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(54) Electropneumatic device for the automatic treading of weft feeders and weft feeder including said device

(57) An electropneumatic device for the automatic threading of weft feeders (10) that comprise a fixed drum (11), a braking means (17) that elastically engages the drum, an inlet bush (19) and an outlet bush (20) for the thread, means (22-23-24) for producing, in the bushes, a pneumatic stream for entraining the thread that passes through the feeder (10) from one end to the other, passing in an intermediate channel (28), and a pneumatic pusher to disengage the braking means (17) from elastic contact with the drum (11) and allow the thread to pass. The pneumatic pusher (29) is arranged on the axis of the drum (11) and is actuated by a pneumatic actuator (30) accommodated in the drum and fed with a stream of air that is transferred into the drum by a distributor (31) arranged outside the drum (11) and can retractably move in order to avoid hindering the free unwinding of the thread (F) from the drum when the threading device is inactive.

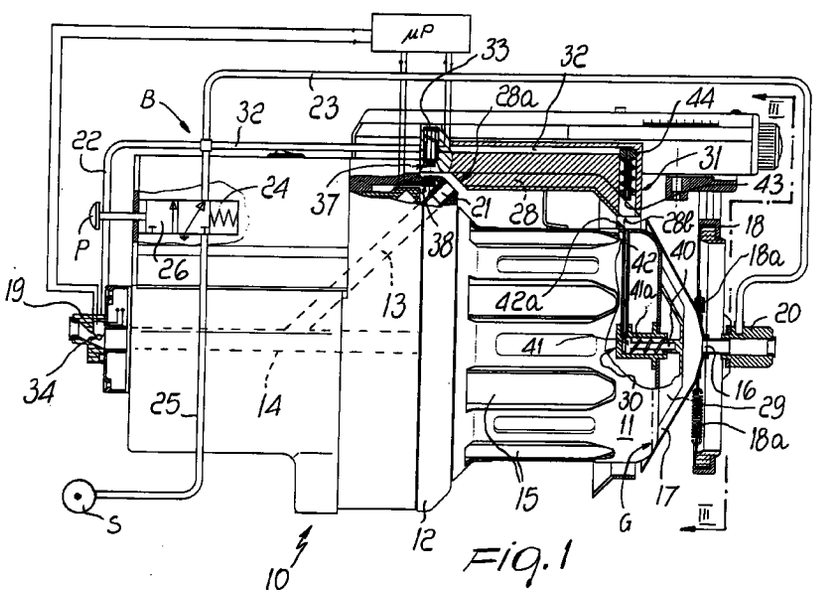

Fig. 1

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Description

The present invention relates to an improved electropneumatic device for the automatic threading of weft feeders in textile machines, particularly looms with high insertion speed, and also relates to a weft feeder that includes said improved threading device.

More specifically, the invention relates to an electropneumatic automatic threading device of the type described in prior patent application published under no. 0 567 045 in the name of the same Applicant and hereinafter briefly referenced as "known electropneumatic device".

Said conventional device is capable of automatically performing, without any manual intervention, the complete threading of weft feeders of any type and particularly of feeders of the type that comprises a thread braking means constituted by a continuous frustum-shaped body that adheres elastically to the fixed drum of the feeder that accommodates the plurality of turns of thread constituting the reserve of weft.

Said weft feeders, which are also well-known to the expert in the field, comprise a rotatable ring that is arranged at the base of said fixed drum and has a radial hollow arm in which the thread that arrives from the spool runs; said thread, by virtue of the rotation of the ring, winds on the drum, forming said turns of the reserve of weft. The thread reaches the cavity of the radial arm by passing through a similar cavity of the driving shaft of the rotatable ring and unwinds from the drum by passing between said drum and the braking means, which is constituted in particular by said frustum-shaped body, to exit through a final thread guiding ring. Inlet, intermediate, and outlet ceramic bushes are provided respectively at the inlet of the cavity of the driving shaft, at the outlet of the hollow radial arm, and on the final thread guiding ring.

