

Jan. 11, 1949.

T. S. WATSON

2,458,544

TIMER FOR FOLDING APPARATUS

Filed May 20, 1946

3 Sheets-Sheet 1

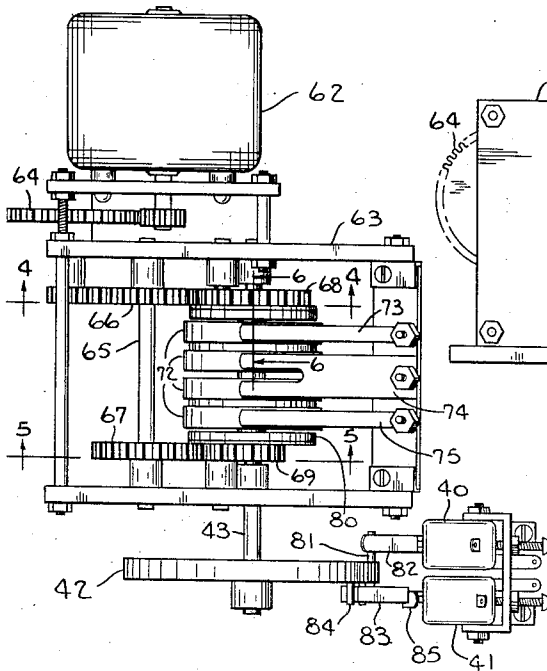


FIG. 1

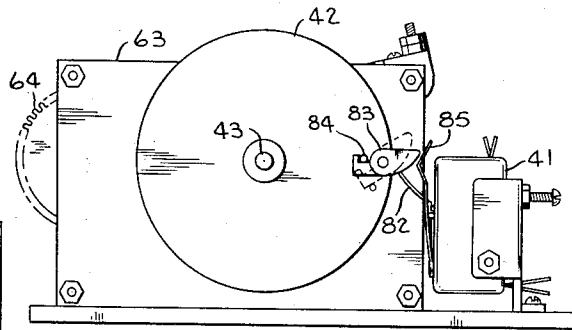


FIG. 2

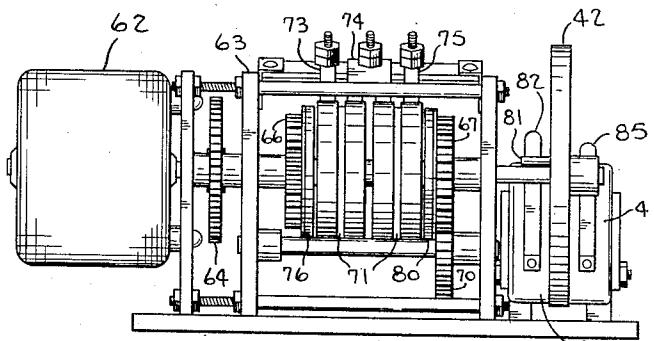


FIG. 3

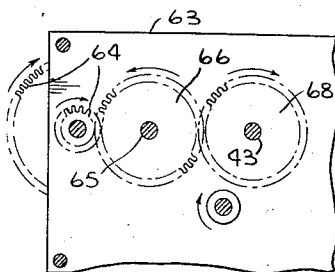


FIG. 4

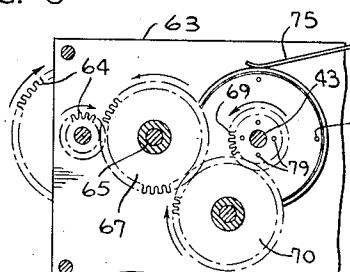


FIG. 5

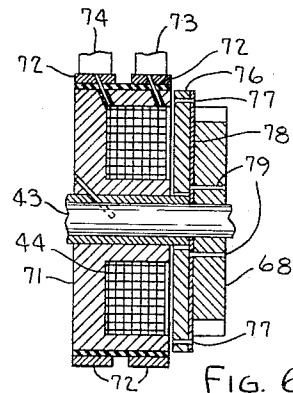


