CONTROL DEVICE AND COMPONENTS THEREOF FOR ELECTROMOTIVE DRIVE FOR WINDING BOBBINS FOR YARN AND THE LIKE

Filed Nov. 6, 1962 3 Sheets-Sheet 1

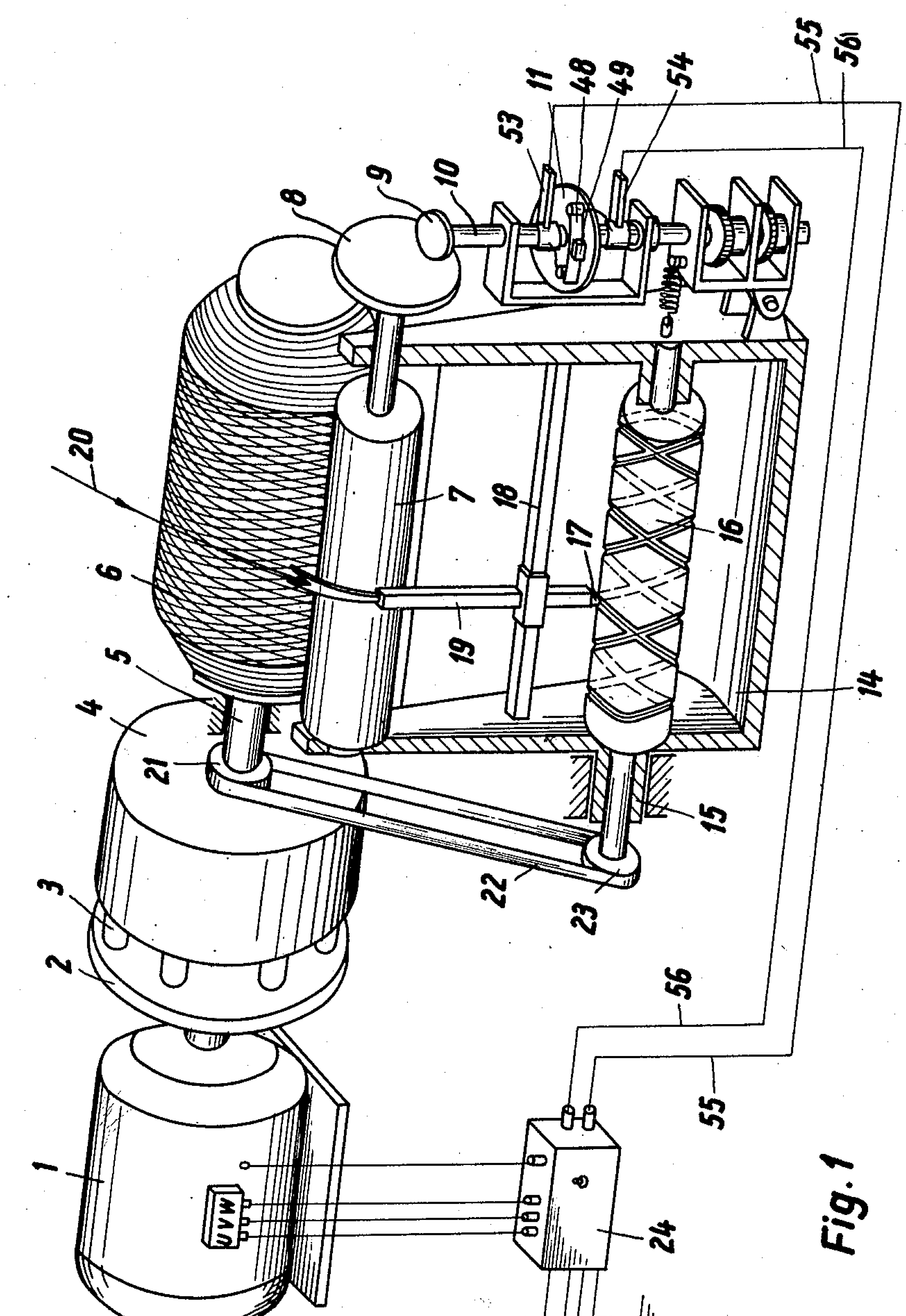

Fig. 1

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CONTROL DEVICE AND COMPONENTS THEREOF FOR ELECTROMOTIVE DRIVE FOR WINDING BOBBINS FOR YARN AND THE LIKE

