United States Patent

Grantham

[15] **3,692,303**

[45] **Sept. 19, 1972**

[54] **SENSING MEANS FOR FOLDER**

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[52] **U.S. Cl.** **270/61**

[51] **Int. Cl.** **B65h 45/00**

[58] **Field of Search** 270/61, 62

[56] **References Cited**

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[57] **ABSTRACT**

A sensing device for folders that are adapted particularly to folding textile pieces and laundry pieces; in the folding operation in such a folder, the means first senses the leading edge of the piece to be folded and initiates a first and slow movement of sensing control, and then senses the trailing edge and initiates a second and fast movement of the sensing control, whereby the fast movement occurs for a longer or shorter period according to whether the piece is respectively shorter or longer, and thereby effects operation of the folding element at the desired location, (e.g., the middle), of the piece regardless of the length of the piece.

12 Claims, 9 Drawing Figures

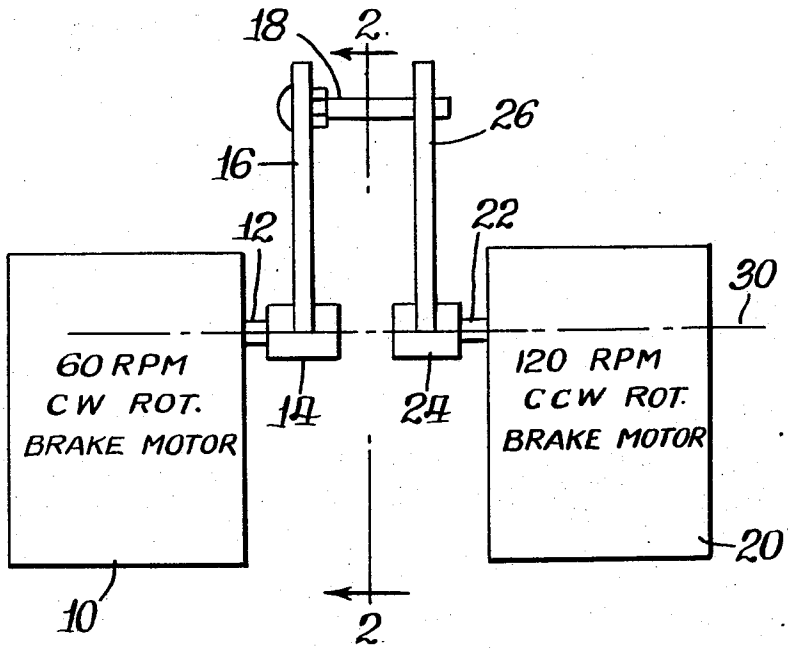

Fig. 1.

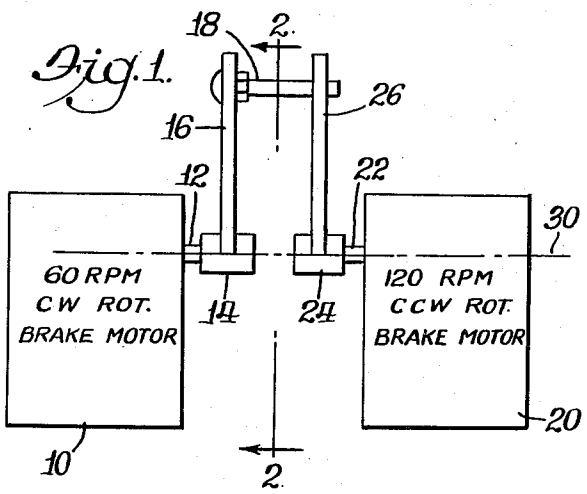

Fig. 2.