The above-mentioned electropneumatic device comprises:

-- a first duct and a second duct for feeding pressurized pneumatic fluid, which are controlled by manually-operated valve means and lead respectively into the rear inlet bush and into the front outlet bush for the thread, so as to generate a pneumatic stream and a consequent suction current that entrains said thread from one end of the device to the other for threading;

-- an open intermediate channel, which is adjacent and parallel to the drum of the apparatus to convey the pneumatic stream in the free portion that lies between the outlet of the radial arm and the braking means;

-- a pneumatic pusher that is arranged at the outlet of the intermediate channel and acts on the braking means to move it, by deforming it, away from contact with the drum and at the same time to guide the thread entrained by the pneumatic stream through the braking means.

Said conventional electropneumatic device has yielded highly satisfactory results in practice, but has shown some drawbacks: mainly, on the one hand, the pneumatic pusher can, in the course of time, damage the braking body, especially if said body is constituted by said continuous frustum-shaped body, due to the concentration and asymmetry of the deformation and displacement force that the former discharges onto the latter, and on the other hand, the dispersion that the pneumatic stream undergoes in passing through the irregular opening that forms between the drum and the braking means when said braking means is actuated by the pusher to move away from contact with the drum.

The aim of the present invention is to improve said conventional electropneumatic device to eliminate the drawbacks mentioned above; the invention achieves this aim with an improved electropneumatic device that has the specific characteristics stated in the appended claims.

Substantially, the invention is based on the concept of producing the disengagement of the braking means from the drum of the feeder, subjecting said braking means to the axial and uniformly distributed thrust produced by a pusher arranged on the axis of said drum and actuated by a pneumatic actuator that is accommodated in the drum and is fed by a stream of air that is transferred inside said drum by a distribution unit located outside the drum and retractably movable so as to avoid hindering the free unwinding of the thread from said drum when the threading device is inactive.

Another improvement according to the present invention resides in the fact that the pusher is also frustum-shaped and is provided with a thread passage and guiding channel that runs along the generatrix of the pusher that is aligned with said intermediate channel adjacent to the drum. When the pusher engages the braking means constituted by said frustum-shaped body, said passage and guiding channel assumes a tubular configuration that is adapted to concentrate and accelerate the pneumatic stream for entraining the thread, significantly facilitating threading.

The characteristics, purposes, and advantages of the improved device according to the present invention will become apparent from the following detailed description and with reference to the accompanying drawings, given only by way of non-limitative example, wherein:

figure 1 is a partially sectional elevation view of a weft feeder with the improved pneumatic threading device according to the present invention, the feeder being shown in the inactive configuration;

figure 2 is a partially sectional view, similar to figure 1, of the device in the active configuration;

figure 3 is a front sectional view, taken along the plane III-III of figure 1;

figures 4 and 4a are highly enlarged transverse sectional views, taken along the plane IV-IV of figure 3.

In the drawings, the reference numeral 10 generally designates a conventional weft feeder that comprises a fixed drum 11, at the base whereof there is provided a rotatable ring 12 having a hollow radial arm 13 that is connected to a corresponding cavity of the driving shaft 14 of the ring 12. The arm 13, by virtue of the rotation of the ring 12, winds onto the drum 11 a reserve of weft (not shown) constituted by a plurality of turns of thread, which are made to advance towards the head of the drum by an oscillating-plate device 15.

The thread F that unwinds from the drum 11 -- according to the demand of the loom or other textile machine -- passes through a thread guiding ring 16 and is tensioned by a braking means which, in the illustrated example, is constituted by a semirigid frustum-shaped element 17 that is supported and pushed into contact engagement with the drum 11, at a tangency circumference C, by an elastic suspension constituted, for example, by a set of three radial springs 18a that are coupled to a supporting ring 18 that is coaxial to the drum 11 and can be moved axially in relation thereto, so as to adjust the elastic contact pressure between the frustum-shaped element 17 and said drum.

