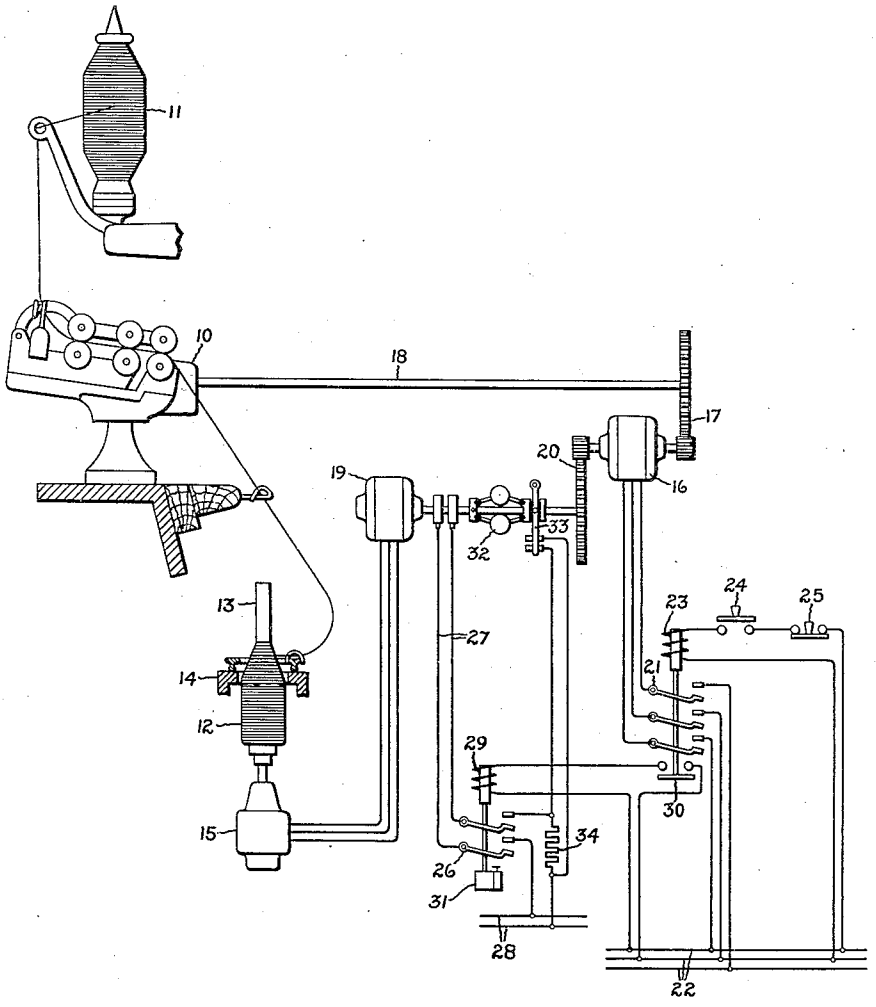
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DRIVING MEANS FOR SPINNING MACHINES

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DRIVING MEANS FOR SPINNING MACHINES

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My invention relates to driving means for spinning machines and the like, more particularly to driving means in which each spindle is driven by a separate motor, and has for its object a simple and reliable system for starting and stopping the spindle motors in synchronism with each other and in a predetermined proportionate speed relation with driving means for the other parts of the spinning machine.

In the operation of spinning machines wherein the spindles are driven by separate high-speed motors and wherein the feeding means and other mechanism, such as the ring rail, are driven by a low-speed motor in the conventional manner it has been found that when the spindle motors and the feed driving motor are de-energized to stop the machine, the motors do not decelerate in synchronism, i. e., in a desired time relation or at the same proportionate rate. The spindle motors tend to coast for a longer period of time with the result that the yarn is twisted excessively between the bobbin and feed rolls. This is detrimental to the yarn and results in a length of yarn of inferior quality on the bobbin when the machine is shut down when the bobbins are only partly filled. Moreover, the excessively twisted portion often results in breakage of the yarn when the machine is started.

In accordance with my invention I provide a main low-speed low-frequency driving motor which is large enough to drive the complete machine, but which is mechanically connected to drive directly only those parts of the machine other than the spindles such as the feeding means and the ring rail. For energization of the separate high-speed spindle motors I provide a high frequency generator which is driven from the main driving motor, together with suitable switching means for energizing the field of the generator when the main driving motor is energized, for maintaining the excitation of the generator during the decelerating period, and increasing it at the beginning of the acceleration and the completion of the deceleration.

