

Jan. 16, 1968

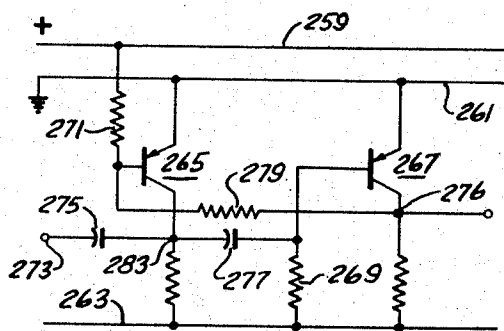
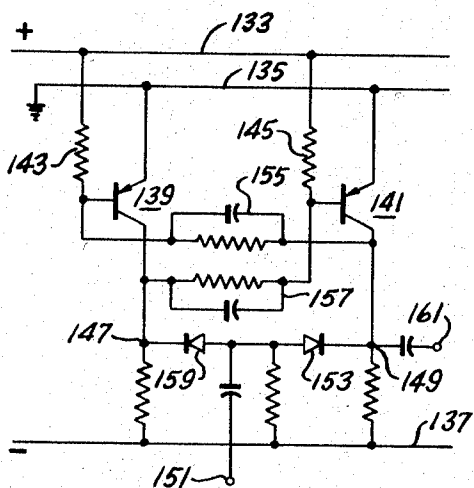
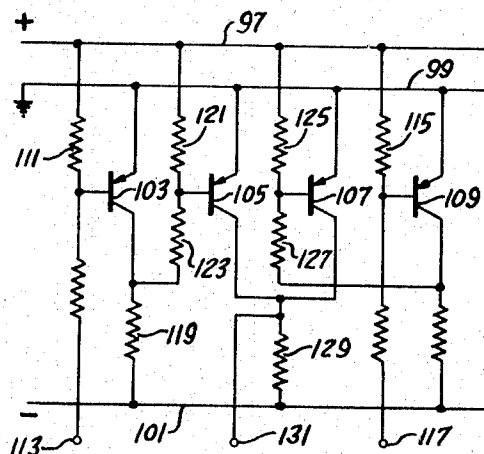
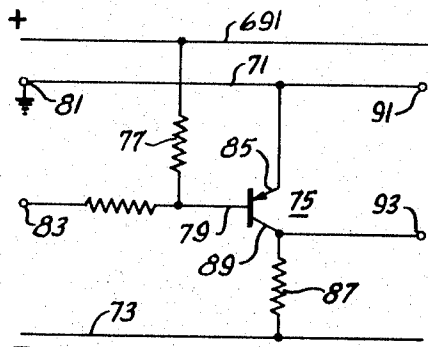
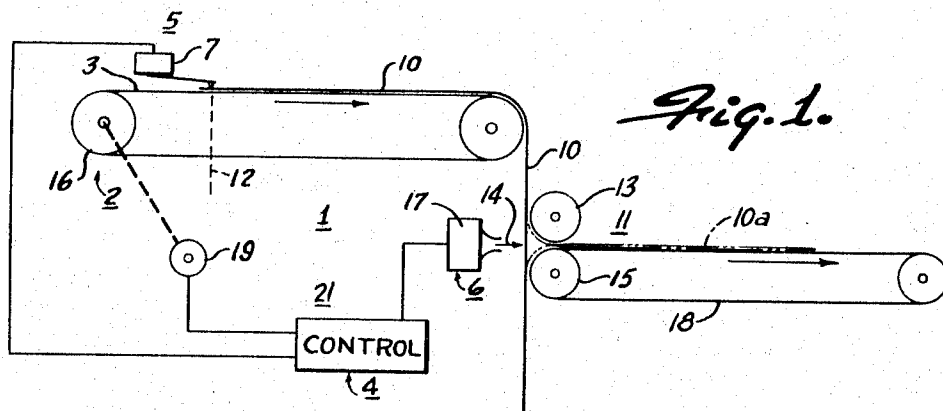
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3,363,897

CONTROL FOR FOLDING MACHINES

Filed March 9, 1965

4 Sheets-Sheet 1



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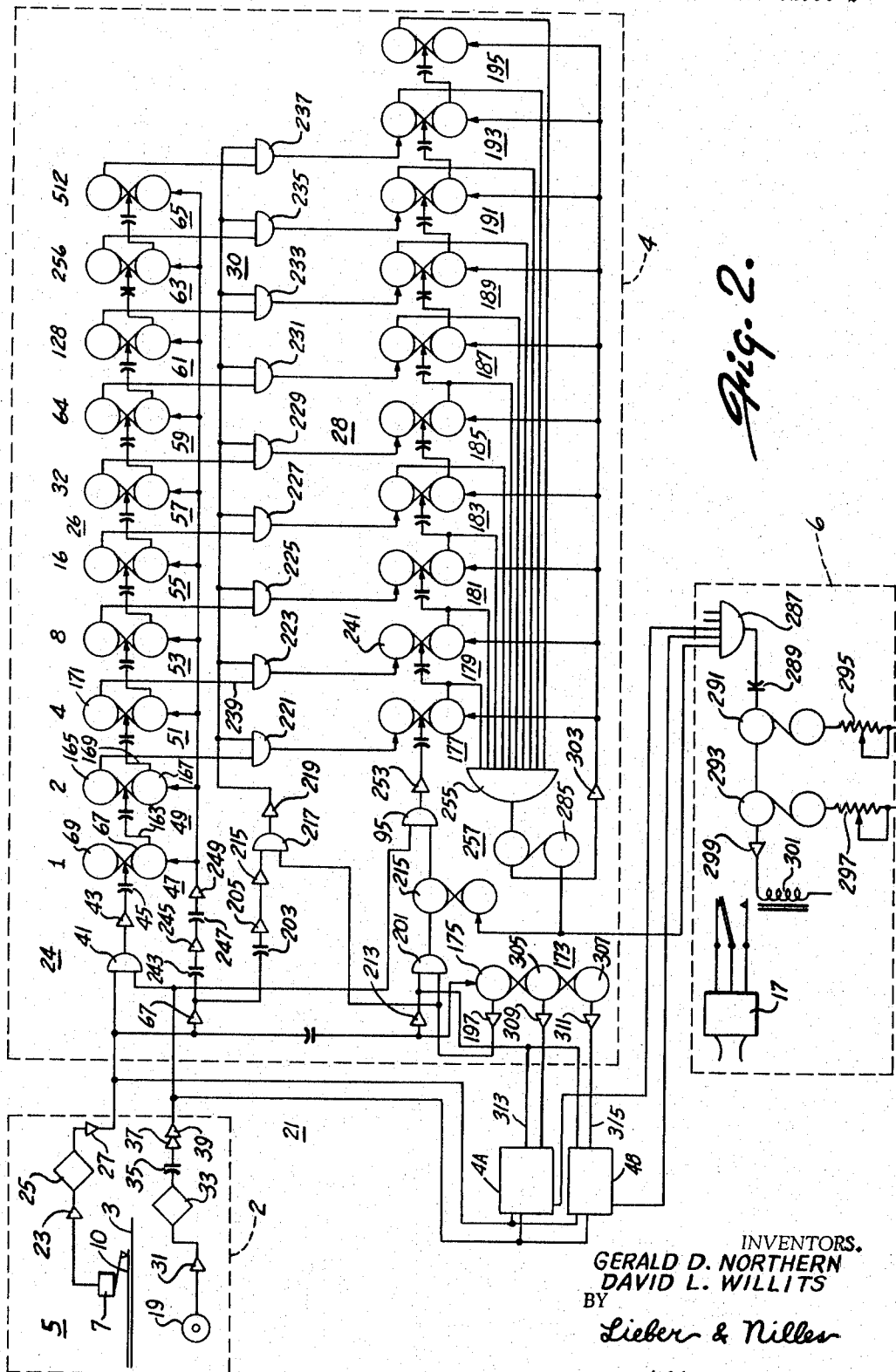
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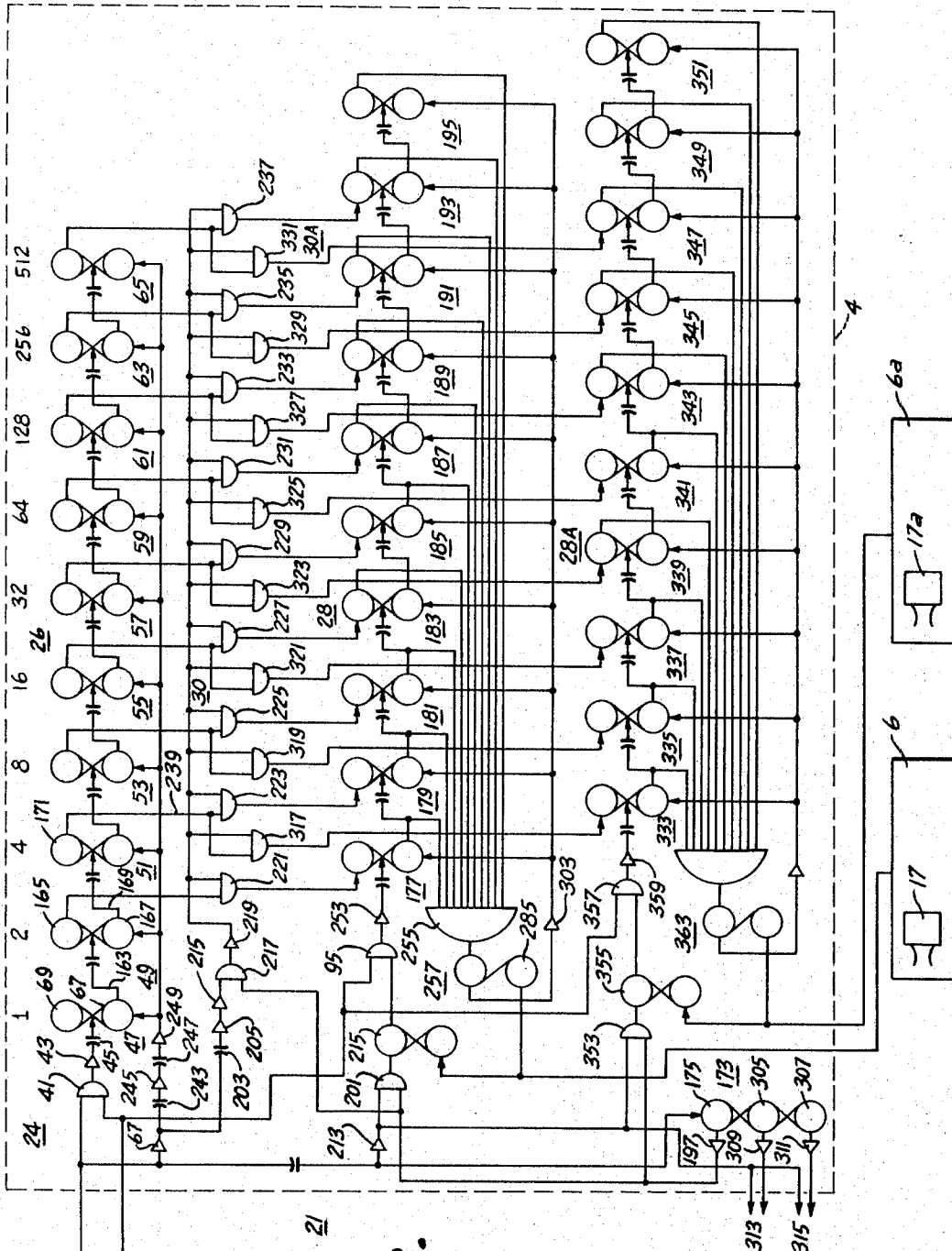


