LAUNDRY FOLDING MACHINE WITH LOW SPEED AND HIGH SPEED FOLD TIMER MOTORS

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This invention relates to folders and more particularly it relates to a folder control system and the timing and measuring device therein.

In the laundry field, folders are used for folding sheets or other flat laundry articles wherein the sheets are fed to a series of conveyors. During the passage they pass over detection switches which measure the length of the sheets or other article and cause it to be folded in a predetermined position. Generally the position of folding is brought about by a control system in which there is a timing and measuring device that measures the length of a sheet by timing the length of its passage past a measuring position. The device will relate the article size to the time necessary to deliver the sheet at a point in the machine at which a fold is desired. This has been done by using high speed and low speed motors to drive a cam shaft through slip clutches. (See U.S. Patent 2,774,592.)

The relationship of the two speeds of the motors determines the fold point of the laundry article so that there should be a full speed and a one-half speed motor, the laundry article will be folded at one-half of its length. This is accomplished by first using the one-half speed motor operation to measure the length of the article and then switching to the high speed motor operation which runs for the predetermined time period to cause the sheet to be properly placed in a fold position, whereupon the folding mechanism is actuated at the end of that time period. Complicated motor arrangements of this type which include clutches, external gear trains, and the like, have the problem that they tend to collect lint and dirt on the exposed gear trains which may result in high maintenance costs and more importantly in folding errors.

The electrical problem with electronic timers of this type may be that they do not stop at the precise time in order to cause the fold to occur in a desired position. Part of this may be because the motor current is broken on a halfwave and if on the wrong half, as much as ½ of a second could be lost to cause undesirable folding errors. One of the objects of the present invention is to provide a timing and measuring device which will provide a more compact low maintenance motor arrangement.

A further object of the present invention is to provide a more compact motor arrangement and circuit which will cause a more precise positioning of the motor at the moment of stopping. Accordingly, in one aspect of this invention, there is a timing system for an article folder in which a timing and measuring device runs at one predetermined speed proportionally to that the conveyor during the time that the article length is being measured and at a second higher speed after the measurement to this instant of folding. There is arranged in the system a pair of motors driving a common shaft in tandem. One of the motors drives the shaft at the low speed and the second motor drives the shaft at the higher speed, such being a proportional multiple of the low speed motor. Associated with the timer, there is switch means which causes the operating current to the high speed motor to be broken at the predetermined time that folding occurs.

The timing and measuring device of the invention has a single shaft with twocams at longitudinally spaced positions. A folder operating switch is operated by one of the cams and a second switch is operated by the second of said cams, the second switch being connected to the article sensing means to control operation of the low and high speed motors. A two speed motor or drive means is arranged to directly drive the shaft, with the drive means having two motors. One of said motors operates the shaft at a low speed and the other at a higher and proportionally multiple speed of the lower speed motor. Means are provided for operating the lower speed motor to measure the length of the article and automatically cease while activating the high speed motor after measurement has occurred. The high speed motor is connected so that the switch operated by the second cam will open at a positive position of the second cam and cause the timer to stop whereby during the rotation of the timer and measurer mechanism, the first cam will cause the folder to operate at a predetermined position.

Additionally, the invention provides a rectifier means in the motor circuits to brake said drive means and a means for activating the rectifiers upon the interruption of the operating current to the motor.

These and other objects, advantages and features of the invention will become apparent from the following descriptions and drawings which are merely exemplary.

In the drawing:

FIG. 1 is a fragmentary perspective view of an article folder to which the invention may be applied;

FIG. 2 is a partially exploded view of the timer and measuring mechanism of the present invention;

FIG. 3 is a circuit diagram of a control system according to the invention which is shown for use in the folding apparatus of FIG. 1.

A laundry article or the like, to be folded, is shown as Sheet A for transportation on an endless belt 10 after it has passed through a previous machine, such as an ironer. Belt 10 may be of the conventional ribbon type. Sheet A is received by a second endless belt 11 where it is carried past a sheet measuring or sensing switch 30. Belt 12 cooperates with belt 11 to guide the sheet in its movement past the first measuring station 30. As will be explained more fully hereinafter, the sensing switch 30 causes a measuring and timing mechanism in the control system to begin to operate so that a pulse or signal is sent to an air blast or folding mechanism 13 at a predetermined time so as to move a portion of the sheet sidewise and cause it to be grasped between the rolls of the folding mechanism 14. The folding mechanism may be any one of the type that is capable of forcing sheets between oppositely rotating rolls.

The once folded sheet is then carried on an endless belt 15 where it is grasped between it and the endless belt 16, such serving as a second conveyor means in the folding machine for carrying the sheet to the second folding means. A second sensing switch 130 may be activated by the sheet as it passes thereover so as to ultimately provide a pulse to a second folding device 17 at the proper time. The sheet will be blown or moved sidewise so as to be grasped between the folding machine rolls 18 whereupon endless belt 19 removes the folded sheet and delivers it to a delivery table or suitable point 20. Alternatively, the folding device 17 may be bypassed and the sheet could then be dropped on an endless belt 20 and delivered to table 22.