FIG. 6

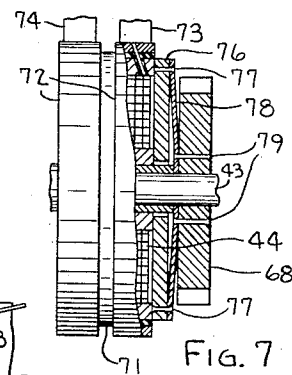


FIG. 7

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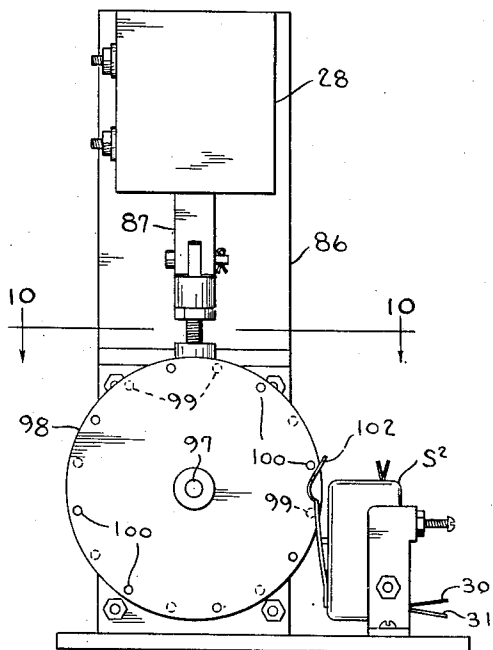
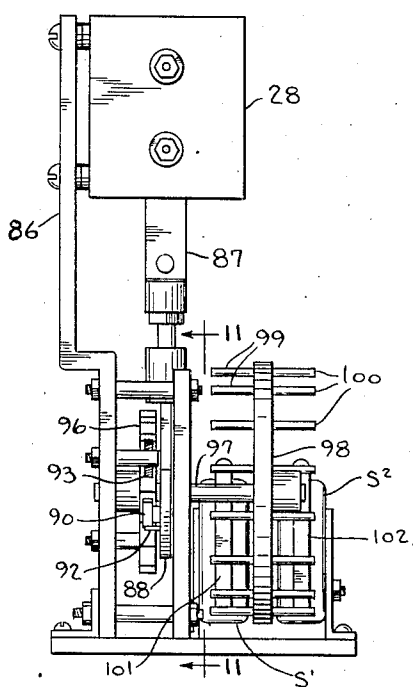


FIG. 8



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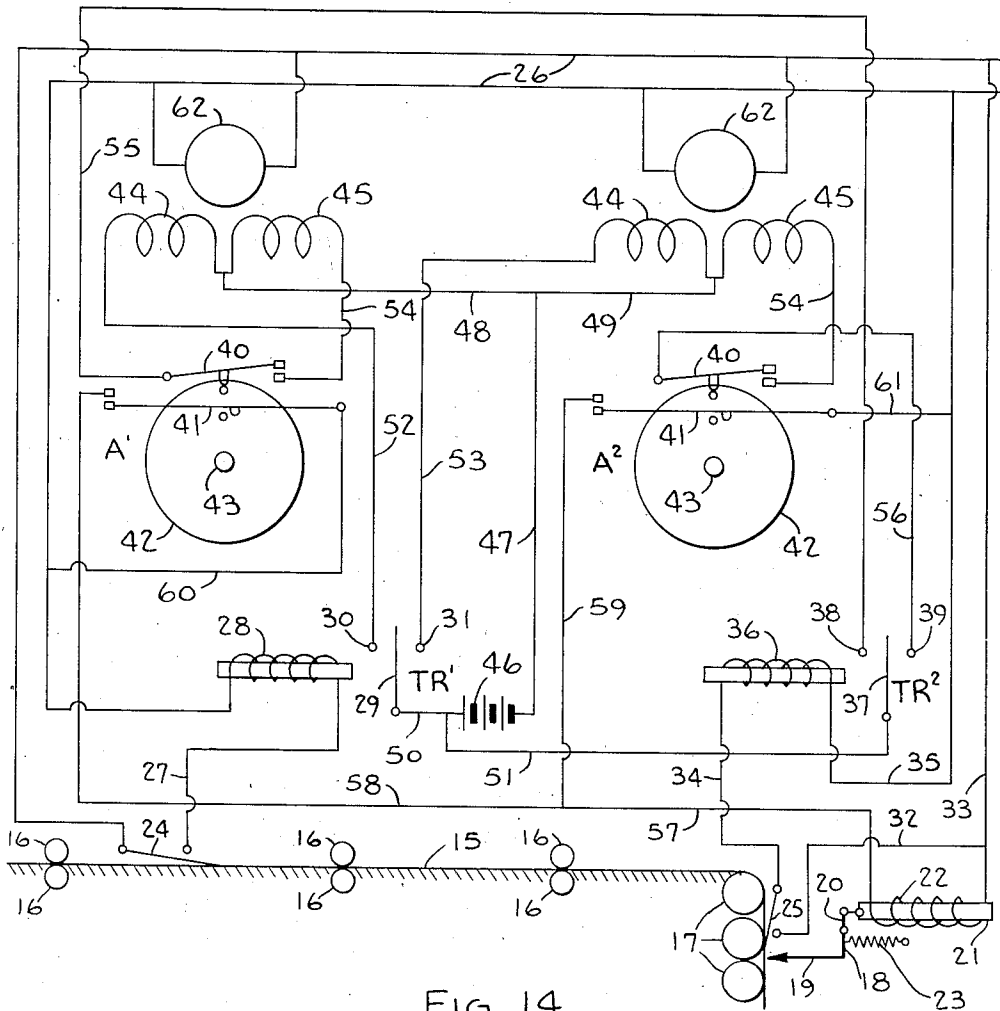
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TIMER FOR FOLDING APPARATUS