Thus the spindle motors are electrically locked with the generator during acceleration and deceleration and during deceleration may be regeneratively braked through the generator in the event that they do not decelerate as fast as the main driving motor.

For a more complete understanding of my invention reference should be had to the accompanying drawing the single figure of which is a diagrammatic representation of a driving system for spinning machines embodying my invention.

Referring to the drawing, for purposes of simplicity and clarity the elements of the spinning machine essential to an understanding of the invention only have been shown. It will be understood that my invention is applicable to any spinning machine and the like with separate driving motors for the spindles, including machines in which there is no draft mechanism, sometimes known as twisting machines. The spinning machine comprises suitable feed and draft mechanism 10 for feeding the untwisted yarn from the bobbin 11 to the bobbin 12 on the spindle 13, a suitable ring rail mechanism 14 being provided for simultaneously effecting the twisting and feeding of the yarn to the bobbin in a conventional manner. It will be understood that the machine consists of a plurality of feeding bobbins 11, and spinning bobbins 12, perhaps several hundred, with suitable feeding mechanism. Each bobbin 12 is driven by a separate individual high-frequency high-speed motor 15 having a speed on the order of 6,000 to 12,000 R. P. M. so that the motor can be connected directly to its spindle.

In accordance with my invention I provide a main driving motor 16 of sufficient size to drive the entire machine including the spindles 13. This motor, however, is connected to drive directly through gearing 17 and shaft 18 the feed and various other mechanism of the machine but not the spindles 13. For the operation of the spindles I provide a generator 19, having a normal high frequency, such as 180 cycles, which is connected through suitable gearing 20 to the main driving motor 16. The spindle motors 15 are connected in parallel relation to each other to the high frequency generator 19. The speed of the generator 19 and hence its frequency and the speed of the spindle motors 15 may be varied by suitably varying the ratio of the gearing 20.

The main driving motor 16 is preferably a suitable three-phase motor of standard frequency such as a three-phase 60 cycle squirrel cage induction motor. It may be connected by means of an electromagnetic switch 21 to a suitable three-phase supply source 22, the coil 23 of the switch being controlled by suitable means such as push buttons 24 and 25.

For the control of the field of the generator 19 I have provided an electromagnetic switch 26 for connecting the field circuit 27 to a suitable direct current source of supply 28. The coil 29 of this switch is controlled by a contact

30 which is operated by the switch 21 and opened and closed simultaneously with the switch 21. Therefore, when the switch 21 is closed by closing the button 24, which is preferably provided with suitable means for holding it closed, the switch 26 is closed and field energization applied to the generator whereby the voltage of the generator gradually builds up as the speed of the generator increases with the speed of the motor 16. Consequently the spindle motors 15 are accelerated in a predetermined proportionate speed relation with the main driving motor 16. Preferably the spindle motors 15 are three-phase high-torque squirrel cage induction motors which accelerate in synchronism with the increase in frequency of the generator.

When it is desired to stop the machine the button 25 is depressed to de-energize the coil 23, the button 24 being thereupon opened. Preferably a suitable time delay mechanism such as a dashpot 31 is provided for the switch 26 so that it is held closed, after the de-energization of its coil 29, during the decelerating period. Or suitable timing mechanism may be provided for delaying the de-energization of the coil 29 for a predetermined interval after the opening of the contact 30. Thus during deceleration the spindle motors 15 are electrically locked to the generator 19 which in turn is mechanically locked to the driving motor 16. This assures deceleration of the motors together. In case the spindle motors tend to decelerate at a proportionately slower rate than the driving motor they act as generators supplying power to the generator 19 which then acts as a motor and tends to drive or prevent deceleration of the motor 16.

To further assure the electrical interlocking of the spindle motors with the generator 19 at low speeds and low frequencies during both the acceleration and deceleration, I have provided a centrifugal speed-responsive device 32 which is driven by the motor 16 and operates a pivoted switch arm 33. At low speeds this switch arm as shown in the drawing closes a circuit around a resistance 34 in the field circuit of the generator 19. This provides for increased excitation of the generator at low speeds. At a predetermined high speed the centrifugal device moves the arm 33 to open the circuit around the resistance 34 thereby inserting the remittance in the field circuit and decreasing the field to its normal value.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A driving system for spinning machines and the like provided with yarn feeding means and individual spindle motors, comprising a main driving motor for said feeding means, a generator provided with a field circuit and connected to be driven by said main driving motor, electrical connections between said generator and said spindle motors, main switching means for controlling the energization of said main driving motor, and field switching means in said field circuit controlled by said main switching means to energize the field of said generator whereby said spindle motors are started and accelerated with said main driving motor.

