

May 20, 1969

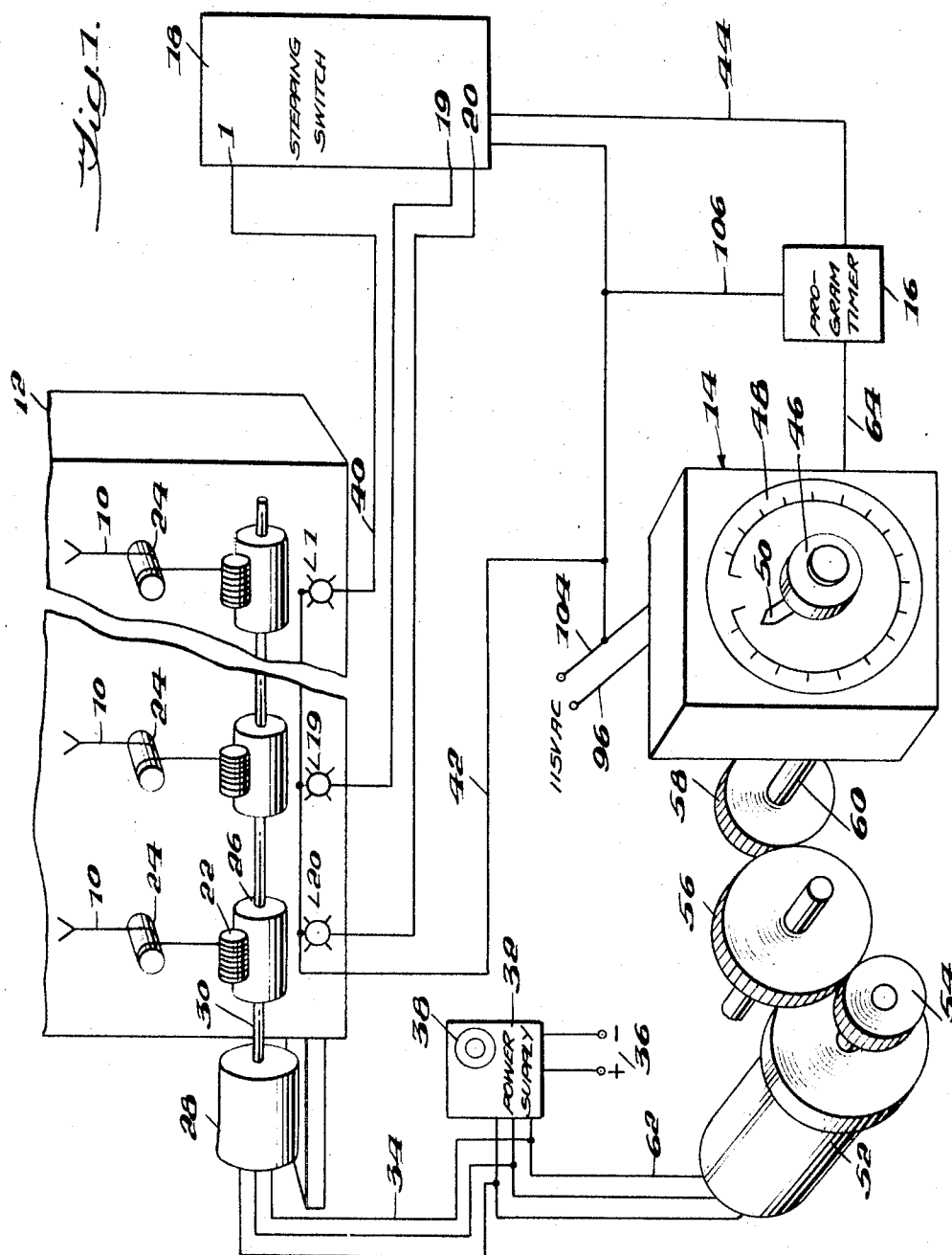
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3,445,837

