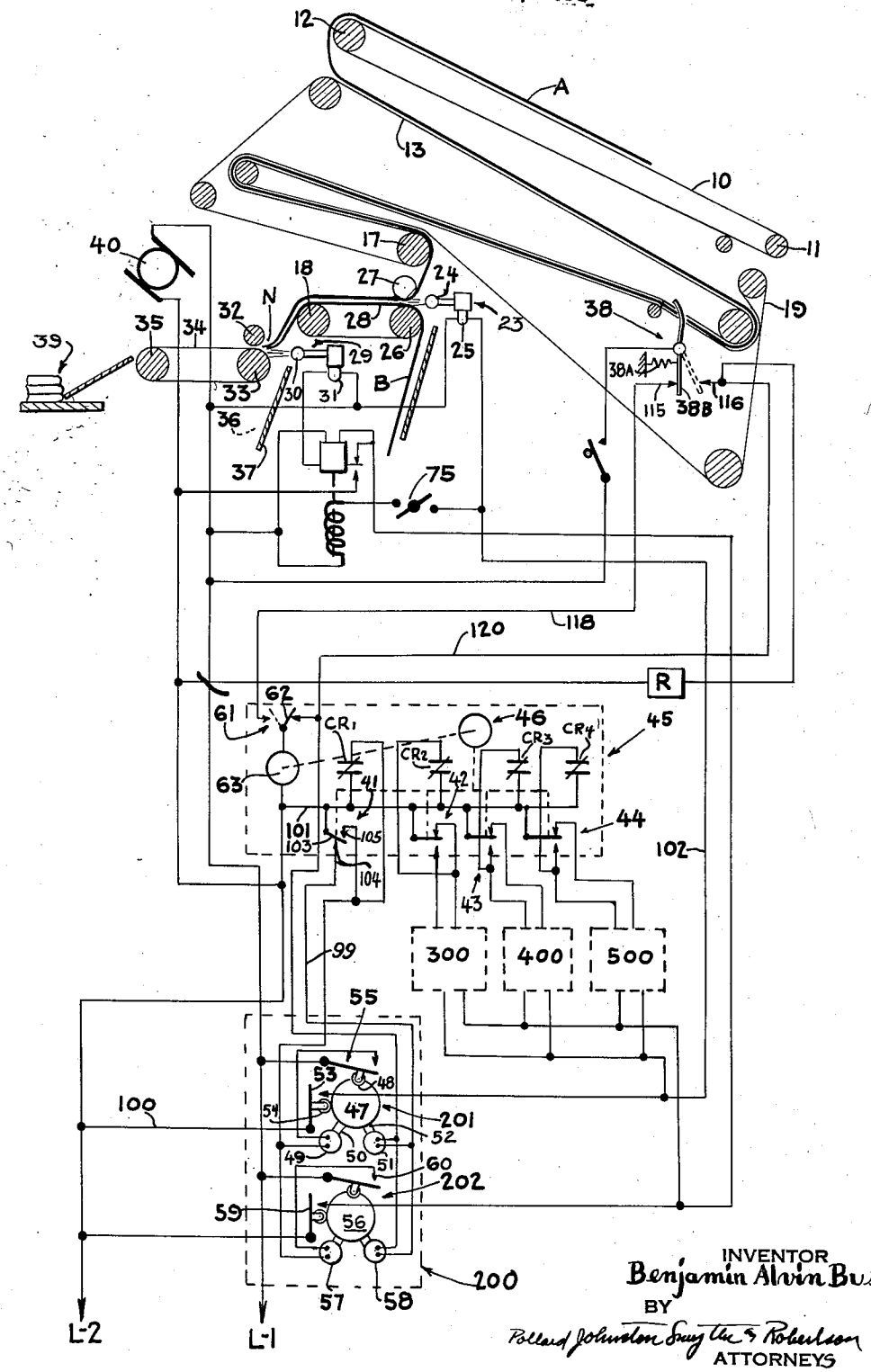
Jan. 24, 1961 B. A. BUSS 2,969,233

LAUNDRY FOLDING MACHINES

Filed Jan. 27, 1958



INVENTOR
Benjamin Alvin Buss
BY
Pollard Johnston Swayne & Robertson
ATTORNEYS

United States Patent Office 2,969,233 Patented Jan. 24, 1961

2,969,233

LAUNDRY FOLDING MACHINES

Benjamin Alvin Buss, East Moline, Ill., assignor to American Machine and Metals, Inc., East Moline, Ill., a corporation of Delaware

Filed Jan. 27, 1958, Ser. No. 711,509

7 Claims. (Cl. 270—69)

This invention relates to a control system for a textile article processing arrangement, and particularly to a control system wherein a sequence controller governs the operation of a plurality of timing mechanisms employed in such apparatus for actuating folding means for operating on successive articles.

