June 20, 1967 M. SPINRAD ETAL 3,326,341

VARIABLE SPEED CONTROL FOR KNITTING MACHINE

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FIG. 1

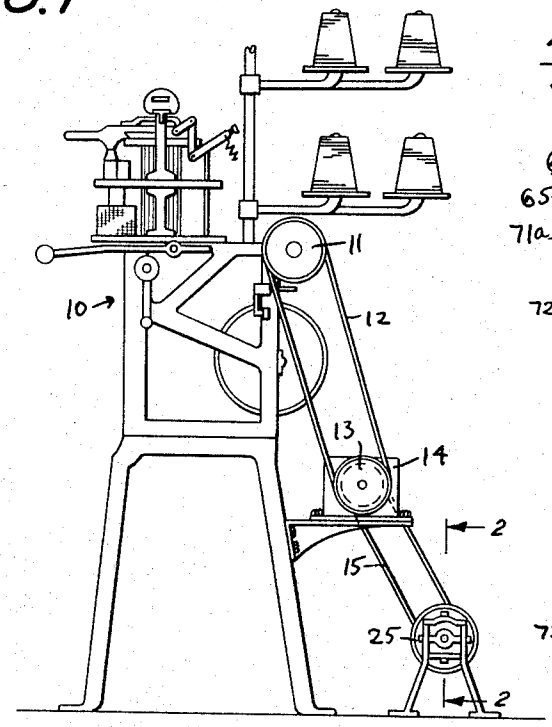


FIG. 3

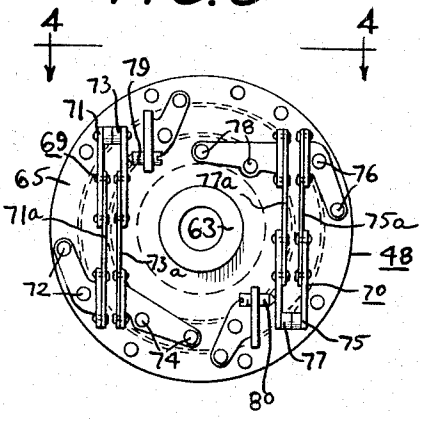
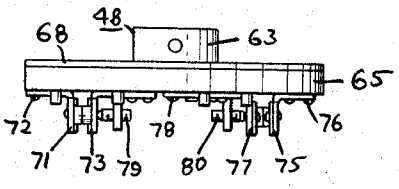


