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(71) Applicant: **MARSILLI & CO. S.P.A.**
Via per Ripalta Arpina
I-26012 Castelleone (Cremona)(IT)

(72) Inventor: **Parati, Gian Battista**
Via Chiosi, 4
I-26012 Castelleone (Prov. of Cremona)(IT)
Inventor: **Bertolone, Alberto**
Via Del Gelso, 8
I-20077 Dresano (Prov. of Milan)(IT)

(74) Representative: **Modiano, Guido et al**
MODIANO, JOSIF, PISANTY & STAUB
Modiano & Associati Via Meravigli, 16
I-20123 Milano(IT)

(54) Programmable self-adjusting device for tensioning wires during winding.

(57) The present invention relates to a programmable self-adjusting device for tensioning wires during winding which has the peculiarity of comprising, in the direction of advancement of a wire (2) to be wound, a pre-braking device (3) for tensioning the wire (2) which winds on a brake pulley (4) downstream of which there is a transmission roller (7) which is supported by a compensating arm (10). At the exit from the transmission roller (7), the wire engages a wire tension sensing unit (11) which drives the brake pulley (4).

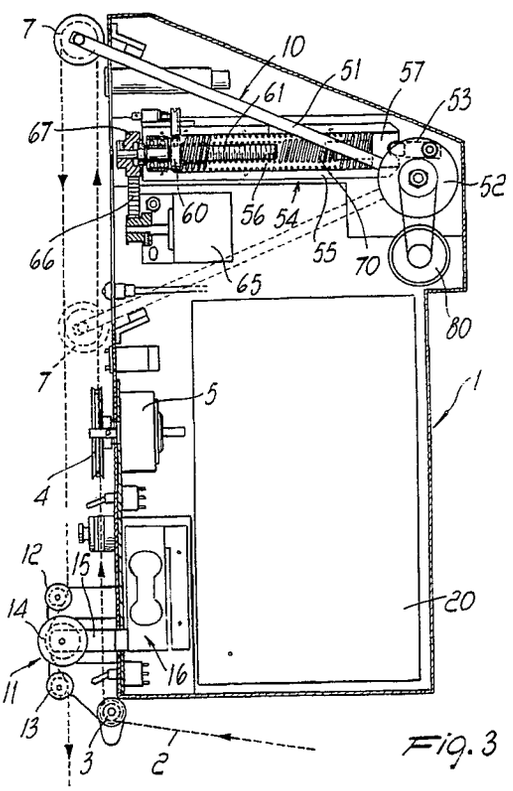

Fig. 3

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PROGRAMMABLE SELF-ADJUSTING DEVICE FOR TENSIONING WIRES DURING WINDING

The present invention relates to a programmable self-adjusting device for tensioning wires during winding.

As is known, in the operations for winding electromechanical components, such as for example relays, transformers, solenoids and the like, it is necessary that the force which acts on the wire being wound be kept as constant as possible during the entire process; that is to say, the tension, i.e. the value in grams of the applied force with which the wire being wound is kept tensioned, must be kept constant.

The tension or gram force varies according to the diameter of the various wires and as a function of the winding characteristics to be obtained.

Transient phenomena furthermore occur during the winding process, due to the accelerations and decelerations of the winding machine and to other unforeseeable phenomena intrinsic to the characteristics of the wire being wound, which create tension changes which must necessarily be compensated.

Wire tensioning devices are currently used in order to keep the tension constant; their function is to return the value of the wire tension within set margins, to avoid incorrect windings or breakages of the wire.

The most common wire tensioning devices are currently of the mechanical type, i.e. are constituted by arms compensated by adjustable springs which, according to their position, interact with friction braking systems which act on the wire being wound.

This kind of wire tensioning device has the disadvantage of having very high variability as regards the values of the set adjustment as the speed varies, and furthermore creates a considerable limit to the advancement speed of the wire, beyond which adjustment is no longer practically possible.

Another disadvantage of said tensioning devices is constituted by the fact that high deviations of the gram forces occur during the transient periods of acceleration and deceleration of the machine, together with non-uniformity of the set values during work shifts, due to the heating of the mechanical braking parts.

Adjustments must furthermore be performed with additional tools, without having an immediate automatic control of the gram force values of the wire during the winding steps.

To the above it should be furthermore added that the above used systems require considerable maintenance interventions, especially as regards the mechanical braking parts.