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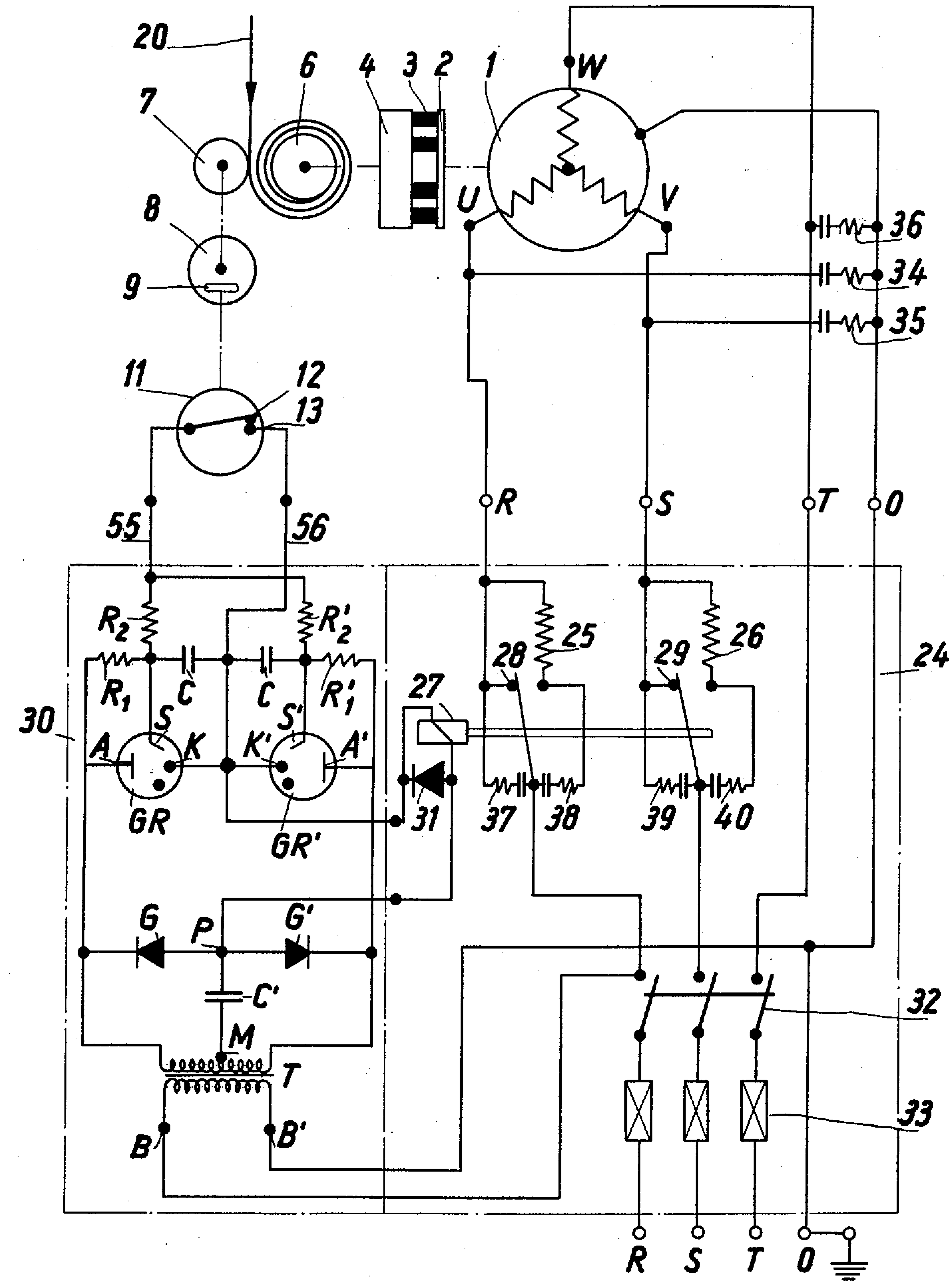

Fig. 2

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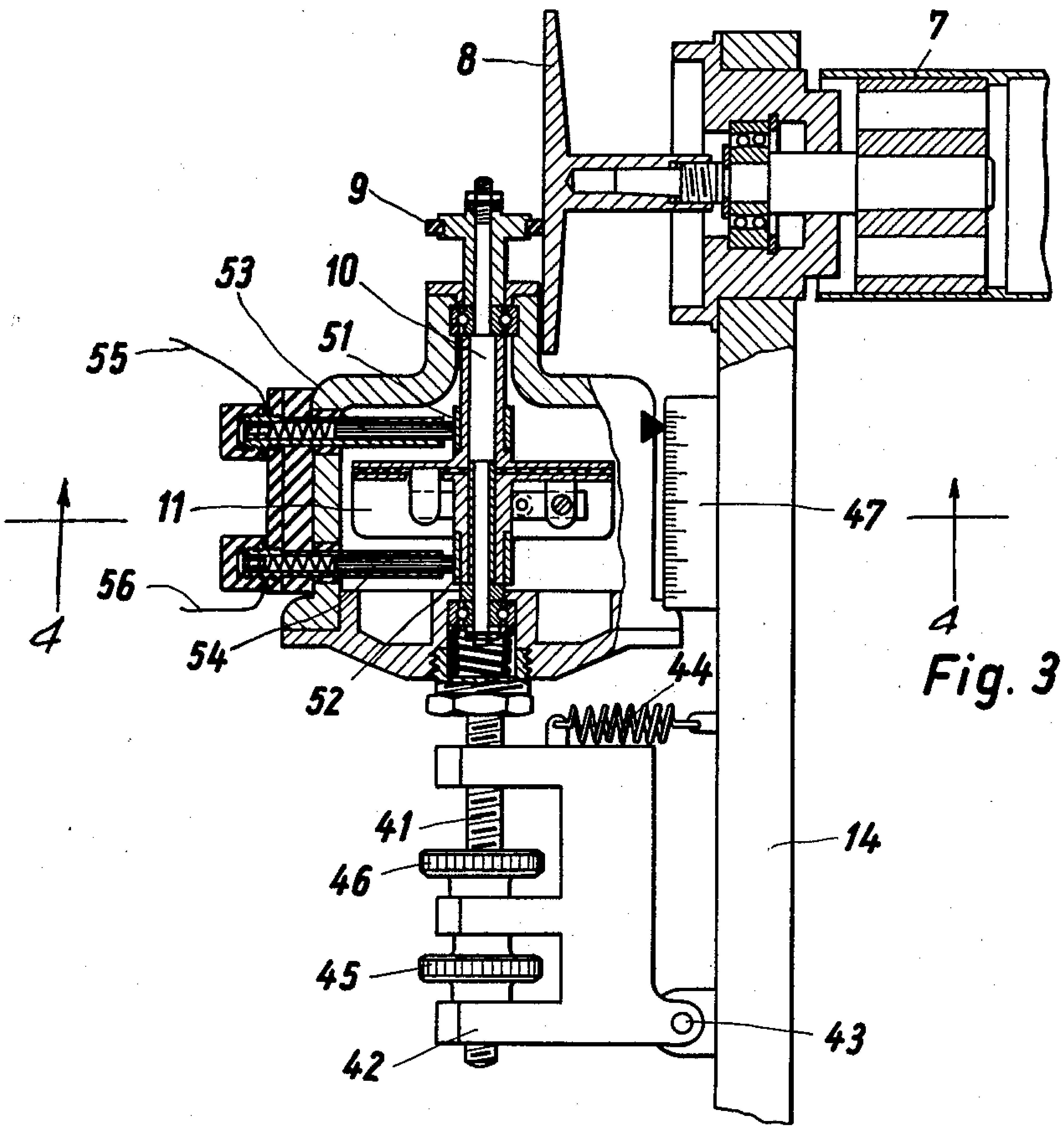