APPARATUS FOR CONTROL OF PACKAGE WINDING

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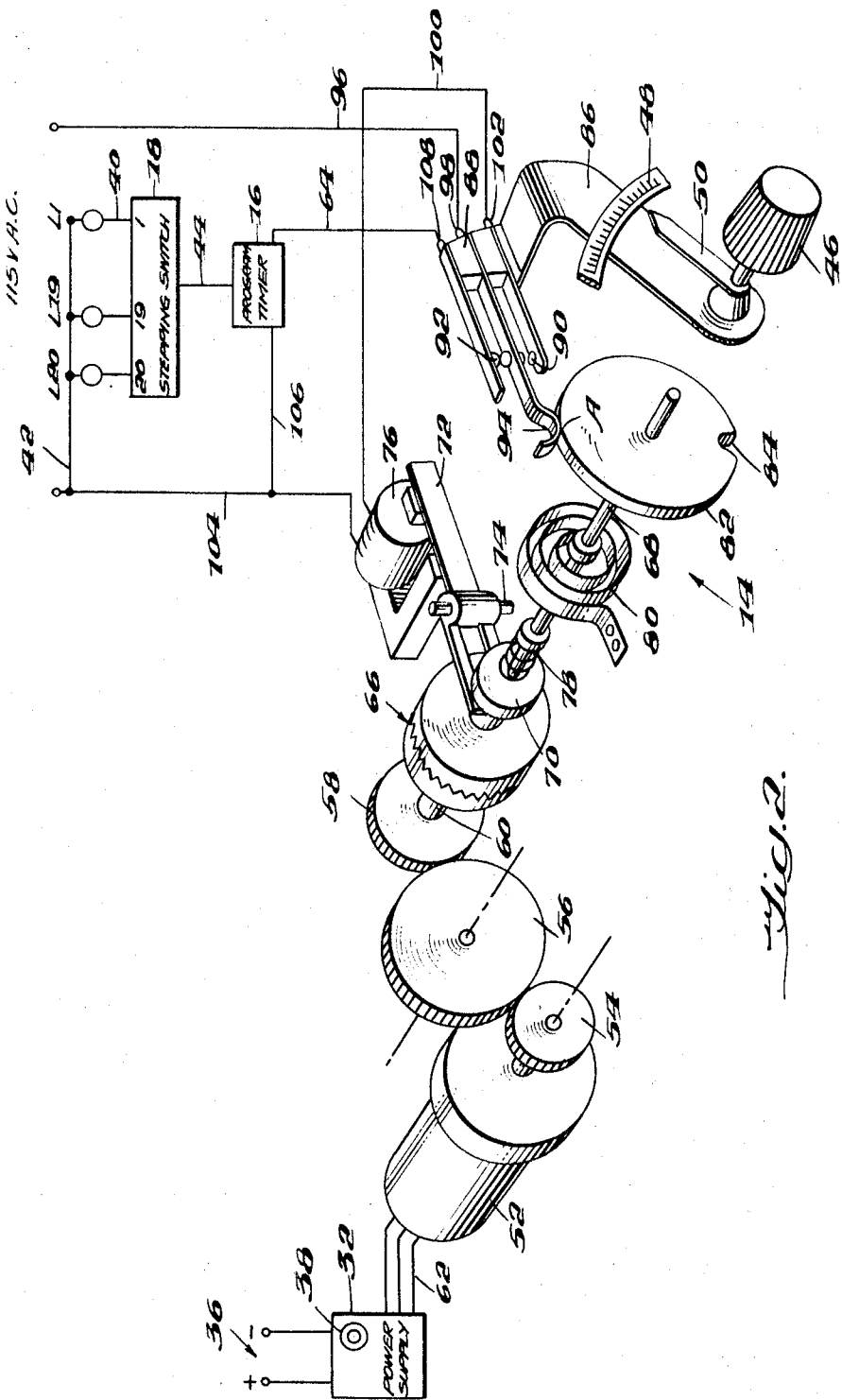


Fig. 2.