In order to try to obviate these disadvantages, electromagnetic braking systems have already been introduced which in practice are constituted by a mechanical arm associated with an electronic transducer for sensing the braking gram force of the wire which, though it provides a theoretically correct system, is currently incapable of being sufficiently accurate.

The aim of the invention is indeed to solve the above described problems by providing a programmable self-adjusting device for tensioning wires during winding, which allows continuous real-time control of the gram force values, thus allowing in each instance to instantaneously provide the related adjustment, thus obtaining tension values which are always constant and accurate.

Within the scope of the above described aim, a particular object of the invention is to provide an automatic device in which all the elements which produce mechanical friction by sliding are eliminated, thus obtaining, besides greater precision in operation, a drastic reduction in maintenance operations.

Still another object of the present invention is to provide a self-adjusting device which allows to continuously adjust the set gram forces according to the contingent winding requirements and which furthermore offers considerable repeatability of the results even in different moments and on different machines.

Not least object of the present invention is to provide a self-adjusting device which is easily obtainable starting from commonly commercially available elements and materials and which is furthermore competitive from a merely economical point of view.

This aim, the objects mentioned and others which will become apparent hereinafter are achieved by a programmable self-adjusting device for tensioning wires during winding, according to the invention, characterized in that it comprises, in the direction of advancement of the wire to be wound, a pre-braking device for pre-tensioning the wire which winds on a brake pulley downstream of which there is a transmission roller which is supported by a compensating arm, said wire engaging, at the exit from said transmission roller, a wire tension sensing unit which drives said brake pulley.

Further characteristics and advantages will become apparent from the description of a preferred but not exclusive embodiment of a programmable self-adjusting device for tensioning wires during winding, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

figure 1 is a schematic perspective view of the

device;

figure 2 is a front view of the device;

figure 3 is a partially sectional lateral elevation view of the device.

With reference to the above figures, the programmable self-adjusting device according to the invention, which can for example be associated with a winding machine but could be connected to other devices, has a box-like containment casing generally indicated by the reference numeral 1.

The device according to the invention has, in the direction of advancement of the wire 2 to be wound, a pre-braking element 3 associated with the lower part of the body 1 which has the function of creating a force which is sufficient to tighten the loop of wire around a brake pulley indicated by 4 which is rotatably supported by the casing 1 and is connected to a constant-torque electromagnetic hysteresis rotating brake 5; the wire is wound on the brake pulley 4 for at least an angle of 360° or possibly for a greater angle.

At the exit from the brake pulley 4, the wire 2 winds on a transmission roller 7 which has its axis perpendicular to the axis of the pulley 4 and is supported by a compensating arm 10 which will be described in greater detail hereinafter.

At the exit from the transmission roller 7, the wire 2 engages a wire tension sensing unit 11 which is constituted by an entry abutment roller 12 and by an bit abutment roller 13 which have their axes mutually spaced and parallel, between which a feeler roller 14 is provided; the roller 14 is supported by a support 15 which acts on a load cell, generally indicated by the reference numeral 16, which has the function of continuously sensing the tension on the wire 2.

The load cell 16 is connected to a control unit, generally indicated by 20, advantageously of the electronic type, on which the braking values of the hysteresis rotating brake 5 can be set. The control unit 20 handles the signals arriving from the load cell 16 so as to modulate the braking of the brake 5 in accordance with the occurrence of transient phenomena.

The control unit 20 thus ensures perfect control between the signals generated by the load cell 16, which performs the measurements of the actual gram force of the wire 2, and the drive of the brake 5 which is preset to give the required gram force both in dynamic conditions, i.e. during the winding process, and in static conditions, i.e. the minimum assured residual gram force at the end of the winding process.

The compensating arm 10 is also operatively associated with the control unit 20 and has the function of keeping the wire 2 tensioned when the winding machine is stopped, or of tensioning or de-tensioning the wire 2 according to the requirements.

Advantageously, the compensating arm, which has been previously generally indicated by the reference numeral 10, has a rod 51 which supports the transmission roller 7 and is connected to a hub 52 on which a feeler piston 53 is eccentrically articulated and interacts with an elastic adjustment unit generally indicated by the reference numeral 54.

The elastic adjustment unit 54 has a containment body 55 with a cavity 56 in which a biasing piston 57, on which the piston 53 acts, is slidable.

