Sept. 6, 1955 H. D. ABELL ET AL 2,717,153

TIMING MECHANISM FOR AUTOMATIC FOLDERS

Original Filed April 27, 1949 3 Sheets-Sheet 1

Fig. 2

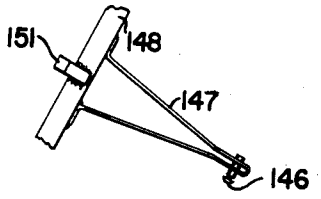
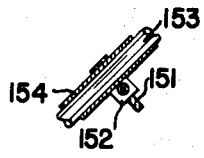


Fig. 3



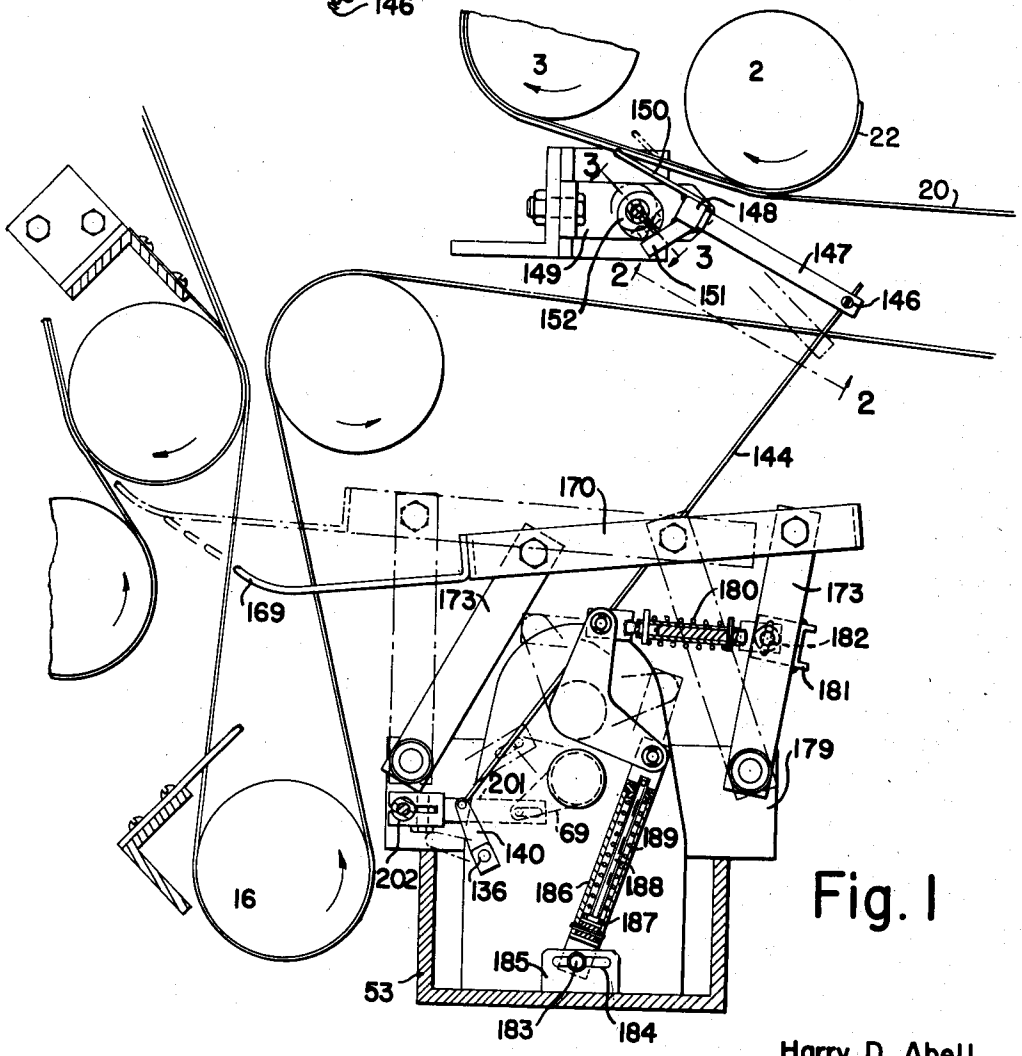


Fig. 1

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Fig. 4

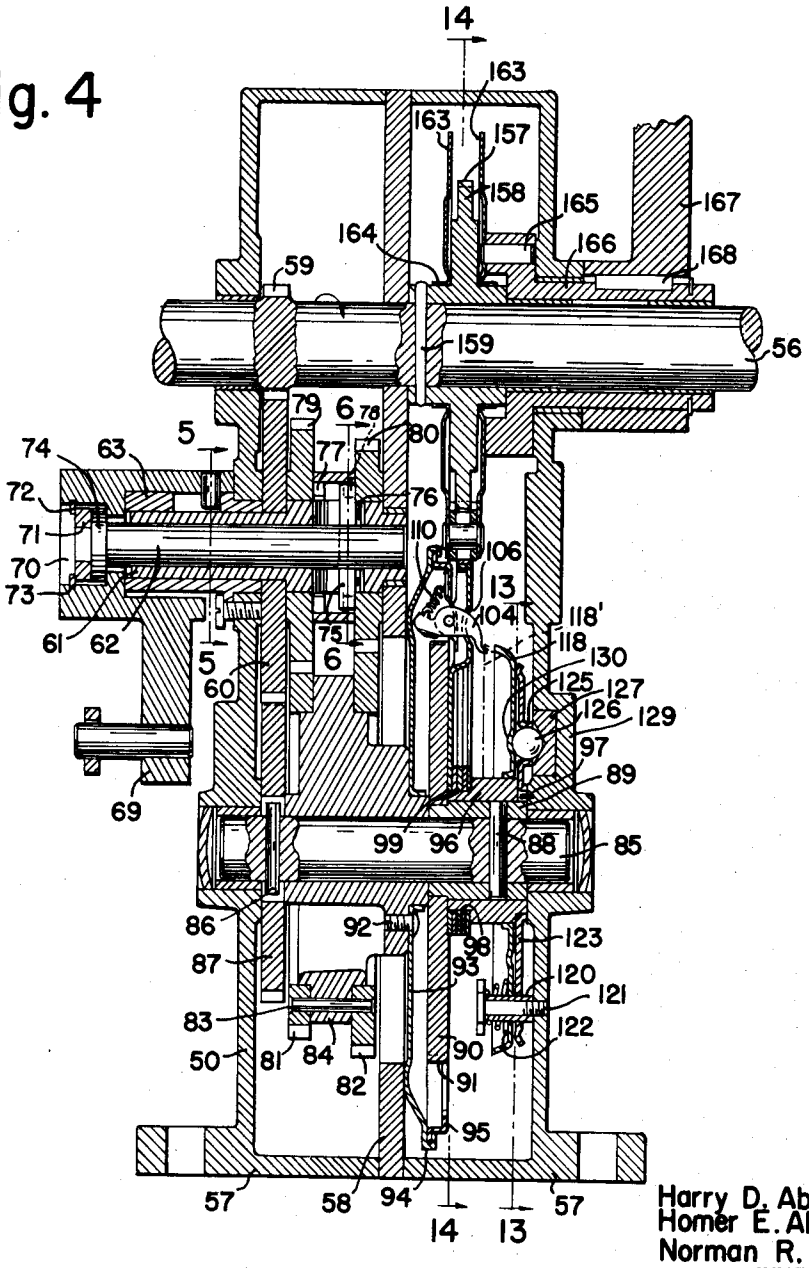

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Fig. 5

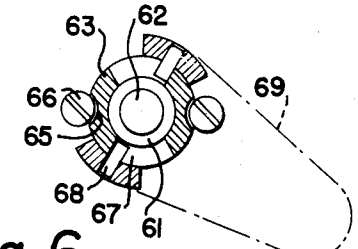


Fig. 6

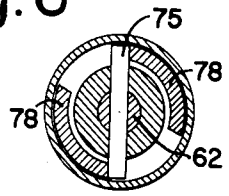


Fig. 7

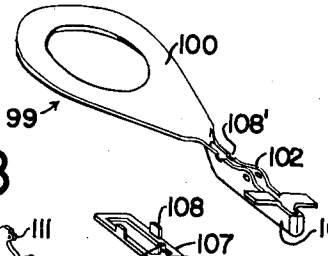


Fig. 8

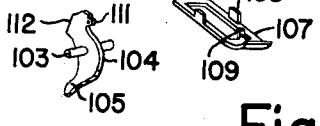


Fig. 9