Fig. 8.

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CONTROL FOR FOLDING MACHINES

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10 Claims. (Cl. 270—84)

ABSTRACT OF THE DISCLOSURE

A control for a material piece folding machine utilizes, as a measuring device, a means generating pulses at a uniform rate. A pulse counting means is interposed between the uniform pulse rate means and a preset pulse counter to provide the compensation to the control necessary to permit accommodation of varying lengths of material pieces in the folding machine.

This invention relates to an improved control for apparatus for effecting folds at fractional intervals along linear material. While not limited thereto, such control may find application in a laundry folding machine for folding flatwork such as bed sheets, tablecloths or towels.

Folding machines generally employ a conveyor means, such as a moving belt to move the material through the machine. The control for the folding machine ascertains the position of the material on the belt and actuates a folding means to fold the material at the desired point.

The most commonly used control system, as described in the below mentioned patents, utilizes the following principle of operation. For purposes of illustration the control will be described in the context of a laundry folding machine wherein a piece of flatwork, such as a sheet is to be folded in half. The sheet is placed on the conveyor for transport to the folding means. A sensing device or switch is placed adjacent the conveyor to sense the presence of the sheet on the conveyor. This sensing device is placed rearward of the folding means a distance equal to one-half the length of the longest sheet to be folded. The sensing device senses the leading edge and the trailing edge of the sheet. When the sensing device senses the leading edge of the sheet, it starts a timing or measuring device in the folding machine control which will activate the folding means at the end of its timing or measuring operation. The timing or measuring device is set so that it will complete its operation when a maximum size sheet has passed under the sensing means or trip. Under these circumstances, as the trailing edge of the sheet is passing under the sensing device, the center of the sheet will be under the folding means since the sensing device has been placed to the rear of the folding means a distance equal to one-half the length of this longest piece of material. The timing device then actuates the folding means, folding the sheet in half.

If the control senses that a sheet of less than maximum length is on the conveyor belt, that is, if the trailing edge of the sheet passes under the trip before the timing operation of the timer is complete, the control doubles the rate of timing or measuring of the timing device when the trip senses the trailing edge. This hastens completion of the timing or measuring sequence to compensate for the shorter sheet so that the folding means is actuated as the center of the shorter sheet passes under it. It will be appreciated that this method is not limited to folding a piece in half, but by adjustment of the position of the trip or the rate of accelerated timing or measuring, the folding machine may be controlled to fold the sheet at any desired point along its length.

The above mode of operation has been employed by

numerous prior art control systems. For example, the U.S. Patent No. 2,374,779 to Preston and the U.S. Patent No. 2,643,879 to Sprecklmeister employ a capacitive timing circuit. A capacitor is discharged at one rate while the material is passing under the sensing device and then at double that rate when the material leaves the sensing device. The U.S. Patent No. 2,774,592 to Kagan employs motor-gear train combinations with over-running clutches. One motor drives a common timing shaft at one speed until the piece leaves the sensing device. Then another motor is engaged which drives the shaft at twice that speed. Another modification of this type of control is one in which the timing rate is effected by shifting gears to increase the speed of the timing shaft when the piece has left the sensing device.

U.S. Patent No. 2,942,874 to Hajos shows an analogous system in which pulses are fed to a preset counter at one rate when the piece is under the sensing device and fed at a higher rate as the piece leaves the sensing device.

It is to be noted that all of the above control structures require a timing or measuring device operating at two different rates, that is, a low rate while the piece is under the sensing device and a higher rate after the piece has left the sensing device. As such, they have required apparatus such as pulse rate doublers, over-running mechanical clutches, or gear-shifting mechanisms for satisfactory operation. Such apparatus has added to the complexity of operation and adjustment of these controls while lessening the reliability and accuracy thereof.

It is therefore an object of this invention to provide a control for apparatus for effecting folds at fractional intervals along linear material employing only a single timing or measuring rate.

An additional object of this invention is to provide a folding machine control wherein the single timing or measuring rate permits the use of a low speed static electric counter in the control.

It is a further object of this invention to provide such a control which utilizes the above mentioned single timing or measuring rate in conjunction with static electronic logic circuits to provide long life and reliable operation.

A further object of this invention is to provide such a control for a folding machine which may be easily adjusted to fold material passing therethrough at varying intervals along its length.

Yet another object of this invention is to provide a folding machine control which will control the folding of a plurality of pieces of material simultaneously moving through the machine.

Another object of this invention is to provide such a control which will effect a plurality of segmental folding operations on material passing therethrough.