A pusher spring 58 accommodated in the cavity 56 acts on the biasing piston 57 and can be adjusted by means of a slider 60 which engages around a threaded pin 61 which is rotatable so as to move the slider 60.

The threaded pin 61 is rotated by means of an electric motor 65 connected, by means of a toothed belt 66, to a small pinion 67 which is keyed on the threaded pin 61 so as to rotate said pin and consequently move the slider 60 to set the elastic adjustment of the spring 58.

A second spring 70 is furthermore provided and is arranged operatively in series with respect to the first spring 58 and is used for greater setting values.

An encoder 80 is furthermore connected to the hub 52 and constantly senses the position of the compensating arm, thus allowing its precise control.

The compensating arm 10, as described, has the advantage that it can be adjusted automatically, by varying the setting of the adjustment values, even during the steps of unreeling the wire 2 for winding.

In practical operation, during the winding steps, the wire 2, which is pre-tensioned by the pre-braking device 3, winds onto the brake pulley 4 and, after passing on the transmission roller 7, engages the tension sensing unit 11 which, by continuously controlling the actual tension on the wire at the exit of the device, allows to drive the brake pulley 5 so as to have, even during transient instants, always the same tension on the wire 2 regardless of the operating speed of the machine and of any unevenness of the wire.

As already mentioned earlier, the compensating arm 10 has in practice the auxiliary function of keeping the wire 2 tensioned when the machine is at rest, so as to prevent it from disengaging from the brake pulley 5, and furthermore has the function of creating further variations if a further tensioning or de-tensioning of the wire is required during the winding steps.

From what has been described above it can thus be seen that the invention achieves the proposed aim and objects, and in particular the fact is

stressed that the use of an electromagnetic hysteresis brake 5 driven directly by a unit 11 which senses the tension of the wire 2 at the exit, allows first of all to always have an extremely precise adjustment of the tension and secondly not to be subject to wear and maintenance.

The invention thus conceived is susceptible to numerous modifications and variations, all of which are within the scope of the inventive concept.

All the details may furthermore be replaced with other technically equivalent elements.

In practice, the materials employed, as well as the contingent shapes and dimensions, may be any according to the requirements.

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 scope of each element identified by way of example by such reference signs.

Claims

1. Programmable self-adjusting device for tensioning wires during winding, characterized in that it comprises, in the direction of advancement of a wire (2) tp be wound, a pre-braking device (3) for tensioning the wire (2) which winds on a brake pulley (4) downstream of which there is a transmission roller (7) which is supported by a compensating arm (10), said wire (2) engaging, at the exit from said transmission roller (7), a wire tension sensing unit (11) which drives said brake pulley (4).

2. Device according to claim 1, characterized in that said brake pulley (4) is associated with a constant-torque electromagnetic hysteresis rotating brake (5).

3. Device according to claim 1, characterized in that said wire tension sensing unit (11) has an entry abutment roller (12) and an exit abutment roller (13) which are mutually parallel and spaced, a feeler roller (14) acting between said abutment rollers (11,12) and being supported by a support (15) which is connected to a load cell (16) which is connected to a control unit (20) which drives said brake pulley (4).

4. Device according to claim 3, characterized in that it comprises means, associated with said control unit (20), for setting the required wire tension values.

5. Device according to claim 1, characterized in that said compensating arm (10) comprises a rod (51) which supports said transmission roller (7) and protrudes from a hub (52) to which a feeler piston (53) is eccentrically articulated and acts by contact on an elastic adjustment unit (54).

6. Device aocording to claim 1, characterized in that said elastic adjustment unit (54) comprises a body (55) which defines a cavity (56) inside which a piston (57) is slidable, said feeler piston (53) engaging thereon by contact, a first spring (58) acting on said piston (57) and being associated, at the other end, with a slider (60) which is movable by virtue of the action of a threaded pin (61) which is rotatable by virtue of the action of an electric motor (65) which is operatively interconnected to said control unit (20).

7. Device according to one or more of the preceding claims, characterized in that it comprises a second spring (70) which is arranged coaxially to said first spring (58) in said elastic adjustment unit (54) and acts in series to said first spring (58).