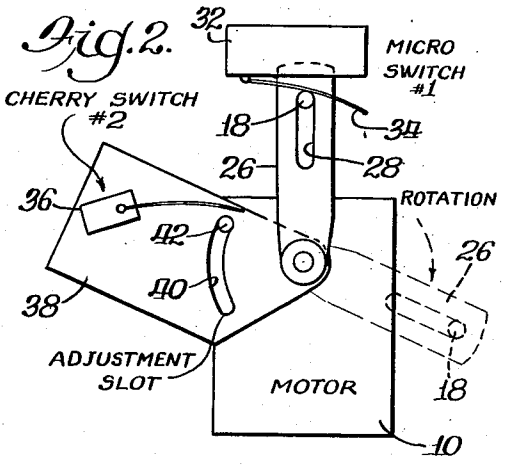

Fig. 3.

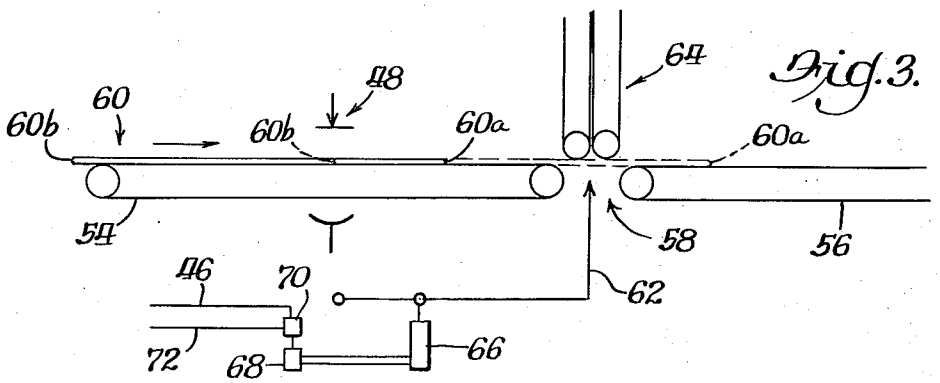

Fig. 4.

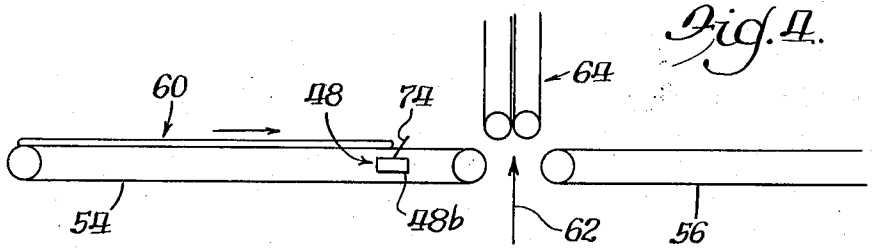

Fig. 5.

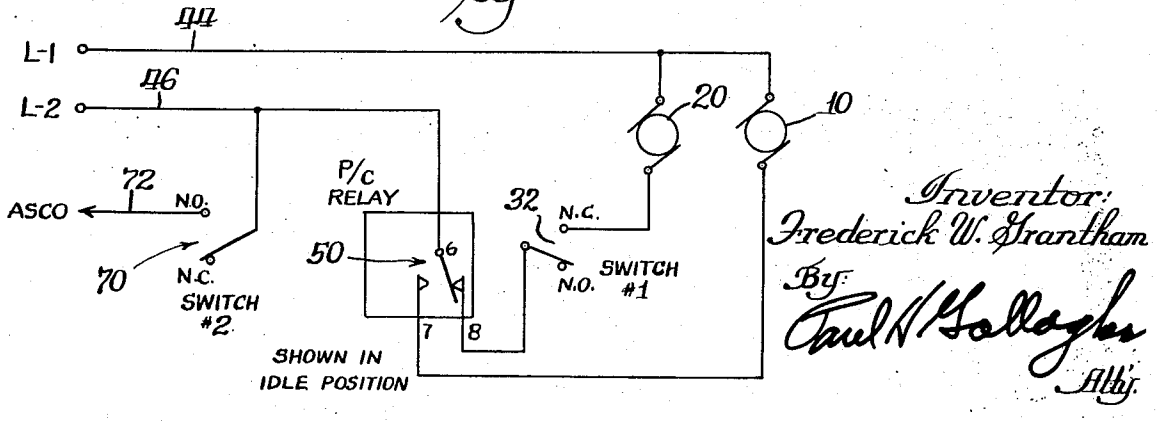

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Fig. 6.