FIG. 4



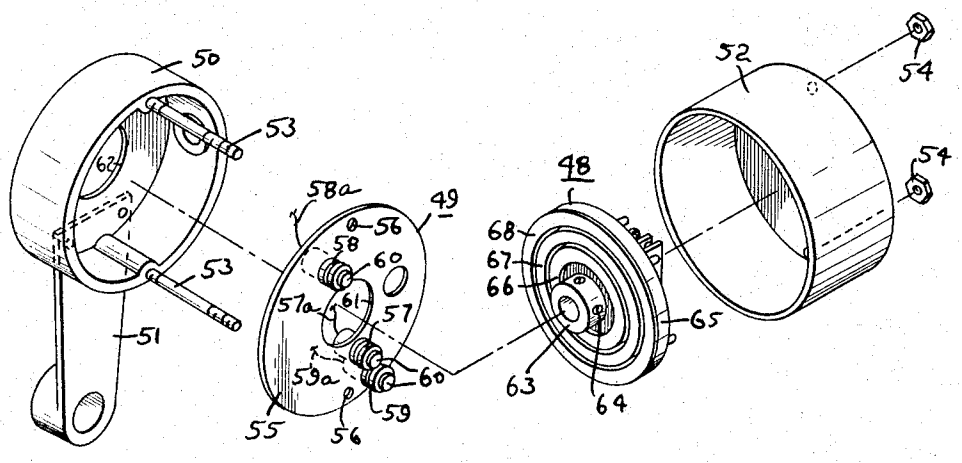


FIG. 5

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VARIABLE SPEED CONTROL FOR KNITTING MACHINE

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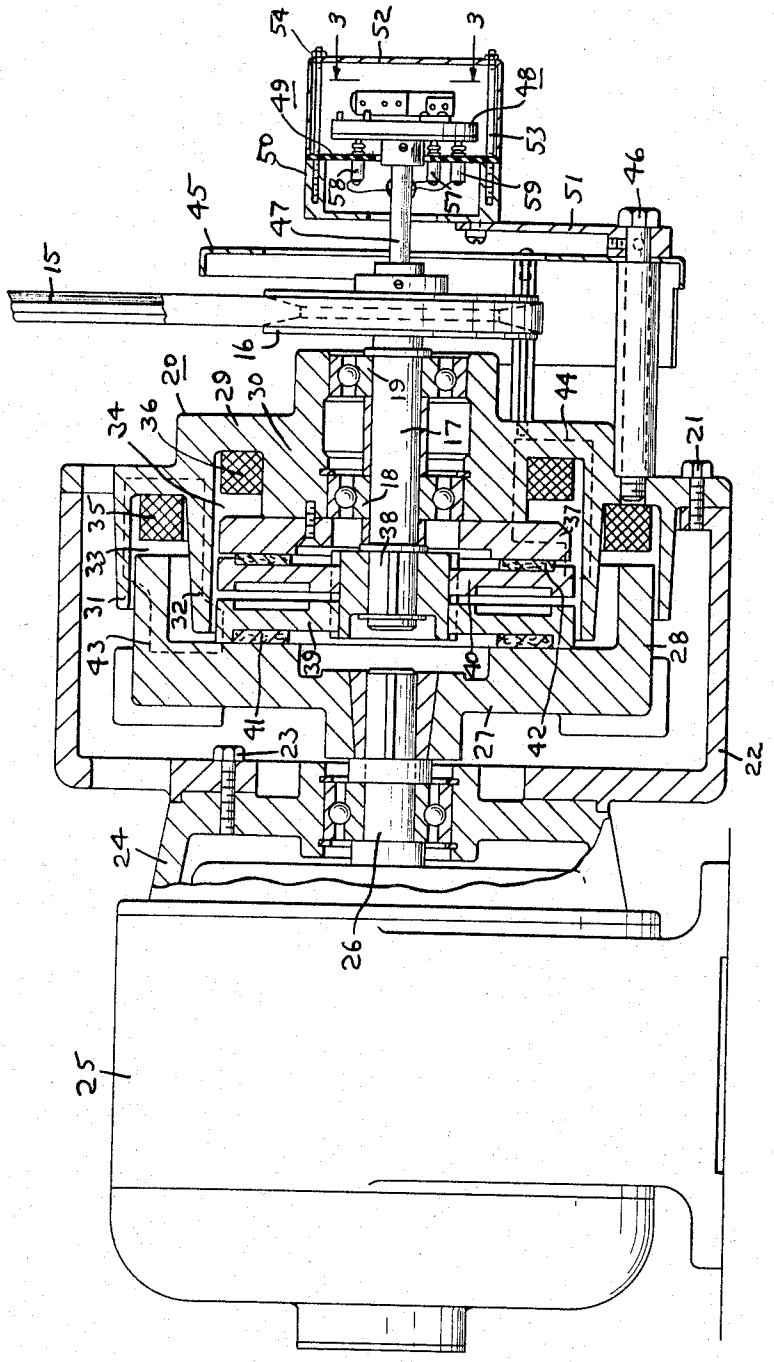