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3 Sheets-Sheet 3



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TIMER FOR FOLDING APPARATUS

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7 Claims. (Cl. 270—83)

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The invention relates to folding apparatus and more particularly to apparatus for folding sheet material especially towels, sheets, and the like.

The main object of the invention is to provide sheet controlled folding apparatus which is of simple construction where the sheet material may be folded into any desired fractional amount of its original length. More particularly the invention includes a timer controlled by the moving sheet and adapted to be operated at different speeds during the cycle of operation of the apparatus to cause the folder to operate after a predetermined length, for example, half the length of the sheet material has passed the folder.

A further object of the invention is to provide a pair of timing mechanisms and a pair of transfer switches which are electrically controlled and operated by switches operated by the passage of the sheet material past them whereby the sheet material is folded into the desired lengths.

The invention further consists in the several features hereinafter set forth and more particularly defined by claims at the conclusion hereof.

In the drawings:

Fig. 1 is a plan view of one of the timers forming a part of this invention;

Fig. 2 is a front elevation view of said timer;

Fig. 3 is a side elevation view of said timer;

Fig. 4 is a detailed vertical sectional view through the timer taken on the line 4—4 of Fig. 1;

Fig. 5 is a detailed vertical sectional view through the timer taken on the line 5—5 of Fig. 1;

Fig. 6 is a detailed vertical sectional view through the timer taken on the line 6—6 showing the clutch for the timer gear disengaged;

Fig. 7 is a view similar to Fig. 6 showing the clutch engaged;

Fig. 8 is a front elevation view of one of the transfer switches forming a part of this invention;

Fig. 9 is a side elevational view of said transfer switch;

Fig. 10 is a horizontal sectional view through the transfer switch taken on the line 10—10 of Fig. 8;

Fig. 11 is a vertical sectional view through the transfer switch taken on the line 11—11 of Fig. 9 showing the parts in one position with parts broken away;

Fig. 12 is a view similar to Fig. 11 showing the parts in another position;

Fig. 13 is a view of parts shown in Fig. 8 showing one of the switches in closed position, parts being broken away;

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Fig. 14 is a circuit wiring diagram of the apparatus embodying the invention.

Referring to Fig. 14, the numeral 15 designates a support along which the sheet material is fed by suitable conveyor rolls 16 to rolls 17. Associated with two of the rolls 17 is a folder 18 of any suitable construction and here shown as a folder blade 19 operatively connected by a lever 20 to the plunger 21 of a solenoid energized by coil 22 and moved to folding position thereby and returned by a spring 23. Sheet controlled and operated closure switches 24 and 25 are arranged one above the conveyor and the other adjacent the folding rolls so that as a sheet passes under them, it will move them to a closed position.

The switch 24 is in a circuit including current supply conductors 26, a conductor 27, and an energizing coil 28 for a transfer switch mechanism TR' here shown for diagram purposes as comprising a movable switch arm 29 and fixed contacts 30 and 31.