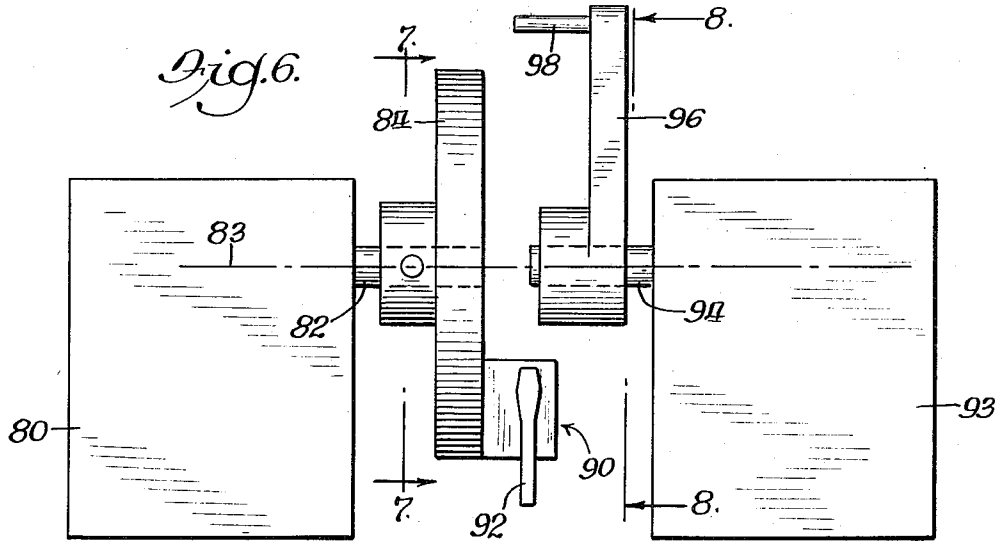


Fig. 7.

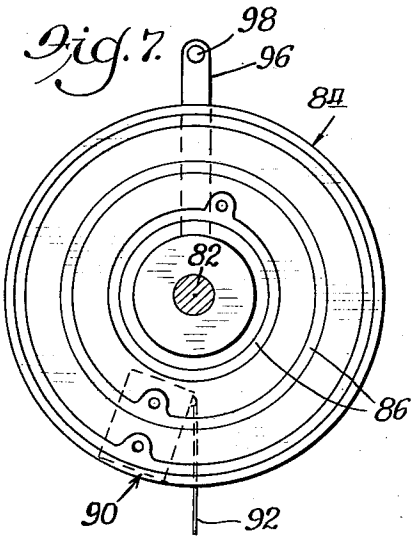


Fig. 8.