For a complete description of a typical folder and control system see Patent No. 2,652,246, 2,856,129 and 2,993,693.

In FIG. 2 there is shown a timing and measuring device 24 in which there is a two speed driving arrangement with a common output shaft 25 and which there are arranged two longitudinally spaced positions 26 and 27. Folder cam 27 is arranged to operate the folding mechanism 13 and timer motor stop cam 26 is arranged to
cause the motor to stop operating. The motor driving device 24 may be arranged with a high speed motor 28 and the cam 29. Contact 25, both of which are arranged to directly drive the shaft 25 in a manner described hereinafter. The periphery of the cams 26 and 27 and the speed of the motors are selected so as to bear a definite relationship to the speed of the endless belts 10, 12, 16, 19 and 21 so that in one revolution of the shaft 25 the shaft 25 will have passed to a point where it will be in position to be folded at the proper position of its length. This operation will be described more completely hereinafter. Each of the cams has a notch or indentation 26A, 27A on its periphery activating the followers for switches 42 and 52.

The electrical circuit diagram for the control system of the folder found in FIG. 1 is shown in FIG. 3. As the sheet A passes along the endless belt means 12, it passes over the measuring switch 30 and hits a measuring finger thereof causing the normally closed switch to contact 39 to open and close on contact 31, resulting in electrical energy flowing through lead 32 and sequence switch 33 through the one-half speed motor 29 of timer drive 24 (FIG. 2). The shaft 25 will then begin to rotate at one-half speed relative to the full speed motor 28.

Simultaneously as the switch 30 is closed, line 40 is de-energized and control relay CR1 is de-energized, and a current is permitted reclosing energy relay CR1A and to bypass relay contact CR1B and rectifier 35 to sequence motor 36. The sequence motor will then run through the stop switch 37 for one quarter of a turn. The sequence motor is of the type shown in Patent 2,858,129 and will not be further illustrated here except to say that the motor is arranged so that after it runs one-quarter of a turn, it will stop automatically moving switch blade 37 to contact 38. The motor will stop and remain stopped until after sheet A is measured and switch 30 returned to its closed position. The time for the one-quarter turn of a sheet is determined by the time it takes for the sheet A that is being measured to pass the measuring station 30.

After sheet A has its trailing edge leave the measuring station 30, the switch will return to its contact 39, thus allowing power to flow through line 40 and through switch 39 to contact 38 into line 40. Again, it will again run for one-quarter of a turn and stop. At the moment that the sequence motor stops, switch 33 is caused to move to contact 33a which is in the line with half-speed motor 49 of the second tier and switch 37 is removed from contact 38 to allow rectifier 35 to send a braking current into the motor 36 where CR1B is closed. When the first fold measuring means 30 again moves to contact 39, the power also flows through control relay CR1 which opens control relay CR1A and closes control relay CR1B contact to allow the rectifier 35 to put a braking current into the sequence motor 36 when it has stopped its second one-quarter revolution and switch 37 has been opened relative to contact 38.

Further, as control relay CR1 is energized after the sheet has been measured, CR1A causes contacts CR1C of relay CR1 to close, thus energizing the full speed motor 29. The full speed motor will then continue to run until cap 26 has its indentation 26A operate the motor stop switch 42 to move it from 42B so that switch 42 is again connected to line 44 to place a braking current from rectifier 46 on the half speed motor 28. Simultaneously upon the movement of switch 42, a braking action is also supplied to the full speed motor 29 bypassed when switch 42 was closed on contact 42B. As the motors 28 and 29 are both connected to the same shaft, the braking currents from the two rectifiers 45 and 46 cause a braking action on adjacent half-cycles of the A.C. that will assure the positive stopping of the motor and the resultant cams at the desired position.

To allow a second sheet that is closely following sheet A to be measured and folded the sequence operation comes into operation. Sequence switch 47 is placed in the upper of the two in tandem to sequence motor after it has run its second one-quarter turn as described above. The sequence switch 47 acts as a hold for future operation. For more detailed explanation of a typical sequence system and its method of operation, see Patent 2,858,129.

As the high speed motor 29 rotates the shaft 25 and the cams 26 and 27, the notch 27A in cam 27 will actuate switch 52 whereupon a pulse will be sent to the folding means 13 and the sheet A thereupon be folded at a predetermined position. The duration of energization of the solenoid which operates the first fold device 13 is determined by the length of the notch 27A in the cam 27.