A ceramic thread inlet bush 19 is arranged at the end of the driving shaft; likewise, a ceramic thread outlet bush 20 is arranged on the thread guide 16. A third intermediate ceramic bush 21 is arranged at the outlet of the radial arm 13. In a per se known manner, and as described in the cited prior patent application in the name of the same Applicant, an electropneumatic device D is associated with the feeder 10 and is adapted to produce the threading of said feeder, i.e., the automatic passage of the thread F from the bush 19 to the bush 20 through the bush 21 and the braking means 17. The device D comprises two pneumatic ducts 22-23 that are controlled by a monostable valve element 24 and end respectively in the bushes 19 and 20 so as to produce, in said bushes, a stream of air that is directed from the inlet to the outlet of the feeder 10 and a consequent equally orientated suction current for the thread F. A duct 25 feeds the pressurized pneumatic fluid, supplied by a source S, to the valve element 24 and a self-releasing pushbutton P is provided to move the shutter 26 of the element 24 to feed or respectively interrupt the flow of fluid to the ducts 22-23 and to an additional duct 32 that will be described hereinafter.

In order to convey the stream and the thread entrained thereby in the free portion that lies between the intermediate bush 21 and the braking means 17, there is provided an intermediate channel 28 whose cross-section is shaped like an inverted U and is arranged adjacent and parallel to the drum 11. The channel 28 has an inlet section 28a that is adjacent to the intermediate bush 21 and faces it and an outlet section 28b that is inclined along the plane that lies tangent to the drum 11 and is parallel to the generatrices of the braking means 17.

In order to establish the pneumatic stream through the channel 28, said channel must be perfectly aligned with the bush 21 when the pushbutton P is pressed to feed the pneumatic fluid to the ducts 22-23 and 32. This is performed by an electromagnetic position-marking element 33 that is rigidly coupled to the fixed structure of the feeder 10 and is energized by a microprocessor μP when a piezoelectric sensor 34, associated with the inlet bush 19, reports to said microprocessor that there is no mechanical tension in the thread F, due either to breakage or depletion of said thread.

The electromagnetic element 33, also described in detail in the cited prior patent application, substantially comprises a permanent magnet 37 that is adapted to interact with a corresponding electromagnet 38 of the ring 12 to stop said ring when said magnet and said electromagnet are aligned and the element 33 and the electromagnet 38 are energized by the microprocessor μP on command from the sensor 34.

According to the present invention, the thread F passes between the braking means 17 and the drum 11 by virtue of the shifting of the entire braking element 17 away from contact with the drum 11; this shift is produced by a pusher 29 arranged on the axis of said drum 11 and is actuated by a pneumatic actuator 30 accommodated inside said drum. The actuator 30 comprises a stem 40 protruding outside the drum 11 to rigidly connect to the pusher 29 and a plunger 41 that can slide hermetically, in contrast with the action of a spring 41a, in the cylinder 30a of the actuator 30.

A retainer pin is provided in order to rotationally couple the pusher 29; said pin, not shown, is arranged parallel to the stem 40, and can also move axially. A feeder duct 42 is connected to the pneumatic actuator 30, runs radially inside the drum 11, and ends with a section 42a for the intake of the pneumatic fluid that is arranged on the cylindrical surface of said drum.