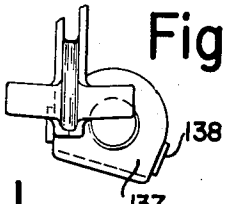


Fig. 10

Fig. 11

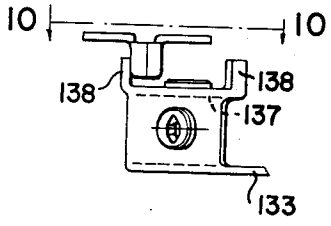


Fig. 12

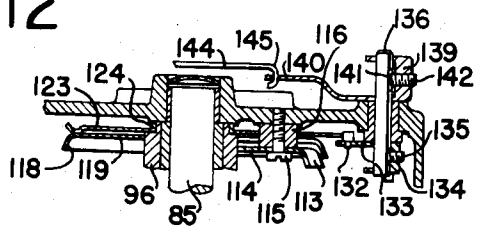


Fig. 13

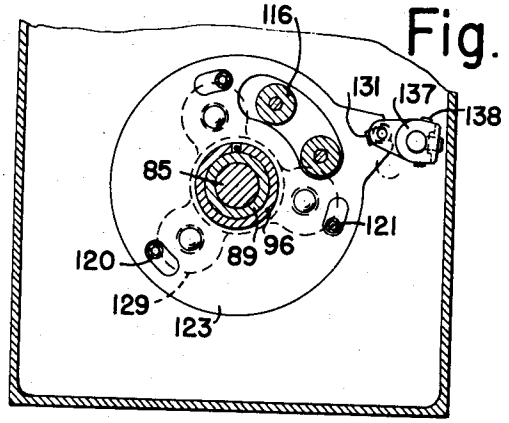
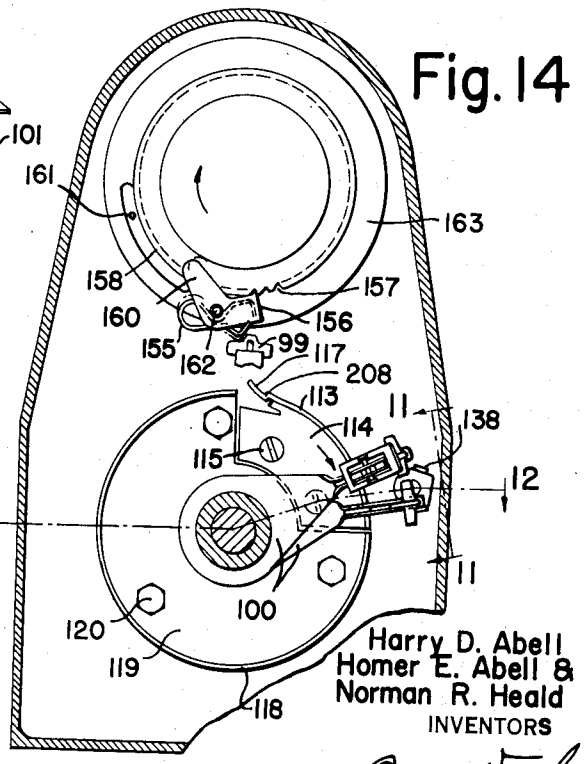


Fig. 14



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2,717,153

TIMING MECHANISM FOR AUTOMATIC FOLDERS

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Original application April 27, 1949, Serial No. 89,904, now Patent No. 2,709,585, dated May 31, 1955. Divided and this application September 25, 1952, Serial No. 311,499

2 Claims. (Cl. 270—81)

This invention relates to folding machines of the type in which sheet material, such as laundered articles, is automatically folded at one or more definite fractions of its length. Such machines are in general well known, and embody a conveyor tape system to carry the articles through the machine, one or more folding blades operating to tuck the material between two adjacent belts, and folder control mechanism operated by contact with the sheet to actuate the folders to fold the sheet on the desired lines. The present invention is an improvement on prior machines of this type in the particulars noted below. This application is a division of our prior application Ser. No. 89,904, filed April 27, 1949, now Patent No. 2,709,585.