A further object of this invention is to provide a control for apparatus for effecting folds at fractional intervals along linear material including; a means for sensing the presence or absence of material passing said sensing means, a folding means to effect the folding of the material a predetermined distance from said sensing means, a pulse generating means producing control pulses of a single frequency responsive to the passage of said material, and control circuitry means having an input operated by said sensing means and connected to said pulse generating means and an output connected to said folding means, said control circuitry means storing control pulses corresponding to the length of said material in an input register, said control circuitry means also including a control register preset in conformity with said predetermined distance and utilizing a portion of said stored control pulses and additional control pulses from said pulse generating means to determine when the material is in the

desired relation to said folding means and to actuate said folding means.

An additional object of this invention is to provide a control for a material folding machine to fold material at fractional intervals along its length including a means for sensing the presence or absence of material passing said sensing means, a folding means to effect the folding of the material a predetermined distance from said sensing means, a pulse generating means producing pulses of a single frequency responsive to the passage of said material, and control circuitry means having an input operated by said sensing means and connected to said pulse generating means and an output connected to said folding means, said control circuitry including input register means storing control pulses corresponding to the length of said material, said circuitry means also including means for adjusting the total of said stored pulses in proportion to the fractional interval of folding and control register means preset in conformity with said predetermined distance, utilizing said adjusted total of said stored pulses and additional pulses to attain said preset when said material is in the desired relation to said folding means and to actuate said folding means.

The above and other objects of this invention may be better understood by reference to the following specification and drawings, forming a part thereof, in which:

FIGURES 1 and 7 are schematic diagrams of folding machines to which the control of this invention may be applied;

FIGURE 2 is a circuit diagram of the control with certain elements thereof represented in symbolic form;

FIGURE 3 is an amplifier circuit which may be employed in the circuit of FIGURE 2;

FIGURE 4 is an AND gate circuit which may be employed in the circuit shown in FIGURE 2;

FIGURE 5 is a binary logic circuit which may be employed in the circuit shown in FIGURE 2; and

FIGURE 6 is a monostable logic circuit which may be employed in the circuit shown in FIGURE 2;

FIGURE 8 is another embodiment of the control with certain elements shown in symbolic form.

Brief description of control system

Referring now to the figures and particularly FIGURE 1, there is shown therein the exemplary application of the control of the present invention to a material folding machine. Such a machine, which may be employed to fold pieces of laundry passing therethrough, is designated by the numeral 1. The machine includes a conveyor 3 which moves the material therethrough. The control consists of input circuitry 2, control circuitry 4, and output circuitry 6. Input circuitry 2 contains sensing means 5 which is sensitive to the passage of material through machine 1. While sensing means 5 is shown as limit switch 7, it may also be a photo cell and light source sensing device or other similar means. The material to be folded, such as laundry piece 10, passes down conveyor belt 3 and hangs vertically from the end thereof. Folding means 11 of machine 1 effects the folding of laundry piece 10 from this vertical position and comprises folding rolls 13 and 15 and a device in output circuitry 6 to insert laundry piece 10 between rolls 13 and 15 at the point at which it is to be folded. The device is shown in FIGURE 1 as air jet 17 which blows the material between said rolls. A mechanical device such as a folding knife may also be utilized. The folded material 10A is removed from the folding machine on conveyor 18. The point 12 at which presence or absence of material is sensed by folding means 5 and the point 14 at which the folding operation takes place is a predetermined distance and is utilized by folding machine control 21 for a purpose hereinafter explained.

As shown in FIGURES 1 and 2, control circuitry 4 is connected to sensing means 5 and pulse generating means 19, of input circuitry 2. Pulse generating means 19 pro-

duces control pulses of a single frequency in response to movement of conveyor 3 and laundry piece 10. This device, which may be a rotary electro-mechanical machine, may be connected to drive pulley 16 of conveyor belt 3 to generate pulses as drive pulley 16 rotates to drive conveyor 3 carrying laundry piece 10. For example, pulse generating means 19 may generate a pulse for each one quarter inch of travel of conveyor 3. Control circuitry 4 is also connected to output circuitry 6 to actuate air jet 17 to fold the material at the proper point along its length.

FIGURE 2 shows a simplified circuit diagram of the control 21 with certain elements indicated in symbolic or block form for clarity. These elements are shown in greater detail in FIGURES 3 through 6. Control circuitry 4 comprises input circuitry 24, an input register 26, a control register 28, and AND gate circuitry 30.

Briefly, the control operates in the following manner. When sensing means 5 senses the presence of material 10 on conveyor 3, a signal is supplied to input circuitry 24 to operate control circuitry 4 to supply the pulses from pulse generating means 19 to input register 26. Input register 26, which may contain binary counting circuitry as hereinafter described, records the pulses from pulse generating means 19 to measure the length of material 10 as it travels down conveyor 3.

When the piece of laundry to be folded has been moved by conveyor 3 past sensing means 5, the input circuitry 24 stops supplying pulses to input register 26. The number of pulses then stored in input register 26 represents a measurement of the length of laundry piece 10 in pulses. For example, if pulse generating means 19 generates a pulse for every one-quarter inch of travel of laundry piece 10, there will be four counts in the register for every inch of length of laundry piece 10.

When the laundry piece 10 has moved beyond sensing means 5 toward folding means 11 and input circuitry 24 stops supplying pulses to input register 26, input circuitry 24 operates additional circuitry in input register 26 to divide the total number of pulses stored in the counting circuitry of input register 26 to provide a fractional portion of the total number of pulses recorded in input register 26 to control register 28. The fractional portion of the recorded pulses supplied to control register 28 corresponds to the fractional point of folding on the laundry piece 10. For example, if it is desired to fold laundry piece 10 in half, half of the pulses stored in input register 26 will be entered on control register 28.

Control register 28, which may also contain counting circuitry of the binary type, is a preset register. That is, the register delivers an output signal when a preset number of pulses are recorded in the counting circuit. The preset number on control register 28 is determined by the distance from sensing means 5 to folding means 11. The preset number is such that the laundry piece 10 will be in a position to be folded at the desired point when the preset number is reached.

After the laundry piece 10 has been moved past sensing means 5, input circuitry 24 operates control circuitry 4 to provide the pulses from pulse generating means 19 to control register 28. These pulses are added to the pulses transferred to control register 28 from input register 26. When the total number of pulses recorded on control register 28 reaches the preset number, a control signal is sent to the output circuitry 6. This signal operates air jet 17 to insert laundry piece 10 between folding rolls 13 and 15 to fold the laundry at the desired fractional point along its length.

Although only one set of components 24, 26, 28 is shown in FIGURE 2 for clarity, additional sets of components may be included in control circuitry 4 to provide folding to a plurality of material pieces 10 simultaneously on conveyor 3, or to provide subsequent additional folds to the pieces.

The following examples of typical operation of the

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control 21 will serve to more fully illustrate its performance. It may be assumed that the control 21 is set to fold laundry piece 10 in half. Further, assume the distance from point 12 (sensing means 5), to point 14 (the folding mechanism 11), to be 60 inches. This means the largest piece of laundry 10 that can be accommodated is 120 inches in length; i.e., when the control 21 has completed its determination of the length of the material by means of sensing means 5 sensing the trailing edge of laundry piece 10, the center of a 120-inch laundry piece will be in front of air jet 17 and folding rolls 13 and 15, 60 inches from the sensing means. The control 21 must then act immediately to fold laundry piece 10 in half.

It is also assumed, as previously mentioned, that pulse generating means 19 delivers one pulse for each one-quarter inch of travel of laundry piece 10 and conveyor means 3. In terms of pulses, a maximum size piece of laundry 120 inches long represents 480 pulses. A fractional portion of this number of pulses corresponding to the distance between sensing means 5 and folding means 11 in pulses is utilized as the preset number in control register 28. In this example, where the laundry piece is to be folded in half, the control register 28 would be set to deliver a control output signal to output circuitry 6 when 240 pulses are recorded in the counting circuitry thereof.