Fig. 3

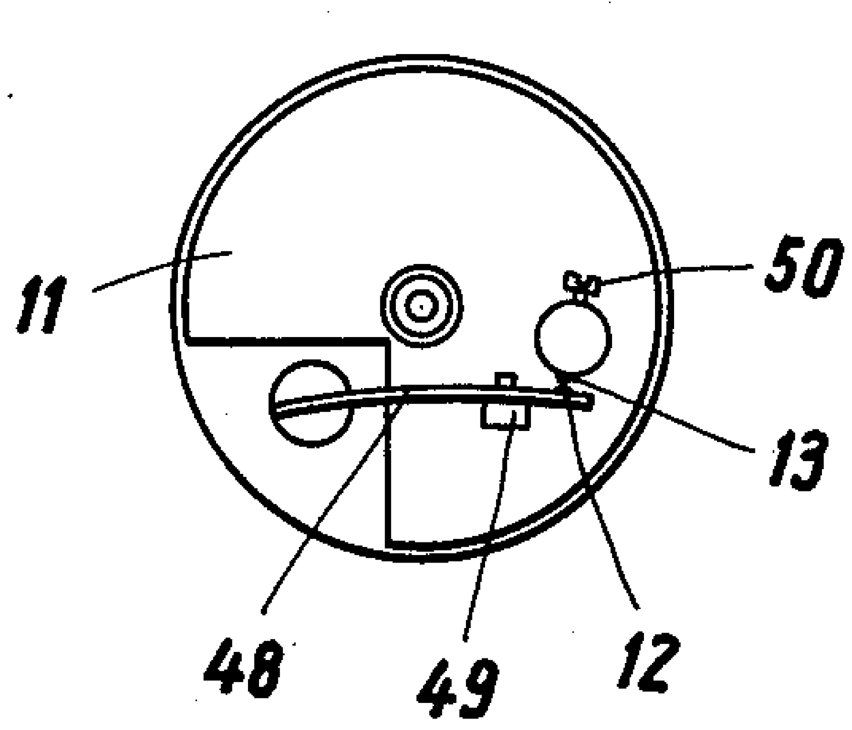

Fig. 4

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CONTROL DEVICE AND COMPONENTS THEREOF FOR ELECTROMOTIVE DRIVE FOR WINDING BOBBINS FOR YARN AND THE LIKE

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The present invention relates to a control device for the electromotive drive of winding bobbins for threads made of synthetic material, wool, cotton or a similar material in conjunction with three-phase current driving motors, and further employs centrifugal governors which are adjustable to various speeds during the running of such motors, for the purpose of achieving a preferably constant winding speed and thus a preferably constant stretching or uniformity of the thread.

If, while winding up the thread, the diameter of the bobbin is increased and the winding speed or the peripheral speed shall remain constant, the revolutions per minute of the bobbin must be accordingly reduced. A centrifugal governor is driven by a follower roller which bears against the bobbin and is thereby driven by friction. The centrifugal governor is set to a certain speed; if this speed is surpassed by a certain amount, the electric contacts of the centrifugal governor open, whereas the contacts of the centrifugal governor close if the speed of rotation falls by a certain amount below the pre-adjusted speed. As the diameter of the bobbin increases and the speed of rotation of the bobbin remains constant, the follower roller would rotate accordingly faster. This, however, is not permitted by the centrifugal governor, since it immediately switches off when the speed of rotation of the follower roller increases. In this way, as the diameter of the bobbin increases and the speed of rotation of the centrifugal governor remains constant, the speed of rotation of the wind-up bobbin is more and more reduced so that the winding speed remains constant.

