

Aug. 30, 1966

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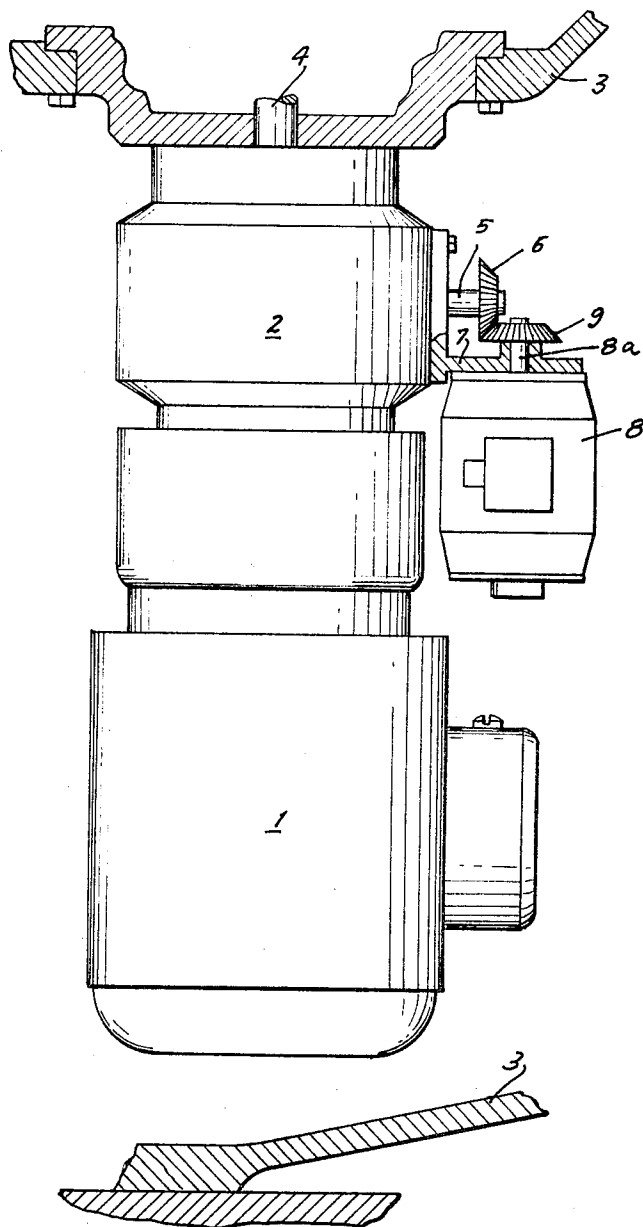
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VARIABLE KNITTING MACHINE DRIVE

Filed Aug. 6, 1964

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FIG. 1



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VARIABLE KNITTING MACHINE DRIVE

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FIG. 2

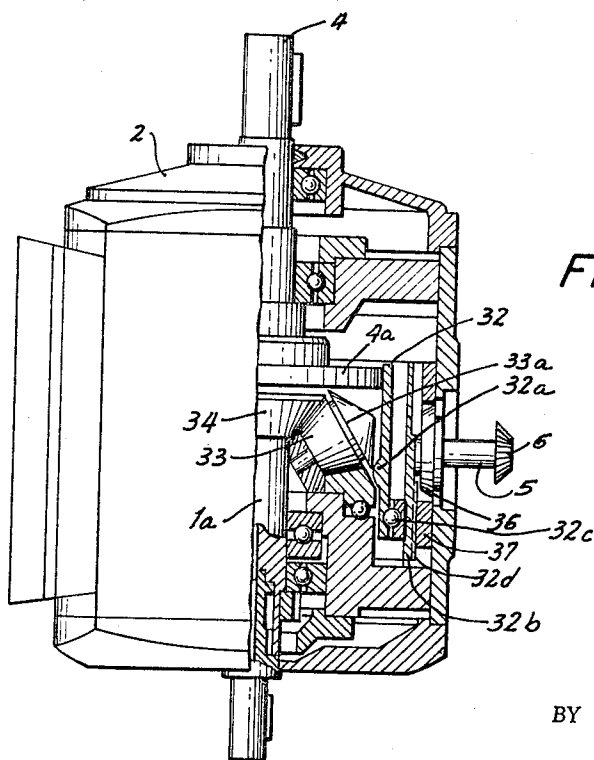
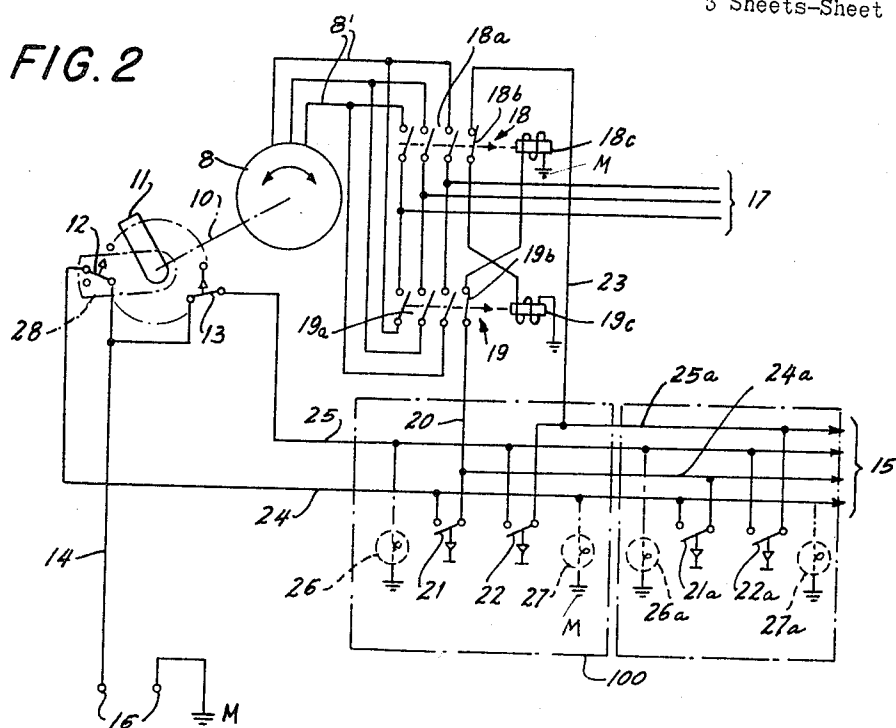