The switch 25 is in a circuit including conductors 32, 33, and 34, supply conductors 26, a conductor 35, and an energizing coil 36 for a second transfer switch mechanism TR² similar to the first and comprising a switch arm 37 and fixed contacts 38 and 39.

There are two timers A' and A² of like construction, each including a pair of switches 40 and 41 controlled by a rotatable timer member 42 on a shaft 43 which member is operated through gearing connections, hereafter described, controlled by electromagnetically operated clutches whose coils 44 and 45 are shown in Fig. 14. The coils 44 and 45 of the timers are energized from any suitable source of direct current as a battery 46. One side of this battery is connected by a conductor 47 and branches 48 and 49 to one of the ends of each set of coils, the other side of said battery being connected by a conductor 50 to the arm 29 of the first transfer switch and by a conductor 51 to the arm 37 of the second transfer switch.

The fixed contact 30 of the first transfer switch is connected by a conductor 52 to the forward rotation clutch control coil 44 of the first timer and the contact 31 by a conductor 53 to the similar control coil 45 of the second timer.

The reverse rotation clutch coil 45 of each of the timers is connected by conductor 54 to the fixed contact of the switch 40. The movable contact of the switch 40 of the first timer is connected by a conductor 55 to the fixed contact 38 of the second transfer switch and the similar contact of the switch 40 of the second timer is

connected by a conductor 56 to the fixed contact 39.

The switches 41 control the coil 22, one end of which is connected by conductor 33 to one of the supply lines 26 and the other end of which is connected by a conductor 57 and branch conductors 58 and 59 to the fixed contacts of the switches 41 while the movable contact of switch 41 for the first timer is connected by conductor 60 to the other one of the lines 26 and the similar contact of switch 41 for the second timer is connected by conductors 61 and 35 to this same supply line.

The shaft 43 for each of the timers is driven by an electric motor 62 receiving current from the supply lines 26.

With the above described arrangement, as the first article to be folded is carried by the conveyor 16 along the support 15, its front edge lifts switch 24 to a closed position and holds it in this position while traveling thereunder. Switch 24 then closes the circuit from the supply line 26 to coil 28 operating transfer switch TR' to move arm 29 into closing contact with contact 30, thereby causing battery 46 to energize the coil 44 of timer A' which starts to rotate clockwise closing switch 40 of said timer. Switch 41 of said timer stays open, however, as hereinafter explained. Timer A' continues to turn forward until the rear edge of the sheet material leaves switch 24, and then said switch opens, and arm 29 of switch TR' moves back to neutral. Thereafter, the sheet material travels along until it lifts switch 25 to a closed position, thus energizing coil 36 of the transfer switch TR² which closes the circuit for reverse direction clutch coil 45 of timer A', thus causing its disk 42 to rotate counterclockwise and through the gearing hereinafter described twice as fast as in its forward direction so that after half the length of the material to be folded has passed the folding rolls 17, the switch 41 of timer A' will be closed, thus connecting coil 22 with the supply line and causing it to move blade 19 to a folding position to tuck the material between the folding rolls 17, so that it will be delivered therefrom in a folded condition, and then switch 41 is again opened. Directly thereafter switch 40 of timer A' is opened breaking the circuit to reverse rotation clutch coil 45. As soon as the folded material leaves switch 25, it opens, thus deenergizing coil 36 and allowing arm 37 of transfer switch TR² to return to neutral or open position.

As the first sheet of material article passes along the conveyor, it is followed by another sheet whose front edge closes switch 24 closing circuit through coil 28 which then acts to move switch 29 into contact with contact 31 which closes circuit through forward rotation clutch coil 44 of timer A² driving disk 42 thereof in a clockwise direction closing its switch 40 while its switch 41 stays open as hereinafter explained, disk 42 continuing to turn until the rear edge of the second sheet leaves switch 24, and then said switch opens and arm 29 of switch TR' moves back to neutral. When the front edge of this second sheet reaches the switch 25, it closes the same, thus energizing coil 36 of switch TR² which under these conditions makes contact between arm 37 and contact 39 which closes the circuit for reverse rotation clutch coil 45 of timer A², thus causing its disk 42 to rotate counterclockwise, and through gearing hereinafter described twice as fast as in its forward direction, so that after half the length of the second sheet of material has passed the rolls 17, the switch 41 of timer A² closes, thus