It is one object of the present invention to provide a control device, which solves this control problem. The control is better, the smaller the distance between the upper and lower speeds of rotation in a given speed range and the smaller the intervals of the switching actions are. It will be understood without further explanations that the quality of the control is dependent on the quality of the electric switching means used for the control device, on the acceleration and deceleration of the driven masses which take place during the control, and on the rapidity of the switching action.

A device is already known, wherein a centrifugal governor is directly arranged upon the shaft of a follower roller, the latter of which bears against a wind-up spool or bobbin and is thereby driven, and by means of switching members periodically bridges the series resistance of a motor branch circuit of a direct current motor or a single phase alternating current motor. Since the electric contacts of the centrifugal governor open or close in accordance with the speed of rotation of the follower roller, such act upon the supply circuit of the drive motor for the wind-up bobbin or upon an auxiliary circuit coupled with the supply circuit, for example, by means of a relay or another suitable switching element, so that by virtue of the switching-in and switching-out the series resistance of the drive motor the desired regulation occurs.

A control device has also been proposed for application with three-phase current short-circuit rotor motors. Such three-phase current short-circuit rotor motors have proven themselves to be cheapest and most reliable for the most varying fields of application, since they neither possess commutators nor slip rings. Furthermore, they have proven to be advantageous in that their speed of rotation can be regulated within a very large speed range, without detracting from their output. If a three-phase current short-circuit rotor motor is employed, as the drive motor for the winding bobbin, the three conductors of such motor leading to its three phases are connected with three actuatable switch members, which are synchronized with respect to one another for simultaneous interruption of the current flow in such three phases.

These switch members are controlled by the centrifugal governor driven by the speed-regulated shaft. The three windings of the stator of such three-phase current short-circuit rotor motor are arranged in star connection and the neutral or star point is connected to earth. The switch members for the synchronous control coupled to the three conductors can be formed as a single relay provided with three work contacts, or comprise three transductors or electronic switches. Furthermore, capacitors and/or resistors may be arranged in the current circuit between the working contacts of the switch member and the phase windings of the three-phase current motor for spark extinguishing or unloading of the contacts.

Such control device has not proven to be useful in practice since normal relays were used and these were not able to achieve the required quick sequence of switching operations. Furthermore, such control action deteriorated owing to wear of the contacts particularly on the centrifugal contact governor and, in addition, the intervals between the switching operations became longer and inaccurate. In such a known control device the centrifugal contact governor directly actuated the relay without any increase in power, whereby a large drop of potential was created over the centrifugal contact governor, while opening the contacts so that a corresponding voltaic arc or spark was drawn. This burning-off very soon caused changes on the contact surface and therefore a disadjustment of the centrifugal contact governor.

Furthermore, a very disturbing drawback of the proposed control device was the lack of a flywheel mass as, during the control operation, the winding bobbin which is of rather light weight was accelerated too fast when the current was switched on and decelerated too fast when the current was switched out, so that the control curve was undesirably steep at the start and between the regulating steps. Furthermore, a quite considerable expenditure of switching members is necessary in order to control all three phases of the three-phase current short-circuit rotor motor by means of switching members.

It is another object of the present invention to provide a control device which improves the control for the drive of winding bobbins for threads made of synthetic material, wool, cotton or similar material by a three-phase current short-circuit rotor motor by reducing the expenditure of switching members and by improving the latter.

It is a further object of the present invention to provide a control device which provides the possibility to reduce such an expenditure of the switching members in that with one embodiment of the invention only two phases of the three-phase current short-circuit rotor motor are connected through the switch members, whereas the third phase is directly connected with the power supply or network. With the interlinking of the three stator windings of the three-phase current motor the desired control effect is faultlessly achieved through the control of only two phase windings which are provided with suitably arranged switch members. If the two of the phases are switched out, then the motor is switched over. The star point remains free of the potential. If the interlinking of the three stator windings is made in form of a star connection, the star point must not be connected to earth; only the casing of the motor is connected to earth.

No switching off of the two phases takes place by the contacts 28 and 29, rather the insertion of a resistance on each of the two phases. The current is thereby reduced and the number of revolutions is reduced. The switching on and off of the machine is brought about by the switch 32.

In the known device the centrifugal governor is rigidly connected with the follower roller. A considerable disadvantage of such an arrangement resides in the fact that only a single speed can be controlled or achieved with such a rigidly arranged centrifugal governor, and neither an adjustment because of a deviation in the winding speed occurring during operation nor a readjustment to another speed range is possible. Only with the condition of rest of the machine can the centrifugal governor be adjusted, or exchanged for another, in order to obtain the desired speed of operation. Periods of inactivity of the equipment are of course undesirable because they result in a reduction of production capacity.

Such a disadvantage of known devices is effectively overcome by employing the teachings of the present invention wherein the centrifugal governor is provided with a friction wheel or roller which is driven by a friction disk operatively secured to the follower roller, and wherein the centrifugal governor is displaceably arranged radially to the friction disk. By means of a finely threaded spindle and a scale provided for the radial displacement, it is possible to achieve a sensitive adjustment of the wind-up speed during the running of the machine.