In laundry folding machines, it is necessary to fold a series of articles which are successively fed thereto. For example, in commercial laundries the pieces of laundry such as sheets are washed, ironed and folded by automatic equipment. The sheet folding apparatus employed requires the use of a control which will insure that the successive folding operations will be performed at selected proportionately spaced points and such must be done even when articles may be closely spaced. To accomplish this, a suitable control system may include a timing mechanism which controls the operation of one or more folding devices that actually perform the folding operations. The number of folding devices employed in such a system usually corresponds to the number of folds desired in the sheets being folded.

While the use of a single timing mechanism in a machine may be sufficient for some laundries, it is not in laundries where the time interval between successively fed sheets may be extremely small. If a single timing mechanism were employed for a folding machine, the time interval between successively fed sheets would have to be made sufficiently large so that operations on a single article would be completed before the next succeeding sheet could be fed to the machine. In order to take care of this problem, a plurality of timing mechanisms can be utilized in conjunction with a sequence controller governing the sequence of their operation. The sequence controller functions to insure that control of the folding devices for a single sheet is exercised by only one of the timing mechanisms, the next timing mechanism being used for the next sheet. Thus, the folding operations can continue at their normal rate irrespective of the time interval between successively fed sheets.

One of the objects of this invention is to provide a control system for article processing apparatus which is accurate in operation and which will function even when articles are closely spaced in the machine.

Another object of this invention is the provision of an improved sequence controller for use in article processing apparatus control systems of the type employing a plurality of timing mechanisms which will permit each timing mechanism to complete its folding control function.

A further object of the invention is to provide an arrangement wherein the number of timing mechanisms needed can be reduced.

In one aspect of the invention, a plurality of timing mechanisms for the machine or each lane thereof can be provided each being arranged to control sequentially following means for a sheet or textile article to be folded. A sequence controller transfers control of a sensing switch or sheet measuring means sequentially to the various timing mechanisms. A means is connected to said sensing switch and the sequence controller arrangement to insure completion of each folding operation even though the next article has reached the sensing means and is being measured by the next tier of timing mechanisms. This can be accomplished, for example, by employing control relay means operable by the sensing switch to provide a by-pass circuit for the timing mechanisms so that they will remain energized after an article has passed the sensing switch.

These and other objects, advantages and features of the invention will become apparent from the following description and drawings.

In the drawing:

Fig. 1 shows a schematic wiring diagram of a folding and timing apparatus made in accordance with the present invention.

Reference may be made to copending application Serial No. 545,872, filed November 9, 1955, now Patent No. 2,858,129, for details of one form of measuring and folding devices and timing mechanisms, it being understood that any suitable arrangement can be used.

As an example, one system with which the present invention can be used is illustrated in said copending application Serial No. 545,872. Briefly and in general, folder conveyor motor **40** may be connected between power lines L1, L2. Sheet A is illustrated as being transported on the conventional endless conveyor ribbon belt means **10**, said belt means passing over spaced rollers **11, 12**, sheet A being fed therefrom onto belt **13**. Conveyor belt means **19**, cooperating with belt means **13**, is arranged to receive sheet A so that the sheet will be gripped between belts **13** and **19** and carried thereby.

As the sheet passes over roll **17**, it can be directed downwardly, the sheet passing in front of the first folding station. Any number of lanes can be used, for example, five, a separate folding apparatus **23** with its related valve **25** being provided for each lane. Mechanical folders also could be used, although pneumatic ones are preferred.

Pneumatic blast folding arrangements including a manifold or pipe **24** extending across each of the lanes can be provided, air thereto being controlled by a suitable solenoid valve **25** for each pipe, the valve being opened by a signal from the timing mechanism for the particular lane or lanes.

When the sheet reaches a correct position in front of the air blast as determined by the measuring and timing apparatus being employed, the particular air blast solenoid valve is energized so as to blow and move a center portion of the sheet between the first folding roll means **26** and **27**, belt **28** being guided by the first folding rollers **26** and **18**.