energizing coil 22 and moving blade 19 to its folding position to tuck the sheet material between said rolls, so that it will be delivered therefrom in a folded condition, and then switch 41 is again opened. Directly thereafter switch 40 of timer A² is opened, breaking the circuit to reverse coil 45 of said timer, and as soon as the rear edge of the second sheet leaves the switch 25, the coil 36, of transfer switch TR² is deenergized, thus allowing arm 37 of said switch TR² to return to neutral position. It will be noted that as hereinafter described instead of one contact arm for each transfer switch that actually there are two switches, one closing the circuit to the coil 44 and the other to coil 45 of each timer, and that there is a slight lead of the actuator for the switch 41 of each timer as compared to its switch 40. As other articles proceed along the conveyor, the cycle described above repeats itself.

Referring now to Figs. 1 to 7, inclusive, each of the timers includes a frame 63 carrying the motor 62 connected by reduction gearing 64 to an intermediate shaft 65 carrying gears 66 and 67. The shaft 43 carries a gear 68, meshing with the gear 66 and, which when coupled to said gear, rotates forward at a predetermined speed while it carries another smaller gear 69 connected through an idler gear 70 to the gear 67 and, which when coupled to said gear 69, rotates in a reverse direction at twice its forward speed.

Drums or pole pieces 71 are fixed to shaft 43 and each has conductor rings 72 mounted thereon upon which resilient contacts 73, 74, and 75, mounted on the frame 63, bear. The clutch operating coil 44 is mounted in one end of each drum 71 to cooperate with a clutch plate 76 of magnetic material which is connected at its outer periphery by rivets 77 to a resilient diaphragm 78 whose inner diameter is connected by pins 79 to the gear 68. The clutch operating coil 45 is similarly mounted in the other drum 71 to cooperate with a clutch plate 80 of magnetic material which like the plate 76 is similarly associated with the gear 69. Energization of either the coil 44 or coil 45 draws its cooperative armature (clutch plate 76 or 80) into driving relation with its drum 71 so as to couple the gear 68 or 69 to the shaft 43. Contact 73 is connected to conductor 52 or 53 of the diagram, contact 74 with conductor 48 and 49, and contact 75 is connected to each conductor 54.

The shaft 43 carries the disk 42 which has a switch operating pin 81 fixed thereto and projecting from one side thereof to engage the switch operating arm 82 of a microswitch designated as 40 in Fig. 14. Said disk on its other side has a pawl 83 pivoted thereon and adapted to tip up to the dotted line position of Fig. 2 when disk 42 is rotating clockwise but to engage with a stop pin 84 on reverse rotation so as to move switch operating arm 85 of a microswitch designated as 41 in Fig. 14, pawl 83 having a slight lead over pin 81, so that switch 41 is opened before switch 40 closes. The terminal connections for these switches are designated in Fig. 14.

It will now be apparent that shaft 43 is driven forwardly when coil 44 is energized at one speed and switch 40 is closed during this period so long as the article to be folded is holding switch 24 closed and that said shaft is driven in the reverse direction when coil 45 is energized and at twice the forward speed until pawl 83 moves arm 85 to close switch 41 momentarily and then through pin 81 and arm 82 open switch 40. As the action of switch 40 acts to measure the length

of the article by the period of time it takes for the article to pass the switch 24 it is obvious that with the shaft 43 rotating twice as fast in the reverse direction the switch 41 will be closed in half the time, and hence that the folder controlled by this switch will fold the article in the middle of its length.

To permit continuous successive measuring and folding of the articles fed along the conveyor, the two timers A' and A² are provided which act in conjunction with the two transfer switches TR' and TR².

Each transfer switch includes a frame 86 having a coil 23 or 36 of a plunger type solenoid mounted thereon in which a plunger 87 reciprocates, said plunger carrying a member 88 guided in the frame by a pin and slot connection 89 and having pawls 90 and 91 pivotally mounted on opposite ends thereof. The pawl 90 is gravity actuated and swings between a stop pin 92 on the member 88 and an adjustable stop 93 on the frame. The pawl 91 is spring urged upwardly and swings between a stop pin 94 on the member 88 and an adjustable stop 95 on the frame. Both pawls cooperate with a ratchet wheel 96 whose shaft 97 is mounted to rotate in the frame 86 and carries a disk 98 having sets of pins 99 and 100 projecting from opposite sides thereof. The pins of each set are spaced equal distance apart, but the pins of one set are staggered or set over half the spacing distance of the other set, so that the switches operated by these pins will be operated alternately. The pins 99 operate a switch operating arm 101 of a switch S' for that part of the circuit designated by parts 29 and 30 or 37 and 38 of Fig. 14 while the pins 100 operate a switch operating arm 102 of a switch S² for that part of the circuit designated by the parts 29 and 31 or 37 and 39 of Fig. 14, and it will, therefore, be apparent that the only difference between the circuit diaphragm and the transfer switch shown in detail is that two movable switch members connected to a common conductor are used in place of the arms 29 and 37 of said diagram, the fixed contacts 30 and 31 being similarly referenced in Fig. 10 to those of Fig. 14.