It has already been mentioned that the small flywheel mass of the driven parts is a very disturbing feature of the known and/or proposed control devices for the drive of wind-up bobbins. This causes undesirable oscillations of the running speed at the start of the winding operation when the bobbin or spool is empty, which cannot be avoided in spite of the quickest control impulses. The large starting torque of the three-phase current motor results, in conjunction with small gyrating masses or working loads of the rotating members, in undesirable speed amplitudes and exceptionally high stress reversal of the members secured to the shaft. This disadvantage can be avoided in accordance with the present invention in that between the three-phase current motor and the drive of the bobbin there is coupled a flywheel which is connected with the motor by means of an elastic or resilient coupling. The elastic coupling in cooperation with the flywheel absorbs the hard cut-in or starting impacts, stores the received energy and slowly returns the same. Thus, the starting curve becomes less steep in ascent, the control amplitudes become smaller and also gentler in ascent.

The relay is actuated by the centrifugal contact governor by means of a contact protection circuit. Thus, the current load on the contacts of the centrifugal contact governor which has up to now been several milliamperes is now reduced to 2 or 3 microamperes. Now, the current load no longer results in a wear of the contacts of the centrifugal contact governor, the life of the latter depending solely on the mechanical deformation of the contacts. The contacts of the centrifugal contact governor operate faultlessly without breakdown spark and without sticking together.

The contact protection circuit which in itself has been known, but has not yet been used for this purpose, allows to connect only a relay of low inductivity, since high inductivities would result in backfiring in the cold cathode tubes which are used in the contact protection circuit. These backfirings are avoided by the arrangement of a rectifier parallel to the relay.

The relay being used is an easily switchable special relay, the details of which are described further below.

Accordingly, it is yet another object of the present invention to provide a control device for the electromotive drive of winding bobbins for threads which permits of a substantially constant wind-up speed and a substantially constant stretching of the thread or yarn for the entire bobbin or spool.

It is still a further object of the present invention to provide an improved control device for the drive of a yarn bobbin enabling readjustment of the yarn winding speed during the winding operation.

It is also a still further important object of the present invention to provide an improved control device for the electromotive drive of wind-up spools or bobbins for threads, which is highly reliable in operation and permits of speed control of the winding operation with a high degree of accuracy and within a very exacting speed range.

It is yet another object of the present invention to provide an improved control device for the electromotive drive of winding bobbins for threads and the like, which drive is a three-phase current short-circuit rotor motor.

It is also a further object of the present invention to provide an improved control device for winding bobbins including means for absorbing the starting impacts, to prevent or minimize the occurrence of undesirable speed amplitudes and high stress reversal of members secured to the drive motor shaft.

It is also a still further object of the present invention to provide an improved control device for winding bobbins, including a control circuit for actuating a relay or suitable arrangement, which control circuit includes a contact protection circuit and is responsive to the action of a centrifugal governor.

It is yet an object of the present invention to provide an improved control device for winding bobbins, which control device employs an easily actuatable relay permitting of a quick sequence of switching operations and having a relatively long operating life.

Still further objects and the entire scope of applicability of the present invention will become apparent from the detailed description given hereinafter; it should be understood, however, that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description. The present invention will be clearly understood in connection with the accompanying drawings, in which:

FIGURE 1 is a perspective view of the control device according to the present invention for the drive of a wind-up bobbin;

FIG. 2 illustrates a circuit diagram of the control device with the drive according to FIG. 1 and according to the present invention employing a two-phase switching of the three-phase current short-circuit rotor motor and a control circuit actuated by a centrifugal governor;

FIG. 3 is a side elevation of the adjustable centrifugal governor, partially in cross-section; and

FIG. 4 is a section along the lines 4—4 of FIG. 3 showing details of the centrifugal switch thereof.

Referring now to the drawings and, more particularly to FIG. 1, wherein a drive is illustrated for a wind-up bobbin with the desired control device, the three-phase current short-circuit rotor motor 1 drives the wind-up spool or bobbin 6 by means of the coupling disk 2, the elastic or resilient coupling means 3, the flywheel mass 4 and the shaft 5. A follower roller 7 which rolls or rides on the periphery of the wind-up bobbin 6 is provided with a friction disk 8 in engagement with the friction wheel 9 of the centrifugal governor 11 mounted on the axle 10.

The operation of the centrifugal governor 11 the two contacts 12 and 13 of which are electrically connected with the control circuit will be described further below with reference to the FIGS. 3 and 4.

The follower roller 7 is rotatably mounted on the rocker arm or beam 14 whch pivots about the axle 15 during continuous contact of the follower roller 7 with the wind-up bobbin 6 and with increasing diameter of the wound thread package. The cross spindle 16 and the block 17 serve to drive the thread guide 19 moving to and fro on the guide rail 18 and being employed for winding the thread 20 by means of the follower roller 7 in a familiar manner on to the wind-up spool or bobbin 6, distributed over the entire width of the latter. The cross spindle 16 is driven from the fly wheel 4 by means of a belt pulley 21, the belt 22 and the belt pulley 23. The details of the drive for the thread guide 18 do not constitute a part of the present invention, so that no further descriptions thereof are believed necessary.

