The present invention relates to a textile yarn winding machine for winding of yarn packages, in which a plurality of spindles for the yarn packages are associated with commonly driven grooved patterning drums, and more particularly to such a textile machine which is provided with an anti-pattern device to provide high cone quality and to prevent formation of undesirable patterning as the spool or yarn package is being formed.

It has previously been proposed to intermittently, rapidly interrupt the drive to the grooved drum over which the yarn passes during formation of the spool or yarn package, in order to prevent a patterned winding from being wound on the yarn. The slip between the package and the grooved drum is constantly changed, and thus the direct proportionality, based on whole numbers, between the effective circumference of the grooved drum and the package is distorted. This distortion prevents formation of a patterned package. One form of anti-patterning arrangement utilizes relays which intermittently interrupt three-phase power to a three-phase motor. The ON time of the relay must be selected to be sufficiently large so that the motor reaches its nominal speed. This has the disadvantage that the relays are subjected to substantial wear; further, the apparatus is highly dependent on variations of supply voltage and load, and there is substantial time delay between the various ON-OFF cycles. It is difficult to effectively prevent formation of a pattern on the cone.

Mechanical means to vary the speed of the drum, such as variable speed drives utilizing V-belts, and providing varying speeds cyclically changing from a center value are subject to similar difficulties.

It has been proposed to provide a direct current motor to drive the grooved patterning drum and, by means of an electronic interrupting circuit, to disconnect the direct current motor in uniformly recurring cycles, the average speed of the motor being controlled by voltage regulation of the supply there to. Besides the higher maintenance required for D-C motors, it is difficult to maintain the average speed constant due to changes in loading on the motor as well as due to supply voltage variations.

It is an object of the present invention to provide a textile spooling or winding machine, which may be referred to as a coiner to make textile cones or yarn packages, and which, independently of changes in loading, or voltage variations of supply effectively prevents undesirable patterning on the cone during formation of the cone.
the motor torque in dependence on loading thereon. These motor torque control means include phase shifters R19, S19, T19, connected in series and in advance of the trigger or firing pulse generators R18, S18, T18 respectively. A first input of each phase shift circuit is connected to the output of the motor on the one hand, and the input of each phase shift circuit is connected to the output of an inverter 20. A third input of each phase shift circuit is connected to a synchronizing line R', S', T', respectively, which connects with the respective phases R, S, T to supply a signal to the phase shifters when each voltage wave of the power source 10 goes through zero, or null. Inverter 20 is connected in series with a gate 21, in form of a NAND-gate, which has one input connected to the output of the flip-flop 16; the other input is connected to the output of a pulse generator 22 which is triggered from the output of the lower threshold circuit 15, by being connected to its output. A discharge or leakage resistor 23 bridges the integrator 20. It is only necessary to control the time duration $t_1$ (Fig. 2) of the motor during which the motor is connected, that is, during acceleration of the motor, since torque has to be generated which should be independent of changes in the supply line and which is sufficient to overcome the variable sum of all the single masses, and single resistances and loads of the various spools of a multiple spindle spooling or cooking machine. The delay time, during the OFF period of connection of the motor from the supply network 10, that is the time $t_2$ (Fig. 2) can be assumed to be essentially constant. Threshold switch 14 responds when the upper speed $n_{max}$ is exceeded; threshold switch 15 responds when a lower speed $n_{min}$ is passed, the switches, of course, responding to electrical signals from the tachometer generator representative of the respective minimum and maximum speeds. The first line of the graph of Fig. 2 illustrates this variation as a function of time. Upon appearance of a signal as threshold switch 15, a voltage $U_j$ will appear at the output of flip-flop 16, until threshold switch 14 responds. The pulses of voltage $U_j$ are seen in the second line of the graph of Fig. 2. It is apparent that, without further controls, the duration or length $t_1$ of the switching-on pulses $U_j$ will depend on the loading on the motor. For example, if the motor is heavily loaded, a longer period of time $t_1$ must pass until the motor reaches a speed $n_{max}$ than if the motor were only lightly loaded.