FIG. 3

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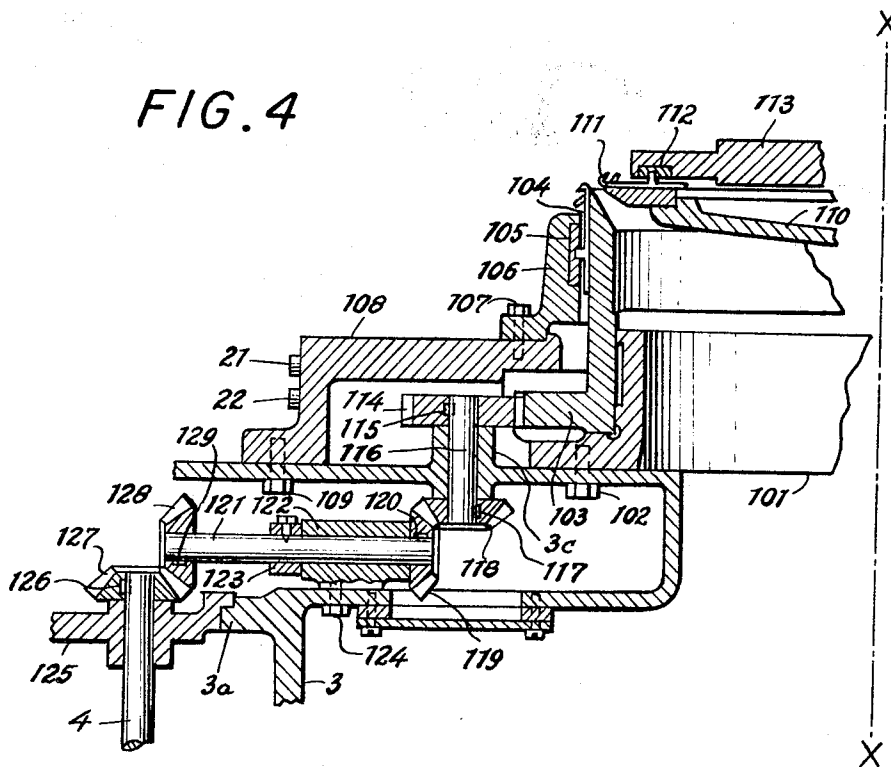
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VARIABLE KNITTING MACHINE DRIVE

Filed Aug. 6, 1964

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FIG. 4



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VARIABLE KNITTING MACHINE DRIVE

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Filed Aug. 6, 1964, Ser. No. 387,832

Claims priority, application Germany, Aug. 7, 1963,

M 57,748

14 Claims. (Cl. 74—675)

The present invention relates to a knitting machine drive, and more particularly to a circular knitting machine provided with an infinitely variable drive.

Circular knitting machines operate at a predetermined high working speed, which corresponds to a maximum rotary speed of the needle cylinder, and in interlock machines also to a maximum speed of the dial. However, it is sometimes necessary to reduce the rotary speed of the needles in the cylinder, or of the needle cylinder and dial, to such a low speed that the operation of the needles is slowed down to such an extent that it can be observed by the person operating the machine.