If after sheet A has passed through the sensing means, there is a second sheet following it shortly thereafter, the half speed motor 49 in tier 2 of a motor drive similar to drive 34 will be energized upon the breaking of contact switch 39 with contact 39, the current then flowing through line 32 through switch 33 contact 33c and through a second one-half speed motor 49. When this is done, the sequence motor 36 will run its one-quarter turn, cause switch 37 to be repositioned to 38 and ready to be run again as described above with reference to tier 1. Upon the initial opening of half-speed motor 49 in the second tier, switch 42A will be positioned to bypass the rectifier 60 in line 61 to full speed motor 51 of the second tier, thus readying it for operation when the sheet is measured. When the second sheet has been measured and contact has again been made by the switch 39 with contact 39, switch 33 will again be in position to operate half speed motor 28 of the first tier.

Relay CR1 will close contacts CR1D, to allow current to flow through line 61 and operate the full speed motor 51 of tier 2 until cam 26 makes its full rotation and a detent corresponding to detent 26A repositions switch 42 of the second tier. When it does, current will flow through half speed motor 49 from the rectifier 62 to brake it while rectifier 60 puts a braking current into high speed motor 51. Meanwhile, the solenoid fold switch 52A has been caused to operate by the action of a cam corresponding to cam 27 of first tier.

The operation of the second fold control for the folder 17 of FIG. 1 is the same as that of folder 13, just described, where it is actuated by control switch 139. Accordingly, each of the switches, relays and motor and circuits have been given the same numbers as given to those for the first tier. CR1B is shown in the prefex of 100. The description above can then be directly applied to the second fold control with the mere substitution of the series 100 numbers for those of the first fold control.

It should be apparent that modifications may be made in the construction and arrangement described without departing from the spirit of the invention, except as defined in the claims appended hereto.

What is claimed is:

1. In a textile sheet folding machine, or the like, having conveying means extending therethrough for carrying sheets of varying lengths along a path through said machine, said machine having folding means adjacent said path, and having a source of electric power, the combination including sensing means responsive to the passage of sheets in said path, timing and measuring means including a single shaft means, a low speed motor connected to said shaft means, a high speed motor connected to said shaft means to operate the folding machine at a higher proportionally multiple speed relative to said low speed motor, folding cam means connected to said shaft means to operate said folding means at a predetermined time, motor control cam means mounted on said shaft means, circuit means connecting said low speed motor to said sensing means and the source of power during passage of a sheet past said sensing means, and circuit means con-

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necting said high speed motor to said source of power after the sheet has passed the sensing means and until it reaches the desired position in relation to said folding means and said folding means has been operated, said folding cam means actuating said folding means at a positive position of said shaft means so that said folding action will be accurately timed.

2. In a textile sheet folding machine, or the like, having conveying means extending therethrough for carrying sheets of varying lengths along a path through said machine, said machine having folding means adjacent said path, and having a source of electric power, the combination including a sensing means responsive to the passage of sheets in said path, timing and measuring means including a single shaft means, a low speed motor connected to said shaft means, a high speed motor connected to said shaft means to operate the shaft means at a higher proportionally multiple speed relative to said low speed motor, folding cam means connected to said shaft means to operate said folding means at a predetermined time, motor control cam means mounted on said shaft means, circuit means connecting said low speed motor to said sensing means and the source of power during passage of a sheet past said sensing means, circuit means connecting said high speed motor to said source of power after the sheet has passed the sensing means and until it reaches the desired position in relation to said folding means and said folding means has been operated, rectifier means in braking circuit means connected to said low speed motor means operable in one of the half-wave cycles of power, and means energizing said braking circuit means after the folding means has been actuated and operating electric power has been removed from said high speed motor means, so that said shaft means will be positively stopped in a predetermined position after each operation.

4. A timing and measuring means for a textile sheet folder, or the like, including a folding means comprising a sensing device responsive to passage of articles thereby, a single shaft means, a low speed motor connected to said shaft means, a high speed motor connected to said shaft means to operate the shaft means at a higher proportionally multiple speed relative to said low speed motor, folding cam means mounted on said shaft means, said folding cam means having a folding device switch operated thereby at a predetermined position, said folding device switch being connected to said folding means, a motor control cam means mounted on said shaft means and having a motor control switch means operable thereby, and circuit means connected to said motor control switch means for maintaining energization of said high speed motor after said sensing means has been actuated and until said folding means has been actuated.

5. A timing and measuring means for a textile sheet folder, or the like, including a folding means comprising a sensing device responsive to passage of articles thereby, a single shaft means, a low speed motor connected to said shaft means, a high speed motor connected to said shaft means to operate the shaft means at a higher proportionally multiple speed relative to said low speed motor, folding cam means mounted on said shaft means, said folding cam means having a folding device switch operated thereby at a predetermined position, said folding device switch being connected to said folding means, a motor control cam means mounted on said shaft means and having a motor control switch means operable thereby, circuit means connected to said motor control switch means for maintaining energization of said high speed motor after said sensing means has been actuated and until said folding means has been actuated, a rectifier means in each of the circuits to the low speed motor and the high speed motor, said rectifier means being connected in opposite directions, and means to energize said rectifier means so as to apply braking energy to said motor means on every half-cycle.

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