The folded edge N of sheet B then will be moved on belt **28** so as to pass downwardly over roll **18** and in front of the second folding apparatus **29** for each lane. Similar to the first folding means **23**, each of the second folding apparatus preferably may comprise an air blast manifold or pipe **30** for each lane and solenoid valve **31** operable to control the flow of air from pipe **30**. The second folding rolls **32, 33** are arranged similar to the first station, belt means **34** being guided by roll **33** and roll **35**.

If a second fold is to be made in the sheet, the once folded edge N of sheet B moves downwardly as indicated in dotted lines **36** and will be guided by guide **37**. At an appropriate time and in proportion to the length of the sheet, the second air blast folder **29** will be activated so as to cause the desired portion of the sheet or article to move sidewise into gripping relationship between folding rolls **32** and **33**.

Air blast solenoid valves **25** and **31** will be actuated at appropriate times in accordance with the timing mecha-

nism as governed by the appropriate sheet measuring switch or sensing finger for the piece as described in said copending application Serial No. 545,872. In the event that only a single fold is to be made, air blast 29 may be activated by the timing mechanism so that the leading edge N of sheet B will receive a blast of air before or as it reaches folding rolls 32, 33, so that the leading folded edge N will be drawn directly between the side rolls and carried to collecting station 39. This feature is not absolutely necessary in the present invention.

Normally, a plurality of timing and selecting means will be used for each lane, such as shown in said application Serial No. 545,872, but it is to be understood that other types of selecting and timing mechanisms can be employed. Usually a plurality of timing mechanisms have been required, such as four, for each tier but by the use of the present invention, it has been found possible to reduce the number to two for each tier.

In order to control successive operations of folding mechanisms 23 and 29 and provide the successive timed blasts of air when a plurality of sheets, one following the other, pass through the machine, a plurality of timing mechanisms 200, 300, 400 and 500 can be provided as needed. Each of the timing mechanisms governs folding operations of the air blast folding means 23 and 29. Each of the timing mechanisms may consist of a plurality of subtiming devices, one for each of the folding means used. Timing devices 300, 400 and 500 may be similar to timing device 200.

Timing device 200 may have subtiming mechanisms 201, 202, subtiming mechanism 201 operating the first pneumatic blast folding mechanism and subtiming means 202 operating the second pneumatic blast timing mechanism at the desired time.

Each of the subtiming devices 201 and 202 in the timing mechanism 200 is controlled by measuring switch means 38 and motor switch means 41, other selector switches 42, 43, 44 being provided as indicated in block 45, said selector switches being operated, for example, by a cam means schematically shown at 46. In normal operation, successive sheets passing the measuring switch will activate successive ones of the timing devices 200, 300, 400 and 500 so as to provide operation of the air blast means at the required time.

Subtiming device 201 controlling air blast means 23 may be composed of a cam 47 having an indentation 48 therein. High constant speed motor 49 drives cam 47 through overrunning clutch means 50, while low constant speed motor 51 drives cam 47 through overrunning clutch means 52. Thus, cam 47 can be driven by either of motors 49 or 51, the slow speed motor driving the cam as a sheet is passing the measuring finger.

A switch 53 is placed at a predetermined location relative to cam 47 and serves to operate the first station air blast means 23 when the indentation 48 on the cam is engaged by follower 54 of switch 53. Further along periphery of cam 47 is located switch 55 with an associated follower, switch 55 operating to control energization of high speed motor 49 by means of the action of notch 48 and the follower.

The other subtiming device 202 controls operation of the second air blast folding means 29, and can be composed of cam 56 and motors 57 and 58 corresponding to similar elements in device 201, motors 57 and 58 having overrunning clutches to permit rotation of cam 56 by either of said motors. Switch 59 with its associated follower serves to control energization of air blast folding means 29, while switch 60 with its associated follower provides control of high speed motor 57. Switch 53 is connected to supply line L–2 by lead 100 and the fixed contact is connected to folding means 25 by leads 101, 102. Switch 55 is connected to supply line L–1 while the fixed contact thereof is connected to high speed motor. Switch 59 has its movable member connected to supply line L–2 and its contact connected to folding means 29.

Measuring switch 38 is actuated by a sheet or other article between conveyor belts 13 and 19. A spring 38A is provided to keep switch 38 in a position to be engaged by a sheet. In this position, the movable member 38B of the measuring switch engages fixed contact 115, and when a sheet depresses the article engaging portion of the switch, the member 38B engages fixed contact 116. Switch member 38B is directly connected to supply line L–1. During the time that the sheet depresses the measuring finger, the slow speed motors of the respective subtiming devices will be energized, and when the sheet passes, the high speed motor of each will be energized to actuate the appropriate folding means.