If the machine is comparatively small, a drive wheel or gear is manually turned, and if the machine has a large diameter for example an interlock machine, a transmission provided with hand wheels acts on the turnable elements of the machine so that the same can be slowly turned. The person observing the operation of the needles at low speed must, at the same time, turn the hand wheel, which requires great force, and moreover, the operating person is compelled to stand in the proximity of the hand wheel, while observation of needles at another point of the diameter of the machine may be necessary. Even if several hand wheels are provided, it is not possible to mount a sufficient number of hand wheels and associated transmissions around the periphery of the machine to permit the observer to see all needles during the slow motion operation. Due to the fact that the operating person must apply great force to turn the machine, he cannot concentrate on the observation of the needle operation. Another disadvantage of the known manual operations of knitting machines resides in that the knitting machine can be turned substantially at one low speed. It is not possible to vary the speed of the needle operation during observation while the machine is manually turned.

It is one object of the invention to overcome the disadvantages of known constructions for operating machines, particularly knitting machines, at a very low speed, and to provide means for operating a machine by a motor at a very low speed, so that no manual operation is required during observation of machine operations.

Another object of the invention is to provide means for driving a machine, particularly a circular knitting machine, in opposite directions at an infinitely variable speed, which can be adjusted between a normal high operating speed, and a very low speed at which machine operations, and particularly needle operations can be observed in slow motion.

Another object of the invention is to provide means for driving a knitting machine at an infinitely variable speed including a very low speed, and to provide means for adjusting the rotary speed of the machine at several points around the circumferential periphery of the machine so that the operator controlling the speed of the machine can observe any selected part of the machine from suitable points at the periphery of the machine.

Another object of the machine is to provide means for

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normally preventing an adjustment of the drive to a speed exceeding a desired working speed of the machine.

With these objects in view, the present invention relates to an infinitely variable drive for a machine, particularly a circular knitting machine. One embodiment of the invention comprises a drive motor, an infinitely variable transmission including an output shaft for driving the machine, and a movable control element for varying the speed of the output shaft; a reversible control motor for operating the control element of the variable transmission; and manually operable switching means, preferably provided on the housing of the machine in circumferentially spaced position, and electrically connected with the control motor for starting and reversing the same. By operating the switching means, which preferably include pairs of switches for driving the control motor in one or the other direction of rotation, the operator can reduce and increase the speed of the machine, and particularly can cause rotation of the needle cylinder and operations of the needles at such a low speed that the function of the needles can be clearly observed.

If the control motor is disconnected and stopped by operation of the switching means in any position, the variable transmission will drive the knitting machine at a corresponding speed which may be the normal high working speed or a very low observation speed.

The switching means do not require additional space, since the connectors and cables can be easily mounted within the housing of the machine so that only the manually operated switches have to be mounted on peripheral portions of the housing. The circumferential spacing of the manually operated switches would be selected to permit the operator to observe the machine operation from as many points around the perimeter of the machine as is necessary. In this manner, the speed of the machine can be varied, or maintained at a desired low level at any observation point around the circumference of the machine.

In the preferred embodiment of the invention, the control motor operates an actuating member by which two limit switches are actuated to cause stopping of the control motor so that the control element of the variable transmission also stops resulting in rotation of the knitting machine at a certain terminal speed. The two limit switches determine the speed limits of the machine corresponding to the desired high working speed and to a very low observation speed. Preferably adjusting means are provided for adjusting the position of the limit switch which controls the maximum speed of the knitting machine so that the working speed can be selected.

It is advantageous to lock the limit switch arrangement in a selected position corresponding to the maximum working speed so that unauthorized persons cannot increase the working speed of the machine beyond the speed limit set by the supervisor.

The limit switches also prevent damage to the transmission since the control element by which the speed of the output shaft of the transmission is determined, cannot be moved by the control motor beyond its normal end positions corresponding to the limits of adjustment of the variable transmission.

Several switch units are provided around the circumference of the machine housing, each switch unit including first and second manually operable switches which cause, respectively, increase or decrease of the speed of the knitting machine when actuated, and stopping of the

control motor and continued operation of the machine at a constant speed, when released by the operator.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is an elevation, partially in section, illustrating one embodiment of the invention;

FIG. 2 is a diagram illustrating the electric circuit of one embodiment of the invention;

FIG. 3 is an elevation, partially in axial section, illustrating an infinitely variable transmission used in the drive arrangement of the present invention; and

FIG. 4 is an axial sectional view of a circular knitting machine provided with the apparatus of the invention.