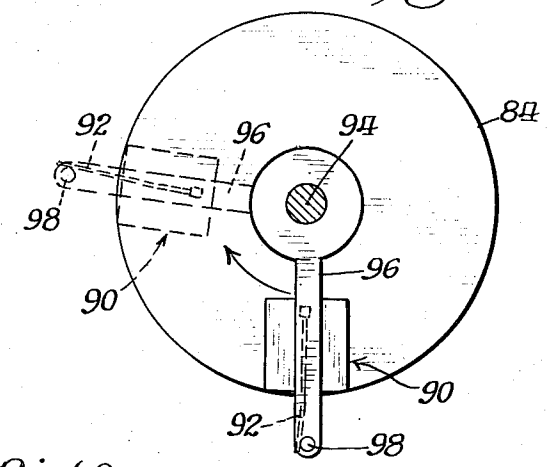
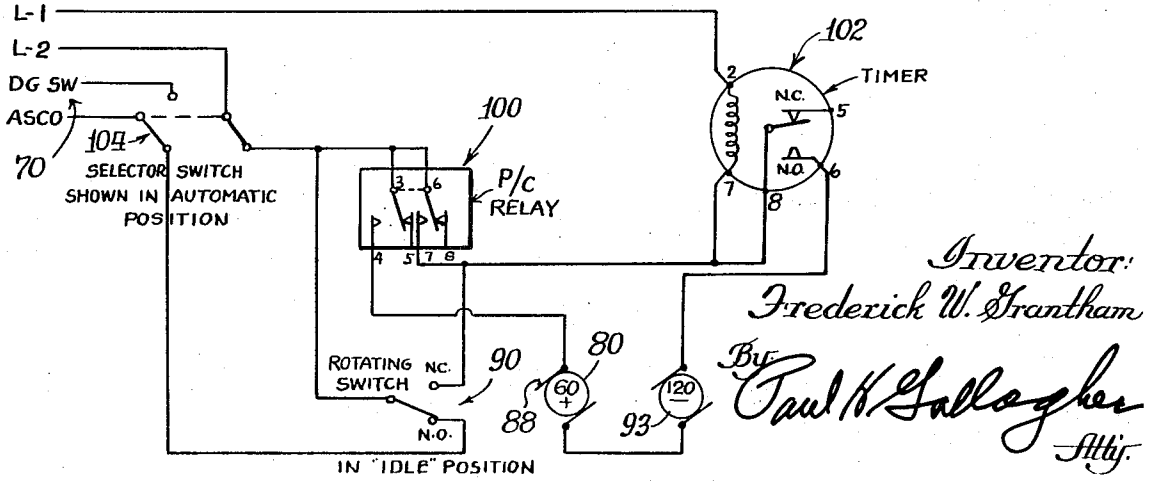


Fig. 9.



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SENSING MEANS FOR FOLDER

OBJECTS OF THE INVENTION:

A broad object of the invention is to provide in a folder novel means for folding pieces regardless of their length when pieces are introduced into the folder in random lengths.

Another object is to provide folding means of the kind just previously referred to which includes novel mechanical means for so performing the operation.

Still another and more specific object is to provide a folder of the foregoing character which includes a first and low-speed motor controlling a switch operation which moves a switch control element toward a second switch, and a control element controlled by the movement of the piece to be folded for controlling a second and high-speed motor which in turn controls the second switch and the folding operation.

A still further and more specific object, is to provide a folder of the kind referred to just immediately above, and which includes two forms, in a first of which the motors begin and terminate in a zero position in a construction which may be regarded as the more simple, and in the second of which the motors begin and terminate in any and random positions, regardless of the effective position in the next previous operation.

DESCRIPTION OF A PREFERRED EMBODIMENT:

In the drawings:

FIG. **1** is a side elevational view of a motor-drive operation utilized in a first form of the invention;

FIG. **2** is a view taken at line **2—2** of FIG. **1**;

FIG. **3** is a semi-diagrammatic illustration of the principal components of a folder embodying features of the present invention;

FIG. **4** is a view similar to FIG. **3**, representing a modified form of electrical control;

FIG. **5** is a diagram of the electrical circuit utilized in the form of FIGS. **1** to **4**;

FIG. **6** is a side view of a motor-drive of a modified form of control and oriented in a direction similar to that of FIG. **1**;

FIG. **7** is a view taken at line **7—7** of FIG. **6** and showing only the elements exposed in the plane of that line;

FIG. **8** is a view taken at line **8—8** of FIg. **6**; and

FIg. **9** is an electrical circuit utilized in the form of the construction of FIGS. **6** to **8**.

Referring in detail to the accompanying drawings, attention is first directed to FIGS. **1** to **5** showing a first form of the invention. In FIG. **1** a motor **10** is shown, of low speed operation such as 60 RPM, having a drive shaft **12** to which is connected an overrunning clutch **14**. Connected to the shaft and leading from the clutch is a radial arm **16** at the outer end of which is secured an axial pin **18** and referred to also as a connector.