A box 24 contains the electric switch members provided for the operation and the control of the drive according to the present invention, the control circuit being actuated by the centrifugal governor 11 with a contact protection circuit, and the switching relay. The operation of the box 24 is described in conjunction with FIG. 2.

Referring now to FIG. 2, the electric circuit diagram illustrates the desired control device for the drive of a wind-up bobbin 6. The three-phase current short-circuit rotor motor 1, the coupling disk 2, the elastic or resilient coupling members 3, the flywheel mass 4, the wind-up bobbin 6, the follower roller 7, the friction disk 8, the friction wheel 9, the centrifugal governor 11, and the thread 20, according to FIG. 1 are illustrated only schematically.

The three phases U.V.W. of the three-phase current short-circuit rotor motor 1 are interlinked in star connection, and the star point is not connected to earth but the casing of the motor 1 is connected to earth. In the two phases R and S of the three-phase current network there are provided series resistors 25 and 26, the phase T being directly connected with the motor 1. Furthermore, there is provided a relay 27 with two change-over contacts 28 and 29. The change-over contact 28 lies in the phase R and serves to connect or bridge the series resistor 25, whereas the change-over contact 29 lying in the phase S serves the same object for the resistor 26. The relay 27 is actuated by the centrifugal governor 11 through the control circuit 30 with the contact protection circuit. A rectifier 31 is connected parallel to the relay 27 in order to short-circuit the reverse voltages occurring when the relay is deenergized. Prior to placing the control device into operation the two change-over contacts 28 and 29 of the relay 27 are located in a position in which the series resistors 25 and 26 are not arranged in the path of the current flow.

By means of a switch 32 and three fuses 33 the three-phase current short-circuit rotor motor 1 is connected directly with the three phases R, S and T and the earth conductor O of the three-phase current network and thus switched in. The motor 1 starts running whereby the wind-up spool or bobbin 6 will be correspondingly driven. Due to the winding of the thread 20, which takes place in consequence of the foregoing action, the diameter of the thread package wound onto the bobbin 6 increases. As a result of the continually increasing diameter of the wound thread package with constant speed of rotation of the bobbin 6, the rotational speed of the follower roller 7 continually increases. At the same time the speed of rotation of the centrifugal governor 11 increases. The contact members 12 and 13 of the centrifugal governor 11 which have been correspondingly adjusted are caused to open upon reaching a predetermined upper speed of rotation, whereby the current flow produced in the control circuit 30 and flowing through the relay 27 is interrupted. Consequently, the contact members 28 and 29 of the relay 27 simultaneously open, so that the resistors 25 and 26 are now connected with the two phases R and S. This results in a reduction of the voltage in these current circuits and, therewith, a reduction of the speed of rotation of the drive motor 1. The resistors 25 and 26 are so dimensioned that, upon their switching in, a rest current remains and the speed of rotation of the motor 1 decreases to about 20% of its nominal value. As a result, the speed of rotation of the bobbin 6 and the speed of rotation of the follower roller 7, the speed of the latter of which is dependent upon the rotational speed of the bobbin 6, is reduced until the centrifugal governor 11 again closes its centrifugal contacts 12 and 13.

It is possible to employ other switching members in place of the relay 27 provided with the switch contacts 28 and 29; for example, premagnetized iron-core choke coils (transductors) or electronic switches.

The provision of series arrangements consisting of resistors and capacitors designated by the reference numerals 34, 35 and 36 between the three phases U.V.W. of the stator winding of the motor 1 and the neutral conductor illustrates a possible arrangement for spark extinguishing and switch unloading. The same purpose is served by the series arrangements consisting of a resistor and a capacitor with the reference numerals 37, 38, and 39, 40 connected with the switch contacts 28 and 29 of the relay 27.

Now, the details of a possible construction for the control circuit 30 with the contact protection circuit are described. A substantially similar type of control circuit, but however not employed in combination with a centrifugal governor and not with the general arrangement herein described, is disclosed in the German Patents 1,049,498 and 1,054,177, in which Otto Hinrich Blunck, one of the applicants, has been named as the inventor, and owned by the assignee of this application. Referring now to FIG. 2, it will be appreciated that a suitable alternating voltage is applied to the inlet terminals B and B′ of the control circuit 30. With the centrifugal contacts 12 and 13 in open position after the centrifugal governor 11 has reached its upper speed of rotation to which it has been preadjusted, and with positive phase, that is B is positive and B′ negative, almost the entire voltage is applied between the anode A and the cathode K of the glow discharge tube GR (e.g. cold cathode tube).

The rectifiers G and G′ connected in parallel to the glow discharge tubes GR and GR′ serve as voltage dividers, since the rectifier G in this phase is high-resistive, whereas in contrast thereto the rectifier G′ is low-resistive. On the other hand, practically the entire voltage drop at the high-ohm resistors R_2, R_2' and R_1' appears as the ignition voltage between the control electrode S′ and the cathode K of the glow discharge tube GR, so that with a suitable relationship of $R_1:(2R_2+R_1)$ the glow discharge tube GR ignites. The current flows from this glow discharge tube through the relay 27 and the low-resistive rectifier G′ of this phase to the terminal B′ of the transformer T.