To make the cyclical ON-OFF period of the motor uniform, each ON pulse of the threshold switch 15 is applied to a pulse generator 22, which provides a pulse of a command value $t_2$, to effect acceleration of the motor from the phase angle $\alpha_{min}$ to the phase angle $\alpha_{max}$, when the actual speed duration $n_{max}$. The output pulses $U_j$ derived from the output of pulse generator 22 (triggered by the threshold switch 15) will have a pulse duration $t_2$ and are seen at graph $U_j$ in the third line of the diagram of Fig. 2. The actual time pulses $U_j$ of time duration $t_2$ are applied to gate 21, which provides an output or difference pulse $U_{21}$ of time $t_2$. This pulse is seen in the fourth line of the diagram of Fig. 2, and applied to the integrator 20. Integrator 20 will store and integrate the difference pulses $U_{21}$ of time duration $t_2$ and provide an output voltage $U_j$ that will drop from the preceding value during the intervals between succeeding pulses $U_{21}$ of time $t_2$ due to the presence of the leakage resistance 23. The output voltage $U_j$ from integrator 20 is used a control voltage for the phase shifters R19, S19, T19. These phase shift pulses from the trigger or firing pulse generator R18, S18, T18 to provide the trigger pulses for the triacs R17, S17, T17, respectively, and to phase shift the trigger pulses with respect to the line power supply from source 10 by a predetermined phase angle $\alpha$. As seen in Figs. 4 and 5, the phase angle $\alpha$ should increase with respect to the phase angle $\alpha_0$ when the actual time duration $t_1$ of pulses $U_j$ is greater, due to increasing loading on the motor, than the commanded time $t_2$ of pulses $U_{21}$.
T19) interconnecting the bistable switch and the control input of the controlled switch means;
means (T; 12, 13) generating a motor speed control signal;
threshold switch means (14, 15) connected to and controlled by said motor speed control signal and providing an output signal to control switch over of the bistable switch (16) in dependence on the motor speed control signal reaching an upper, or lower threshold level, respectively;
and load responsive means (20, 21, 22) interconnecting the output of the bistable switch (16) and the control means (R19, S19, T19) and being responsive to loading of the motor to adjust the phasing of the controlled switch means with respect to the phase of said source to maintain the ON-time of the bistable switch at a constant value.

2. Machine according to claim 1, wherein the control means comprises
phase control means (R19, S19, T19) which change the phase angle of current flow (a);
and the load responsive means comprises a pulse source
(22) providing command pulses (U2) of duration (t2) representative of a phase angle of connection of the motor to the source required to cause the motor to increase speed, and comparator means (21) having said command pulses applied thereto and the output pulses (U1) from said bistable switch (16) and having a duration (t1) representative of phase angle of connection of the motor as determined by actual motor speed, said comparator means (21) providing a difference output signal (U3) of duration (t3) representative of the difference (t1−t2) of the duration of said command pulses (U2) and said bistable switch pulses (U1);
said difference pulses (U3) controlling the phase control means (R19, S19, T19).

3. Machine according to claim 2, wherein the comparator means (21) comprises a gate.

4. Machine according to claim 2, wherein said load responsive means comprises an integrator (20) to store and integrate the difference output signal (U3) and provide an integrated output (U4), said integrated output being applied to the phase control means (R19, S19, T19).

5. Machine according to claim 4, further comprising a leakage resistance (23) bridging the output of the integrator (20).

6. Machine according to claim 2, further comprising a synchronizing line (R’, S’, T’) interconnecting the phase control means (R19, S19, T19) and the source (10) to synchronize the phase control means with the power supply as the voltage of the power supply passes through zero.

7. Machine according to claim 1, wherein the means generating a motor speed control signal comprises a reference source (12, 13);
signal generator means (T) providing an output signal representative of motor speed;
and comparator means (11) comparing the actual motor speed signal and the output of the reference source and providing a difference signal, said difference signal forming said speed control signal being applied to said threshold switch means.

8. Machine according to claim 1, comprising a synchronizing line (R’, S’, T’) interconnecting the phase control means (R19, S19, T19) and the source (10) to synchronize the phase control means with the power supply as the voltage of the power supply passes through zero;
and wherein the load responsive means comprises a pulse source (22) providing command pulses (U2) of a duration (t2) representative of a phase angle of connection of the motor to the source with respect to the phase of the power supply as required to cause the motor to increase speed or torque, and comparator means (21) having said command pulses applied thereto and the output pulses (U1) from said bistable switch (16) as controlled by said threshold switch means (14, 15) and having a duration (t1) representative of phase angle of connection of the motor as determined by actual motor speed, said comparator means providing a control output signal (U3) of duration representative of the difference (t1−t2) of the duration of said command pulses (U2) and said bistable switch pulses (U1), said difference pulses controlling the phasing of the connection of the motor to said source by controlling the phase control means (R19, S19, T19) connected to said controlled switch means (R17, S17, T17).

9. Machine according to claim 8, wherein said load responsive means comprises an integrator (20) to store and integrate the difference output signal supplied by said comparator means (21) and providing an integrated output (U4), said integrated output being applied to control the phasing of said phase control means (R19, S19, T19).

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U.S. Cl. X.R.

318—327