FIG. 2

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VARIABLE SPEED CONTROL FOR KNITTING MACHINE

Filed Oct. 1, 1965 3 Sheets-Sheet 3

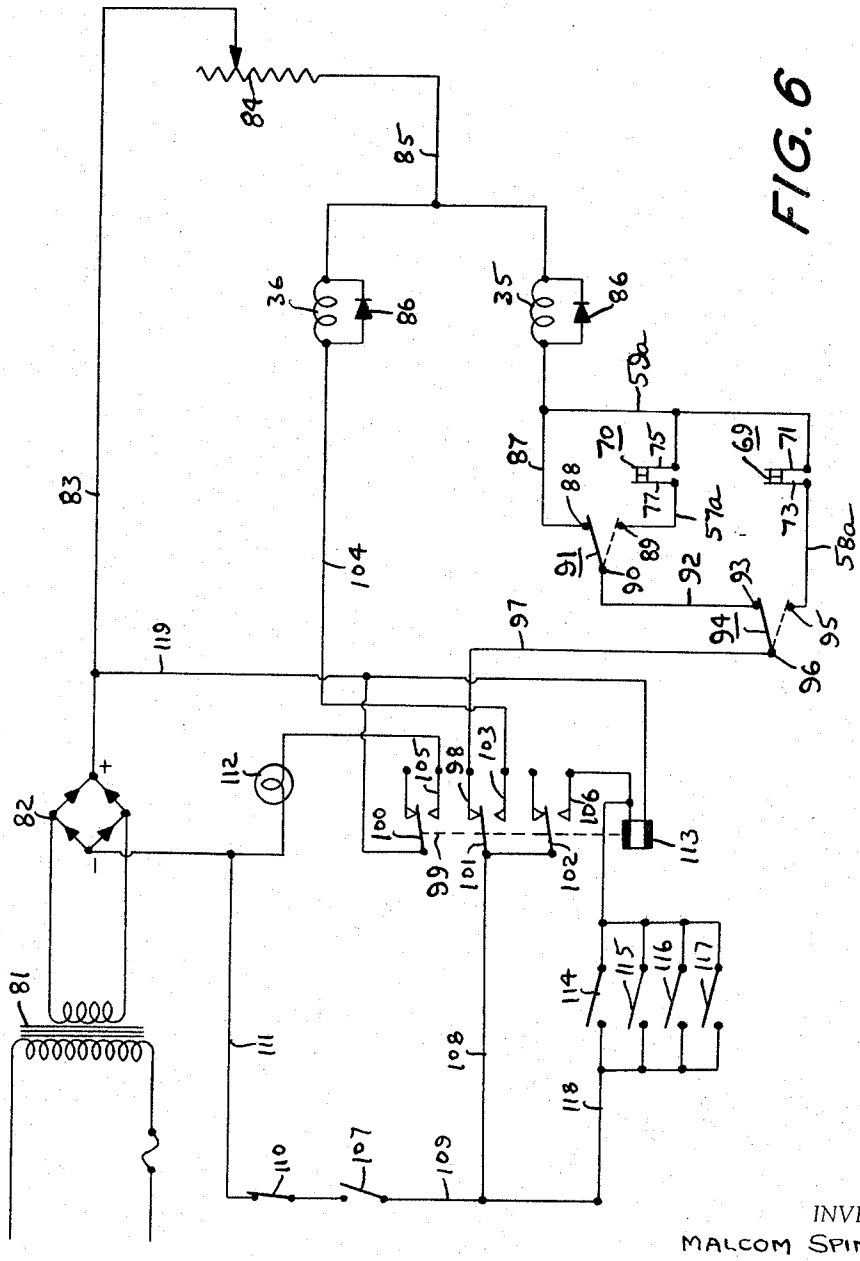


FIG. 6

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3,326,341

VARIABLE SPEED CONTROL FOR KNITTING MACHINE

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10 Claims. (Cl. 192—18)

This invention relates generally to speed control for knitting machines, and more particularly is directed toward speed changing for such machines by electrical control means as distinguished from mechanical pulley or gear changing or hydraulic speed changing devices.

As is well known, circular knitting machines are operated at various different speeds when different portions of a stocking are for example being knitted. By way of illustration, a relatively high speed may be employed for the knitting of welt, leg and foot portions of the stocking while a lower speed is required for heel and toe knitting. Other speeds are also required for pattern drum moves and yarn changes. In the past, speed changing has been generally accomplished by selectively utilizing one of a plurality of different speed drive pulleys, by mechanical gear shifting in a gear control box interposed between a motor or line shaft and the knitting machine drive mechanism, by providing multi-speed electrical motors together with somewhat elaborate electrical control circuitry, or by employing a fluid drive speed changing unit utilizing a fluid motor and pump.

The present invention constitutes an improvement over these systems in that the speed control mechanism is physically small, mechanically and electrically simple, quickly and easily installable to existing equipment and readily inexpensively serviceable in the field. Briefly, the invention contemplates the use of an electrically controlled clutch-brake device operatively disposed between a substantially constant speed motor or line shaft and the drive system of the knitting machine, together with a centrifugally operated governor apparatus which determines the duty cycle of the clutch device to thereby control the coupling of the constantly running motor or line shaft to the knitting machine drive system. Accordingly, it is a primary object of our invention to provide a novel apparatus for driving a rotatable shaft at any one of a number of selectable speeds from a constantly rotating input drive shaft by electrically controlling the mechanical coupling between the two shafts.

Another object of our invention is to provide a novel variable speed control apparatus as aforesaid in which the output shaft is coupled to the input shaft on a time variable basis resulting in a coupling duty cycle between 0% and 100% corresponding to an output shaft speed variable between 0% and 100% of the input shaft speed.

A further object of our invention is to provide a novel speed control apparatus as aforesaid wherein the coupling between output shaft and input shaft is mechanically effected by means of electrical control circuitry including output shaft speed monitoring means and apparatus for programming such monitor means in accordance with the desired output shaft speed at different times in the operating cycle of the work utility or apparatus driven from the output shaft.