With a negative phase, that is terminal B is negative and terminal B′ positive, the glow discharge tube GR′ ignites. The manner of operation of the circuit with negative phase is similar to the previous description of the positive phase, and one need merely replace the non-primed reference numerals with the primed reference numerals and vice versa. The relay 27 thus has a pulsating direct current (inverted alternating current) flowing therethrough which is similar to that produced by a full-wave rectifier. There is thus produced a sawtooth-like current in which no longer every second tooth is missing. Thus the relay 27 is caused to respond when the contacts 12 and 13 are open. Upon response of relay 27 the contacts 28 and 29 are caused to switch over, the resistors 25 and 26 are connected with the phases R and S of the motor circuit, and the motor 1 is caused to decrease its speed of rotation until the centrifugal governor 11 runs so slowly that its contacts 12 and 13 again close.

If the contacts 12 and 13 are closed the potential difference between the control electrodes S° or S′ and the cathodes K or K′ is reduced, since the voltage now only drops across the high-ohm resitsors R_1 and R_2 or R_1' and

R_2'. With a suitable selection of the relationship $R_1:R_2$ the result can be achieved that the voltage drop at the resistor R_2 is not sufficient for igniting the glow discharge tube GR. Consequently, the current flow through the glow discharge tube GR is interrupted and the relay 27 is released, since the current flow over the contacts 12 and 13 of the centrifugal governor 11 is only equal to several microamperes. Additionally, the control circuit 30 is provided with a capacitor C′ coupled between the center-tap M of the secondary winding of the transformer T and the common junction or contact point P and connected with the relay 27 and the rectifiers G and G′. This capaictor C′ is particularly effective in preventing false ignition of the glow discharge tubes as well as malfunctions in the circuit. The rectifier 31 which is coupled across the relay 27 serves to intercept the backlash potential or counter-voltage resulting upon current interruption.

In the contact protection circuit consisting substantially of the control circuit described above for actuating a relay, two glow discharge tubes in push-pull arrangement are employed for using both phases of an alternating current. The arrangement of rectifiers parallel to the glow tubes makes such that the full operating voltage is applied to the glow tube to be ignited, whereas the other glow tube is short-circuited. In order to achieve a safe response of the relay independently of the phase position, a capacitor is arranged between the common switchpoint of the relay and the two rectifiers on the one side and the potential middle of the applied alternating current voltage on the other side. Each of the glow discharge tubes has control electrodes and the switch means of the control circuit include a relay having two simultaneously actuable work contacts. The contact protection circuit includes further resistor means with the control electrodes of each of the glow discharge tubes, and also a transformer having a primary and a secondary winding and connected with input terminals of the control circuit, the secondary winding having a center tap and a capacitor is connected between the common junction and the center tap of the secondary winding of the transformer.

In FIGS. 3 and 4 there are shown details of a possible construction of the centrifugal governor 11 used in the control device according to FIGS. 1 and 2. Arranged on the shaft of the follower roller 7 is a friction disk 8 for the friction wheel 9 of the centrifugal governor 11 with the two centrifugal contacts 12 and 13 mounted on the axle 10. In this manner the rotational movement of the follower roller 7 is effectively transmitted to the friction disk 8 and the friction wheel 9 thereby driving the centrifugal governor 11. In the desired embodiment illustrated the centrifugal governor 11 is provided in the extension of the axle 10 with a threaded rod 41 mounted upon the housing of the centrifugal governor 11 and thereby supporting the centrifugal governor 11 in the bearing block 42. This bearing block 42 is rotatably mounted upon the rocker arm 14 by means of a hinge 43, so that the axle 10 of the centrifugal governor 11 and the axle of the follower roller 7 are disposed vertically upon each other and the friction wheel 9 is free to ride or roll on the friction disk 8. The centrifugal governor 11 is maintained in this position by means of the spring 44 which at the same time provides for urging the friction wheel 9 against the friction disk 8, which is required for a faultless operation. The radial adjustment of the centrifugal governor 11 with respect to the friction disk 8 takes place by displacing the entire centrifugal governor 11 in the direction of the axle 10 in the bearing block 42 by means of the threaded rod 41 which is supported at three positions of the bearing block 42. The displacement of the centrifugal governor 11 in direction of the axle 10 is further made possible by the knurled nut 45 which is so arranged in the bearing block 42 that it cannot be moved in the direction of the axle 10; consequently, when the knurled nut 45 is turned the threaded rod 41 and thus the centrifugal governor 11 are displaced in direction of the axle 10. A second knurled nut 46 serves as a locking nut in order to secure the threaded rod 41 and thus the centrifugal governor 11 in the position adjusted.

Arranged between the centrifugal contact governor 11 and the rocker arm 14 is a scale member 47 having divisions or markings thereon in accordance with the circumferential speed of the wind-up bobbin or spool 6. The farther the friction wheel 9 on the friction disk 8 is moved outwards, the slower the wind-up bobbin 6 must rotate and the lower will be the circumferential speed thereof with the same adjustment of the centrifugal contact governor 11.