Referring now to the drawing, and infinitely variable transmission 2, having an output shaft 4, and a drive motor 1 driving the input shaft 1a, see FIG. 3, of the variable transmission 2, are mounted by means of a flange on the stationary housing 3 of the machine. Output shaft 4 is connected with the main shaft of the machine and drives, for example, the needle cylinder of a circular knitting machine, and also the dial of an interlock machine. As best seen in FIG. 4, a needle cylinder ring 101 is secured to the housing 3 by screws 102. Ring 101 turnably supports the lower end of the needle cylinder 103 which has axially extending channels for guiding cylinder needles 104 which are reciprocated by cams 105 of the stationary cam cylinder 106. Cam cylinder 106 is secured by screws 107 to a stationary ring 108 secured by screws 109 to housing 3 which includes supporting legs, not shown.

A dial 110 supports dial needles 111 for radial movement. Dial cams 112 on a dial cam plate 113 cooperate with the dial needles 111. Dial 110 is rotated in synchronism with needle cylinder 103.

The lower part of needle cylinder 103 has a gear ring meshing with a gear 114. Gear 114 is secured by a key 115 to the vertical shaft 116 which is mounted in a bearing 3c of housing 3. The lower end of shaft 116 is secured by a key 117 to a bevel gear 118 which meshes with a bevel gear 119 secured by a key 120 to a horizontal shaft 121 which is turnable in a bearing 122, but non-movable in axial direction due to a ring 123 fixed on shaft 121. Bearing 122 is secured by screws 124 to the housing 3.

Housing 3 has a flange 3a to which a part 125 of the casing of transmission 2 is secured. Shaft 4, to which bevel gear 127 is secured by key 126, is mounted in a bearing of part 125. Bevel gear 127 meshes with bevel gear 128 on shaft 121, so that the needle cylinder, and thereby the dial, are driven from output shaft 4. A control element, shown to be the shaft 5 with a bevel gear 6 controls the ratio of the infinitely variable transmission 2, bevel gear 6 meshing with a bevel gear 9 on the output shaft 8a of a reversible electric control motor 8 which is mounted on the housing of transmission 2 by means of a bracket 7.

Any variable transmission may be used in the drive arrangement of the invention, and FIG. 3 illustrates an infinitely variable transmission 2 which is available in the trade. The drive shaft 1a of transmission 2 carries a frusto-conical friction wheel 34, which is in frictional engagement with a plurality of planetary frusto-conical friction wheels 33 which are rotatable about the respective axes thereof, and also mounted on a spider structure for revolving about the axis of shaft 1a. An outer friction ring 32 has a cylindrical inner surface whose axis coincides with the axis of shaft 1a and of output shaft 4. A friction wheel 4a on shaft 4 is in frictional engagement with the cylindrical inner surface of the outer friction ring 32. Friction ring 32 has an inner annular projection

32a in frictional engagement with conical friction surfaces 33a of the planetary friction wheels 33. When ring 32 is shifted in axial direction, the ratio of the transmission is infinitely and gradually varied so that the rotary speed of the output shaft 4 is varied between a minimum and a maximum.

The adjustment of friction ring 32 is accomplished by turning movement of the control element 5, 6. Shaft 5 carries a gear 36 cooperating with a gear portion on a cylindrical member 37, which is not movable in axial direction thereof, but is turnable about the axis of shaft 1a and has inner threads meshing with an outer thread 32d on a cylindrical member 32b which is surrounded by member 37 and is non-turnably mounted. A ball bearing 32c coaxial with shaft 1a connects member 32b with ring 32 for movement in axial direction but permits rotation of ring 32 in member 32b so that axial movement of ring 32, and adjustment of the transmission are effected when control motor 8 rotates shaft 5 through meshing bevel gears 9 and 6. In all axially shifted positions of friction ring 32, friction wheel 4a with output shaft 4 are driven at different speeds depending on the position of the annular projection 32a on the friction cone 33a.

When control motor 8 rotates in one direction, the speed of output shaft 4, and of the knitting machine is increased from a minimum to a maximum. When control motor 8 rotates in the opposite direction, the transmission is adjusted by control element 5, 6 to reduce the speed of output shaft 4 from a maximum to a minimum.

The electrical circuit of the apparatus will now be described with reference to FIG. 2. Output shaft 8a and bevel gear 9 of control motor 8 are not only connected to control element 5, 6 of the variable transmission but also to the shaft 10 of a turnable actuating member 11. It will be understood that actuating member 11 is turnable through an angle substantially corresponding to the angle through which control element 5, 6 turns during adjustment of the transmission 2 from maximum ratio to minimum ratio. It is assumed that control motor 8 effects a reduction of the speed when turning in clockwise direction, as viewed in FIG. 2, and an increase of the speed when turning in counter-clockwise direction. Shaft 10 carries a bevel gear, not shown, meshing with bevel gear 9 so as to be rotated in synchronism with control element 5.