The foregoing other objects of our invention will become clear from a reading of the following specification

in conjunction with an examination of the appended drawings wherein:

FIGURE 1 illustrates in end elevation a knitting machine with the speed control apparatus according to the invention operatively coupled thereto;

FIGURE 2 is a vertical sectional view on an enlarged scale through the electrically controlled clutch-brake device and speed control governor portion of the apparatus according to the invention as would be seen when viewed along the line 2—2 of FIGURE 1;

FIGURE 3 is an end view on an enlarged scale of the rotatable portion of the speed governor device as would be seen when viewed along the line 3—3 of FIGURE 2;

FIGURE 4 is a view of the rotatable switch control portion of the apparatus shown in FIGURE 3 taken at right angles to FIGURE 3 as would be seen when viewed along the lines 4—4 thereof;

FIGURE 5 is an exploded perspective view of the switch controlled governor structure, a portion of which is seen in FIGURES 3 and 4, illustrating aspects not clearly visible in the sectional view of FIGURE 2; and

FIGURE 6 is a schematic electrical diagram of the entire speed control system according to the invention.

In the several figures, like elements are denoted by like reference characters.

Turning now to the drawings, consider first FIGURE 1 which illustrates a knitting machine designated generally as **10**, the functioning parts of which are driven from a pulley **11** by means of a drive belt **12** which latter extends downward and is trained about a pulley **13** driven through a gear reduction box **14** from a drive belt **15**. As best seen from FIGURE 2, the drive belt **15** is trained about a pulley **16** fixedly secured upon a drive shaft **17** journaled by ball bearings **18** and **19** in the cup-shaped end bell **20** which is fixedly secured as by bolts **21** to a clutch-brake housing **22**. The housing **22** is fixedly secured by bolts **23** to the frame **24** of an electric motor **25** so that the drive shaft **17** is axially aligned with butt end spaced from the shaft **26** of electric motor **25** which extends into the clutch-brake housing **22** and has fixedly secured upon an end thereof a flywheel **27** formed with an annular cylindrical flange **28** presenting toward the end bell structure **20**.

Th end bell **20** is formed with a main wall **29** having a central hub **30** within which are held the drive shaft ball bearing supports **18** and **19**. Projecting axially toward the flywheel **27** from the main wall **29** of the end bell **20** are a pair of concentric annular cylindrical outer and inner flanges **31** and **32** respectively, an outer annular recess **33** being defined between the flanges **31** and **32** and an inner annular recess **34** being defined between the inner flange **32** and the hub structure **30** of the end bell **20**. Positioned in the base of the annular recess **33** is an electrically energizable annular clutch coil **35**, and similarly positioned within the annular recess **34** is an electrically energizable annular brake coil **36**. Fixedly secured to the inner face of the hub **30** and within the inner cylindrical flange **32** is a brake shoe disk **37**.

The inner end of drive shaft **17** has affixed thereon for rotation therewith a hub **38** upon which is disposed for axial shifting movement with respect thereto a clutch disk **39** and a brake disk **40** provided respectively with friction facings **41** and **42**. The clutch coil **35** when electrically energized sets up a magnetic flux path **43** which causes the clutch disk **39** to shift to the left on shaft hub **38** and

engage constantly rotating motor flywheel **27** to thereby rotate the drive shaft **17** and output pulley **16**. Energization of the brake coil **36** establishes the magnetic flux path **44** which shifts brake disk **40** to the right on shaft hub **38** of drive shaft **17** so that it strongly engages the brake shoe disk **37** to thereby brake the drive shaft **17** to a stop. The output pulley **16** is thus driven by the electric motor **25** when the clutch coil **35** is energized, and is braked to a stop whenever the brake coil **36** is energized.

The output pulley **16** is provided with a pulley guard **45** secured to the end bell **20** as by means of the long bolt **46**. Extending outward through a central opening in the pulley guard **45** is a reduced diameter extension **47** of drive shaft **17** upon the outer end of which is fixedly secured for rotation therewith the rotor **48** of a governor device for controlling the speed of output pulleys **16**. The governor rotor is engaged in an electric circuit with the governor stator **49** which is fixedly carried by a hollow generally cylindrical governor housing **50** mechanically supported by arm **51** secured to the pulley guard **45** and end bell **20** by bolt **46**. The rotor and stator are enclosed by a hollow cylindrical cover cap **52** securable to the housing shell **50** by studs **53** extending from the housing through the cover cap and upon which are threaded nuts **54**.

While FIGURE 2 shows the assembled organization of the governor device, detailed structural aspects of the governor are most clearly understood by referring also to FIGURES 3, 4 and 5. As best seen in FIGURE 5, the stator **49** is formed from an annular circular disk **55** of electrical insulating material, such as phenolic board, and is provided at diametrically opposite edges with holes **56** through which are projectable the studs **53** carried by the housing shell **50** so that the stator disk **55** seats flatwise against the open annular end of the housing shell **50**. Fixedly carried by the stator insulator disk **55** at radially different distances from the center of the disk are inner, intermediate and outer electrical brush holders **57**, **58** and **59** respectively each carrying an electrical contact brush **60**. The stator insulator disk **55** and governor housing shell **50** are centrally apertured as at **61** and **62** respectively to permit passage therethrough of the governor rotor support shaft **47** onto the end of which is projected the rotor hub **63** secured thereon by set screws **64**.