The construction of FIG. **1** also includes a second motor **20** of higher speed than the first motor **10**, and in the present instance of twice that speed, or 120 RPM. The motor **20** includes a drive shaft **22** to which is secured an overrunning clutch **24**, and a radial operating arm **26** is connected with the shaft **22** and leads from the overrunning clutch. The operating arm **26** has a slot **28** receiving the connector pin **18** so that the two arms rotate together about the common axis **30** of the shafts **12, 22**. The overrunning clutches **14, 24** may be of any suitable and known kind.

The motors **10, 20** have been designated as being **60** and 120 RPM, and thus of the ratio 1:2, which effects folding of the pieces at the middle, which in most cases is desired, but it may be desired to fold the pieces at a location other than the middle and in that case the motors would be pre-selected for different corresponding speed. This relationship will be referred to again hereinbelow.

THe construction includes a first switch **32** in fixed position, having a switch actuating blade **34** actuatable by the connector or pin **18**.

The construction also includes a a second switch **36** mounted on an arm **38** angularly adjustable about the axis **30**, which can be fixed in adjusted position by conventional means indicated at **40**. The switch **36** includes an actuating arm **42** which is also engageable by the connector or pin **18** in a manner referred to hereinbelow.

FIG. **5** shows the circuit embodying the motors and switches referred to above. The circuit includes input lines **44, 46**, the motors **10, 20**, and the switches **32, 36**. The circuit also includes relay means **48** which is also included in FIGS. **3** and **4**. The relay means **48** may take the form of a PE cell or a mechanical electrical switch as desired and as will be referred to again hereinbelow, the PE cell being indicated at **48*a*** in FIG. **3** and a mechanical switch being indicated at **48*b*** in FIG. **4**. The operation is the same in both cases and the difference in construction is dictated according to preference. The relay means **48** (FIG. **5**) includes a switch **50** of single pole, double throw character, having terminals No. **7** and No. **8**.

Reference is next made to FIG. **3** representing in a diagrammatic way, a folder **52**. The folder includes a first conveyor belt **54** and a second conveyor belt **56** with a gap **58** therebetween. A piece to be folded is indicated at **60**, on the first conveyor belt **54** along which it moves and onto the second conveyor belt **56**. The piece has a leading edge **60*a*** and a trailing edge **60*b***, and as it goes across the gap **58** from the first conveyor to the second, it is folded by a folding knife **62** in cooperation with folding conveyors **64**, this knife and those conveyors being of conventional kind. The folding knife **62** is operated by an air cylinder **66** controlled by an air valve **68** in turn controlled by an electric switch **70**. This switch **70** is shown in FIG. **5** and connected with conductor **46** referred to above and a conductor **72**.

In the operation of the device of FIGS. **1** to **5**, the arms **16–26** assume a single zero position which may be upright as shown in FIGS. **1** and **2**. In such position the connector **18** is in engagement with the switch arm **34** holding the switch **32** at NO position (FIG. **5**) in which that portion of the circuit is open. In this same position switch No. **2** is in NC position, and in this position this portion of the circuit is also open.

In the movement of the piece along the conveyor means, the leading edge **60*a*** approaches the PE cell and the latter "sees" the leading edge of the piece, causing a transfer in the relay **48**, moving the blade of the switch **50** over to contact No. **7** and starts the 60 RPM motor **10**. This motor swings the arm **16** at a corresponding rate, and through the connector pin **18**, swings the arm **26** therewith, the overrunning clutch **24** functioning to permit the latter movement.

As the arms move from their zero position, the connector **18** moves beyond the switch blade **34** changing the switch No. **1** to its NC position. At this point in the operation there is no change in the circuit of FIG. **5**.

The piece **60** to be folded continues moving along the conveyor, and as the trailing edge **60***b* passes the PE cell **48**, the switch means **50** (FIG. **5**) is moved to its opposite position, completing circuit through contact No. **8**. This stops the 60 RPM motor **10** and starts the 120 RPM motor **20**, and the latter moves the arm **26** at a faster rate, carrying the arm **26** therewith, the latter being moved at the faster rate because of the overrunning clutch **14**.