Motor 63 is connected across the supply lines L–1 and L–2 by a circuit consisting of movable member 38B, either of leads 118 or 120, and the movable member 62 of timer switch 61. The relative positions of the movable members 38B and 62 of switches 38 and 61, respectively, determine whether lead 118 or lead 120 will complete the energizing circuit to the motor. When both switches 38 and 61 are in their normal positions as shown by the full line construction in the drawing, the energizing circuit for motor 63 is open and the sequence controller inoperative. Should the leading edge of a sheet placed on the belts actuate switch 38, an energizing circuit for motor 63 is completed through lead 120 causing the motor 63 to rotate. At this time, the low speed motors of timing mechanism 200 also will be energized. The motor 63 will continue to rotate until timer switch 61 is actuated to the dotted line position shown in Fig. 1 of the drawing, when the energizing circuit for the motor will be broken.

After the trailing edge of the sheet passes the article engaging portion of the measuring switch 38, spring 38A becomes operative to return switch 38 to its normal position. When this occurs, the energizing circuit for motor 63 is completed through 118 since the movable member 117 of switch 61 is in the dottted line position shown. The cam mechanism 46 in block 45 is arranged as set forth in copending application Serial No. 545,872, so that motor 63 need only rotate a short distance before cam actuated switch 41 assumes its inoperative position and the next switch 42, its operative position. This same rotation of motor 63 has also rotated timer switch 61 so that timer switch 61 has been returned to its normal position illustrated by the full line construction of the drawing. With the timer switch 61 again in its normal position, the energizing circuit for motor 63 is broken and the sequence controller is ready for the next sheet. High speed motors 49 and 57 of timing mechanism 200 are still energized through switch 41 even though control by the measuring switch 38 has been transferred to the low speed motors of timing mechanism 300. Thus, cams 47 and 56 of timing mechanism 200 continue to rotate at high speed and close switch 53 and 59 which control folding means 23 and 29, respectively. When cams 47 and 56 have completed one full revolution, switches 55 and 60 are opened as explained above, to deenergize the high speed motors.

In the aforementioned operation, pneumatic blast folding devices 23 and 29 are operated in their proper sequence in accordance with the length of the sheet so as to produce a double fold in the sheet.

In the event it is desired to produce only a single fold, switch 75 can be used so that the same pulse is fed to both solenoid valves, such not being part of the present invention.

In some instances, if the next sheet follows rather closely, there may be an inaccuracy because of the prior timing mechanism not having completed its operation. In order to prevent this, a control relay R as described hereafter can be included, said relay operating normally closed switches CR_1, CR_2, CR_3 and CR_4.

Lead 101 connects each of the movable blades of se-

quence switches 41, 42, 43 and 44 to lead L–2. The first selector switch 41 is shown in position so as to cause operation of its timer 200 by the sensing switch 38. Contact arm 103 thereof is in contact with 104 so that power will be applied through lead 99 to the low speed motors of the sub-timing device 201 and 202 when switch 38 is is depressed by an article passing thereover. After the article completes its pass over the sensing switch motor 63 will be operated so as to cause blade 103 to move into engagement with contact 105 and thus energize the high speed motors 49, 57 of the sub-timing means 201 and 202 of timing mechanism 200. At the same time, the next sequence switch 42 will have its movable blade moved in readiness for the actuation of the next timing mechanism 300 as the next piece passes the sensing means 38. Normally closed relay R is connected between lead 120 to motor 63 and line L–2, said relay when energized opening normally closed switch CR_1, as well as the other normally closed switches. It can be seen that control relay R is connected to the common side 116 of the measuring switch when it is in its measuring condition so that control relay is energized. Upon completion of the measuring operation, sequence switch blade 103 of the first tier of timing mechanisms will start to move. The control relay R, however, will open and thus permit the normally closed contacts of CR_1 to close immediately which will continue operation of the high speed motors of the respective timing mechanism until their circuit is opened by their motor switch, e.g., switches 55 and 60. In the meantime, sequence switch 42 of the second tier for controlling the second timing mechanism 300 will be moved and closed awaiting the measuring operation of the next piece to pass through the machine. When the next piece passes through the machine, the sensing finger of the measuring switch moves in response to a piece passing thereover so that the low speed motors of the second tier or second subtiming mechanism 300 will be operated, such continuing until the measuring switch again moves to the full line position in the drawing. This will open the control relay circuit again and permit all of the normally closed contacts CR_1 to CR_4 to close including specifically CR_2 which cooperates with sequence switch 42. Such will provide for continuation of the operation of the high speed motors of the timing mechanisms which may then be activated until their respective switches have been opened. It can be seen that activation of the control relay will take place instantly and thus bridge the circuit and this will compensate for any time delay that might possibly be involved in the movement of the sequence switch between its two positions.