The control 21 operates to fold a piece of laundry 120 inches long in half as follows. Laundry piece 10 moves down conveyor 3. Sensing means 5 senses the leading edge of the piece. Input circuitry 24 in response to a signal from sensing means 5 supplies pulses from pulse generating means 19 to input register 26. Four pulses are supplied for each inch of travel of laundry piece 10. 480 pulses will have been recorded in input register 26 by the time sensing means 5 senses the trailing edge of laundry piece 10. At this point 60 inches of laundry piece 10 will be between sensing means 5 and folding means 11 and the other 60 inches will be beyond folding means 11. The folding operations must therefore be immediately effected to fold laundry piece 10 in half.

When sensing means 5 senses the trailing edge of laundry piece 10 input circuitry 24 operates control circuitry 4 to cease supplying pulses to input register 26 and further operates control circuitry 4 to divide the 480 pulses stored in input register 26 by the fractional interval of folding, i.e., in half, and to supply a count of 240 pulses to the control register 28.

As previously noted, control register 28 is preset to operate folding means 11 when the counting circuitry thereof has received 240 pulses. As the control register 28 records a simultaneous input of 240 pulses from input register 26, the preset number is immediately obtained and folding means 11 is operated to fold laundry piece 10 in half.

If a piece of laundry shorter than maximum length, say a piece 100 inches long, passes down conveyor 3, the following operation takes place. Input circuitry 24 is operated by sensing means 5 to supply the pulses from pulse generating means 19 to input register 26 when sensing means 5 senses the leading edge of the laundry piece. As the piece passes under sensing means 5 four pulses per inch of travel are recorded in input register 26. By the time sensing means 5 senses the trailing edge of the 100-inch piece of laundry 400 pulses will have been recorded.

When the trailing edge of the laundry piece is sensed by sensing means 5, the laundry piece is positioned on the conveyor so that 60 inches lie between sensing means 5 and folding means 11 and 40 inches extend beyond the folding means 11. The laundry piece must travel another 10 inches down conveyor means 3 before 50 inches of the piece extend beyond the folding means.

The control 21 provides compensation for this shorter piece of material and allows it to travel the additional 10 inches before being folded as follows. When the

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trailing edge of the laundry piece is sensed, the 400 pulse total recorded in input register 26 is divided in half and supplied to control register 28. Control register 28 records a count of 200 pulses. Input circuitry 24 supplies additional pulses from pulse generating means 19 to control register 28. During the additional 10 inches of material travel necessary to compensate for the shorter piece of laundry, an additional 40 pulses, i.e., 4 pulses per inch for 10 inches, will be supplied to control register 28. These 40 pulses, when combined with the 200 pulses from input register 26, will cause control register 28 to reach the preset number of 240 pulses by the time the piece of laundry has travelled the additional 10 inches necessary to compensate for the shorter length. When the preset number of 240 is obtained control register 28 actuates folding means 11 to fold the laundry piece.

Other varying sized laundry pieces are accommodated in a similar manner. That is, the length of the laundry piece when it passes under sensing means 5 is recorded in input register 26 in terms of pulses. When the sensing means 5 senses the trailing edge of the material, the length recorded in input register 26 is divided in half and supplied to control register 28. Sufficient additional pulses are provided from pulse generating means 19 to control register 28 to compensate for varying length laundry pieces so that control register 19 reaches the preset number when the center of the laundry piece is at the folding means. It is to be noted that only a single timing or measuring rate is utilized rather than the variable measuring rates utilized by the above mentioned prior art. Any compensation necessary to accommodate varying sized pieces of laundry is provided by control circuitry 4, thereby providing reliable, accurate control.

If the distance between sensing means 5 and folding means 11 is changed, the maximum length of material which may be accommodated as well as the preset number on control register 28 must be adjusted accordingly. Likewise, if it is desired to fold the laundry at a fractional interval other than in half the fractional portion of the total pulses in input register 26 supplied to control register 28 must be altered. For example, if it is desired to fold the laundry piece at one third of its length, two thirds of the pulse total on input register 26 is supplied to control register 28.

Detailed description of control system

Input circuitry 2 includes a preamplifier 23 connected to limit switch 7 to amplify the signals therefrom, a pulse shaping circuit 25 such as a Schmitt trigger circuit, and an amplifier 27 to further amplify the signals. The output of amplifier 27 is supplied to AND gate 41 and amplifier 67 of input circuitry 24. Input circuitry 2 also contains preamplifier 31 connected to pulse generating means 19, pulse shaping circuit 33, capacitor 35, and amplifiers 37 and 39. A signal from pulse generating means 19 is also supplied to AND gate 41 of input circuitry 24. Circuits which may be employed as amplifiers 23, 27, 31, 37 and 39 and AND gate 41 are described below.

Sensing means 5 will generate a signal to control circuitry 4 when the leading edge of a piece of laundry passes thereunder. This signal will be supplied to AND gate 41. Pulse generator 19 will also supply signals to AND gate 41. The simultaneous application of the signal from sensing means 5 and from pulse generating means 19 to AND gate 41 will cause the gate to generate an output signal to amplifier 43. These signals will be a pulse chain corresponding to that generated by pulse generator 19. The pulse chain is shaped to a chain of voltage spikes by capacitor 45. The pulses are then supplied to input register 26 of control circuitry 4.

Input register 26 consists of a plurality of binary counting devices shown diagrammatically as bi-stable circuits 47 through 65. The bi-stable circuits count and record the number of pulses from pulse generating means entering the register through AND gate 41.

The bi-stable counting circuits 47 through 65 are shown as schematic elements of input register 26 in FIGURE 2 for simplicity. FIGURE 5 shows a circuit which may be employed as circuits 47 through 65 in FIGURE 2. Each circuit 47 through 65 shown therein provides an output signal for each two input signals supplied thereto and when connected in series as shown in FIGURE 2, serve to record the number of pulses supplied to register 26.

The two stable states of bi-stable circuits 47 through 65 are shown schematically in FIGURE 2 by a pair of circles. These circles may be considered to represent transistors 139 and 141 in the circuit diagram shown in FIGURE 5. For example, the first pulse received by bi-stable circuit 47 from pulse generator 19 will switch bi-stable circuit 47 from the state represented by circle 67 to the state represented by circle 69. This is the equivalent of turning off transistor 141 and turning on transistor 139. The next pulse injected into bi-stable circuit 47 will cause the circuit to revert to its original state. That is, the element represented by circle 67 will be on and the element represented by circle 69 will be off. This is the equivalent of turning on transistor 141 and turning off transistor 139. The change in output caused by the reversion of bi-stable circuit 47 to its original state will produce an output signal in output conductor 163. This signal will cause bi-stable circuit 49 to switch so that the element represented by the upper circle 165 is conducting. The third pulse received by input register 26 will cause the upper element of bi-stable circuit 47 to assume the on state. No output pulse will be generated in conductor 163 as a pulse is generated therein only when element 67 assumes the on state. Thus, element 165 also remains in the on state.

When the fourth pulse is received by input register 26, bi-stable circuit 47 will revert to its original condition, sending an output pulse through conductor 163. This output will cause bi-stable circuit 49 to revert to its original condition, that is, with element 167 rather than element 165 in the conducting state. The reversion of bi-stable counting element 49 to its original state will produce an output signal in conductor 169. This will cause bi-stable circuit 51 to switch from its original condition to a condition wherein element 171 is on. The above described counting process is continued in input register 26 as long as pulses from pulse generator 19 are supplied through AND gate 41 to the register. The numbers shown above each bi-stable circuit indicate the number of pulses recorded by the register when the upper element of that circuit is in the on state. Thus, when element 171 is on, four counts will have been recorded by the counter. When the upper element of bi-stable circuit 61 is on, the lower elements of all the remaining circuits being on 128 counts will have been recorded by the input register 26.

Control register 28 contains bi-stable circuits 177 through 195 which record counts in the same manner as input register 26. Input circuitry 24 of control circuitry 4 provides pulses from pulse generator 19 to both AND gates 41 and 95. As AND gate 41 is supplied with an additional signal from sensing means 5, the pulses will pass through AND gate 41 and become stored in register 26. Initially, input circuitry 24 does not supply a second signal to AND gate 95 to open the gate and allow pulses from pulse generator 19 to pass through and no counting operation takes place in control register 28.