One object of the invention is to provide an improved timing device of a known generic type in which a plurality of arms are coupled successively to a member whose speed is proportional to a half or a third of that of the sheet, and then coupling the arm to a full speed member until it reaches a predetermined position where it causes actuation of the folder. A further object is to produce a timing device which is sufficiently compact to be mounted closely adjacent and preferably within the endless belts which convey the material through the machine. A further object is to provide a timing device having positive means for preventing the release of the rotating arms due to the pressure exerted by a plurality of them when piled up against the releasing mechanism. Additional objects will appear from the following description and claims.

The invention will now be described with reference to the accompanying drawings, in which

Fig. 1 is a side elevation, partly in section, of a folder with its associated timing device;

Fig. 2 is a section on line 2—2 of Fig. 1;

Fig. 3 is a section on line 3—3 of Fig. 1;

Fig. 4 is a central section through the timing mechanism;

Fig. 5 is a section on line 5—5 of Fig. 4;

Fig. 6 is a section on line 6—6 of Fig. 4;

Fig. 7 is a perspective view of a control finger with its pawl and friction plate removed;

Fig. 8 is a perspective view of the control finger pawl;

Fig. 9 is a perspective view of the control finger friction plate;

Fig. 10 is a view on line 10—10 of Fig. 11;

Fig. 11 is an enlarged view on line 11—11 of Fig. 14;

Fig. 12 is a section on line 12—12 of Fig. 14;

Fig. 13 is a section on line 13—13 of Fig. 4; and

Fig. 14 is a section on line 14—14 of Fig. 4.

The nature and operation of the timing mechanism within the control boxes 50 will now be described. This mechanism has for its purpose the measurement of the length of a sheet, and the actuation of a folder at the instant when the half or third point of the sheet is in the correct position. Broadly this is done in the usual way

by coupling an actuating arm to a member whose speed is proportional to a half or a third of that of the sheet, and then coupling the arm to a full speed member until it reaches a predetermined position where it causes actuation of the folder. Several arms are employed in order that several articles may be in process simultaneously, and it is necessary to release the foremost of the piled up arms one at a time while holding back the remainder. In the present machine an improved escapement has been provided for this purpose which prevents accidental release of arms where several are piled up. Before describing its operation it will be necessary to consider other mechanical devices in the control box

The box is made in two halves 57 which can be die-cast in identical form, although slightly different finishing operations are required, and which are held in any desired way on opposite sides of a central partition 58 which serves as a bearing. The drive shaft 56 has a 20-tooth gear 59 meshing with a 60-tooth gear 60 press-fitted on a sleeve 61 rotatable on a longitudinally movable shaft 62. Surrounding sleeve 61 is a stationary sleeve 63 having a shoulder bearing against the side of the casing and also having grooves 65 (Fig. 5) to accommodate the heads of set screws 66 threaded into the box wall to keep the sleeve from either endwise or rotary motion. The sleeve 63 has a pair of slanting grooves 67 receiving pins 68 attached to a rocker 69. This rocker has a recess 70 to receive a washer 71 and a spring washer 72 fitting into a groove 73, so that the head 74 of the shaft 62 and the rocker 69 are coupled together for longitudinal motion. The purpose of the rocker is to move the shaft in and out, thus operating clutch mechanism to be described, and the seemingly elaborate mechanism for a simple motion is due to the desirability of controlling the several boxes from the side of the machine by a rocking handle located there.