A retractable distributor 31 is aligned with the inlet section 42a of the duct 42, is arranged outside the drum 11, is fed by the duct 32, and is adapted to transfer the pneumatic fluid to the actuator 30 arranged inside the drum when the pushbutton P is pressed to actuate the threading device D. The distributor 31 comprises a cylindrical slide valve 43 that can move radially relative to the drum 11. The slide valve is provided with a plunger 44 that can move hermetically in a corresponding cylindrical seat 45 in contrast with the action of a spring 46 and is provided with an axial opening 47 that is aligned with the inlet section 42a of the duct 42. The slide valve 43 moves in the respective cylindrical seat 45 between two extreme positions, respectively an inactive one (figure 1) and an active one (figure 2). In the inactive position, which is caused to be stable by the action of the spring 46, the slide valve 43 is entirely retractably contained within the respective cylindrical seat 45 to avoid interfering with the thread F, hindering its free unwinding from the drum 11 when the threading device is inactive. On the other hand, in the active position, the slide valve 43, actuated by the stream of air fed by the duct 32, moves in contrast with the action of the spring 46 and protrudes from the respective cylindrical

seat 45 to engage, with its free end 43a, the inlet section 42a of the duct 42 and transfer to the latter, through its own axial opening 47, the stream of air fed by the duct 32. The air thus fed into the duct 42 energizes the actuator 30, which axially moves the pusher 29, which entrains the braking means 17, moving it away from the drum 11.

As clearly shown in the figure, the pusher 29 has an active surface whose profile is complementary to the profile of the internal surface of the braking means 17 with which it mates. In the illustrated example, in which the braking means 17 is constituted by a frustum-shaped body, the surface of the pusher 29 has a corresponding frustum-shaped profile and has the same taper angle as the braking means 17. This ensures correct surface coupling between the pusher 29 and the braking body 17 and a consequent correct distribution of the force that the former discharges onto the latter, to the benefit of the preservation of the integrity of the braking body.

In order to allow the thread to pass between the braking body 17 and the pusher 29, said pusher is provided with a passage channel 29a that has a substantially U-shaped profile and is directed towards the internal surface of said braking body (figure 4). The channel 29a runs parallel to the generatrices of the frustum-shaped pusher 29 and is arranged on the imaginary extension of the intermediate channel 28 for guiding and retaining the thread F. When the pusher 29 engages the braking means 17 to disengage it from contact with the drum 11, the passage channel 29a assumes a tubular configuration (figure 4a) by virtue of the fact that the internal surface of the braking body 17 closes the U-shaped opening of said channel. This tubular configuration concentrates and accelerates the pneumatic stream for entraining the thread F that arrives from the intermediate channel 28, with the result of significantly facilitating the threading of the feeder 10.

Although the above description relates to a feeder 10 provided with a braking means 17 constituted by a frustum-shaped body, the structure of the braking means is not limitative for the scope of the invention. In particular, the frustum-shaped braking means 17 can be replaced with a known ring of bristles or with an element with metallic laminae, provided that said rings or said element are elastically suspended and can be moved axially in relation to the drum 11.

Furthermore, of course, without altering the concept of the invention, the details of execution and the embodiments may be altered extensively, with respect to what has been described and illustrated by way of non-limitative example, without thereby abandoning the scope of the invention defined by the following claims, wherein the reference numerals are provided merely for the sake of better comprehension.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. An electropneumatic device for the automatic threading of weft feeders (10) that comprise a fixed drum (11), a braking means (17) that elastically engages the drum, an inlet bush (19) and an outlet bush (20) for the thread, means (22-23-24) for producing, in said bushes, a pneumatic stream for entraining the thread that passes through the feeder (10) from one end to the other, passing in an intermediate channel (28), and a pneumatic pusher to disengage the braking means (17) from elastic contact with the drum (11) and allow the thread to pass; characterized in that the pneumatic pusher (29) is arranged on the axis of the drum (11) and is actuated by a pneumatic actuator (30) that is accommodated in the drum and is fed with a stream of air that is transferred into said drum by a distributor (31) arranged outside the drum (11) and can retractably move in order to avoid hindering the free unwinding of the thread (F) from said drum when the threading device is inactive.