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3,445,837 APPARATUS FOR CONTROL OF PACKAGE WINDING

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Filed Apr. 20, 1965, Ser. No. 449,598

Int. Cl. G08b 1/00; D01h 9/14; B65h 63/00

U.S. Cl. 340—309.4

3 Claims

ABSTRACT OF THE DISCLOSURE

A control system for spinning machine windups which includes a winding cycle timer for initiating a programmed display of doff signal lights. The timer motor is connected to the same solid state power source which supplies the windups and follows or tracks variations in windup speed, thus insuring uniformity of package sizes.

This invention relates to spinning machines and in particular to an apparatus for accurately producing the same yardage of spun yarn on all bobbins wound on a multi-position spinning machine.

In the textile industry, a large portion of synthetic fiber production is processed in mill operations that require take-off from a spun yarn bobbin. In these operations, all full bobbins are stocked at the same time and all are removed when the first bobbin runs out. The yarn heels remaining on the bobbins either become waste or must be rewound. Since waste yarn and labor costs increase with increased deviation from the specified yardage, it is highly desirable that all spun bobbins consigned to the same end use be wound with equal yardages of yarn.

Since yarn package size is a function of windup speed and time, uncontrolled variations in either will cause undesirable variations in yarn package size from one spinning machine doff period to another.

Spinning machine windup speeds can be regulated by the application of high accuracy, variable frequency power supplies to the windup drive motors. The apparatus used to regulate package size is a doff cycle timer which, after a preset time period, actuates a program timer to sequentially energize a series of indicating lights mounted at the respective spinning positions. These lights notify an operator when a full spinning bobbin should be removed and replaced with an empty one. The doff cycle timer is usually a pulse or revolution counter that is driven by a Western Union or Naval Observatory master time pulse or by a synchronous clock motor energized from a 110 v. AC line. A master time pulse, although accurate for regulating the doff cycle timer, is not always readily available. In addition, since the single pulse source controls the doffing cycles of all spinning machines in a plant, a failure of this source results in a considerable problem in regulating spinning machine doff cycles until it has been restored. The use of a 110 v. AC synchronous clock motor to drive the timer is not entirely satisfactory because line frequency variations inherent in 110 v. AC supplied by the public utilities cause corresponding variations in the speed of the cycle timer motor, resulting in variable spinning machine doff periods.

The most important object of this invention is to provide a doff timing apparatus for use in combination with multi-position spinning machines which apparatus provides precise automatic doff signals for each bobbin of yarn so as to accurately and consistently produce equal yardages of yarn on successive bobbins regardless of spinning machine speed variations. It is a corollary objective to provide a doff timing apparatus which insures repeatability of the total doff time cycle without reliance on a master time pulse. Another object of the invention

is to provide such an apparatus in which the usual effects of line voltage frequency variations inherent in public utility power are avoided. It is a further object of this invention to provide a doff timing apparatus that can be readily adapted to a wide range of doff cycle time periods. A more particular object of this invention is to provide a doff timing apparatus that will follow or track variations in windup speed corresponding to frequency adjustments in the power supply.

The above objects are achieved in a spinning machine having a 3-phase adjustable frequency and voltage power supply for the drive motors by providing a doff timing apparatus which includes a winding cycle timer comprised of a shaft driven counter and a hysteresis synchronous motor connected to the counter shaft, the timer motor receiving its power from the power supply for the spinning machine drive motors. The cycle timer motor is responsive to voltage and frequency changes in the power supply and, accordingly, changes speed directly with windup speed to insure uniform sized yarn packages.

Additional objectives and advantages will be apparent from the following specification wherein reference is made to the accompanying drawings in which:

FIGURE 1 is a schematic illustration of the doff timing apparatus in association with a multi-position spinning machine; and

FIGURE 2 is a detailed, schematic illustration of the doff timing apparatus.