As the arms **26**, **16** continue swinging in angular movement, the connector **18** approaches the switch No. **2**, the 120 RPM motor having started before that time, and when it does reach that switch, the connector pin actuates the arm **42** in the switch No. **2** (see FIG. **5**), moving the contact arm from its NC position to its NO position. This latter position then energizes the folding knife mechanism through the conductors **46**, **72**, as referred to above in connection with FIG. **3**. The folding knife **62** then moves through the gap **58** and creases the piece **60** at the corresponding position (in this case, the middle) and the piece is then gripped by the conveyor means **64** and correspondingly folded. The arms **26**, **16** in further rotation clear the arm **42** of the second switch **36**, enabling the latter to revert to its NC position of FIG. **5**, and upon additional movement, move up to the switch arm **34** of switch No. **1**, and move it to its NO position. The arms have completed a revolution, or cycle, and are again in zero position from which they start in the next folding operation.

In explanation of the operation of the folding step, it is to be stated that the relationship between the leading edge of the piece actuating a control element, such as a PE cell or a switch, and the trailing edge actuating that same switch, determines the actuation of the folding step at the desired point. In further explanation it is to be stated that the sooner the trailing edge of the piece actuates the control element in the cycle, the sooner will the faster operating motor begin operating, whereby in the case of a shorter piece, the faster operating motor will operate in a greater portion of the cycle, and the longer the piece is, the lesser portion of the cycle will the faster operating motor operate. The consequence is that regardless of the length of the piece being folded, the shorter the piece is, the longer in time will the faster motor operate, and progressively in the opposite direction, namely the longer in length the piece is the shorter period of time will the higher speed motor operate.

The result is that the pieces to be folded can be fed into the folder in random order, a long piece, a short piece, an intermediate piece, etc. and they will all be folded at the desired position, in the case referred to, in the middle. However, if the pieces are to be folded at a position other than the middle, the ratio of the speed of the motors is correspondingly changed, according to whether the fold is to be made ahead of the middle, or after the middle. The specific speeds of the motors are arbitrary, so long as the desired ratio is maintained, but in the case of folding the pieces in the middle the motors may be of 30 RPM and 60 RPM respectively, or 120 RPM and 240 RPM, respectively, etc.

It is also practical to utilize a single motor having dual speed characteristics so that instead of operating two different motors at different speeds, the single motor can be operated in the different phases of the cycle at the correspondingly different speeds.

FIG. **4** represents a form that may be utilized in place of that of FIG. **3**. In FIG. **4** the control element **48** is a switch **48***b* identified above, and it has a finger **74** engageable by the piece **60**. The finger **74** when engaged by the piece is held in a deflected position throughout the travel of the piece and after the trailing edge of the piece passes the switch, the finger flicks back to its normal position, with the consequence that while the piece is passing over the switch **48***b* it has the same effect as if passing through the beam of the PE cell **48***a* of FIG. **3**.

FIGS. **6** to **9** show a modified form of the apparatus. In the present arrangement, the same two motors, a low-speed and a high-speed motor are utilized, but in this case there is no zero position, but the beginning and terminating position, while the same, may be at any random angular location, around the axis of the motor drive shafts.

A low-speed or 60 RPM motor **80** is provided, having a drive shaft **82** on an axis **83**, and a commutator **84** mounted on that drive shaft, the commutator having rings **86** associated with brushes **88** (see also FIG. **7**). Mounted on the commutator adjacent the periphery thereof is a switch **90** having a radial actuating finger **92**. A high-speed or 120 RPM motor **93** is also provided, having a drive shaft **94** on the same axis **83** as the shaft of the first motor. Mounted on the shaft **94** is an operating arm **96** having an axial pin or actuating element **98** positioned for engagement with the switch finger **92** at certain times as explained hereinbelow.