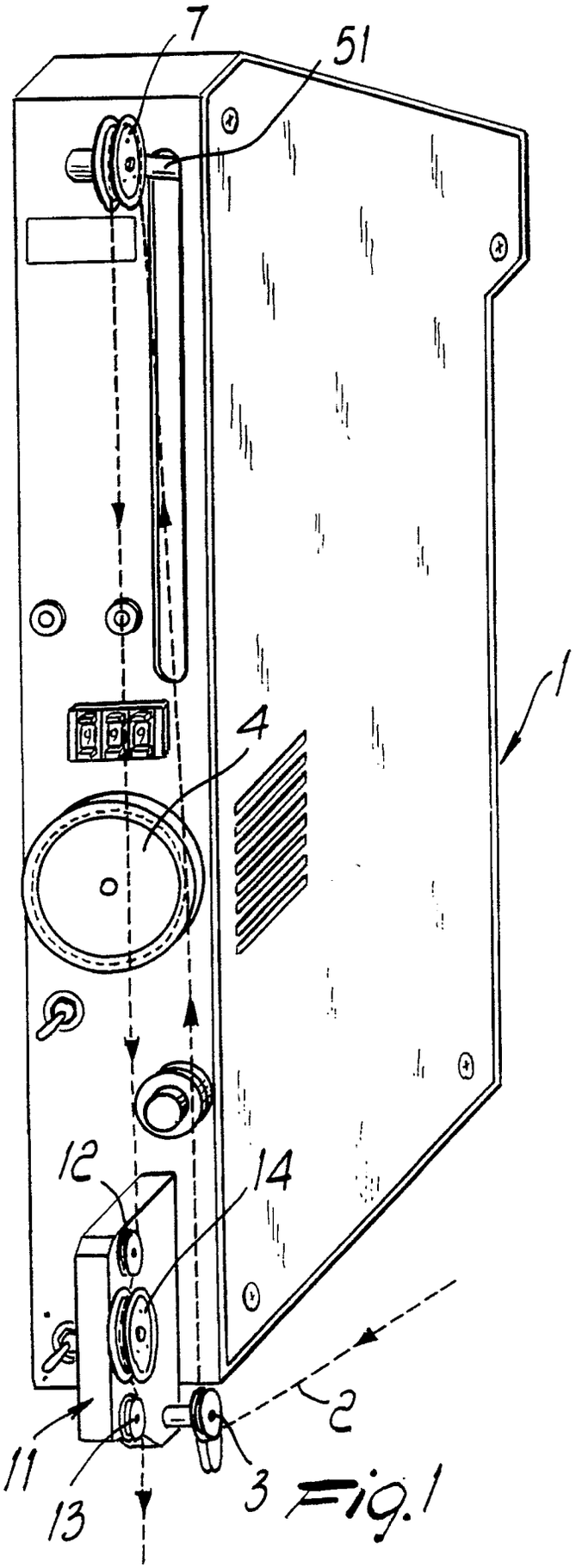

Fig.1

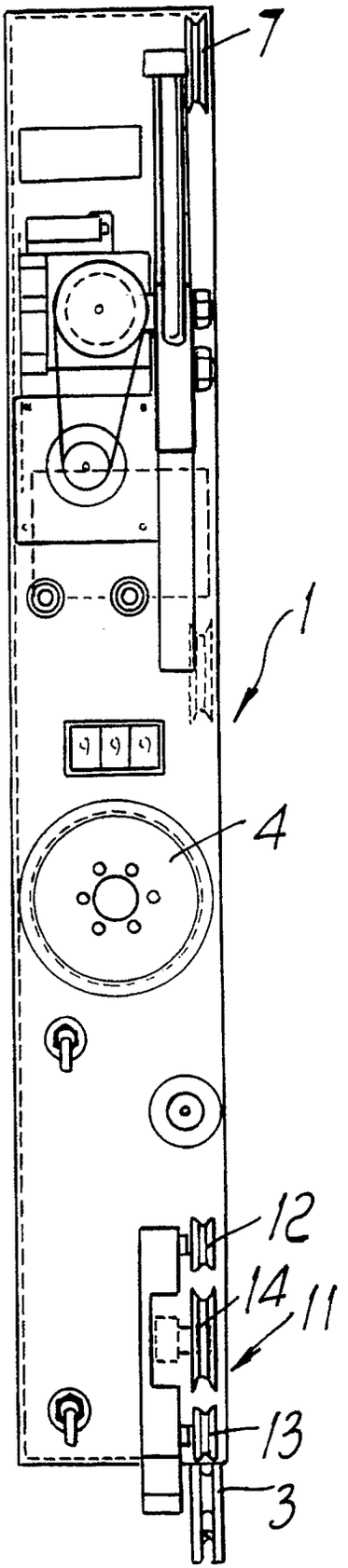

Fig.2

