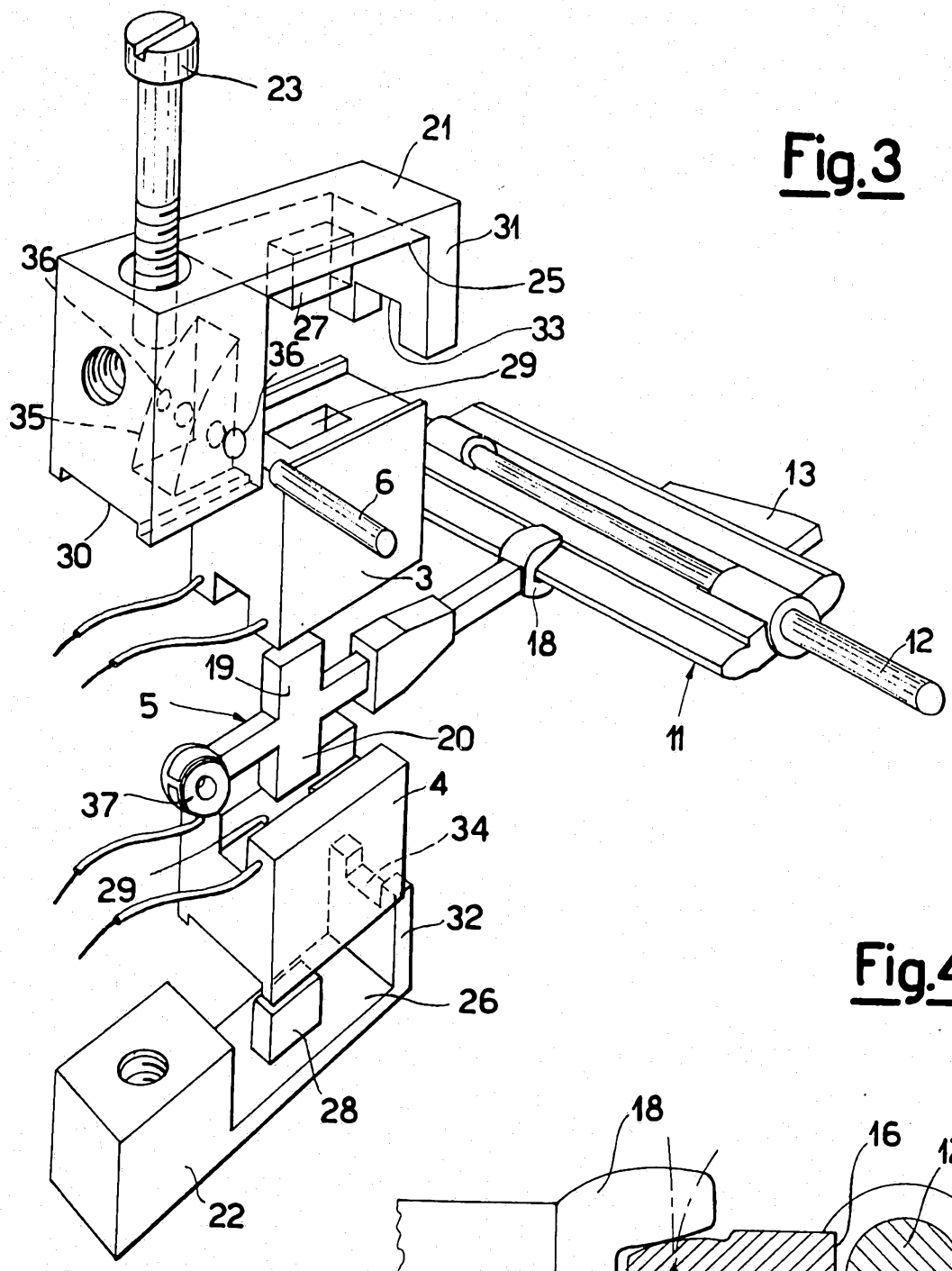
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Fig.3

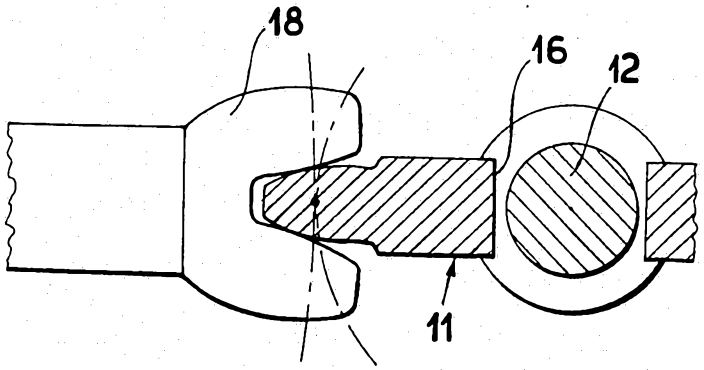
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Fig.4