As a result of this arrangement herein, it can be seen that the space between sheets and towels and the time necessary for them to pass along the conveyor will be available to complete rotation of the cam of the sequence controller before the circuit is completely transferred to the next tier or timing mechanism.

It should be apparent that the details of construction can be varied and that other types of sequence operators and switches can be employed without departing from the invention except as defined in the appended claims.

What is claimed is:

1. A control system for textile article processing apparatus adapted to receive successively fed articles of varying length measured along their path of travel through said apparatus comprising textile article operating means adapted to perform selected operations upon the articles being processed in sequence; a plurality of timing mechanisms each being connected to said article operating means for controlling said article operating means; sensing means disposed in said path of travel responsive to said length of the articles being processed as they pass sequentially thereby and adapted sequentially to control each of said timing mechanisms; and sequence controller means for sequentially transferring control by said sensing means to each of said timing mechanisms as articles pass in sequence so that one of the timing mechanisms assumes control of the article operating means for a particular article being processed, said sequence controller means performing its transfer function in two discrete steps, the first step being performed as the article is being sensed by said sensing means and the second step being performed by said sequence controller means after the article has passed said sensing means so as to transfer control to the next timing mechanism, said sensing means, after the article has been sensed, continuing operation of each of said timing mechanisms after it has been activated while said sequence controller is changing from said first step to said second step.

2. A control system for textile article processing apparatus adapted to receive successively fed articles of varying length measured along their path of travel through said apparatus comprising textile article operating means adapted to perform selected operations upon the articles being processed in sequence; a plurality of timing mechanisms each being connected to said article operating means for controlling said article operating means; sensing means disposed in said path of travel responsive to said length of the articles being processed as they pass sequentially thereby and adapted sequentially to control each of said timing mechanisms; sequence controller means for sequentially transferring control by said sensing means to each of said timing mechanisms as articles pass in sequence so that one of the timing mechanisms assumes control of the article operating means for a particular article being processed, said sequence controller means performing its transfer function in two discrete steps, the first step being performed, as the article is being sensed by said sensing means, by a cam means operated by said sequence controller means and the second step being performed by said cam means after the article has passed said sensing means so as to transfer control to the next timing mechanism, and control relay means connected with said sensing means and said sequence controller means actuable to continue operation of each of said timing mechanisms while said sequence controller is changing from said first step to said second step thereby.

3. A control system for textile article processing apparatus adapted to receive successively fed articles of varying length measured along their path of travel through said apparatus comprising textile article operating means adapted to perform selected operations upon the articles being processed in sequence; a plurality of timing mechanisms each being connected to said article operating means for controlling said article operating means; sensing means disposed in said path of travel responsive to said length of the articles being processed as they pass sequentially thereby and adapted sequentially to control each of said timing mechanisms; and sequence controller means for sequentially transferring control by said sensing means to each of said timing mechanisms as articles pass in sequence so that one of the timing mechanisms assumes control of the article operating means for a particular article being processed, said sequence controller means performing its transfer function in two discrete steps, the first step being performed, as the article is being sensed by said sensing means, by a cam means operated by said sequence controller means and the second step being performed by said cam means after the article has passed said sensing means so as to transfer control to the next timing mechanism, and control relay means connected with said sensing means and said sequence controller means actuable to continue operation of each of said timing mechanisms while said sequence controller is changing from said first step to said second step, and means stopping each of said timing mechanisms upon completion of its movement.