Input circuitry 2 also provides a signal from sensing means 5 to a switching circuit 173. Switching circuit 173 provides for the operation of a plurality of control circuits 4 to control the folding of a plurality of pieces of material proceeding in seriatim along on conveyor 3. As shown schematically in FIGURE 2, switching circuit 173 is the same as bi-stable elements 47 through 65 and 177 through 195 with the exception of the addition of a third stable state, indicated by the element 307. Such additional circuitry is illustrated in FIGURE 2 and is similar to that shown. The additional control circuits 4A and 4B are

connected to conductors 313 and 315 and to OR gate 287 of output circuitry 6, as hereinafter described. The signal from input circuitry 2 turns on the first element of that circuit, element 175, preparing the control circuitry 4 shown in FIGURE 2 for operation and supplying a signal through amplifier 197 to AND gate 201. Initially, the second signal necessary for the operation of AND gate 201 is not provided thereto and the supplying of the signal by input circuitry 24 has no further effect.

When sensing means 5 senses the trailing edge of the piece of laundry to be folded, it ceases to provide a control signal. AND gate 41 loses one of the signals necessary for its operation and turns off preventing any additional pulses from pulse generator 19 from passing there-through. Input register 26, however, retains the number of pulses stored in it.

Amplifier 213 is sensitive to the loss of the control signal from sensing means 5 and provides a signal to AND gate 201. Amplifier 67 is also sensitive to the loss of the control signal from sensing means 5 and supplies a signal through capacitor 203 and amplifier 205 to AND gate 217. AND gate 217 is supplied with a second signal from amplifier 197 as element 175 of switching circuit 173 is on. This supplies a signal through AND gate 217 to amplifier 219.

The output amplifier 219 is connected to a plurality of AND gates 221 to 237, in AND gate circuitry 30. The other signal necessary for the operation of AND gates 221 through 237 is provided by the upper element of bi-stable circuits 47 through 65. It will be noted that the output of element 165 of the second bi-stable circuit 49 of input register 26 is connected to AND gate 221. The output of this AND gate is connected to the first bi-stable circuit 177 of control register 28. Likewise, the third bi-stable circuit 51 of input register 26 is connected through AND gate 223 to the second bi-stable circuit 179 of control register 28. The remaining bi-stable circuits of input register 26 are connected in a similar manner to the remaining bi-stable circuits of control register 28.

The above-described connection between the bi-stable circuits 47 through 65 of input register 26 through AND gates 221 to 237 to bi-stable circuits 177 to 195 of control register 28 provides the dividing operation necessary for the operation of control 21. Assuming the laundry piece 10 is to be divided in half, the number of counts registered on input register 26 must be divided in half and entered on control register 28 as the piece leaves sensing means 5. This is accomplished by connecting each bi-stable circuit in input register 26 to a preceding bi-stable circuit in control register 28 as shown in FIGURE 2. By way of illustration, assume that four counts have been registered on input register 26 prior to the dividing operation, the upper element 171 of bi-stable circuit 51 will be conducting while the lower elements of the remaining bi-stable circuits will be conducting. There will, therefore, be a signal in conductor 239 but in none of the other conductors connecting the bi-stable circuits of input register 26 to AND gates 221 to 237. This will cause AND gate 223 to pass a signal to bi-stable circuit 179 of control register 28 which will switch that circuit from its normal condition to a condition wherein element 241 is on. None of the other bi-stable counting circuits in control register 28 will be affected as only AND gate 223 is turned on by a signal to both its inputs. The on condition of element 241 in bi-stable circuit 179 may be read as the equivalent of two counts stored in the register. This is one-half of the count total existing on input register 26 prior to the transfer to the control register 28 and hence the number of counts on the control register 28 may be considered to be half of counts on the input register. A similar operation in dividing the number of pulses on the input register 26 and the transferring of them to control register 28 will take place for any given number of pulses on the input register 26. Obtaining a fractional portion of the number of

pulses on input register 26 other than one half may be accomplished by altering the connection of AND gates 221 through 237 to input register 26 and control register 28. For example, if it is desired to provide only one fourth the number of pulses on input register 26 to control register 28, bi-stable circuit 51 of input register 26 would be connected through an AND gate to bi-stable circuit 177 of control register 28. The other bi-stable circuits would be connected in a similar manner so that for every four pulses on input register 26 a count of one pulse will be transferred to control register 28.

A signal from amplifier 67 through capacitor 243, amplifier 245, capacitor 247, and amplifier 249, is supplied to each bi-stable circuit 49 through 65 of input register 26 to reset that register to zero in preparation for a succeeding counting operation. The resetting operation is delayed by capacitors 243 and 247 for a sufficient period of time to allow the pulses stored in input register 26 to be transferred to control register 28.

As previously mentioned, the signal from amplifier 213 is provided to AND gate 201 along with the signal from amplifier 197. These signals will provide an output to bi-stable circuit 215 which in turn provides a signal to AND gate 95. This turns on AND gate 95 to permit the pulses from pulse generator 19 to enter control register 28 through amplifier 253. These pulses are added to the count already placed on control register 28 from input register 26.

AND plate 255 is preset to provide an output signal when the count on control register 28 achieves a predetermined number. As described above, this number is determined by the distance that the sensing means is placed from the folding knife along conveyor 3. The pre-setting of AND gate 255 is accomplished by connecting the inputs thereto to the desired counting elements of the bi-stable circuits 177 through 195 making up control register 28. When the preset number is attained on control register 28, the correct number of signals will be generated in the inputs to AND gate 255 and the AND gate will open supplying a signal to monostable switching circuit 257. Monostable switching circuit 257 is comprised of a circuit which switches from one state to another for a given period of time and then reverts automatically to its original state. Such a circuit is shown in FIGURE 6.

When monostable circuit 257 receives a signal from AND gate 255 it switches to a state wherein element 285 is on. This provides a signal to OR gate 287 in output circuitry 6. OR gate 287 provides an output signal whenever any of numerous inputs is providing a signal thereto. As such it may simply be a transistor with a plurality of connections to the base terminal, a signal in one of which will bias the transistor on to provide an output signal in the emitter-collector circuit. The other inputs to OR gate 287 comprise other control circuits 4A and 4B connected to switching circuit 173. The signal from OR gate 287 is spiked by capacitor 289 and supplied to two monostable circuits 291 and 293. The period of time after which monostable circuits 291 and 293 will revert to the original condition may be adjustably controlled by means such as rheostats 295 and 297. The signal from monostable circuits 291 and 293, through amplifier 299, energizes relay coil 301 which operates air jet 17. Monostable circuit 291 provides an adjustable time delay, when desired, in the folding operation while monostable circuit 293 controls the length of time air jet 17 is on.

Simultaneously, monostable circuit 257 also provides a signal to bi-stable circuit 251, causing that circuit to revert to its original state and closing AND gate 95. This prevents further pulses from pulse generator 19 from entering control register 28.

When monostable circuit 257 reverts to its original condition, a signal is supplied through amplifier 303 to reset control register 28 to zero for a succeeding folding operation.

In instances where a plurality of material pieces are moving in seriatim along conveyor 3, the signal from input circuitry 2 to switching circuit 173 caused by the passage of the first material piece turns on element 175, as described above. The second signal from input circuitry 2 to switching circuit 173 due to the passage of the second material piece turns on element 305 and renders control circuit 4A operative to fold the second material piece. In a similar manner, the third signal from input circuitry 2 responsive to the passage of the third material piece turns on element 305 and renders control circuit 4B operative to fold the third material piece.

FIGURES 7 and 8 show a control 21 capable of automatically effecting two sequential folds to a piece of material. For example, it may be desired to fold a piece in half and then in half again. A folding machine for performing such an operation is shown in FIGURE 7 by the numeral 101. The machine is similar to the one shown in FIGURE 1 with the addition of a second set of folding rolls 13A and 15B at the end of conveyor 18 and an additional air jet 17A. It is to be particularly noted that no additional sensing means, such as limit switch 7 or pulse generating equipment, such as pulse generator 19, is required to perform a plurality of sequential folds to a laundry piece.