2. A driving system for spinning machines and the like provided with yarn feeding means and individual high-speed spindle motors, comprising a main driving motor for said feeding means, a high-frequency generator provided with a field circuit and connected to be driven by said main driving motor, electrical connections between said generator and said feed motors, main switching means for controlling the energization of said main driving motor, field switching means in said field circuit operated by said main switching means to energize the field of said generator simultaneously with the energization of said main driving motor whereby said spindle motors are started simultaneously with said main driving motor, and means responsive to the speed of said generator for increasing the field excitation of said generator during low speed operation of said generator.

3. A driving system for spinning machines and the like provided with yarn feeding means and individual spindle motors, comprising a main driving motor for said feeding means, a generator provided with a field circuit and connected to be driven by said main driving motor, electrical connections between said generator and said spindle motors, switching means for energizing said main driving motor and said field circuit whereby said spindle motors are started with said main driving motor, and means for maintaining the field circuit of said generator energized after deenergization of said main driving motor until said main motor and said spindle motors have come to rest.

4. A driving system for spinning machines and the like provided with yarn feeding means and individual spindle motors, comprising a main driving motor for said feeding means, a generator provided with a field circuit and connected to be driven by said main driving motor, electrical connections between said generator and said spindle motors, main switching means for controlling the energization of said main driving motor, field switching means in said field circuit controlled by said main switching means to energize the field of said generator whereby said spindle motors are started and accelerated with said main driving motor, and means for maintaining the field circuit of said generator closed after operation of said main switching means to deenergize said main driving motor until said main motor and said spindle motors have come to rest, whereby said spindle motors and said main motor are decelerated in a predetermined proportionate speed relation with each other.

5. A driving system for spinning machines and the like provided with yarn feeding means and individual high-speed spindle motors, comprising a main driving motor for said feeding means, a high-frequency generator provided with a field circuit and connected to be driven by said main driving motor, electrical connections between said generator and said feed motors, main switching means for controlling the energization of said main driving motor, field switching means in said field circuit operated by said main switching means to energize the field of said generator simultaneously with the energization of said main driving motor whereby said spindle motors are started simultaneously with said main driving motor, means controlling said field switching means to maintain the field circuit of said generator energized after deenergization of said main driving motor until said main motor and said spindle motors have come to rest, whereby said spindle motors and said main motor are deceler-

ated in a predetermined proportionate speed relation with each other, and means responsive to the speed of said generator for increasing the field excitation of said generator during low speed operation.

6. A driving system for spinning machines and the like provided with yarn feeding means and individual highspeed spindle motors, comprising a main driving motor connected to drive said feeding means, a high-frequency generator provided with a field circuit and connected to be driven by said main driving motor, electrical connections between said generator and said spindle motors, main switching means for controlling the energization of said main driving motor, field switching means in said field circuit operated to closed position by said main switching means to energize the field of said generator simultaneously with the closure of said main switching means to energize said main driving motor whereby said spindle motors are started and accelerated in a predetermined proportionate speed relation with said main driving motor, and means for maintaining said field switching means closed for a predetermined time interval after the opening of said main switching means for deenergization of said main driving motor thereby to maintain field energization of said generator until said main motor and said spindle motors have come to rest, whereby said spindle motors and said main motor are decelerated in a predetermined proportionate speed relation with each other.

7. A driving system for spinning machines and the like provided with yarn feeding means and individual high-speed spindle motors, comprising a main driving motor connected to drive said feeding means, a high-frequency generator provided with a field circuit and connected to be driven by said main driving motor, electrical connections between said generator and said spindle motors, main switching means for controlling the energization of said main driving motor, field switching means in said field circuit operated to closed position by said main switching means to energize the field of said generator simultaneously with the closure of said main switching means to energize said main driving motor whereby said spindle motors are started and accelerated in a predetermined proportionate speed relation with said main driving motor, means for maintaining said field switching means closed for a predetermined time interval after the opening of said main switching means for deenergization of said main driving motor thereby to maintain field energization of said generator until said main motor and said spindle motors have come to rest, whereby said spindle motors and said main motor are decelerated in a predetermined proportionate speed relation with each other, and means responsive to the speed of said generator for increasing the excitation of said generator during low-speed operation of said generator.

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