In the illustrated embodiment, a multi-position machine for spinning and winding yarns 10 has been designated by the number 12. Associated with machine 12, there is a cycle timer 14 which can be manually set to run for a desired doffing cycle (the winding time between successive doffs of the spinning machine) and which energizes a program timer 16 on completion of the winding cycle. The program timer actuates a stepping switch 18 to sequentially energize a series of indicating lights L-1 . . . L-19, L-20 located at the respective windup positions. In this manner, an operator is notified when it is time to remove a full bobbin 22 and replace it with an empty one. Each yarn 10 is advanced from a spinning chamber (not shown) by a driven roll 24 to its bobbin 22 which is surface driven by a roll 26. Each drive roll 26 is coupled to a motor 28 through shaft 30.

Motor 28 is a variable speed, synchronous, reluctance motor which is designed to operate over a frequency range of 12.5-75 c.p.s. It is energized from a three-phase power supply 32 through leads 34. Supply 32 includes a static inverter of the type disclosed by Schmidt in U.S. Patent No. 2,953,735 which produces a polyphase alternating current from a DC source 36. The output frequency from supply 32 and, therefore, the speed of drive motor 28 are adjustable over the operating range of 12.5-75 c.p.s. at control knob 38.

Spinning machine 12 is represented as a twenty-position machine with all rolls 26 driven by one windup motor 28. However, any number of positions may be provided and normally a plurality of windup motors are used to wind segmented sections of the spinning machine. As illustrated, one of the lights L-1 . . . L-19, L-20 is mounted on machine 12 adjacent each spinning position. Each light is connected to a corresponding position on stepping switch 18 as, for example, L-1 through lead 40 to terminal 1. Lead 42 is the common return line for all of the lights. Program timer 16 electrically actuates stepping switch 18 through cable 44. The desired winding cycle is set manually at knob 46 on cycle timer 14 and is indicated on scale 48 by pointer 50. Timer 14 is driven by a 3-phase hysteresis synchronous motor 52 through gears 54, 56, 58 and shaft 60. Motor 52 also receives its power from power supply 32, through leads 62.

As indicated previously, the flexibility required for operation of machine 12 over a wide range of spun deniers is provided by power supply 32 and motor 28. The motor speed corresponding to a given spun denier is obtained by adjusting knob 38 and thereby varying the supply current frequency to motor 28.

Timer motor 52 is a hysteresis synchronous motor similar to those disclosed in U.S. Patents Nos. 2,423,435 and 2,547,599. Although designed to operate synchronously at fixed frequencies, it does in fact operate synchronously, under light load applications, over a range of frequencies without pulling out of step. Motor 52 is designed for operation at sixty cycles but actually operates synchronously over the previously noted range of 12.5-75 c.p.s. Cycle timer 14 counts the motor revolutions. Since motor 52 is energized by the same power supply 32 as windup motor 28, the actual time lapse for a set winding cycle is directly related to windup speed. The range of cycle timer 14 may be varied readily by changing the ratio between gears 54, 56, 58.

Program timer 16 is a model HF54 Polypulse Timer, marketed by Eagle Signal Company. It is actuated by the cycle timer 14 through cable 64 and functions to step switch 18, i.e., to sequentially energize the indicating lights on spinning machine 12. The signal lights go on in fixed one-minute intervals. Duration of the "on" time in each one-minute interval is selected within the program timer 16 to range from fifteen to forty seconds, depending on the time required to remove a full bobbin 22 and replace it with an empty one.

As noted, synchronous motor 52 is coupled to the timing mechanism of cycle timer 14 through gears 54, 56, 58 and shaft 60. Referring to FIG. 2, a clutch 66 couples shafts 60 and 68, which are rotatably mounted in the housing for timer 14. A collar 70 is fastened to shaft 68 adjacent to clutch 66. A forked throw out lever 72 is pivotally mounted to the timer housing by a pin 74, with the forked end of the lever engaging collar 70. The other end of lever 72 is located adjacent to solenoid 76. A coil spring 78 is biased against collar 70. A helical spring 80 is attached to shaft 68 in such a manner as to oppose its clockwise rotation. Cam wheel 82 has a peripheral notch 84 and is also attached to shaft 68. Knob 46 and pointer 50 are attached to the pivoted end of an arm 86. There is a switch 88 mounted to the other end of arm 86, which is rotatably attached to timer housing 14 in axial alignment with shaft 68. Switch 88 has a center spring finger which carries make and break buttons for contacts 90, 92 and also a follower 94. Lead 96 connects one side of the 115 v. AC line to the intermediate terminal 98 of switch 88. Lead 100 through terminal 102 and contact 90 connects solenoid 76 to supply leads 96, 104. Program timer 16 is supplied by leads 96, 104 through leads 106, cable 64, terminal 108, contact 92 and terminal 98.