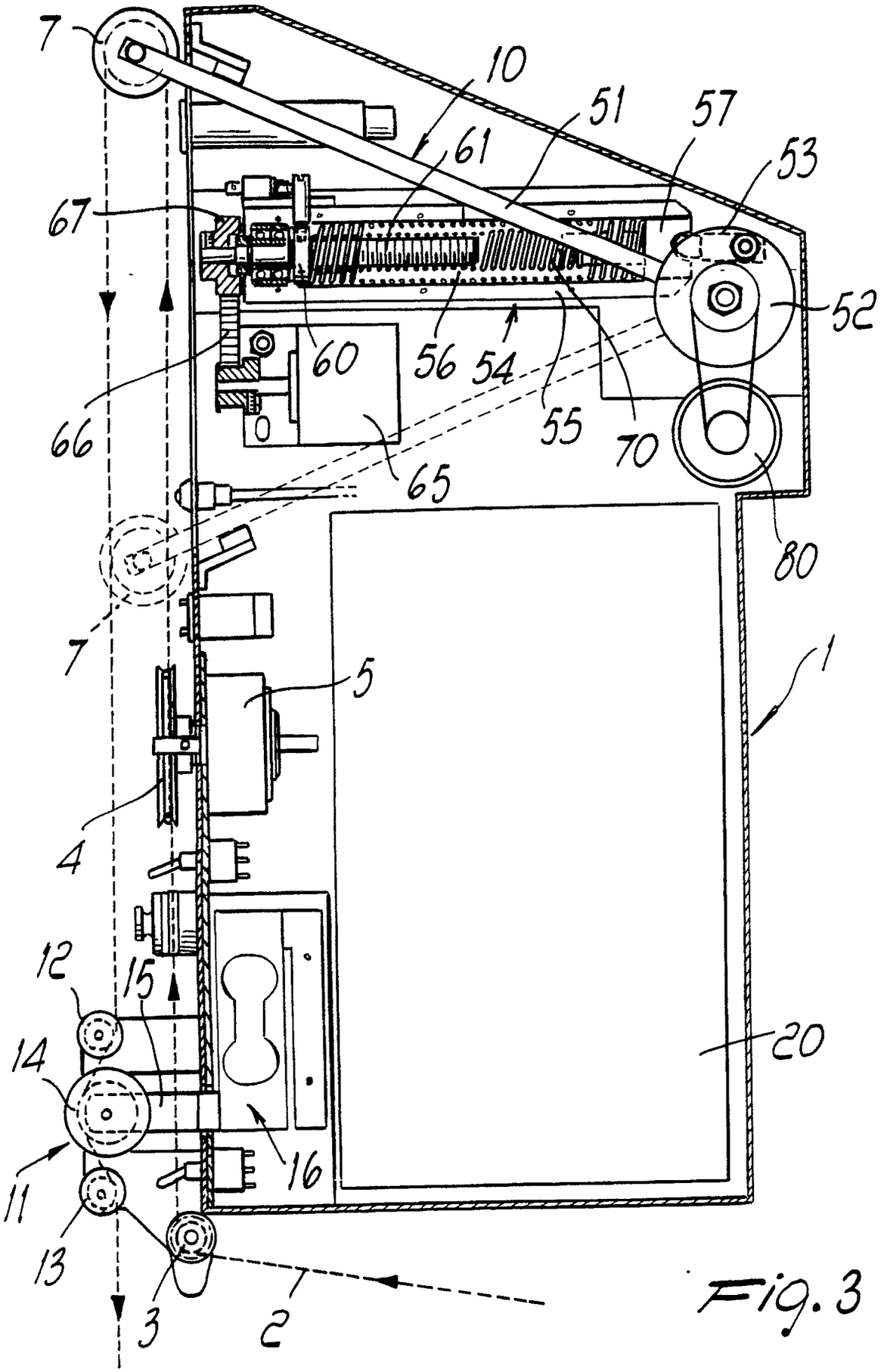
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Fig. 3