2. A device according to claim 1, characterized in that the pneumatic actuator (30) of the pusher (29) comprises a pneumatic fluid feed duct (42) that runs radially inside the drum (11) and ends with an inlet section (42a) that is arranged on the cylindrical surface of said drum in alignment with said retractable distributor (31).

3. A device according to claim 1, characterized in that the distributor (31) comprises a slide valve (43) that can move radially with respect to the drum (11).

4. A device according to claim 3, characterized in that said slide valve (43) is cylindrical, is provided with a plunger (44) that can move hermetically in a corresponding cylindrical seat (45) in contrast with the action of a spring (46), and is provided with an axial opening (47) that is aligned with the inlet section (42a) of the radial duct (42) that feeds the actuator (30).

5. A device according to claim 4, characterized in that said slide valve (43) moves in the respective cylindrical seat (45) between two extreme positions, respectively an inactive position and an active position, and in that in the inactive position, which is stabilized by the action of said spring (46), the slide valve (43) is fully retractably contained in said cylindrical seat (45), and in that in the active position, assumed by virtue of the action of the pneumatic stream on said plunger (44), the slide valve exits from the respective seat (45) to engage, with its

free end (43a), the inlet section (42a) of the radial duct (42) that feeds the pneumatic actuator (30).

6. A device according to claim 1, characterized in that the pneumatic pusher (29) has an active surface whose profile is complementary to that of the internal surface of the braking means (17) with which it mates.

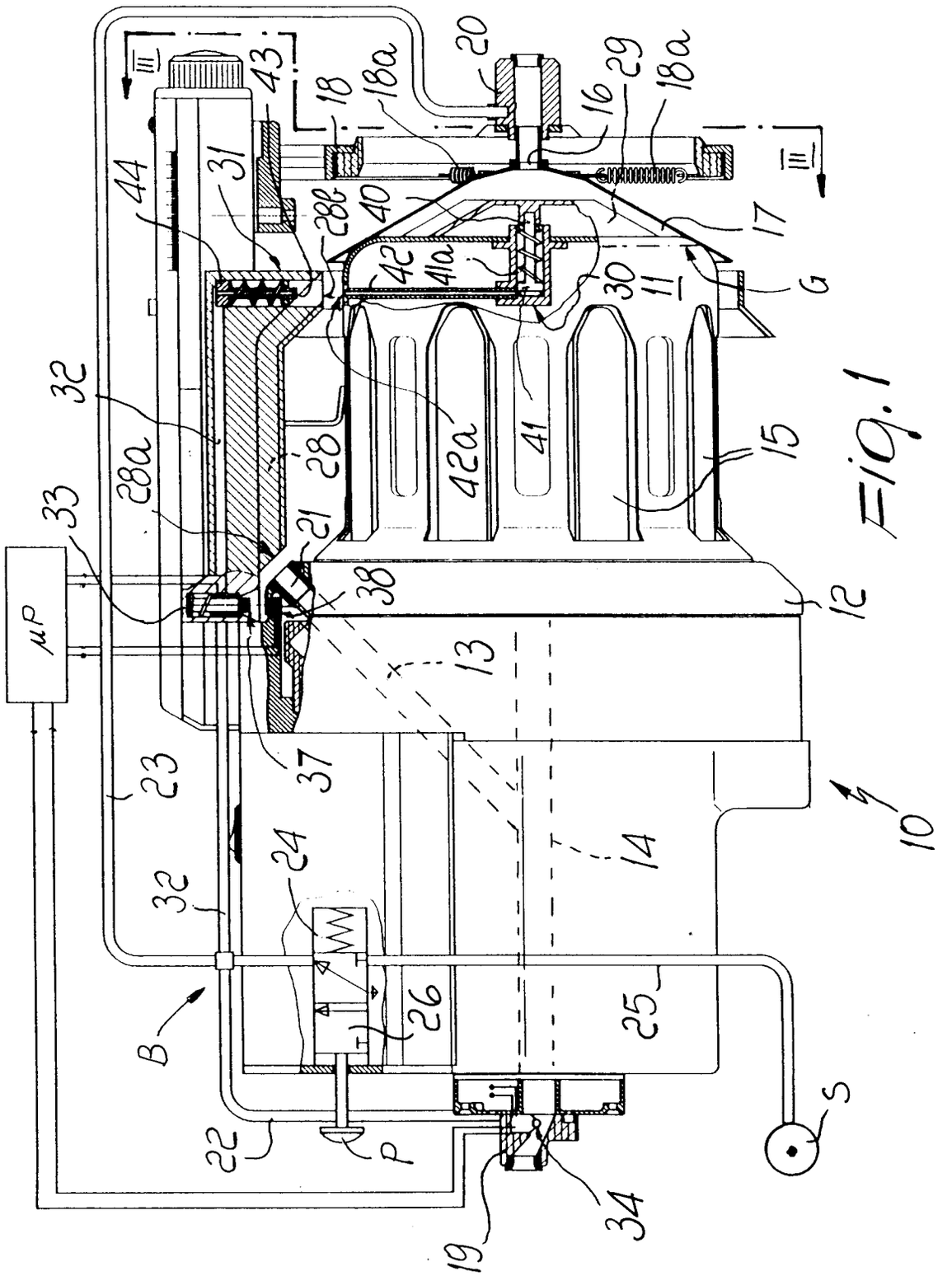
7. A device according to claim 6, characterized in that the mating surfaces of the pusher (29) and of the braking means (17) are frustum-shaped.

