Jan. 1, 1929. **1,697,010**

W. W. JONES ET AL

FLAT WASH FOLDER

Filed Sept. 3, 1926 11 Sheets-Sheet 1

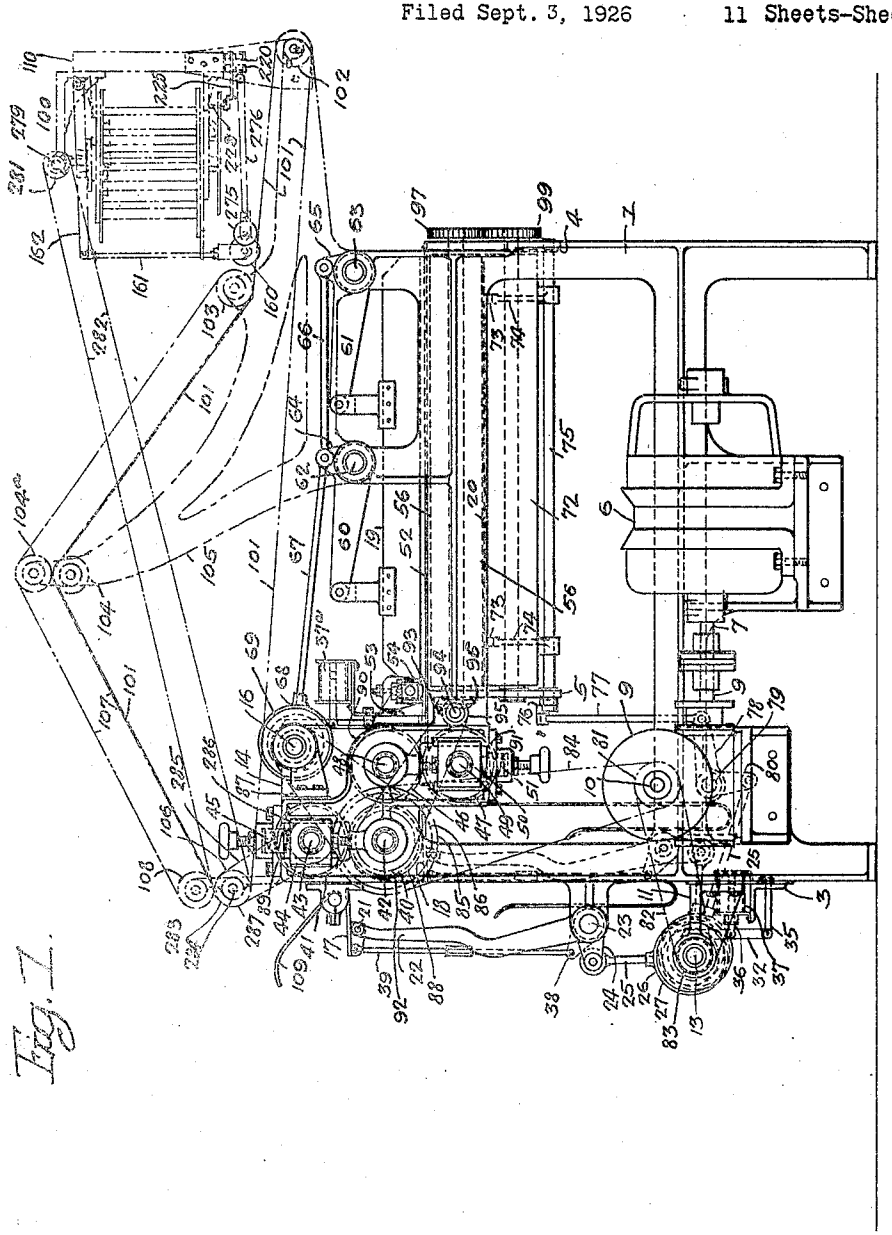

Fig. 1.