Each transfer switch operates, as follows: the first upward pull of the solenoid 28 or 36 moves the plunger 87 and member 88 upwardly, thus causing pawl 90 to move from the position shown in Fig. 11 to the position shown in Fig. 12, thus moving ratchet wheel 96 a distance of a half a tooth, and when plunger 87 moves down, pawl 91 moves from the position shown in Fig. 12 to the position shown in Fig. 11, thus moving wheel 96 a distance of one-half a tooth, so that on each reciprocation of said plunger 87 the ratchet is moved clockwise one tooth, and hence the disk or pin gear 98 is moved through half the distance between the pins of either of the sets 99 or 100, but since these sets are staggered, one of the pins 99 will engage its switch operating arm 101 on this reciprocation while on the next reciprocation one of the pins 100 will engage its operating arm 102, it being noted that on the first up-stroke the switch including contacts 30 and 29 or 37 and 38 of Fig. 14 is closed and that for the next up-stroke the switch including contacts 29 and 31 or 37 and 39 of Fig. 14 is closed, and that for each down-stroke the pin gear is advanced to a position intermediate that of the pins on each side of the disk 98. Thus energization of the coil 28 by the closing of switch

24 by the first sheet of material closes contacts 30 and 29 or switch S', and that energization of this coil by the closing of switch 24 by the next sheet of material closes contacts 29 and 31 or switch S² and similarly energization of coil 36 by the closing of switch 25 by the first sheet of material closes contacts 37 and 38 or its switch S', and that energization of this coil by the closing of switch 25 by the next sheet of material closes contacts 37 and 39 or its switch S², so that the operations of these transfer switches operate as described in connection with the diagram in Fig. 14, to switch the current from the battery 46 from the coil 44 of timer A' to the coil 44 of timer A² and from the coil 45 of timer A' to the coil 45 of timer A².

With the above general description of the complete apparatus and the specific description of the timers and transfer switches, it will be apparent that I have provided a folding mechanism in which the action of the sheet material passing along a conveyor operates the control switches 24 and 25 which through the action of the transfer switches TR' and TR² control timers A' and A² to in turn control the solenoid 22 operating the folding blade 19.

I desire it to be understood that this invention is not to be limited to the details of construction herein described except as said limitations are included in the appended claims.

What I claim as my invention is:

1. In an apparatus for folding sheet material including a conveyor operating at a constant speed and folding mechanism including an electrically controlled folder to which the sheet material is fed by said conveyor, the combination of a movable timing member, an operating circuit for said folder including a folder control switch operated by said timing member, a pair of circuit closures spaced along the conveyor at a distance greater than that of the longest length of sheet material to be folded, the second of said closures being located adjacent said folder, each closure operable to close a circuit while in contact with an article of sheet material passing along said conveyor, electrically controlled means for moving said timing member in one direction at a speed proportional to that of the movement of the article by the conveyor and controlled by the closing of the first of said circuit closures by the full length of sheet material moving along the conveyor, electrically controlled means for moving said timing member in the opposite direction at a higher speed than that of its first mentioned direction and controlled by the closing of said second closure by a portion of the same sheet moving along said conveyor, said folder control switch being operated by said timing member at the end of its high speed movement to fold said sheet into a shorter length, said length being dependent upon the ratio of the speeds of movement of said timing member.