8. A device according to claim 1, characterized in that the pusher (29) is rigidly rotationally coupled and is provided with a channel (29a) for the passage of the pneumatic stream and of the thread, and in that said passage channel is directed towards the internal surface of the braking body (17) to assume a tubular configuration when the pusher (29) engages the braking means (17) to disengage it from contact with the drum (11).

9. A device according to claim 8, characterized in that said passage channel (29a) runs parallel to the generatrices of the pusher (29) and is arranged along the imaginary extension of said intermediate channel (28) for guiding and retaining the thread (F).

10. A weft feeder (10) for textile machines, comprising: a drum (11) for accommodating turns of thread (F) that constitute a weft reserve; a rotating arm (13) for winding said reserve turns on the drum; a thread braking means (17), which acts by elastic contact engagement with said drum; an inlet bush (19) and an outlet bush (20) for the thread; means (22-23-24) for feeding a pneumatic stream into said bushes and for producing, for the purpose of threading the feeder (10), a flow for entraining the thread that passes through the feeder from one end to the other; and pusher means for disengaging the braking means (17) of the drum (11) and allowing the thread to pass when the means for feeding the pneumatic fluid are activated; characterized in that the pusher means (29) are arranged coaxially to the drum (11) that accommodates the reserve turns and are actuated by a pneumatic actuator (30) arranged inside the drum and fed by an external source (S) of pressurized fluid by means of a retracting distributor (31).

11. A weft feeder (10) according to claim 10, characterized in that the retracting distributor (31) moves radially with respect to the drum (11), passing from an inactive position, in which it does not interfere with the unwinding of the reserve turns from said drum, to an active position, in which it makes contact with the outer surface of the drum to transfer the pneumatic fluid to the actuator (30) that is accommodated inside said drum.