As best seen from FIGURES 3, 4 and 5, the rotor **48** consists of a disk of insulating material **65** to one surface of which are fixedly secured inner, intermediate and outer conductive rings **66**, **67** and **68** respectively. The conductive rings are all insulated electrically from one another and are concentric with the rotor hub **63**. In the assembled governor device as seen in FIGURE 2, the brushes of brush holders **57**, **58** and **59** engage respectviely with the conductive rings **66**, **67** and **68**. As best seen from FIGURES 3 and 4, secured to the opposite side of the rotor insulator disk **65** are two pairs of contact assemblies designated generally as **69** and **70**. The contact assembly **69** includes a first contact arm **71** electrically connected through insulator disc **65** to conductive ring **68** by metal pins **72**, and a contact arm **73** electrically connected to conductive ring **67** by metal pins **74**. Similarly, contact assembly **70** includes a contact arm **75** electrically connected to outer conductive ring **68** by pins **76**, and a contact arm **77** electrically connected to inner conductive ring **66** by pins **78**.

Each of the contact arms includes an intermediate resilient portion which allows the contact arm to flex in a direction transverse to the axis of rotor rotation, these resiliently flexible contact arm portions being designated as **71***a*, **73***a*, **75***a* and **77***a*. The arm sections **71***a* and **75***a* are somewhat more flexible than the arm sections **73***a* and **77***a* so that the centrifugal forces developed at the free ends of the contact assemblies **69** and **70** under conditions of rotor rotation cause contact arms **71** and **75** to shift outward away from the rotor hub at a different rate from that experienced by contact arms **73** and **77**. Consequently, the normally closed contacts at the ends of

contact arms **71** and **73**, as well as arms **75** and **77**, are caused to separate when a sufficiently high rotor rotation has been developed to cause flexure of contact arm sections **71***a* and **75***a*.

Since, with the contacts of contact assembly **69** engaged with one another electrical continuity is maintained between conductive rings **67** and **68** of the rotor, and since this electrical continuity can be broken by causing the contacts of contact assembly **69** to separate when the rotor **48** is rotated at some particular speed, it is apparent that an external electrical circuit connected to the contact assembly through the conductive rings **67** and **68** can be controlled by the speed of the rotor so that circuit continuity exists below a predetermined rotor speed when the contact assembly is closed, and is broken above the predetermined rotor speed when the contacts are open. Similarly, contact assembly **70** functions to control an external electrical circuit connected to rotor conductive rings **66** and **67**.

The particular rotor speeds at which contact assemblies **69** and **70** are caused to open their contacts may be selectively controlled by means of adjustment cones **79** and **80** respectively. Each of the cones **79** and **80** is externally threaded and physically supported in a mount carried by the rotor insulator disk so that the pointed end of the cone **79** bears laterally against the contact arm **73** of contact assembly **69** while the cone **80** is similarly disposed with respect to the contact arms **77** of contact assembly **70**. Rotation of the cones causes the contact arms **73** and **77** to be shifted outward away from the rotor hub **63** and to thereby also carry outward the contact arms **71** and **75**. Such outward movement of contact arms **71** and **75** corresponds of course to progressively higher speeds of rotation of the rotor **48** so that when for example contact arm **71** has been mechanically outwardly shifted by cone **79** to a position which it would not assume until the rotor speed had reached a certain value, then it follows that further outward movement of contact arm **71** will not occur until the actual rotor speed exceeds such value. Thus, the cones **79** and **80** may be used to set the rotor speeds at which the contact assemblies **69** and **70** will open.

With two contact assemblies set to open at different speeds, it is clear that three discrete rotor speed ranges may be established, the first speed range being below the break point of either contact assembly, the second range being above the break speed of one contact assembly but below that of the other, and the third range being above the break speed of the second contact assembly. Similarly, four speed ranges may be provided with three contact assemblies, and so forth as desired.

Recalling from FIGURE 2 that the output pulley **16**, and hence the drive belt **15**, is coupled to the constantly rotating motor flywheel **27** by the clutch disk **39** when the clutch coil **35** is energized, it will now be understood that three different rotational speeds of output pulley **16** may be provided for by controlling the energization of clutch coil **35** in conjunction with the use of governor contact switch assemblies **69** and **70**. By way of illustration, high speed operation of the pulley at the flywheel rate is provided for by constant energization of clutch coil **35** in a circuit which completely bypasses the governor device. Medium speed operation is provided for by energization of the clutch coil **35** through one of the contact assemblies, say contact assembly **70**, at a speed determined by the mechanical setting of rotor control cone **80**. Low speed operation is provided for by controlling energization of the clutch coil **35** through governor contact switch assembly **69** at a speed determined by rotor carried adjustment cone **79**.