Inventors.
William W. Jones.
August C. Jauss.
By Their Attorneys
Thomas Thomas

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FLAT WASH FOLDER

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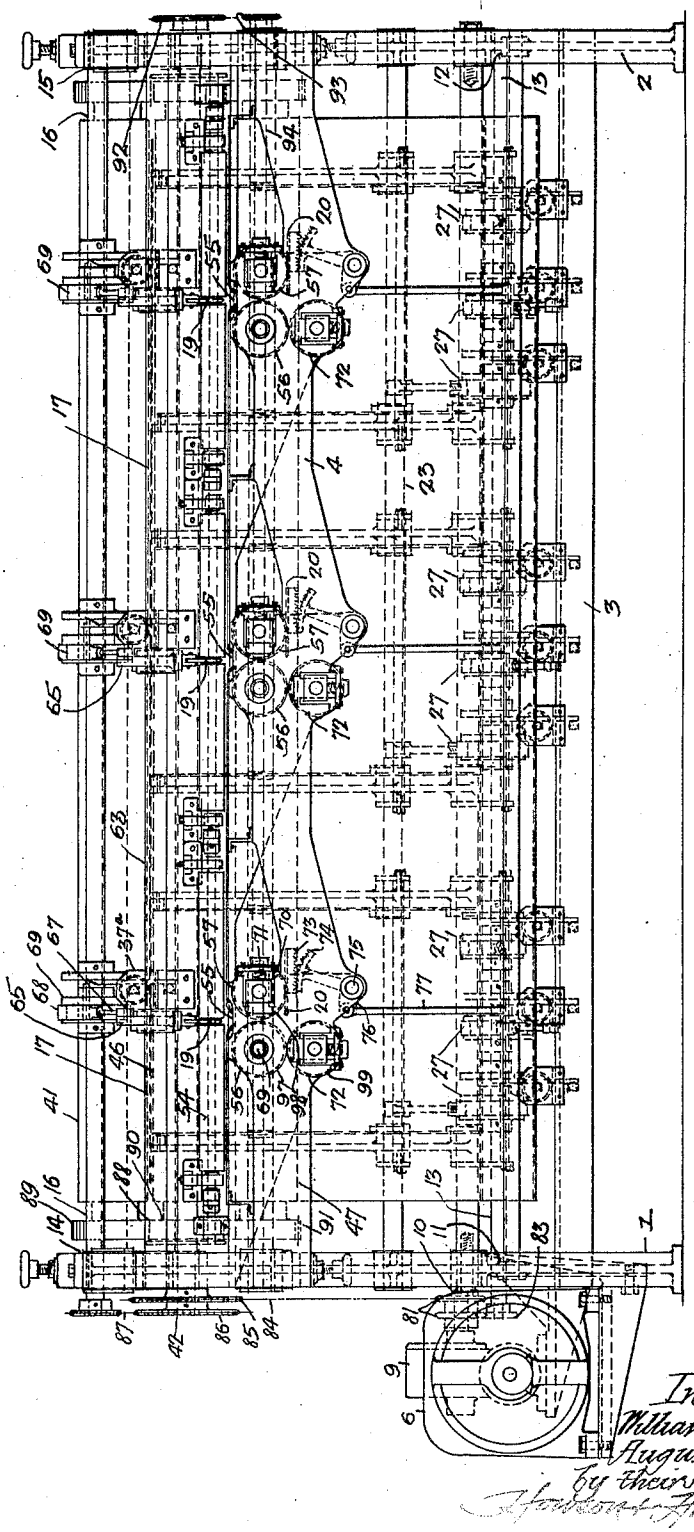

Fig. 2.