FIG. **9** is a diagram of the circuit utilized in the present arrangement. This diagram includes the rotating switch **90**, and the motors **80**, **93**. It also includes a relay **100** corresponding to the relay **48** in the first form, and controlled by the movement of the piece along the conveyors as represented in FIGS. **3** and **4**. Additionally the circuit includes a timer **102** of known kind, and a selector switch **104**.

In the operation of the device of FIGS. **6** to **9**, a beginning position is assumed in which the commutator **84** is in any random position, with the switch **90** in a corresponding angular position, e.g., the bottom, FIGS. **6** and **8**, and in this same beginning position, the operating arm **96** is in position adjacent thereto (FIG. **8**, full line position) in which the finger **98** is in engagement with the switch finger **92**, holding the switch as represented in FIG. **9** with the switch blade in NO position. In this position the switch **70** actuates the folding knife **62**.

As the leading edge of the piece **60** (FIG. **3**) moves to the PE cell, the latter "sees" that edge, and as a consequence the relay is moved from the contacts No. **5** and No. **8** to the contacts No. **4** and No. **7**. This causes the low-speed motor **80** to operate, rotating the switch **90** away from the operating pin **98**, as indicated by the dot-dash line position of the switch in FIG. **8**, and in that switch the contact blade is moved from the NO contact to the NC contact, whereby the knife is removed from its folding position. The timer **102** is also consequently energized, the timer having been previously set according to a period of time for the leading

edge of the piece to move from the PE cell to the folding knife.

As the trailing edge of the piece passes the PE cell, the relay **100** is returned to No. **5** and No. **8**, and consequently the slow-speed motor **80** is brought to a stop, instantaneously because of internal breaking function, as is included in the other motor **93** also. The timer **102** and the circuit controlled thereby is held in ON position through the NC contact in the switch **90**.

As the leading edge of the piece passes the folding knife, the timer **102** fires, according to its predetermined setting and its timing characteristics relative to the movement of the piece along the conveying means, so that as the leading edge passes the folding knife, the high-speed motor **93** is energized, moving at twice the speed of the low-speed motor. The operating arm **96** then traces the same angular displacement as the rotating switch **90**, but it does so at twice the that the switch was moved. When the operating arm **96** reaches the switch **90**, which is at that time stationary, the pin **98** engages the finger **92**, changing the switch blade in the switch **90** back to the NO contact. This position of the arm **96** is shown in dot-dash lines in FIG. **8**, again in direct association with the switch. This causes the timer **102** to transfer to contact No. **5** therein and thus stop the high-speed motor **93**. The apparatus is again in its beginning or idle position.

Thus the movement of the piece along the conveyor produces a timing operation resulting in control of the first and low-speed motor, and then the second and high-speed motor, whereby the latter exercises its function at the end of a period which is one-half of the period in which the low-speed motor moved, and thereby controls the operation of the folding instrumentality at the midway portion of the piece to be folded, as described above in connection with the first form

When the pin **98** engages the switch finger **92** the operation of the motors is brought to an abrupt halt. This may occur in any position angularly about the axis **83** and accordingly the apparatus does not have a fixed zero position.

In the event the piece is longer than the distance from the PE cell to the folding knife, the same sequence will be followed except that the timer **102** will fire before the low-speed motor has stopped. This is a definite advantage in certain cases, compensating for the variation in length of the piece and the distance from the PE cell to the folding knife. This apparatus (FIGS. **6** to **9**) will function to both add and subtract and to do so in connection with a single operation.

I claim:

1. In a folder, means for sensing a piece to be folded, comprising,

means for conveying the piece through the folder,

folding means positioned in predetermined position folding the piece,

a sensing element responsive to movement relative to the conveying means for cooperating therewith for folding the piece, along the conveying means and particularly responsive to the leading edge of the piece passing thereby and similarly responsive to the trailing edge passing thereby,

low-speed motor means and first means for energizing it controlled by the sensing element pursuant to the leading edge of the piece passing by the sensing element,

high-speed motor means and second means for energizing it controlled by the sensing element pursuant to the trailing edge of the piece passing by the sensing element, and

means responsive to the combined effect of the movements of the low-speed and the high-speed motors for operating the folding means at an intermediate position relative to the leading and trailing edges passing by the sensing element.