At its inner end shaft 62 carries a cross pin 75 (Fig. 6) projecting through slots 76 (Fig. 4) in the rotary sleeve 61 into engagement with clutch teeth 77 or 78 mounted respectively on a 48-tooth gear 79 and a 40-tooth gear 80. The sleeve 61 being functionally integral with gear 60, motion at the angular speed of that gear is imparted to either gear 79 or gear 80, depending on the longitudinal position of shaft 62. Gear 79 is in mesh with a ring gear 81 of 72 teeth, and gear 80 is in mesh with a ring gear 82 of 80 teeth, both riveted at 83 to a hub 84 mounted on a cross shaft 85. The shaft is pinned at 86 to a 60-tooth gear 87 in mesh with the gear 60, and at 88 to a sleeve 89. To this sleeve is press fitted a disk 90 having its periphery formed with fine teeth 91. On the hub 84 is screwed at 92 a disk 93 having its periphery rolled over at 94 to hold a friction ring 95. Depending upon the position of shaft 62 the hub 84 and the friction disk 93 are driven at ½ or ⅔ the speed of shaft 85 and the toothed disk 90. The disks 93 and 90 are used to drive control arms which will now be described.

Around sleeve 89 is a sleeve 96 held against rotation by a pin key 97 fastened in the casing wall. A shoulder 98 serves as a bearing upon which may turn a plurality of control arms 99 preferably stamped from sheet metal. These are all identical except for the differing off-sets needed for their inner portions to lie side by side on shoulder 98, and but one of them will be described. Each arm (Fig. 7) has a central circular portion 100 tapering outwardly and folded into a ribbed portion 101 with a degree of off-set sufficient to bring the ribbed portions of the several arms into line while the central portions are stacked side by side as in Fig. 4. A boss 102 (Fig. 7) is formed on the ribbed portion to support a cross pin 103 serving as a pivot for a pawl 104 (Fig. 8) having a tail 105 passing through a hole 106 (Fig. 4) in the arm. A plate 107 (Fig. 9) is centrally cut away to receive the pawl and is pivotally secured to the arm by

lugs **108** fitting into grooves **108'** in the latter. It has a nib **109** bent outwardly so that it may serve as an anchorage for a compression spring **110** (Fig. 4) which is anchored at the other end to a nib **111** (Fig. 8) on the pawl **104**. The spring at all times presses the plate towards the friction ring **95** and the pawl towards the toothed disk **90**, for the purpose of engaging which the pawl is provided with a tooth **112**. If the pawl is permitted to remain in engagement with toothed disk **90** the arm will be carried along by the latter at a speed proportional to the speed of the sheet to be folded, with the plate **107** sliding over the friction ring. If the tail of the pawl is depressed, as it is (by mechanism to be described) while the sheet is passing over a feeler, the pawl will be held out of engagement with the teeth in disk **90**. The movement of the arm will then be under the control of friction ring **95**, which travels at a speed either ½ or ⅔ of the speed of disk **90** depending on the setting of the clutch shaft **62**.

For the purpose of controlling the tail **105** of the pawl a circular track is provided, formed in two parts one of which is stationary and the other movable axially. The stationary part **113** (Figs. 12 and 14) is bent up from a segment **114** which is secured to a wall of the box **50** by screws **115** and spacers **116** (Fig. 12) and has a flaring portion **117** (Fig. 14), the purpose of which will be described. All of the arms stacked up within the stationary section have their pawls held out of contact with the ratchet **90**. The movable part **118** is formed from the turned up edge of a cup plate **119** cut away to receive the stationary track as shown in Fig. 14, and mounted for axial motion on sleeves **120** (Fig. 4) surrounding headed screws **121**. Springs **122** under the heads of the screws keep the cup plate normally against a ball spacer disk **123**. This disk has a flange **124** on which it can turn on sleeve **96** as a bearing, and has three annular flanges **125** (Fig. 4) by which it can retain and control three hardened balls **126**. The balls rest in conical depressions in hardened blocks **127** sunk into bosses **129** formed in the casing walls. Since the two halves of the casing are made identical these bosses appear in both, although they have a function only in one. Depressions **130** in the cup plate **119** act as seats for the balls. When the ball spacer disk **123** is rotated slightly the balls ride up on the sides of the recesses in blocks **127** to shift the cup plate **119** toward the pawl **104**, engaging its tail as shown at **118'** in Fig. 4.