The centrifugal governor 11 is provided with two contacts 12 and 13 of which, for example, the contact 12 is arranged on the free end of a fixed leaf spring or so called regulator spring 48 with the balance weight 49. The pre-load or bias of the regulator spring 48 and thus the speed to be controlled can be adjusted by means of a set screw 50.

The contacts 12 and 13 are connected with the two slip rings 51 and 52 which are insulatedly arranged upon the axle 10. In order to provide a conductive connection between the rotating contacts 12 and 13 and the stationary control circuit 30, there are provided two carbon brushes 53 and 54 which press upon the two slip rings 51 and 52 and are coupled with the electric control circuit 30 through the electric conductors 55 and 56.

The relay 27 is an easily actuatable special relay which has become known under the designation "reed relay" and was described, for example by R. A. E. Fursey in the article "Sealed Contact Reed Relays" in "Electronics" on July 31, 1959. Such relays have contacts hermetically sealed in a glass tube, the ferromagnetic contact reeds of which switch under the influence of a magnetic field. The glass tube contains in its lower part a certain volume of metallically highly pure mercury which rises upwards on the suitably formed contact reed due to the capillary effect and continuously wets the contact surface with a thin film of mercury. This film of mercury on the contact is renewed with every switching operation. The switching point, being protected by an atmosphere of inert gas and coated with a thin film of mercury, is not exposed to any adverse external influence so that, in addition to a relatively low contact resistance, a very high number of switching operations without contact chatter and a very long operating life of the contact tube are guaranteed.

It is obvious that the power required for switching the relay is dependent upon the number of the switch contacts to be moved. Since only two switch contacts are required with a two-phase control, the power required for carrying out the switching operation is lower than with three switch contacts, the latter being required for the switching of three phases.

The application of such a relay in the desired control device according to the FIGS. 1 and 2 results in the following advantages: The lower the moving mass of the relay is, the faster will be the sequence of the switching operations, the shorter will be the intervals between the switching operations and the better will be the control operation itself. Up to now it has been possible to obtain a control accuracy up to 10% of the speed of rotation adjusted, now a control accuracy of 0.3% or ±0.15% of the speed of rotation is achieved.

It should thus be appreciated that the described control arrangement is readily suitable for effectively controlling the winding operation of the material to be wound in order to obtain an approximately uiform wind-up speed and stretching of the material. Furthermore, the winding speed can be adjusted during the winding operation, without requiring stoppage of the machine.

While we have disclosed one embodiment of the present invention, it is to be understood that this embodiment is given only by way of example and not in a limiting sense, the scope of the present invention being determined by the objects and the claims.

We claim:

1. A control device for the electromotive drive of winding bobbins for threads made of synthetic material, wool, cotton or similar material, comprising

a winding bobbin receiving thread to be wound thereon,

a three-phase current short-circuit rotor motor including a stator having three phase windings and a casing having a motor shaft,

means connected with said motor shaft for rotating said winding bobbin,

an electric circuit connected with said three-phase windings of said stator of said three-phase current short-circuit rotor motor,

said electric circuit including a control circuit,

a centrifugal governor electrically coupled to said control circuit,

resistor means in two phases of said three-phase windings rendered operative in response to a predetermined speed of said governor,

follower roller means engaging and driven by said winding bobbin and operatively connected with said centrifugal governor,

said centrifugal governor including means for opening said control circuit in response to a predetermined speed,

said control circuit including a contact protection circuit means and also including means actuable upon opening said control circuit upon reaching said predetermined speed of said centrifugal governor for connecting said resistor means with said two of said three-phase windings,

power supply means connected with said three-phase windings,

said three-phase windings of said stator of said three-phase current short-circuit rotor motor being connected in star arrangement, and

said motor casing being grounded,

whereby a predetermined uniform speed of winding of said thread is brought about.

2. The control device, as set forth in claim 1, wherein said actuable means of said control circuit comprises

a relay having two simultaneously actuable work contacts, and switching means in two phases of said motor circuit for switching in said resistor means.

3. The control device, as set forth in claim 2, wherein said relay has sealed contacts and mercury wetting.

4. The control device, as set forth in claim 3, which includes

a rectifier disposed in parallel with said relay.

5. The control device, as set forth in claim 1, wherein said means connected with said motor shaft for rotating said winding bobbin comprises

a flywheel secured to said motor shaft and

an elastic clutch operatively connected between said flywheel and said three-phase current short-circuit rotor motor.

6. The control device, as set forth in claim 1, wherein

said contact protection circuit includes a pair of glow discharge tubes connected in push-pull arrangement, and

a rectifier disposed in parallel with each of said glow discharge tubes.

7. The control device, as set forth in claim 6, wherein

each of said glow discharge tubes has control electrodes,

said switch means of said control circuit include a relay having two simultaneously actuable work contacts,

said contact protection circuit further includes resistor means connected with said control electrodes of each of said glow discharge tubes, and

said rectifiers are connected with said relay by means of a common junction.

8. The control device, as set forth in claim 7, wherein

said contact protection circuit further includes a transformer having a primary and a secondary winding and connected with input terminals of said control circuit,

said secondary winding has a center-tap, and

a capacitor connected between said common junction and said center-tap of said secondary winding of said transformer.

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MERVIN STEIN, *Primary Examiner.*

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