Assuming that the continuous flywheel speed provided by electric motor **25** is approximately 1750 revolutions per minute and it is desired to operate the knitting machine **10** at a top speed of approximately 440 revolutions per minute, then the gear reducer **14** would be chosen to provide a four to one speed reduction. Further, if the intermediate and low speeds of the knitting machine are

desired to be approximately 250 r.p.m. and 125 r.p.m., then intermediate speed governor contact assembly **70** would be adjusted to open when the rotational speed of output pulley **16** becomes 1000 r.p.m. while the low speed control governor contact assembly **69** would be adjusted to open at an output pulley speed of 500 r.p.m. Substantially constant machine speed is maintained by rapid opening and closing of the particular operative contact assembly of the governor to cause continual declutching from and reclutching to the high speed motor flywheel **27** at the rate required. This operation is automatic since a rise in output pulley speed above the desired level opens the governor contact assembly to declutch from the flywheel and permit the output pulley speed to begin to coast downward. As soon as the output pulley speed drops below the contact assembly preset speed, the contact assembly recloses and again clutches the output pulley into the high speed flywheel to increase the output speed. This cyclic operation maintains the machine speed substantially constant at the desired pressure value.

Refer now to FIGURE 6 which illustrates in schematic form the electrical control circuitry operative to provide speed control for a device such as the knitting machine **10** by means of the apparatus according to the invention as shown in FIGURES 2 through 5. Alternating electrical current is provided from a source of electrical energy through the transformer **81** to the bridge rectifier **82**. The positive terminal of rectifier **82** is connected via conductor **83** to a current controlling rheostat **84** which is in turn connected via conductor **85** to one end of clutch coil **35** and brake coil **36**, each of the clutch and brake coils being shunted by a reversely poled diode **86**. The opposite terminal of clutch coil **35** is connected via conductor **59***a*, its associated brush assembly **59** and rotor conductive ring **68** to contact arms **71** and **75** of rotor contact assemblies **69** and **70**, while also being connected via conductor **87** to one contact **88** of a single pole double throw switch having a second contact **89** and pole **90**. The switch contact **89** is connected via governor brush holder conductor **57***a* and rotor conductive ring **66** to contact arm **77** of rotor contact assembly **70**. Pole **90** of control switch **91** connects via conductor **92** to one contact **93** of a second single pole double throw control switch **94** having a second contact **95** and a pole **96**, the second contact **95** being connected via conductor **58***a* and the associated governor brush holder **58**, brush **60** and conductive ring **67** to contact arm **73** of rotor contact assembly **69**.

Pole **96** of control switch **94** connects via conductor **97** to a normally closed contact **98** of a relay **99** having three poles **100**, **101** and **102**, contact **98** being engaged by pole **101** when relay **99** is in its deenergized condition. When relay **99** is energized so that the poles thereof transfer, pole **101** disengages from contact **98** and engages contact **103** which is connected via conductor **104** to the end of brake coil **36** which is not connected to conductor **85**. Relay poles **100** and **102** are both normally open circuits when relay **99** is deenergized, engaging respectively with contacts **105** and **106** when the relay becomes energized to transfer its poles.

Relay poles **101** and **102** are electrically tied together and commonly connected to one side of start switch **107** via conductors **108** and **109**, the other side of start switch **107** being returned to the negative side of D.C. power supply **82** through normally closed brake release switch **110** and conductor **111**. Relay contact **105** returns to the negative side of rectifier **82** through pilot light **112**, while relay contact **106** connects to one side of relay coil **113** and also to one side of each of a plurality of normally open switches **114** through **117**, the switches being connected in parallel and having their opposite terminals commonly connected through conductor **118** to conductor **109**. The end of relay coil **113** not connected to relay contact **106** is connected via conductor **119** to the positive terminal of rectifier **82**.

The clutch coil **35** and brake coil **36** are of course physically located inside the housing **22** shown in FIGURE 2, the contact assemblies **69** and **70** are located in the governor device also shown in FIGURE 2, and the control switches **91** and **94** are part of the knitting machine **10** and are caused to transfer their poles at appropriate times during the cycle of machine operation to effect changes in machine speed appropriate to the particular machine operation at that point being carried out. Typically, these control switches **91** and **94** may be actuated and deactuated by machine controlled rotating cams. The switches **114** through **117** are also associated with the knitting machine **10** and are typically cam operated to be selectively closed when it is desired to stop the machine, for example upon breakage of a needle or thread, when the machine is to operate for a single cycle, or for some other stop motion function. The switches **107** and **110**, rheostat **84**, relay **99** and the power supply may be conveniently located at any desired point, which usually will be at the machine itself.