Inventors
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FLAT WASH FOLDER

Filed Sept. 3, 1926 11 Sheets-Sheet 3

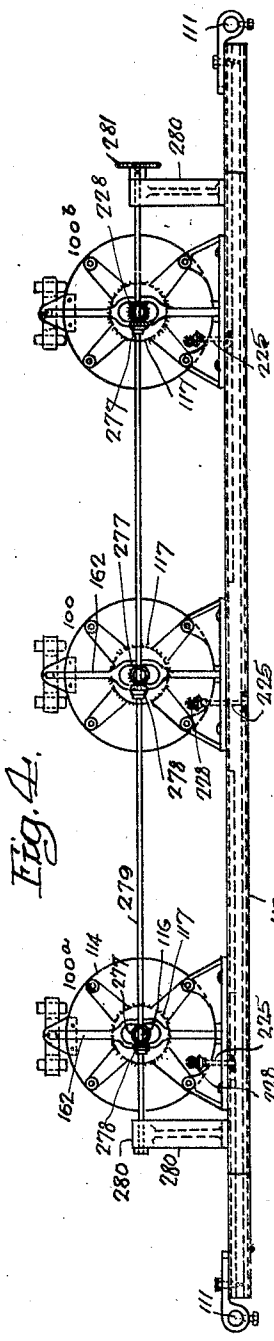

Fig. 4.

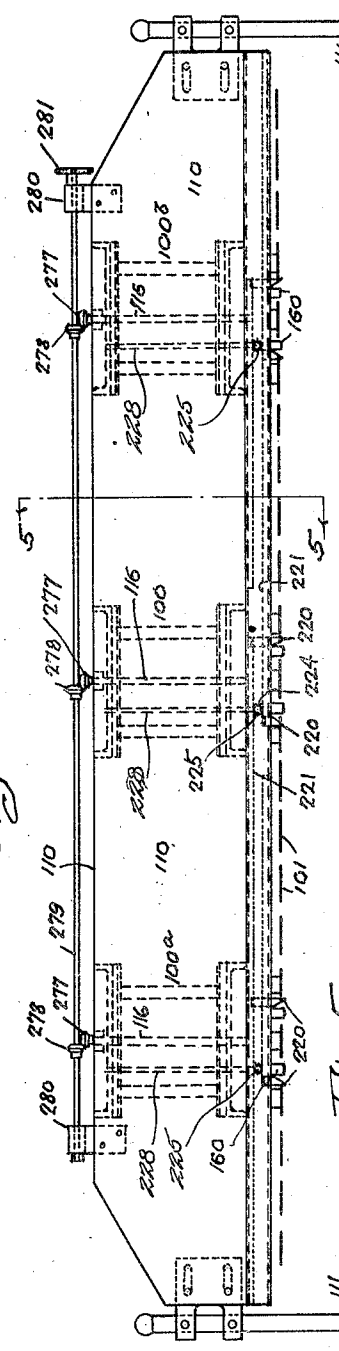

Fig. 3.

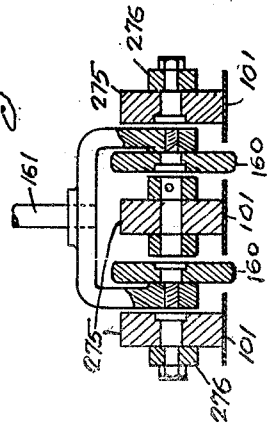

Fig. 6.

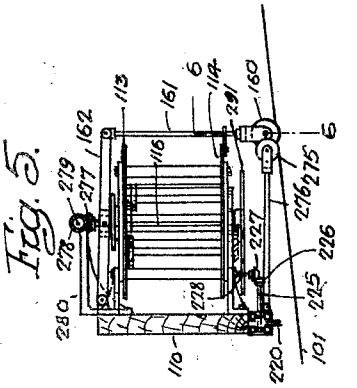

Fig. 5.