FIGURE 8 shows a detailed circuit diagram of the control 21 for the folding machine of FIGURE 7. The control 21 consists of input circuitry 2, control circuitry 4 and output circuits 6 and 6A. Input circuitry 2 is identical with that described in connection with the control shown in FIGURE 2. Output circuitry 6 and 6A are likewise identical with that shown in FIGURE 2 except that the second unit 6A is provided to execute the second folding operation. Control circuitry 4 contains an additional control register 28A and additional AND gate circuitry 30A.

Control register 28A is constructed and operates in the same manner as control register 28. That is, it utilizes both stored pulses obtained from input register 26 through AND gate circuitry 30A and additional pulses generating means 19 to attain a preset number when the previously folded laundry piece 10A is in the desired position in relation to the second air jet 17A. Actuation of air jet 17A inserts laundry piece 10A between folding rolls 13A and 15A to fold it.

AND gate circuitry 30A is similar to AND gate circuitry 30 except that it is connected to input register 26 in a manner to provide one fourth of the pulses on input register 26 to control register 28A. This is accomplished by connecting the first AND gate 317 to the output of element 177 of bi-stable counting circuit 51 of input register 26. The output of AND gate 317 is supplied to bi-stable counting circuit 333 of control register 28A. The next AND gate 319 is connected to bi-stable counting circuit 53 of input register 26 to bi-stable counting circuit 335 of control register 28A. The remainder of the AND gates are connected in like fashion.

The operation of control circuitry 4 to fold the laundry piece 10 in half and then in half again is as follows. Using the same criteria as in the previous examples, in which pulse generator 19 generates four pulses per inch of material travel and the sensing point 12 of limit switch 7 is 60 inches from folding point 14 of air jet 17, it may be assumed that second folding point 14A is an additional 60 inches from folding rolls 13 and 15. Thus, point 14A is 120 inches from point 12; 60 inches from point 12 to point 14 and 60 inches from point 14 to point 14A. Control register 28, as previously explained, is preset at 240 i.e. the distance in pulses from point 12 to point 14, while control register 28A is preset at 480 which is the distance in pulses from point 12 to the second folding point 14A.

To fold a piece of laundry 10 of the maximum 120-inch size, pulse generator 19 provides 480 pulses to input register 26 while the piece is passing under sensing means 5. When the trailing edge of laundry piece 10 leaves sensing means 5, control circuitry 4 is operated

to divide the pulses stored in input register 26 by the fractional interval of folding, i.e., in half, and to supply a count of 240 pulses to control register 28. As the control register 28 records the simultaneous input of 240 pulses, the preset number is immediately obtained and air jet 17 is operated to fold laundry piece 10 in half.

Simultaneously with the above described operation control circuitry 4 functions to divide the 480 pulses stored in input register 26 by the second fractional interval of folding, that is, half of a half or one quarter, to provide a count of 120 pulses to control register 28A.

A count of 120 pulses is entered on control register 28A. The passage of the trailing edge of laundry piece 10 past sensing means 5 produces a signal from amplifier 213 to AND gate 353. AND gate 353 is also supplied with a signal from element 175 of switching circuit 173. These inputs provide an output from AND gate 353 to bi-stable circuit 355 which switches that circuit to provide a signal to AND gate 357.

AND gate 357 provides pulses from pulse generator 19 through amplifier 359 to control register 28A in addition to the 120 pulses transferred from input register 26. The pulses will start entering control register 28A at the same instant that control register 28 attains its preset number and actuates air jet 17 to insert the one-half fold between the folding rolls 13 and 15. As the folded piece of material 10A travels down conveyor 18, pulse generator 19 continues to supply pulses to control register 28A. Assuming conveyor 18 runs at the same speed as conveyor 3, by the time the one-half fold or leading edge of folded laundry piece 10A reaches point 14A, 240 additional counts will have been provided to control register 28A for a total of 360. The 240 counts are produced by the 60-inch travel of the conveyor belt 18 and the count rate of four counts per inch by pulse generator 19. In order to place the one-quarter point of the laundry piece 10A before air jet 17A the piece must move an additional 30 inches down conveyor belt 18. During this travel an additional 120 pulses will be supplied to control register 28A allowing it to attain the preset number of 480 when the center of half folded laundry piece 10A is in front of air jet 17A.

When the preset number of pulses is recorded by control register 28A, the correct combination of inputs is provided to AND gate 361. This in turn provides an output to monostable circuit 363 which operates output circuitry 6A in the same manner monostable element 257 operates output circuitry 6 to fold laundry piece 10A in half.

The control 21 in FIGURE 8 compensates for pieces of laundry shorter than maximum length in exactly the same manner as the control shown in FIGURE 2. If additional subsequent folds in the laundry piece are desired, it is necessary only to provide additional folding means, additional control registers preset in accordance with the distance from the sensing means to the folding means, and additional circuitry to provide fractional portions of the stored pulses on the input register to the additional control registers. No additional sensing means or pulse generating means are required.

Detailed description of circuit elements

FIGURE 3 shows an amplifier circuit which may be employed as the various amplifiers in control circuitry 4. This amplifier is biased with a positive direct current voltage in conductor 691, ground or zero potential in conductor 71, and a negative direct current voltage in conductor 73. In practice, the positive direct current voltage is generally between 15 volts and 30 volts with the negative direct current voltage varying depending on the type of transistor 75 utilized in the amplifier. When resistor 77 is connected between conductor 691 and the base terminal 79 of transistor 75, with no input signal applied to input terminals 81 and 83, base terminal 79 will as-

sume a positive potential. If transistor 75 is of the PNP type, as shown in FIGURE 3, the transistor will be in a nonconducting or off state due to the fact that base terminal 79 is more positive than emitter terminal 85 connected to conductor 71. If a negative signal is applied to the amplifier, the voltage at input terminal 83 becomes negative with respect to the ground potential in conductor 71 and base terminal 79 will assume a more negative potential than emitter terminal 85. This turns transistor 75 on reducing the emitter to collector resistance to almost zero. Current is then drawn through resistor 87 raising the potential at the collector 89 to almost ground potential. This produces an amplified signal at output terminals 91 and 93. It is to be noted that the rising potential of collector terminal 89 connected to output terminal 93 produces a positive output signal even though the input signal was of a negative polarity. If it is desired to produce an output signal of the same polarity as the input signal, two series connected amplifiers such as amplifiers 37 and 39 may be employed. When the input signal is removed from terminals 81 and 83, transistor 75 again reverts to the nonconducting state removing the output signal from output terminals 91 and 93.

FIGURE 4 shows an AND gate circuit. This circuit is likewise supplied with a positive DC potential in conductor 97, a ground potential in conductor 99, and a negative DC potential in conductor 101. The AND gate circuit includes four transistors 103, 105, 107 and 109, and a plurality of resistive voltage divider networks. Resistor 111 connected to the base terminal of transistor 103 biases the base of that transistor above ground potential so that no base current will flow in transistor 103 in the absence of an input signal to terminal 113. Resistor 115 performs a similar function for transistor 109 connected to input terminal 117. Transistors 105 and 107 are biased to the on state by resistive voltage divider networks consisting of resistors 121, 123, and 119 in the case of transistor 105 and resistors 125, 127, and 129 in the case of transistor 107.

When a negative voltage signal is applied to input terminal 113 transistor 103 will be turned on as the base terminal becomes more negative than the emitter terminal connected to ground potential conductor 99. Current flow through the emitter collector circuit of transistor 103 will turn off transistor 105 due to the voltage divider action of the resistive network. However, since transistor 107 has not been effected, the output terminal 131 will still be at ground potential due to the low impedance of the emitter collector path of transistor 107 connected thereto. It may be noted that since the circuit is symmetrical the same results would be obtained if a negative signal had been applied only to input terminal 117 connected to transistor 109. Such a signal would have turned off transistor 107 but a ground potential path to output terminal 131 would have existed through the emitter circuit of transistor 105.