For rotating the ball spacing disk it has a radial extension slotted at **131** (Fig. 13) to receive a pin **132** (Fig. 12) riveted to the long arm **133** of a channel member **134** held by a set screw **135** to a rock shaft **136** extending through a wall of the casing. The rock shaft is oscillated as will be described by contact of a feeler with the work to be folded. When work is passing the feeler the balls are rolled out of their sockets and the cup plate brought into engagement with the tail of the pawl to cause the finger **99** to be driven by the friction plate only.

The short arm **137** of a channel **134** is provided with wings **138** which alternately engage the sides of successive control fingers and release them in the manner of an escapement. It is an important feature of the present invention that the escapement is self-locking, so that the arms cannot push it out of the way. In prior constructions trouble has been experienced due to this cause, since frequently several arms, all being acted on by the continuously driven friction ring **95**, are piled up behind the escapement which is thus subjected to considerable pressure. In the present case the line of pressure passes practically through the center of rock shaft **136** (Fig. 10) and thus does not tend to rotate that shaft to free the control arm from wing **138**.

Rock shaft **136** passes through the control box wall, and outside the latter carries a U-shaped member **139** with one long arm **140**. The shaft **136** is flattened at **141** to receive a set screw **142** passing through the member **139**. A rod **144** is hooked at **145** to the long arm **140**, and at its other end is secured by a set screw **146** to an A-frame **147** welded to a bar **148** pivoted in stationary brackets **149**. Bar **148** carries a set of feelers **150** extending between the spaced tapes of the overlying sets **20** and **22**, and also an arm **151** resting against an eccentric **152** by which the feeler can be shifted to inactive position when desired. Depression of the feelers by the fabric causes angular motion of rock shaft **136** with a consequent turning of the ball spacer disk **123** to which it is coupled by channel **134** and the pin and slot connection **131**, **132**. The balls **126** are thus caused to ride up on the conical sides of the blocks **127** and shift the cup plate **119** so that its track portion **118** will engage the tail of pawl **104**. The fingers **99** are then driven by the friction disk **105**. When the feelers are released by passage of the goods the springs **122** cause the balls to return to their seated position so that the pawl is released by the cup plate and re-engages the ratchet wheel **90**. It may be noted that the shifting of the fingers **150** by the eccentric to inactive position will cause the same initial action as described except that the feeler is not released by the passage of goods and the finger **99** released by the escapement travels around under the drive of friction disk **95** until it strikes the remaining fingers piled up against the eccentric.

In normal half-folding a finger **99** is driven by friction during all the time the feeler is held by the work, its speed being proportional to half that of the work. When the end of the work releases the feeler the arm can thus be considered as being located at a point corresponding to the mid-point of the work. The finger is then coupled to the full speed disk **90** and travels at a rate proportional to the speed of the work until the mid-point of the work is opposite a folder. Slightly before this the finger will be adjacent a spring **155** (Fig. 14) mounted on a folder-actuating pawl **156** and pushes the latter against the teeth **157** of a ratchet **158** mounted on and keyed as at **159** to the constantly rotating shaft **56**. The rachet teeth are preferably slightly undercut, so that as soon as the pawl engages a tooth it will be held there until its tail **160** strikes a pin **161** which is fixedly mounted in the casing **57**. During the period of engagement between the pawl and the constantly rotating ratchet the pawl is moved bodily and its movement is utilized to cause the operation of the folder.

The pawl is pivoted at **162** to a pair of disks **163** which are flanged at **164** so as to ride freely on the hub of ratchet **158**. One disk is pinned at **165** to a sleeve **166** rotatable on shaft **56** and projecting through the casing. Outside the latter a bell crank **167** is keyed to the sleeve **166** at **168**, being rocked from the full to the dotted line position of Fig. 1 by the swing of the pawl. Associated with each control box, and serving the single lane of the machine in which the box is located, is a folder **169** composed of fingers projecting from the forward edge of a rectangular frame **170**. The fingers are spaced so as to enter the spaces between adjacent pairs of tapes which transport the work pieces through the machine. Each frame **170** is connected by pivot bolts **171** to the tops of four rocking arms **173** pivoted at their lower ends.