μP
III
III
43
18
18a
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18a
44
31
28b
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17
42
41a
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G
32
28a
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42a
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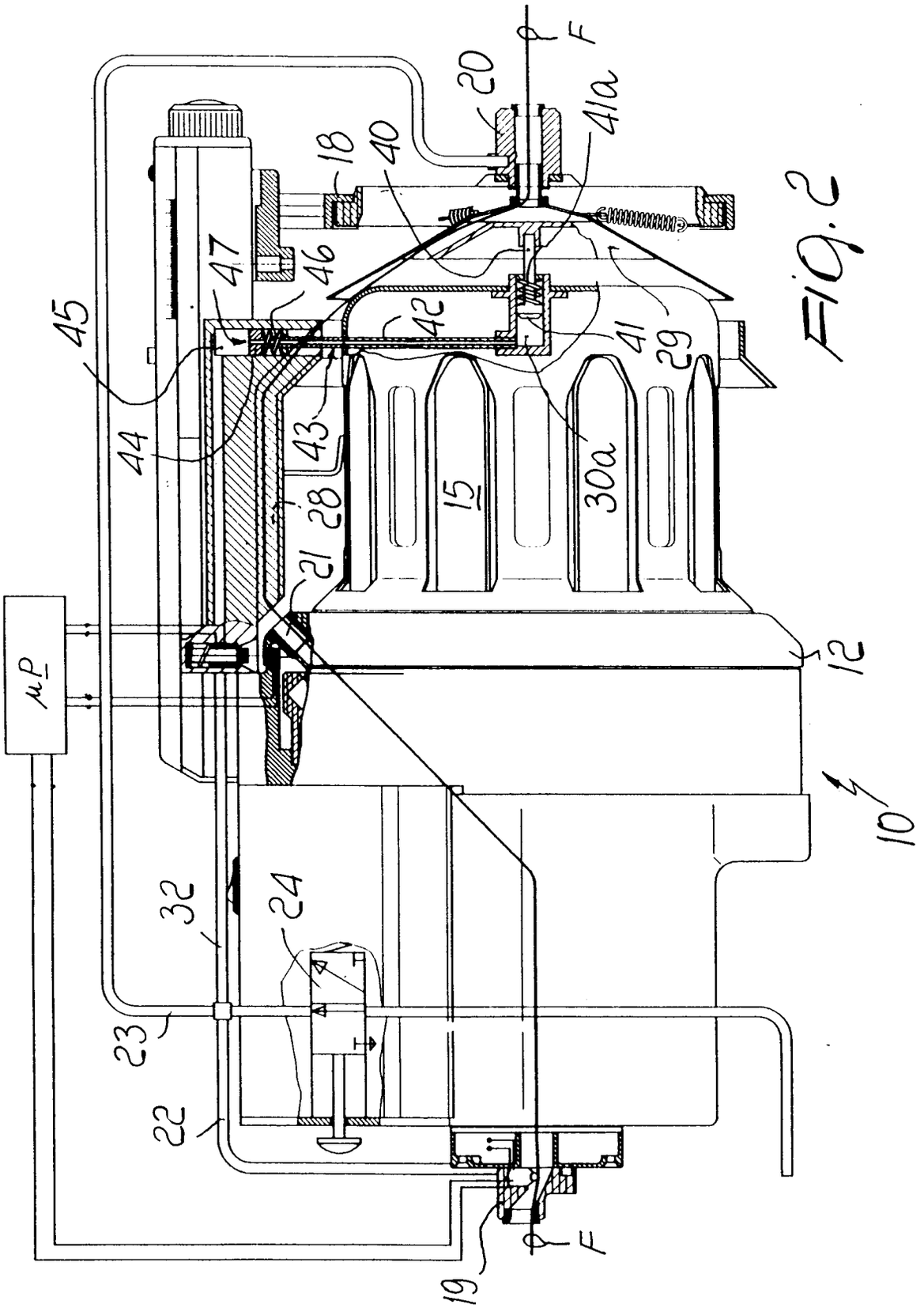
Fig. 1