Limit switches 12 and 13 are disposed in the circular path of actuating member 11 and actuated by the same in two end positions. Limit switches 12 and 13 are connected by a cable 14 to one terminal of a battery 16, or corresponding source of a low voltage whose other terminal is connected to ground or mass. A cable 15 including a plurality of conductors including conductors 24, 25 which are connected to the limit switches, and other conductors 24a, 25a, is mounted on the housing of the knitting machine extending around the periphery thereof. Cable 15 is preferably located in an annular covered or otherwise closed cavity extending around the housing of the machine.

At places spaced around the circumference of the knitting machine, switch units 100, 100a and so forth, for example, 12 units are provided and connected to cable 15. The positions of the switch units are selected so that an operator can observe any part of the machine while standing in the proximity of one of the switch units.

Each switch unit 100, 100a includes a first manually operated switch 21, 21a, a second manually operated switch 22, 22a, a first signal lamp 26, 26a connected to conductor 25 and to mass or ground M, and a second signal lamp 27, 27a connected to conductor 24 and to mass M.

Control motor 8 has three leads 8' which are, respectively, connected to three contacts 18a of a relay 18 and to three contacts 19a of a relay 19, the relay contacts 18a and 19a being connected to a source of power voltage 17 in such a manner that upon closing of relay contacts

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18a control motor 8 will turn in counter-clockwise direction so that the rotary speed of output shaft 4 of the transmission 2 is increased, while closing of contacts 19a will effect turning of control motor 8 in clockwise direction and a reduction of the rotary speed of output shaft 4. Relays 18c and 19c are connected to ground M and also operate normally closed relay contacts 18b and 19b which are, respectively, connected with windings 19c and 18c. All switches 21, 21a and so forth are connected to each other by conductor 24a and to relay contact 19b by conductor 20. All switches 22 are connected to each other by a conductor 25a, and to relay contact 18b by a conductor 23. Relay contacts 18b and 19b are, respectively, connected in series with windings 19c and 18c of relays 18 and 19. All switches 21 are also connected by conductor 24 to limit switch 12 and all switches 22 are also connected by conductor 25 to limit switch 13. Switches 21, 21a and 22, 22a etc. are normally open, and can be closed by a manual operation, but are biased by springs, not shown, to return to the normal open position upon release by the operator.

The arrangement is operated as follows: The operator may stand at any selected place around the periphery of the knitting machine in the region of one of the switching units 100, 100a of which, for example, twelve may be provided. The position is selected by the operator so that he has a good view at a particular part of the machine which he wishes to observe during operation at a very low speed. The operator depresses manually the button of the respective switch 22, 22a of the respective selected unit, so that the relay winding 19a is energized causing turning of control motor 8 in clockwise direction and adjustment of the variable transmission 2 so that the rotary speed of output shaft 4 and of the needle cylinder of the machine is reduced. The current flows from battery 16 through conductor 14, limit switch 13, conductor 25, switch 22, conductor 23, and the normally closed relay contact 18b to relay winding 19c and energizes the same so that relay contacts 19a close and cause rotation of control motor 8 in clockwise direction. When actuator 11 engages and opens limit switch 13, the circuit is interrupted, relay 19 de-energized and relay contacts 19a opened so that control motor 8 stops in a position in which the variable transmission 2 has been adjusted by control elements 5, 6 in such a manner that output shaft 4 drives the needle cylinder at an extremely low speed at which observation of the needle operations by the operator is easily possible. The operator may also observe the operations of needles during the gradual reduction of the rotary speed of the needle cylinder.

In the event that the operator releases the button of the respective switch 22 while actuator member 11 and control elements 5, 6 of transmission 2 are in an intermediate position, control motor 8 stops in an intermediate position, and the needle cylinder of the knitting machine is driven at an intermediate speed. When the operator again depresses the button of switch 22, the speed is further reduced from the intermediate speed to a lower speed so that observation of the operations at different speeds is possible.

When it is desired to increase the speed of the machine again, switch 21 is actuated, and relay 18 is energized. The current flows from battery 16, through conductor 14, limit switch 12, conductor 24, switch 21, conductor 20, the normally closed relay contact 19b to the relay winding 18c so that contacts 18a close and connect control motor 8 in such a manner to the power voltage 7 that control motor 8 rotates in the opposite counter-clockwise direction whereby control elements 5, 6 of transmission 2 is adjusted to increase the speed of output shaft 4 and of the knitting machine. When switch 21 is released, control motor 8 stops in an intermediate position, since the relay winding 18c is disconnected from battery 16. If switch 21 is held depressed until actuating member 11 engages and opens limit switch 12, relay 18 is de-ener-

gized, opens contacts 18a, and control motor 8 is stopped in a position in which control element 5, 6 has adjusted transmission 2 to drive output shaft 4 and the knitting machine at a high speed corresponding to the normal working speed of the knitting machine. In this manner the speed of the machine can be adjusted from an extremely low speed to the normal working speed.