2. In an apparatus for folding sheet material including a conveyor operating at a constant speed and a folder to which the sheet material is fed by said conveyor, the combination of an electrically operated timer, a circuit closure engageable with the sheet material passing along said conveyor and operated thereby, electrically operated means controlled by said closure for moving the timer in one direction for a period determined by the time during which the full length of sheet material is operating said closure, a second circuit closure engageable with the

material for operation thereby during its movement for a portion of its length by said conveyor and disposed adjacent said folder and spaced from said first closure a distance greater than that of the longest length of sheet material to be folded, electrically operated means controlled by said second closure for moving the timer in the reverse direction at a higher speed as the portion of the material passes said folder, and electrically operated means controlled by said timer at the end of its reverse movement to operate said folder at a point intermediate the length of said material.

3. In an apparatus for folding sheet material including a conveyor operating at a constant speed and a folder to which the sheet material is fed by said conveyor, the combination of a rotary timer, a circuit closure engageable with the sheet material for operation thereby while passing along said conveyor, electrically operated means controlled by said closure for rotating the timer in one direction for a period determined by the time of contact of said closure with the full length of said material during the passage of the same along the conveyor, a second circuit closure engageable with the material and operated by a portion of the length of said material as it moves along the conveyor and disposed adjacent said folder and spaced from said first closure a distance greater than that of the longest length of sheet material to be folded, electrically operated means controlled by said second closure for rotating the timer in the reverse direction at a higher speed as said portion of the material passes said folder, and electrically operated means controlled by said timer at the end of its reverse movement to operate said folder at a point intermediate the length of said material.

4. In an apparatus for folding sheet material including a conveyor operating at a constant speed and a folder to which the material is fed by said conveyor, the combination of a rotary timer, timer drive means including change speed and reverse gearing for operating said timer at different speeds and in different directions, electromagnetically operated clutches for controlling said gearing, a control circuit including a circuit closure engageable with and operated by the material moved by said conveyor while the same is passing said closure for operating one of said clutches for driving said timer in one direction for a period determined by the full length of the material as it passes along the conveyor, a control circuit including a circuit closure disposed adjacent said folder and engageable with the material and operated thereby as a portion thereof moves along said conveyor for operating the other of said clutches for driving said timer in the reverse direction and at a higher speed as said portion of the material passes said folder, said second named circuit closure being spaced from the first named circuit closure a distance greater than that of the longest length of sheet material to be folded, and means controlled by said timer at the end of its reverse rotation to operate said folder at a point intermediate the length of said material.

5. In an apparatus for folding successive sheets of sheet material fed along a conveyor operating at a constant speed to a folder, the combination of a pair of electrically operated rotary timers for timing the passage of successive sheets along said conveyor, each timer having drive means including change speed and reverse gearing for re-

spectively operating each of said timers at different speeds and in different directions, electromagnetically operated clutches for controlling said gearing, a control circuit for said clutches including a source of current and a pair of transfer switches, electrically operated means for each of said transfer switches including a source of current and a control circuit having a control switch therein engageable with the material for operation thereby while passing said switch as the material moves along said conveyor, the control switch for the first transfer switch being operable by each sheet of material during the passage of its full length along the conveyor, the control switch for the second transfer switch being spaced from the control switch for the first transfer switch a distance greater than that of the longest length of sheet material to be folded and being disposed adjacent said folder and being operable by each sheet of material during the passage of a portion of its length past said folder, the first of said transfer switches controlling the said magnetic clutch for operating said timer drive means of both the timers in one direction successively on successive sheets of material and having two positions in one of which the said timer drive means for the first timer is rendered operative and in the other of which the timer drive means for the second timer is rendered operative, the second of said transfer switches being operable to control the operation of the electromagnetic clutch establishing reverse rotation for said timers at a higher speed successively and on successive sheets of material and having two positions in one of which the high speed drive for the first timer is rendered operative and in the other of which the high speed drive for the second timer is rendered operative, and electromagnetically operated means controlled by the timers at the end of their reverse movement to operate said folder at a point intermediate the lengths of said successive sheets.

6. Sheet folding apparatus in accordance with claim 5 in which each transfer switch comprises a solenoid and a switch operating pin gear, and a pawl and ratchet drive connection between said solenoid and pin gear.

7. Sheet folding apparatus in accordance with claim 5 in which each transfer switch comprises a solenoid and a switch operating member having two sets of operating pins arranged in offset spaced relation, and a pawl and ratchet drive for said member from said solenoid comprising a ratchet wheel connected to said member and oppositely disposed alternately acting pawls mounted on the plunger of said solenoid.

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