μP
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F

Fig. 2

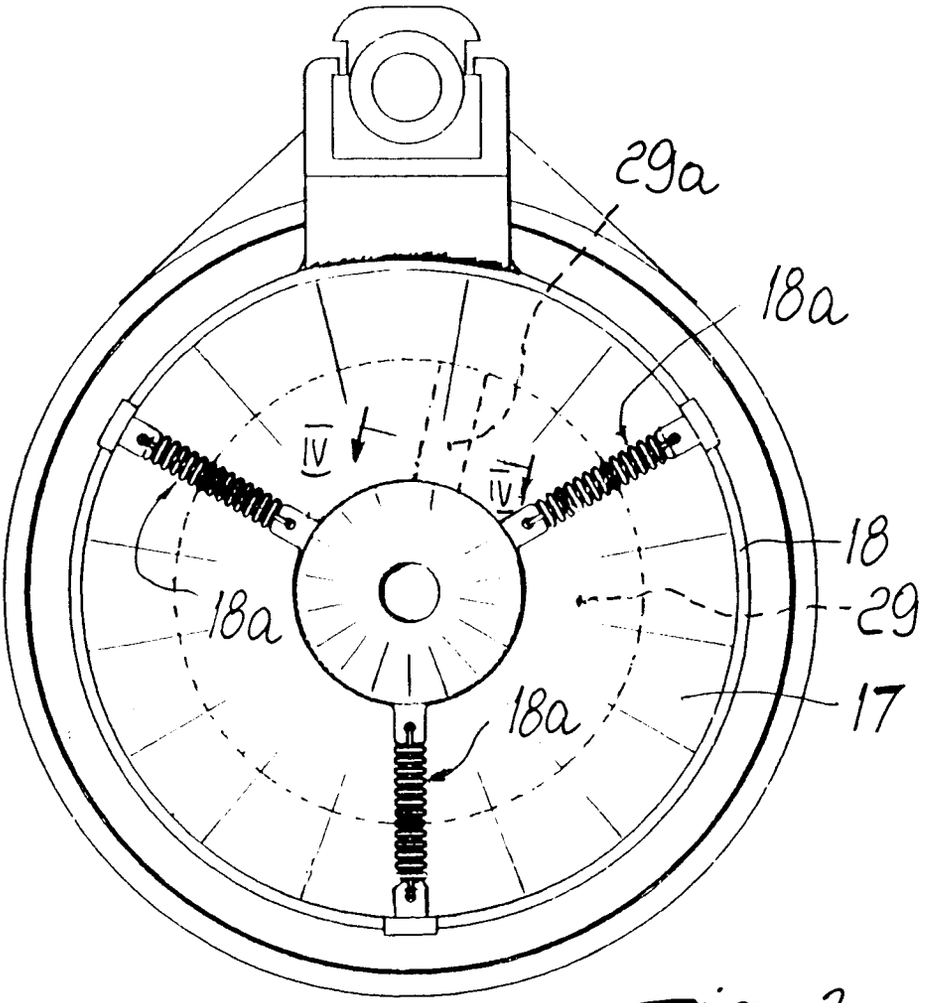

FIG. 3

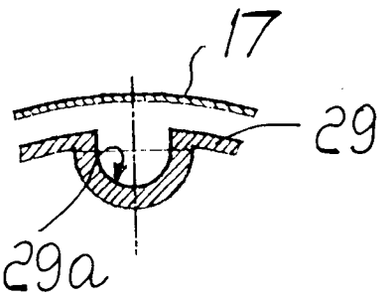

FIG. 4

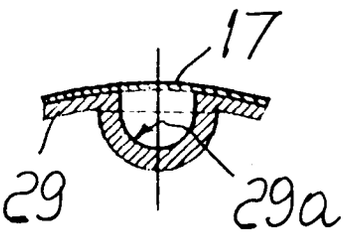

FIG. 4a

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 11 1443

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.6)
A	EP-A-0 436 900 (ROJ ELECTROTEX)		B65H51/22 B65H51/16
A	EP-A-0 446 447 (SOBREVIN)		
A,D	EP-A-0 567 045 (L.G.L. ELECTRONICS)		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B65H
D03D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14 October 1996	Boutelegier, C

CATEGORY OF CITED DOCUMENTS

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