Limit switch 12, whose position along the circular path of movement of actuating member 11 determines the highest speed of the machine, is movable along this circular path, so that its position can be adjusted. Consequently, the machine will be automatically stopped at the desired high working speed, although the variable transmission 2 would permit further adjustment resulting in an even higher speed of the knitting machine, which higher speed, however, is not desired for normal operations. The adjusting means by which the position of limit switch 12 can be adjusted and secured in an adjusted position, is enclosed in a cover provided with locking means for preventing access by unauthorized persons to the adjusting means of limit switch 12. In this manner, adjusting of the knitting machine to an extremely high speed exceeding the normal high working speed can be prevented by a supervisor. While the output of the machine may be increased by such an excessive speed, it is in the interest of safety of operations to run the machine at a selected high working speed, which should not be exceeded.

While switch 22, 22a is closed, signal lamp 26, 26a is illuminated by current flowing through conductor 25. While switch 21 is actuated, signal lamp 27 is illuminated by current flowing through conductor 24. The signal lamps are extinguished when the respective correlated limit switches 12 and 13 open, so that illuminated signal lamps 26 and 27, which may have different colors, respectively indicate a decrease or increase or the rotary speed of the knitting machine during a period of adjustment of control element 5, 6 and variable transmission 2.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of adjustable drives of machines differing from the types described above.

While the invention has been illustrated and described as embodied in a motor-driven infinitely variable transmission for reducing the speed of a circular knitting machine to an extremely low speed permitting observation of knitting operations, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. Control apparatus for a machine of the type described, comprising, in combination, a drive motor; an infinitely variable transmission including an output shaft for driving the machine and a movable control element for varying the speed of said output shaft; a reversible control motor connected to said control element for operating the same; and manually operable switching means electrically connected with said control motor for starting, stopping, and reversing the same so that the speed of said machine is selectively increased or reduced, and can be set to any selected speed by stopping said control motor.

2. Control apparatus for a knitting machine having a housing, comprising, in combination, a drive motor; a variable transmission including an output shaft for driv-

ing the machine and a movable control element for varying the speed of said output shaft; a reversible control motor connected to said control element for operating the same; and manually operable switching means including a plurality of switch units mounted on said housing spaced about the periphery thereof to permit observation of different parts of the machine, each unit being electrically connected with said control motor for starting, stopping, and reversing the same so that the speed of said machine is selectively increased or reduced, and can be set to any selected speed by stopping said control motor.

3. Control apparatus for a circular knitting machine having a housing, comprising, in combination, a drive motor; a variable transmission including an output shaft for driving the machine and a movable control element for varying the speed of said output shaft; a reversible control motor connected to said control element for operating the same; and manually operable switching means including a plurality of switch units mounted on said housing circumferentially spaced about the periphery thereof, each unit including a first switch for causing rotation of said control motor in one direction of rotation and a second switch for causing rotation of said control motor in the opposite direction, said switches being electrically connected with said control motor for starting, stopping, and reversing the same so that the speed of said machine is selectively increased or reduced, and can be set to any selected speed by stopping said control motor.

4. Control apparatus for a machine, comprising, in combination, a drive motor; an infinitely variable transmission including an output shaft for driving the machine and a movable control element for varying the speed of said output shaft; a reversible control motor connected to said control element for operating the same; manually operable switch means electrically connected with said control motor for starting, stopping, and reversing the same so that the speed of said machine is selectively increased or reduced, and can be set to any selected speed by stopping said control motor; a movable actuator member driven by said control motor to move in opposite directions; and a pair of limit switches disposed spaced along the path of movement of said actuating member so as to be actuated by the same, each of said limit switches being connected to said control motor for stopping the same, when actuated so that the machine operates at a maximum permissible speed or at a minimum speed permitting observation of moving parts of the machine.

5. Control apparatus for a knitting machine having a housing, comprising, in combination, a drive motor; an infinitely variable transmission including an output shaft for driving the machine and a movable control element for varying the speed of said output shaft; a reversible control motor connected to said control element for operating the same; manually operable switching means including a plurality of switch units mounted on said housing positioned to permit observation of different parts of the machine, each unit being electrically connected with said control motor for starting, stopping, and reversing the same so that the speed of said machine is selectively increased or reduced, and can be set to any selected speed by stopping said control motor; a movable actuator member driven by said control motor to move in opposite directions; a pair of limit switches disposed spaced along the path of movement of said actuating member so as to be actuated by the same, each of said limit switches being connected to said control motor for stopping the same, when actuated; and adjusting means for moving one of said limit switches along said path and for securing the same in an adjusted position whereby one end position of said actuator member and one speed limit of said knitting machine are determined so that the machine operates at a maximum permissible speed or at a minimum speed permitting observation of moving parts of the machine.