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Jan. 1, 1929. 1,697,010

W. W. JONES ET AL

FLAT WASH FOLDER

Filed Sept. 3, 1926 11 Sheets-Sheet 4

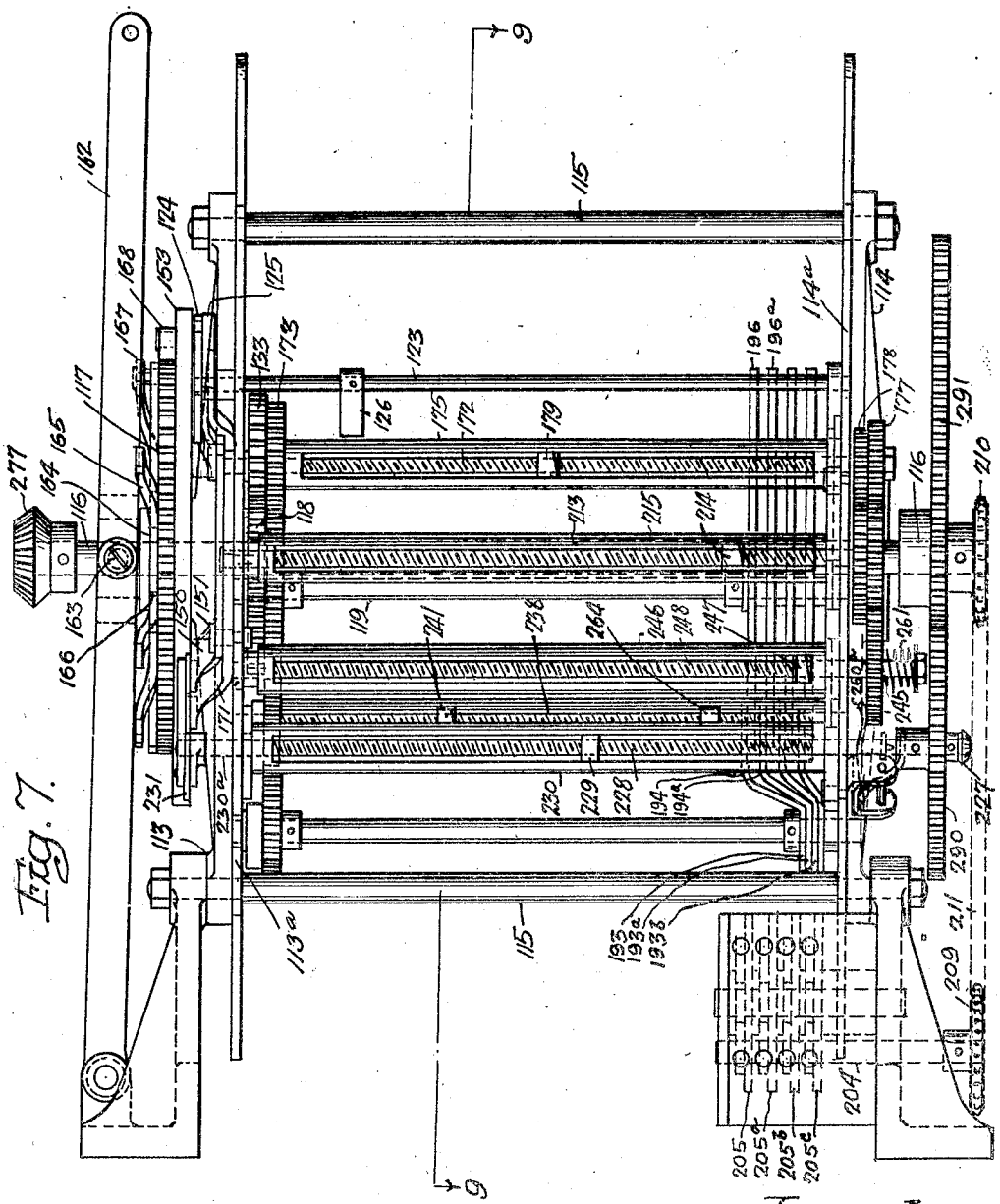

Fig. 7.