The bell crank **167** is connected by a compression spring coupling **180** to a bar **181** secured to the rear pair of rocking arms **173**. Preferably this connection includes a bolt and slot **182** so that the pivot point can be moved up or down relative to the arms, since in this manner the position of the folding fingers at the end of their active stroke can be controlled. Another pivot bolt **183** is adjustable in a slot **184** formed in a bracket **185** secured to the channel **53**. A tube **186** is attached to the pivot, and a piston **187** within it is coupled by a rod **188** to the lower arm of the bell crank. A compression spring **189** lies between the piston

and the upper end of the tube, so that the bell crank is normally held in the position for which the pivot bolt **183** is adjusted. Since this is the position in which the pawl **156** is awaiting activation by the end of a control arm **99** the adjustment **183**, **184** serves as a means of controlling the initiation of the folding operation. In other words, it serves to regulate the position of the fold relative to the exact center (or third point) of the sheet. Its value is mainly that the position of the first fold determines the position of the hidden edge of the fabric after the second fold is made. In cases where the edges of the fabric are not entirely true this adjustment permits the hidden edge to be drawn back so that there is no danger of it being turned over when the second fold is made.

It was mentioned previously that the stationary track **113** was terminated in an outwardly flaring end **117**. This serves to engage the tails of the pawls **104** without shock and to free the pawl tooth **118** from the teeth on disk **90**. A shoulder **208** near the base of the flaring end **117** serves to engage the pawl tails **105** if accidentally the shaft **56** is rotated the wrong way, as it easily might be in setting up or adjusting the machine. Were some such safety device not used a plurality of control arms might be forced around within cup plate **118**, and driven positively by ratchet **90** in the wrong direction with consequent damage to the machine.

What we claim is:

1. A timer for an automatic folding machine wherein flat goods to be folded are carried by tapes, and a folding blade tucks the goods between a pair of folding rolls comprising a plurality of rotatably mounted control arms having a common axis of rotation, a coaxial positively driven rotary positive drive member for intermittently driving said control arms, a coaxial rotary friction drive member for intermittently driving said control arms, means for driving the friction drive member optionally at one-half or two-thirds the speed of the positive drive member and a self locking escapement at a fixed point of the periphery of the arc of rotation of said control arms for releasing said arms one at a time to be driven by said driving means, said arms having means engageable by said escapement, means for actuating said escapement to release an arm when the front edge of the article reaches a fixed point, said last means including a feeler for said flat goods positioned between the tapes ahead of the blade, means for maintaining an arm in driving engagement with the friction member while the article is passing said feeler and in driving engagement with the positive driving member thereafter, and a mechanical trip for starting the folder actuating means, said trip being activated by passage of the arm past a fixed point along the periphery of the arc of rotation of said arms and spaced a predetermined distance from said escapement, and said escapement comprising a member oscillated by the passage of the article to be folded and carrying a pair of wings shifted by the oscillation respectively into and out of the path of an arm, the line of pressure between the arm and the wing passing substantially through the axis of oscillation.

2. A timer for an automatic folding machine wherein flat goods to be folded are carried by tapes, and a folding blade tucks the goods between a pair of folding rolls comprising a plurality of rotatably mounted control arms having a common axis of rotation, a coaxial positively driven rotary positive drive member for intermittently driving said control arms, a coaxial rotary friction drive member for intermittently driving said control arms, means for driving the friction drive member at a speed having a definite ratio to the speed of the positive drive member, and a self locking escapement at a fixed point of the periphery of the arc of rotation of said control arms for releasing said arms one at a time to be driven by said driving means, said arms having means engageable by said escapement, means for actuating said escapement to release an arm when the front edge of the article reaches a fixed point, said last means including a feeler for said flat goods positioned between the tapes ahead of the blade, means for maintaining an arm in driving engagement with the friction member while the article is passing said feeler and in driving engagement with the positive driving member thereafter, and a mechanical trip for starting the folder actuating means, said trip being activated by passage of the arm past a fixed point along the periphery of the arc of rotation of said arms and spaced a predetermined distance from said escapement, and said escapement comprising a member oscillated by the passage of the article to be folded and carrying a pair of wings shifted by the oscillation respectively into and out of the path of an arm, the line of pressure between the arm and the wing passing substantially through the axis of oscillation.

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