6. Control apparatus for a knitting machine having a housing, comprising, in combination, a drive motor; an infinitely variable transmission including an output shaft for driving the machine and a movable control element for varying the speed of said output shaft; a reversible control motor connected to said control element for operating the same; manually operable switching means including a plurality of switch units mounted on said housing positioned to permit observation of different parts of the machine, each unit being electrically connected with said control motor for starting, stopping, and reversing the same so that the speed of said machine is selectively increased or reduced, and can be set to any selected speed by stopping said control motor; a movable actuator member driven by said control motor to move in opposite directions; a pair of limit switches disposed spaced along the path of movement of said actuating member so as to be actuated by the same, each of said limit switches being connected to said control motor for stopping the same, when actuated, adjusting means for moving one of said limit switches along said path and for securing the same on an adjusted position whereby one end position of said actuator member and one speed limit of said knitting machine are determined so that the machine operates at a maximum permissible speed or at a minimum speed permitting observation of moving parts of the machine; and locking means for locking said adjusting means in adjusted positions of said actuator member so that operation of said locking means is required for changing said speed limit of the machine.

7. Control apparatus for a circular knitting machine having a housing, comprising, in combination, a drive motor; an infinitely variable transmission including an output shaft for driving the machine and a movable control element for varying the speed of said output shaft; a reversible control motor connected to said control element for operating the same; manually operable switching means including a plurality of switch units mounted on said housing circumferentially spaced about the periphery of the same to permit observation of different parts of the machine, each unit being electrically connected with said control motor for starting, stopping, and reversing the same so that the speed of said machine is selectively increased or reduced, and can be set to any selected speed by stopping said control motor; a movable actuator member driven by said control motor to move in opposite directions; and a pair of limit switches disposed spaced along the path of movement of said actuating member so as to be actuated by the same, each of said limit switches being connected to said control motor for stopping the same, when actuated so that the machine operates at a maximum permissible speed or at a minimum speed permitting observation of moving parts of the machine.

8. Control apparatus for a circular knitting machine having a housing, comprising, in combination, a drive motor; an infinitely variable transmission including an output shaft for driving the machine and a movable control element for varying the speed of said output shaft; a reversible control motor connected to said control element for operating the same; manually operable switching means including a plurality of switch units mounted on said housing, circumferentially spaced about the periphery of the same to permit observation of different parts of the machine, each unit being electrically connected with said control motor for starting, stopping, and reversing the same so that the speed of said machine is selectively increased or reduced, and can be set to any selected speed by stopping said control motor; a movable actuator member driven by said control motor to move in opposite directions; a pair of limit switches disposed spaced along the path of movement of said actuating member so as to be actuated by the same, each of said limit switches being connected to said control motor for stopping the same, when actuated so that the machine op-

erates at a maximum permissible speed or at a minimum speed permitting observation of moving parts of the machine; and adjusting means for moving one of said limit switches along said path and for securing the same in an adjusted position whereby one end position of said actuator member and one speed limit of said knitting machine are determined.

9. Control apparatus for a knitting machine, comprising, in combination, a drive motor; a variable transmission having an output shaft for driving the knitting machine and having a turntable control element for varying the rotary speed of said output shaft, said control element having two end positions corresponding to a maximum speed and to a minimum speed of said output shaft and of the knitting machine; a reversible control motor connected to said control element for turning the same in opposite directions, said control motor having leads; first and second control relays, each relay having a winding and a plurality of first contacts connected with said leads so that said control motor rotates in opposite directions when one or the other of said relay windings is energized; and at least one of switching unit including first and second manually operated switches connected with said relay windings so to energize and deenergize the same whereby the direction of rotation of said control motor is reversed by actuation of said first or second switches, respectively, and the speed of the machine is selectively increased or decreased, and whereby the machine can be set to any selected speed by deenergizing the respective relays and stopping said control motor.