In operation, the winding cycle is selected by turning knob 46 which rotates arm 86 carrying follower 94 of switch 88 to a desired set point A on cam wheel 82. Cam wheel 82 is rotated clockwise by shaft 68 through clutch 66, shaft 60, gears 54, 56, 58 and motor 52. As cam wheel 82 rotates, notch 84 approaches follower 94. When cam follower 94 drops into notch 84, contact 90 closes, energizing solenoid 76 through leads 96, 100, 104. When energized, solenoid 76 attracts fork lever 72 which moves collar 70 and disengages clutch 66. With the clutch disengaged, reset spring 80 returns cam 82 to the starting position indicated at A and contact 90 is opened, de-energizing the solenoid 76. Spring 78 engages clutch 66 and the cycle timer begins counting the next winding cycle. Simultaneously, contact 92 closes to energize program timer 16 and thereby initiate a signalling sequence for the present doff cycle. In each repetition of its program, timer 16 forwards pulses which step switch 18, energize a signal light and de-energize that light. When stepped to contacts just beyond those corresponding to light L-20, the switch is reset automatically to the ready position and an off-normal switch opens to de-energize

program timer 16. Timer 16 remains in a ready position until completion of the current winding cycle, at which point cam follower 94 first drops into and then rides up out of notch 84, thereby closing contact 90 and the off-normal switch. Program timer 16 and stepping switch 18 are commercially available; construction and operation of these components as such forms no part of the present invention.

The illustrated doff timing apparatus is especially adapted for use as a time measuring device in variable speed processes wherein the process speed is governed by a variable frequency power supply. Since timer motor 52 operates at synchronous speeds over a wide range of voltages and frequencies, accuracy and repeatability of time cycles is readily obtained. The invention need not be limited to the operation of indicating lights as, for example, the timing apparatus disclosed could operate solenoids or other signal devices useful in the regulation of a process. In addition, the range of the timer 14 can be readily changed by modification of the gear train 54, 56, 58. Other changes and adaptations will occur to those skilled in the art without departure from the invention which accordingly is intended to be limited only by the scope of the appended claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A multi-position winding machine comprising: a plurality of drive rolls, each adapted for surface engagement with a yarn package during a winding cycle; a variable speed, three-phase, synchronous drive motor coupled to said rolls; a timing mechanism for indicating completion of the winding cycle; a three-phase, synchronous motor coupled to said mechanism; and an adjustable frequency, three-phase power supply, both motors being connected to said power supply.

2. In a multi-position winding machine including a variable speed drive motor connected to an adjustable frequency, three-phase power supply, a doff signal device at each position, a programmed stepping switch for energizing the signal devices sequentially during a doff cycle and a winding cycle timer having a driven mechanism coupled with the switch for initiation of a doffing cycle, a three-phase hysteresis synchronous motor coupled with said mechanism, said synchronous motor also being connected to said power supply for the drive motor.

3. A multi-position winding machine comprising: a plurality of drive rolls, each adapted for surface engagement with a yarn package during a winding cycle; a variable speed, three-phase, synchronous drive motor coupled to said rolls; a doff signal device associated with each roll; a programmed stepping switch for energizing the signal devices sequentially during a doff cycle; a winding cycle timer having a driven mechanism coupled with the switch for initiation of said doff signal; a three-phase, synchronous motor coupled with said mechanism; and an adjustable frequency, three-phase power supply, both motors being connected to said power supply.

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U.S. Cl. X.R.

57—54; 200—61.13; 242—36