If, however, negative signals are applied to both input terminal 113 and input terminal 117, simultaneously, both transistors 105 and 107 will be turned off and the output signal at terminal 131 will drop to the potential existing in conductor 101 or the negative DC potential. The circuit described in FIGURE 4, therefore, provides a negative output signal only when two negative input signals are simultaneously applied thereto.

Referring to FIGURE 5, there is shown therein a bi-stable circuit for use in input register 26 or control register 28. The bi-stable circuit is supplied with positive direct current voltage from conductor 133, ground potential from conductor 135, and negative potential from conductor 137. The circuit includes two transistors 139 and 141 having their base terminals connected to conductor 133 via resistors 143 and 145 respectively, and their collector-emitter circuits connected between conductor 135 and conductor 137. As either of the transistors in a bi-stable circuit may be on or off it is necessary to assume a set of initial conditions before analyzing the circuit. Assuming

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that transistor 139 is on, and transistor 141 is off, junction 147 is at ground potential while junction 149 is at the negative DC potential in conductor 137. If a positive pulse is supplied to input terminal 151 it will tend to flow through diode 153 to junction 149, attracted by the negative potential existing there. The positive signal thus applied to junction 149 will flow through a parallel resistive-capacitive circuit 155 to the base terminal of transistor 139 turning that transistor off. The turn-off of transistor 139 causes the voltage existing at junction 147 to approach that of the negative DC voltage in conductor 137 and causes transistor 141 to turn on by this negative voltage applied through resistive-capacitive network 157. When the next positive pulse is applied to input 151, it will be attracted to junction 147 through diode 159 turning off transistor 141 and turning on transistor 139. Output terminal 161 is connected to junction 149. With transistor 141 in the nonconducting or off state, as in initial conditions, the voltage at output terminal 161 will be the negative DC voltage existing in conductor 137. When transistor 141 is turned on and transistor 139 is turned off, the voltage at output terminal 161 will rise to ground potential. When transistor 141 is again turned off, the voltage at output terminal 161 will again fall to the negative DC voltage and conductor 137. Thus, the bi-stable circuit shown in FIGURE 5 produces one output pulse, that is, one change from the negative DC voltage to ground and back to the negative DC voltage for every two pulse signals applied to input 151.

FIGURE 6 shows a monostable switching circuit. This circuit is energized by positive DC voltage in conductor 259, ground potential in conductor 261 and negative DC potential in conductor 263. The circuit includes two transistors 265 and 267. Transistor 267 is normally in the conducting or on state since its base is tied to the negative DC voltage in conductor 263 through resistor 269. Transistor 265 is normally in the nonconducting or off state since its base terminal is held above ground potential by resistor 271. If a positive voltage is applied to input terminal 273 through capacitors 275 and 279, transistor 267 will be turned off as the base becomes more positive than the emitter. Junction 276 now assumes the negative potential in conductor 263 and permits transistor 265 to assume the conducting state when that negative potential is applied through resistor 279 to the base of transistor 265. Junction 283 is now at ground potential and will hold transistor 267 in the off or nonconducting state until capacitor 277 charges. When capacitor 277 charges the circuit will return to its original condition. The RC time constant of capacitor 277 and resistor 269 determines the time that transistor 267 will remain off.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

We claim:

1. A folding control for use in apparatus for effecting a fold in a material piece moving therethrough, said fold occurring at a folding point located a fractional interval along the material piece length, said apparatus having a folding means to effect said fold when said folding point has moved into a desired position with respect to said folding means, said folding control including:
 - input circuitry located a predetermined distance upstream from said folding means and operatively associated with said apparatus so that said material piece passes and operates said input circuitry when moving through said apparatus, said input circuitry including means providing a plurality of output pulses as a result of constant incremental movements of said material piece past said input circuitry and through said apparatus, thereby to permit a determination of the length and position of said material piece; and
 - a control circuit for ascertaining when said material piece has moved through said apparatus so that the folding point is in the desired position with respect

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to said folding means and for actuating said folding means including,

pulse counting means connected and responsive to said input circuitry and receiving said plurality of output pulses, said pulse counting means being operable by said input circuitry and adapted to initially count the output pulses resulting from the incremental movements of said material piece in passing said input circuitry, thereby to determine the length of said material piece in terms of a pulse total, said pulse counting means retaining the fractional portion of said output pulse total corresponding to said fractional interval at which said folding point is located, said pulse counting means connected to and providing an actuating output signal for said folding means upon the counting of a predetermined number of pulses corresponding to the movement of said material piece said predetermined distance and, said pulse counting means being further adapted to subsequently count the output pulses resulting from the incremental movements of said material piece through said apparatus in addition to said fractional portion of said output pulse total when the movement of said material piece past said input circuitry has been completed, whereby the summation of said fractional portion of said output pulse total and said subsequently counted output pulses causes said pulse counting means to count said predetermined number of pulses when the folding point has moved into the desired position with respect to said folding means.

2. A folding control for use in apparatus for effecting a fold in a material piece moving therethrough, said fold occurring at a folding point located a fractional interval along the material piece length, said apparatus having a folding means to effect said fold when said point has moved into a desired position with respect to said folding means, said folding control including:

input circuitry located a predetermined distance upstream from said folding means and operatively associated with said apparatus so that said material piece passes and operates said input circuitry when moving through said apparatus, said input circuitry including means uniformly providing a plurality of output pulses as a result of constant incremental movements of said material past said input circuitry and through said apparatus toward said folding means, thereby to permit a determination of the length and position of said material piece; and

a control circuit for ascertaining when said material piece has moved through said apparatus so that the folding point is in the desired position with respect to said folding means and for actuating said folding means including,

pulse counting means connected to said input circuitry and operable by said circuitry, said pulse counting means being adapted to additively count said output pulses resulting from the incremental movements of said material piece in passing said input circuitry, thereby to determine the length of said material piece in terms of an output pulse total, said pulse counting means providing an output signal comprised of the fractional portion of said output pulse total corresponding to the fractional interval of folding, and

presettable pulse counting means connected to and providing an actuating output signal for said folding means upon the counting of a predetermined number of pulses, said presettable pulse counting means being preset to provide an output signal when a predetermined number of pulses corresponding to the movement of said material piece said predetermined distance has been counted, said presettable means connected to said input circuitry and to said pulse counting means and operable by said input circuitry to receive and count said output signal

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from said pulse counting means and, in addition, said output pulses from said input circuitry resulting from the movement of said material piece through said apparatus when the movement of said material piece past said input circuitry has been completed,

whereby the counting of said output signal from said pulse counting means and said output pulses from said input circuitry causes said presettable pulse counting means to count said predetermined number of pulses when the folding point has moved into the desired position with respect to said folding means.

3. The folding control according to claim 2, wherein said input circuitry includes sensing means located a predetermined distance upstream from said folding means and operatively associated with said apparatus, said sensing means being responsive to the movement of said material piece past said sensing means and through said apparatus, said sensing means providing a signal to said pulse counting means when said material piece is passing said sensing means to operate said pulse counting means to additively count said output pulses resulting from the incremental movements of said material piece in passing said sensing means and providing an output signal to said presettable counting means when the movement of said material piece past said sensing means has been completed to operate said presettable pulse counting means to receive and count said output pulses resulting from the incremental movement of said material piece through said apparatus.

4. The folding control according to claim 2, wherein said first means includes a pulse generating means producing output pulses having a single pulse per increment of material piece movement ratio.