4. A control system for textile article processing ap-

paratus adapted to receive successively fed articles of varying length measured along their path of travel through said apparatus comprising textile article folding means adapted to perform folding operations upon the articles being processed in sequence; a plurality of timing mechanisms each being connected to said article operating means and sequentially operable to control said folding means; sensing means disposed in said path of travel operable by said length of the articles being processed as they pass sequentially thereby and adapted sequentially to control each of said timing mechanisms and the folding means; sequence controller means operable as a succeeding article readies said sensing means for sequentially transferring control by said sensing means to each of said timing mechanisms as articles pass in sequence so that one of the timing mechanisms assumes control of the article operating means for a particular article being processed, said sequence controller means performing its transfer functions in two discrete steps, the first step being performed, as the article is being sensed by said sensing means, by a cam means operated by said sequence controller means and the second step being performed by said cam means after the article has passed said sensing means so as to transfer control to the next timing mechanism, and relay means connected to said sensing means and to said sequence controller means operable to continue operation of each of said timing mechanisms after it has been activated while said sequence controller is changing from said first step to said second step and before a succeeding article has activated the sensing means.

5. A control system for textile article processing apparatus adapted to receive successively fed articles of varying length measured along their path of travel through said apparatus comprising textile article folding means adapted to perform folding operations upon the articles being processed in sequence; a plurality of timing mechanisms each being connected to said article operating means and sequentially operable to control said folding means; sensing means disposed in said path of travel and operable by said length of the articles being processed as they pass sequentially thereby and adapted sequentially to control each of said timing mechanisms and the folding means; sequence controller means operable as a succeeding article readies said sensing means for sequentially transferring control by said sensing means to each of said timing mechanisms as articles pass in sequence so that one of the timing mechanisms assumes control of the article operating means for a particular article being processed, said sequence controller means having switch means operable between two positions, said switch means being in the first position as the article is being sensed by said sensing means and the said switch means being in said second position after the article has passed said sensing means so as to transfer control to the next timing mechanism and relay means connected to said sensing means and to said sequence controller means operable to continue operation of each of said timing mechanisms after it has been activated while said sequence controller is changing from said first step to said second step and before a succeeding article has activated the sensing means, said relay means by-passing said sequence controller switch means when in one of its positions.

6. A control system for textile article folding apparatus adapted to receive successively fed articles of varying length measured along their path of travel through said apparatus comprising article folding means adapted to fold said articles as they pass in sequence thereby; a plurality of measuring and timing mechanisms each being connected to said article operating means for controlling said folding means; sensing means disposed in said path of travel responsive to said length of the articles as they pass sequentially thereby and adapted sequentially to control each of said timing mechanisms in accordance with the length of the passing articles; sequence controller means for normally sequentially transferring control by said sensing means to each of said timing mechanisms as articles pass in sequence so that one of the timing mechanisms assumes control of the article operating means for a particular article being processed, said sequence controller means performing its transfer function in two discrete steps, the first step being performed, as the article is being sensed by said sensing means, by a cam means operated by said sequence controller means and the second step being performed by said cam means after the article has passed said sensing means so as to transfer control to the next timing mechanism, the next timing mechanisms being operable by the next article passing and means continuing operation of each of said timing mechanisms after it has been activated while said sequence controller is changing from said first step to said second step and before a succeeding article has activated a timing mechanism.

7. A control system for article processing apparatus of the type adapted to receive successively fed articles of varying length, comprising article operating means adapted to perform selected operations at proportionately spaced points along the lengths of said articles; a plurality of timing mechanisms for selectively controlling said article operating means and being of the type having one sub-timing device included therein for each of the article operating means being controlled, each of said sub-timing devices having two rates of operation which are proportionately related to the rate at which said articles are fed into the processing apparatus and which permit it to actuate its associated article operating means at such time as to cause the selected operation to be performed at one of said proportionately spaced points on an article being processed; sensing means responsive to the length of an article being processed and adapted to control the duration of operation of said sub-timing devices at each of their rates of operation; sequence switch means operable to sequentially transfer control by said sensing means to each of said timing mechanisms so that each timing mechanism controls the article operating means for a particular article being processed; motor means for operating said sequence switch means; and timer switch means operated by said motor means, said timer switch means and said sensing means being jointly operable to control said motor means such as that said motor means operates in two discrete steps to effect each sequential transfer by said sequence switch means, the first step taking place as an article is being sensed and the second step taking place in a shorter interval of time relative to the first step so that control is transferred to the next timing mechanism for he next article reaching the sensing means, and means actuable in response to said sensing means after passage of an article with respect to said sensing means, said means continuing the operation of each of said timing mechanisms until said motor means changes from said first step to said second step.

References Cited in the file of this patent

UNITED STATES PATENTS

2,516,454	Doran	July 25, 1950
2,643,879	Spreckelmeier	June 30, 1953
2,783,994	Petre	Mar. 5, 1957
2,858,129	Buss	Oct. 28, 1958