Consider now that the circuit is as indicated in FIGURE 6 with start switch **107** open and control switches **91** and **94** in their solid line positions as illustrated. The knitting machine **10** is quiescent the clutch coil **35** and brake coil **36** are deenergized but the electric motor **25** is energized so that flywheel **27** is rotating at its constant speed of substantially 1750 revolutions per minute. Closure of start switch **107** causes current to flow from rectifier **82** through conductor **83** and rheostat **84** to clutch coil **35**, over conductor **87** and through control switches **91** and **94** to contact **98** and pole **101** of relay **99**, thence over conductors **108** to **111** through switch **107** and **110** to rectifier **82**.

With clutch coil **35** energized, clutch disk **39** is pulled into engagement with flywheel **27** and output pulley **16** is driven at the full flywheel speed corresponding to high speed operation of the knitting machine **10**. With the machine operating, assume that control switch **91** is caused to transfer its pole **90** from contact **88** to contact **89** so that energization of clutch coil **35** can no longer occur over conductor line **87** but must take place via conductor **59***a*, contact assembly **70** of the speed governor and conductor **57***a*. Since contact assembly **70** is for purposes of illustration to cause output pulley **16** to be driven at a rate of 1000 revolutions per minute, it is clear that the substantially higher flywheel rate of 1750 revolutions per minute has necessarily caused the contact arms **75** and **77** to disengage and prevent energization of clutch coil **35**. Consequently, the clutch is disengaged and output pulley **16** immediately slows down due to the load imposed thereon by the knitting machine **10**. As soon as the pulley speed has dropped to the 1000 r.p.m. level, contact assembly **70** closes to reenergize clutch coil **35** and control the speed of output pulley **16** in the manner previously described.

Assuming now that it is desired to further reduce the machine speed for yet a different type of machine operation to the low speed 500 r.p.m. range, control switch **94** is caused to transfer its pole **96** from contact **93** to contact **95** to thereby remove control of clutch coil energization from governor contact assembly **70** and transfer such control to contact assembly **69**. In this manner changes in machine speed are effected throughout the cycle of machine operation by selectively transferring the poles of the control switches **91** and **94**.

When the machine has completed its operation, a stop motion switch such as **114** is caused to automatically close and thereby enable current to flow from rectifier **82** through conductor **119**, relay coil **113**, switch **114** and conductor **118** back to conductor **109** and hence to the return side of rectifier **82**. Relay **99** is thereby actuated causing poles **100**, **101** and **102** to respectively engage contacts **105**, **103** and **106**. Disengagement of relay pole **101** from contact **98** breaks the circuit continuity to clutch coil **35** to thereafter prevent any clutching operation, and engagement of pole **101** with contact **103** energizes brake

coil 36 to thereby immediately brake output pulley 16 to a halt. Engagement of pole 100 with contact 105 lights pilot light 112 to indicate a stop condition of the machine. Engagement of relay pole 102 with contact 106 establishes a holding current circuit for relay coil 113 to maintain the relay energized under conditions where it may be desirable to utilize switches of the momentary-make type as one or more of the switches 114 through 117. With the machine stopped the brake coil 36 may be deenergized by opening the brake release 110. This of course also deenergizes relay 99 and reestablishes the relay conditions illustrated in FIGURE 6.

Having now described our invention in connection with a particularly illustrated embodiment thereof it will be appreciated that modifications and variations of our invention may now naturally occur from time to time to those persons normally skilled in the art without departing from the essential scope or spirit of our invention, and accordingly it is intended to claim the same broadly as well as specifically as illustrated by the appended claims.

What is claimed to be new and useful is:

1. Speed control apparatus for controlling the operating speed of a work utility which is is desired to drive an any of a plurality of selectable different speeds from a constant speed primary drive source, comprising in combination,

a power transmission having a rotary input drive shaft connectable to a constant speed drive source, a rotary output drive shaft connectable to the work utility to drive the latter, and an electrically actuatable clutch effective when actuated for coupling the rotary output drive-shaft to the rotary input drive-shaft, said speed control apparatus comprising in combination,

speed selection electric switch means for selecting any one of a plurality of different speeds at which it is desired to operate a work utility, and speed sensing electric switch means connected in electric circuit with the electrically actuatable clutch and a source of electric power, said speed sensing switch means being operatively coupled to the power transmission rotary output drive shaft for simultaneous rotation therewith and responsive to departure of the output drive shaft rotational speed from the selected desired speed to alter the electric circuit conditions to thereby actuate said clutch means whenever the output drive shaft rotational speed drops below said desired speed and to deactuate the clutch means whenever the output drive shaft rotational speed rises above the selected desired speed.