10. Control apparatus for a knitting machine, comprising, in combination, a drive motor; a variable transmission having an output shaft for driving the knitting machine and having a turntable control element for varying the rotary speed of said output shaft, said control element having two end positions corresponding to a maximum speed and to a minimum speed of said output shaft and of the knitting machine; a reversible control motor connected to said control element for turning the same in opposite directions, said control motor having leads; first and second control relays, each relay having a winding and a plurality of first contacts connected with said leads so that said control motor rotates in opposite directions when one or the other of said relay windings is energized; a plurality of switching units positioned to permit observation of different parts of the machine, each including first and second manually operated switches connected with said relay windings so to energize and deenergize the same whereby the direction of rotation of said control motor is reversed by actuation of said first or second switches, respectively, and the speed of the machine is selectively increased or decreased, and whereby the machine can be set to any selected speed by deenergizing the respective relays and stopping said control motor; a turntable actuator member driven by said control motor to turn in opposite directions; and a pair of limit switches disposed along the path of movement of said actuator member so as to be actuated by the same, each of said limit switches being connected with one of said relay windings to de-energize the same in end positions of said actuating member whereby said relay contacts are opened and said control motor stopped so that the rotary speed of the machine cannot exceed selected maximum and minimum speeds, the minimum speed being selected to permit observation of moving parts of the machine.

11. Control apparatus for a knitting machine, comprising, in combination, a drive motor; a variable transmission having an output shaft for driving the knitting machine and having a turntable control element for varying the rotary speed of said output shaft, said control element having two end positions corresponding to a maximum speed and to a minimum speed of said output shaft and of the knitting machine; a reversible control motor connected to said control element for turning the same in opposite directions, said control motor having leads; first and second control relays, each relay having a winding and a plurality of first contacts connected with said leads so that said control motor rotates in opposite directions when one or the other of said relay windings is energized; and a plurality of switch-

leads; first and second control relays, each relay having a winding and a plurality of first contacts connected with said leads so that said control motor rotates in opposite directions when one or the other of said relay windings is energized; and a plurality of switching units positioned to permit observation of different parts of the machine, each including first and second manually operated switches connected with said relay windings so to energize and deenergize the same whereby the direction of rotation of said control motor is reversed by actuation of said first or second switches, respectively, and the speed of the machine is selectively increased or decreased, and whereby the machine can be set to any selected speed by deenergizing the respective relays and stopping said control motor, said first and second switches being biased to assume upon release of the operator a normal position in which said relay windings are de-energized.

12. An arrangement as set forth in claim 11 including a pair of signal lamps connected with said limit switches and said first and second switches and being illuminated when one of said relays is energized to indicate turning of said control motor and adjustment of said transmission in opposite directions, respectively.

13. Control apparatus for a knitting machine having a housing, comprising, in combination, a drive motor; a variable transmission having an output shaft for driving the knitting machine and having a turntable control element for varying the rotary speed of said output shaft, said control element having two end positions corresponding to a maximum speed and to a minimum speed of said output shaft and of the knitting machine; a reversible control motor connected to said control element for turning the same in opposite directions, said control motor having leads; first and second control relays, each relay having a winding and a plurality of first contacts connected with said leads so that said control motor rotates in opposite directions when one or the other of said relay windings is energized; a plurality of switching units spaced about said housing to permit observation of different parts of the machine, each including first and second manually operated switches connected with said relay windings so to energize and deenergize the same whereby the direction of rotation of said control motor is reversed by actuation of said first or second switches, respectively, and the speed of the machine is selectively increased or decreased, and whereby the machine can be set to any selected speed by deenergizing the respective relays and stopping said control motor, said first and second are de-energized; a turntable actuator member driven by said control motor to turn in opposite directions; and a pair of limit switches disposed along the path of movement of said actuator member so as to be actuated by the same, each of said limit switches being connected with one of said relay windings to de-energize the same in end positions of said actuating member whereby said relay contacts are opened and said control motor stopped so that the rotary speed of the machine cannot exceed selected maximum and minimum speeds, positioned to permit observation of different parts of the machine.

14. Control apparatus for a knitting machine having a housing, comprising, in combination, a drive motor; a variable transmission having an output shaft for driving the knitting machine and having a turntable control element for varying the rotary speed of said output shaft, said control element having two end positions corresponding to a maximum speed and to a minimum speed of said output shaft and of the knitting machine; a reversible control motor connected to said control element for turning the same in opposite directions, said control motor having leads; first and second control relays, each relay having a winding and a plurality of first contacts connected with said leads so that said control motor rotates in opposite directions when one or the other of said relay windings is energized; and a plurality of switch-

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ing units mounted on said housing spaced circumferentially about the periphery thereof, each including first and second manually operated switches connected with said relay windings so to energize and deenergize the same whereby the direction of rotation of said control motor is reversed by actuation of said first or second switches, respectively, and the speed of the machine is selectively increased or decreased, and whereby the machine can be set to any selected speed by deenergizing the respective relays and stopping said control motor, said first and second switches being biased to assume upon release of the operator a normal position in which said relay windings are de-energized.

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