2. Sensing means in a folder according to claim **1** wherein the last means includes a first switch means in fixed position and actuated by the motor means,

a second switch adjustable in position, and

wherein the motor means are operative first in an initial portion of the movement thereof for actuating the first switch, and in a latter portion thereof for actuating the second switch, and finally to again actuate the first switch for terminating the cycle.

3. Sensing means in a folder according to claim **1** wherein the switch means is mounted on the low-speed motor and moved thereby,

the high-speed motor while moving in its faster rate proceeds to the position of the switch and upon contact therewith effects actuation of the folding means, and

means responsive to actuation of such switch operative for stopping the motors.

4. In a folder means for sensing a piece to be folded comprising,

means for conveying the piece through the folder,

folding means positioned in predetermined position relative to the conveying means for cooperating therewith for folding the piece,

a sensing element responsive to movement of the piece along the conveying means and particularly responsive to the leading edge of the piece passing thereby and similarly responsive to the trailing edge passing thereby,

low-speed and high-speed motor means,

first switch means in fixed location,

second switch means angularly displaced from the first switch means,

a low-speed motor and a high-speed motor with common angularly rotating arms having a zero position in which the contact and control the first switch means, means responsive to the sensing means for initiating movement of the low-speed motor in response to the leading edge of the piece passing by the sensing element whereby the first switch means is actuated to a different control position,

means responsive to the trailing edge of the piece passing by the sensing element for initiating movement of the high-speed motor, whereby the low-speed motor is stopped and the high-speed motor continues to move and wherein the high-speed motor continues to move the angularly movable arms into engagement with a second switch, and they perform a switching operation on the latter which in turn effects actuation of the folding means, and the high-speed motor continues to operate and move the arm means past the second switch and into operative engagement with the first switch terminating movement at substantially the beginning of that movement.

5. Sensing means in a folder according to claim 4 wherein the motors have a common axis and rotate in the same direction considered in axial view and the arm means include overrunning clutches whereby to enable each motor to drive ahead regardless of the position or movement of the first motor.

6. Sensing means in a folder according to claim 5 wherein the sensing element includes a PE cell and a relay control thereby whereby in response to the leading edge of the piece passing by the PE cell the relay is shifted into operative position for operating the low-speed motor and upon its trailing edge passing ny the PE cell, it effects shifting of the relay to a position for stopping the low-speed motor and operating the high-speed motor.

7. Sensing means in a folder according to claim 5 wherein the sensing means includes a switch with an operating finger disposed in the path of the piece and upon engagement by the piece at the leading edge of the latter, the actuating finger is moved to a first position whereby it controls movement of the slow-speed motor and that condition continues throughout the movement of the piece pass the switch and upon the trailing edge of the piece passing the switch, the switch returns to its first position and effects stopping of the low-speed motor and starting of the high-speed motor.

8. Sensing means in a folder according to claim 2 wherein the last means includes a relay movable to respectively opposite positions for controlling the motors.

9. Sensing means in a folder according to claim 8 and including timer means for controlling the relay means.

10. Sensing means according to claim 1 wherein the motors have a common axis and a common beginning position, but random relative to angular position around the axis.

11. Sensing means in a folder according to claim 2 wherein the motors have a common axis, and radial arms for controlling the switches, and the arms move in unison around the axis.

12. Sensing means in a folder according to claim 3 wherein the motors have a common axis, and radial arms for controlling the switches, and the arms move in unison around the axis.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,692,303 Dated September 19, 1972

Inventor(s) Frederick W. Grantham

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the cover sheet, "[73] Assignee: Mecca Bros, Inc., North Collins, N. Y." should be deleted.

Signed and sealed this 1st day of May 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.