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Jan. 1, 1929. 1,697,010

W. W. JONES ET AL.

FLAT WASH FOLDER

Filed Sept. 3, 1926 11 Sheets-Sheet 5

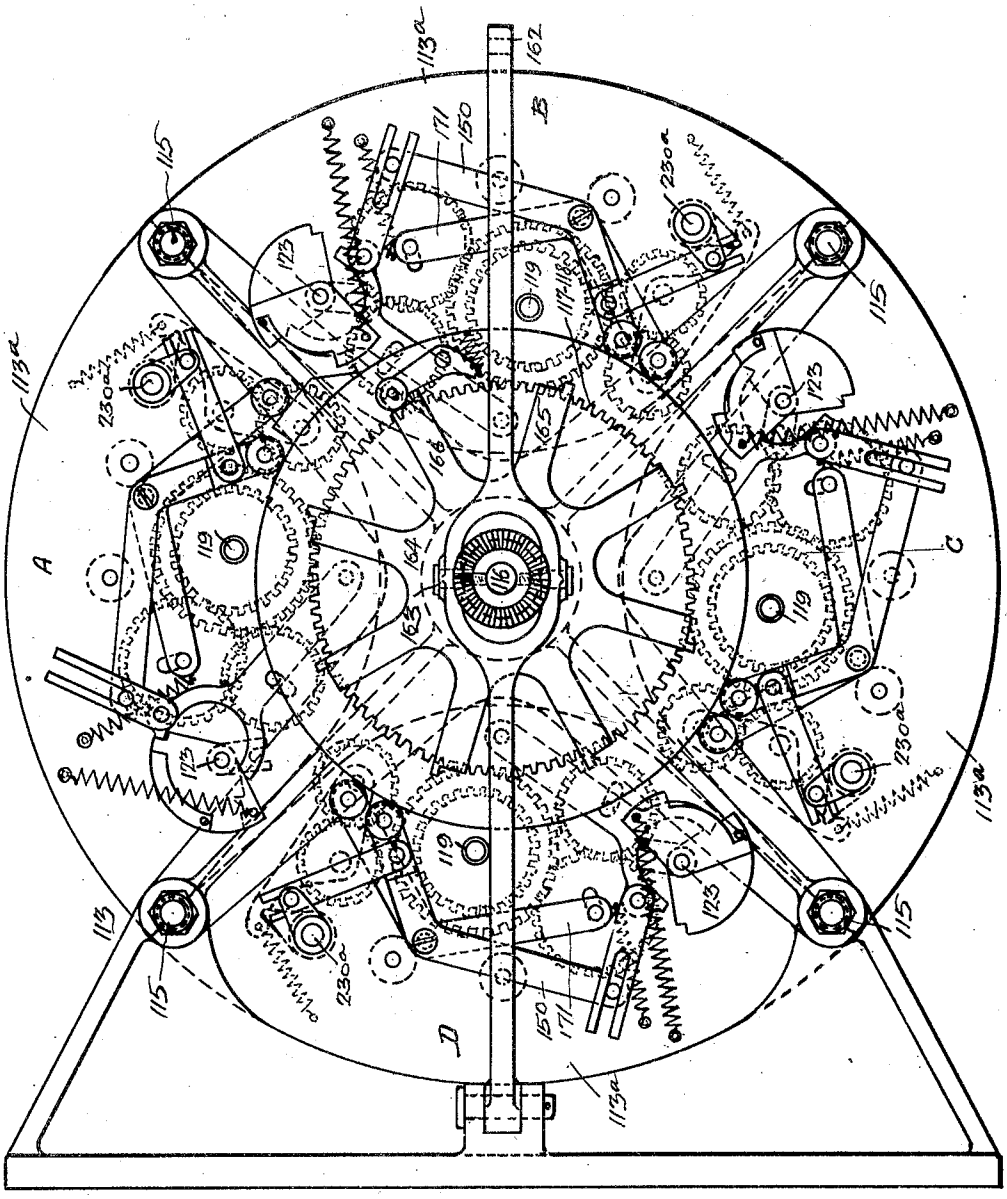

Fig. 8.

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W. W. JONES ET AL.