5. A folding control for use in apparatus for effecting a fold in a material piece moving therethrough, said fold occurring at a folding point located a fractional interval along the material piece length, said apparatus having a folding means to effect said fold when said folding point has moved into a desired position with respect to said folding means, said folding control including:

sensing means located a predetermined distance upstream from said folding means and operatively associated with said apparatus, said sensing means sensing and being operatively responsive to the movement of said material piece past said sensing means and through said apparatus;

pulse generating means producing output pulses as a result of constant incremental movements of said material piece past said sensing means and through said apparatus; and

a control circuit for ascertaining when said material piece has moved through said apparatus so that the folding point is in the desired position with respect to said folding means and for actuating said folding means including:

a pulse counter connected to and receiving input signals from said sensing means and said pulse generating means, said pulse counting means being operable by said sensing means for receiving and additively counting output pulses from said pulse generating means when said sensing means senses said material piece passing said sensing means thereby to determine the length of said material piece in terms of an output pulse total;

a presettable pulse counting means connected to and providing an actuating output signal for said folding means upon the counting of a predetermined number of pulses, said presettable pulse counting means being preset to provide an output signal when a predetermined number of pulses corresponding to the movement of said material said predetermined distance has been counted, said presettable pulse

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counting means connected to, and receiving input signals from, said sensing means and said pulse generating means and being operable by said sensing means for receiving and counting output pulses from said pulse generating means when the movement of said material piece past said sensing means has been completed; and

divider circuitry connected to said pulse counter and to said presettable pulse counting means and adapted to provide the fractional portion of said output pulse total of said pulse counter to said presettable pulse counting means corresponding to the fractional interval at which said folding point is located when the additive counting by said pulse counter has been completed,

whereby the counting of output pulses from said pulse generating means and said fractional portion of the output signal of said pulse counter by said presettable pulse counting means causes said presettable pulse counting means to count the predetermined number of pulses when the folding point has moved into the desired position with respect to said folding means.

6. The folding control according to claim 1 suitable for use in apparatus having at least a first and second folding means to effect first and second sequential folds in said material piece at first and second folding points located a plurality of fractional intervals along the length thereof when each of said folding points has moved into a desired position with respect to the respective folding means, said folding control being further defined in that said input circuitry is located a first and a second predetermined distance from said first and second folding means, respectively, and said control circuit of said folding control ascertains when said material piece has moved through said apparatus so that the first and second folding points are in a desired position with respect to said first and second folding means, respectively, and actuates said first and second folding means, respectively; said pulse counting means of said control circuit being connected to each of said first and second folding means and adapted to sequentially provide an actuating output signal to said first folding means upon the counting of a first predetermined number of pulses corresponding to the movement of said material piece said first predetermined distance and an actuating output signal to said second means upon the counting of a second predetermined number of pulses corresponding to the movement of said material piece said second predetermined distance, said pulse counting means retaining first and second fractional portions of said pulse total corresponding to the fractional interval of said first sequential fold and the fractional interval of said second sequential fold, respectively, said pulse counting means subsequently counting the output pulses resulting from the incremental movement of said material piece through said apparatus in addition to said first and second fractional portions of said pulse total when the movement of said material piece past said first means has been completed,

whereby the summation of said first fractional portion of said pulse total and said additional output pulses causes said pulse counting means to count said first predetermined number of pulses when said first folding point has moved into the desired position with respect to said first folding means and causes said pulse counting means to count said second predetermined number of pulses when said second folding point has moved into the desired position with respect to said second folding means.

7. The folding control according to claim 2, suitable for use in apparatus having at least a first and a second folding means to effect first and second sequential folds in said material piece at first and second folding points located a plurality of fractional intervals along the length thereof when each of said folding points has moved into

a desired position with respect to the respective folding means, said folding control being further defined in that said input circuitry is located a first and a second predetermined distance from said first and second folding means, respectively, and said control circuit of said folding control ascertains when said material piece has moved through said apparatus so that the first and second folding points are in a desired position with respect to said first and second folding means, respectively, and actuates said first and second folding means, respectively, said control circuit includes a first and second presettable pulse counting means providing actuating output signals upon the counting of a predetermined number of pulses to said first and second folding means, respectively; each of said presettable pulse counting means being connected to said input circuitry and said pulse counting means, said first presettable pulse counting means being preset to provide an actuating output signal to said first folding means when a predetermined number of pulses corresponding to the movement of said material piece said first predetermined distance has been counted, said second presettable pulse counting means being preset to provide an actuating output signal to said second folding means when a predetermined number of pulses corresponding to the movement of said material piece said second predetermined distance has been counted, said pulse counting means being adapted to provide a first and second output signal to said first and second presettable pulse counting means, respectively, said first output signal comprised of the fractional portion of said output pulse total corresponding to the fractional interval of said first sequential fold, said second output signal comprised of the fractional portion of said output pulse total corresponding to the fractional interval of said second sequential fold, each of said presettable pulse counting means receiving and counting the respective output signal from said pulse counting means and the output pulses from said input circuitry resulting from the incremental movement of said material piece through said apparatus when the movement of said material piece past said sensing means has been completed,

whereby the counting of said first output signal from said pulse counting means and said additional output pulses by said first presettable pulse counting means causes said first presettable pulse counting means to count said predetermined number of pulses when said first folding point has moved into the desired position with respect to said first folding means and the counting of said second output signal from said pulse counting means and said additional pulses by said second presettable pulse counting means causes said second presettable pulse counting means to count said predetermined number of pulses when said second folding point has moved into the desired position with respect to said second folding means.

8. The folding control according to claim 5, suitable for use in apparatus having at least a first and second folding means to effect first and second sequential folds in said material piece at first and second folding points located a plurality of fraction intervals along the length thereof when each of said folding points has moved into a desired position with respect to the respective folding means, said folding control being further defined in that said sensing means is located a first predetermined distance from said first folding means and said sensing means is located a second predetermined distance from said second folding means, and said control circuit includes first and second presettable pulse counting means connected to said first and second folding means, respectively, said first presettable pulse counting means being preset to provide an actuating output signal to said first folding means when a predetermined number of pulses corresponding to the movement of said material piece said first predetermined distance has been counted, said first

presetable pulse counting means connected to, and receiving input signals from, said sensing means and said pulse generating means for receiving and counting output pulses from said pulse generating means when the movement of said material piece past said sensing means has been completed, said second presettable pulse counting means being preset to provide an actuating output signal to said second folding means when a predetermined number of pulses corresponding to the movement of said material piece said second predetermined distance has been recorded, said second presettable pulse counting means connected to, and receiving input signals from, said sensing means and said pulse generating means, for receiving and counting from output pulses from said pulse generating means when the movement of said material piece past said sensing means has been completed, said divider circuitry being connected to said first and second presettable pulse counting means and adapted to provide a first output signal to said first presettable pulse counting means when the additive counting by said pulse counting means has been completed, said first output signal comprising the fractional portion of said output pulse total of said pulse counting means corresponding to the fractional interval of said first sequential fold and a second output signal to said second presettable pulse counting means when the additive counting by said pulse counting means has been completed, said second output signal comprising the fractional portion of said output pulse total of said pulse counting means corresponding to the fractional interval of said second sequential fold,

whereby the counting of said output pulses from said pulse generating means and said first output signal of said divider means by said first presettable pulse counting means causes said first presettable pulse counting means to count said predetermined number of pulses when said first folding point has moved into the desired position with respect to said first folding means and the counting of said output pulses from said pulse generating means and said second output signal of divider means by said second presettable pulse counting means causes said second presettable pulse counting means to count said predetermined number of pulses when said second folding point has moved into the desired position with respect to said second folding means.

9. The folding control according to claim 1, adapted to effect a fold in each of a plurality of material pieces moving successively through the apparatus, said fold occurring at a folding point located a fractional interval along the length of each material piece, including:

a plurality of said control circuits for ascertaining when each of said material pieces has moved through said apparatus so that the folding point is in the desired position with respect to said folding means, each of said control circuits having pulse counting means connected to said input circuitry and to said folding means, said folding control also including interlocking circuitry connected between said plurality of pulse counting means and responsive to the successive movement of said plurality of material pieces through said apparatus to provide for the successive operation of each of said pulse counting means and the successive actuation of said folding means.

10. The folding control according to claim 1, adapted to effect a fold in each of a plurality of material pieces moving successively through the apparatus, said fold occurring at a folding point located a fractional interval along the length of each material piece including:

a plurality of said control circuits for ascertaining when each of said material pieces has moved through said apparatus so that the folding point is in the desired position with respect to said fold means, the presettable pulse counting means of each of said control circuits connected to and providing an actuating output signal for said folding means; said folding con-

trol also including interlocking circuitry connected between the presettable pulse counting means of each of said control circuit and responsive to the successive movement of said plurality of material pieces through said apparatus to provide for the successive operation of each of said presettable pulse counting means and the successive actuation of said folding means.

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