2. The speed control apparatus as set forth in claim 1 wherein said speed selection switch means further includes means for locking out of said electric circuit said speed sensing switch means and simultaneously continuously actuating the clutch independently of said speed sensing switch means.

3. The speed control apparatus as set forth in claim 1 wherein said speed selection switch means is coupled to and automatically operated by means associated with said work utiilty to thereby provide automatic programmed work utiilty speed selection.

4. The apparatus as set forth in claim 1 wherein the power transmission further includes output drive shaft selectively actuatable brake means, and wherein said speed control apparatus further includes selectively operable means coupled to the actuatable brake means effective when operated to actuate the brake means and quickly brake to a stop the power transmission output drive shaft.

5. Speed control apparatus for controlling the operating speed of a work utiilty which it is desired to drive at any of a plurality of selectable different speeds from a constant speed primary drive source, comprising in combination,

a power transmission having a rotary input drive shaft connectable to a constant speed drive source, a rotary output drive shaft connectable to the work utility to drive the latter, and an electrically actuatable clutch effective when actuated for coupling the rotary output drive-shaft to the rotary input drive-shaft, said speed control apparatus comprising in combination,

(a) a speed control governor including a rotor and a stator, said rotor being mechanically couplable to the transmission output drive shaft for simultaneous rotation therewith and including

(1) speed responsive electric switch means having openable and closable contacts mounted laterally of the rotor rotational axis and so oriented with respect thereto that changes in the centrifugal force exerted on said contacts developed by changes in rotor rotation rate cause the state of said switch contacts to change between closed state and open state,

(2) adjustable means engaged with said electric switch means effective to set the rotor rotation rate at which said switch means contacts change state, and

(3) a plurality of separate electrically conductive rings each of which is electrically connected to a different one of said switch contacts and concentric with the axis of rotor rotation,

said stator being mechanically fixedly positioned adjacent to said rotor and carrying individual electrical contacts each of which is electrically engaged with a different one of said rotor conductive rings,

(b) speed selection electric switch means connected in electric circuit through said stator contacts with said rotor carried speed responsive switch means and connectable with the electrically actuatable clutch and a source of electric power effective to selectably render said speed responsive switch means operative and inoperative for controlling the actuation of the electrically actuatable clutch,

said speed responsive switch means when operative being effective to alter the electric circuit conditions to actuate the clutch whenever the output drive shaft rotational speed drops below said selected speed and being effective to deactuate the clutch whenever the output drive shaft rotational speed rises above the selected speed.

6. The apparatus as set forth in claim 5 wherein said rotor carried speed responsive electric switch means includes at least two independent switches and wherein said adjustable means engaged therewith includes means for independently setting the rotor rotation rates at which the contacts of each rotor switch change state.

7. The apparatus as set forth in claim 5 wherein said rotor carried speed responsive electric switch means includes at least two independent switches and wherein said adjustable means engaged therewith includes means for independently setting the rotor rotation rates at which the contacts of each rotor switch change state, and wherein said speed selection switch means is coupled to and automatically operated by means associated with said work utility to thereby provide automatic programmed work utility speed selection.

8. The apparatus as set forth in claim 5 wherein said speed selection switch means renders the clutch continuously actuated whenever said speed responsive switch means is rendered inoperative by said speed selection switch means.

9. The apparatus as set forth in claim 5 wherein the power transmission also includes output drive shaft selec-

tively actuatable brake means, and wherein said apparatus further includes selectively operable control means coupled to the actuatable brake means effective when operated to actuate the brake to quickly brake to a stop the output drive shaft.

10. The apparatus as set forth in claim **5** wherein the power transmission also includes an output drive shaft selectively electrically actuatable brake, and wherein said apparatus further includes selectively operable control means in electric circuit with the electrically actuatable brake and clutch effective when operated to actuate the brake and deactuate the clutch to quickly brake to a stop said output drive shaft.

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MARK NEWMAN, *Primary Examiner.*

ARTHUR T. McKEON, *Examiner.*

Disclaimer

3,326,341.—*Malcom Spinrad* and *Bryce E. Hoverter, Jr.*, Reading Pa. VARIABLE SPEED CONTROL FOR KNITTING MACHINE. Patent dated June 20, 1967. Disclaimer filed May 28, 1969, by the assignee, *American Safety Table Company, Inc.*

Hereby enters this disclaimer to claims 1, 2, 4, 5, 6, 8, 9 and 10 of said patent.

[*Official Gazette October 14, 1969.*]