FLAT WASH FOLDER

Filed Sept. 3, 1926 11 Sheets-Sheet 6

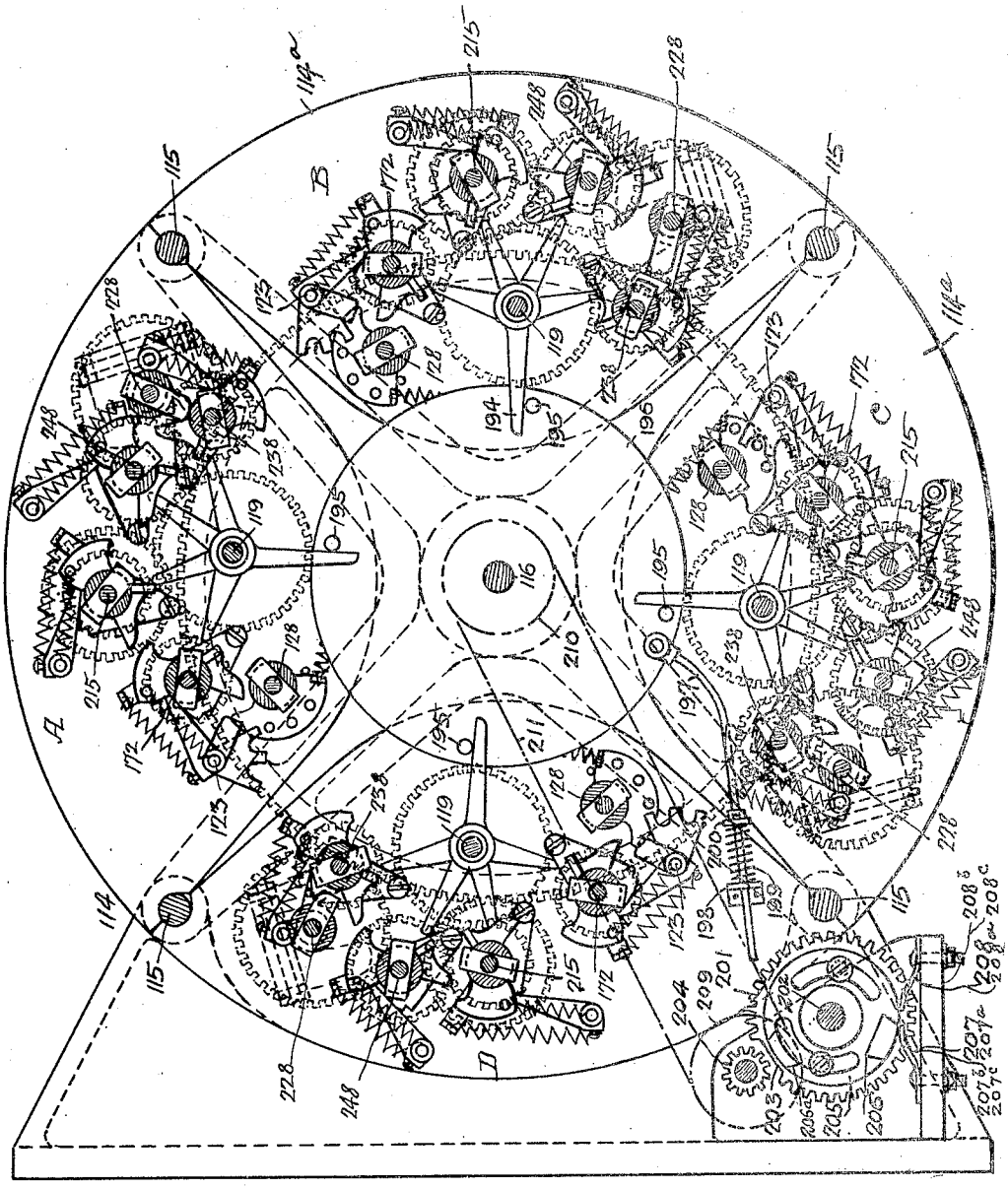

Fig. 9.

Inventors-
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FLAT WASH FOLDER

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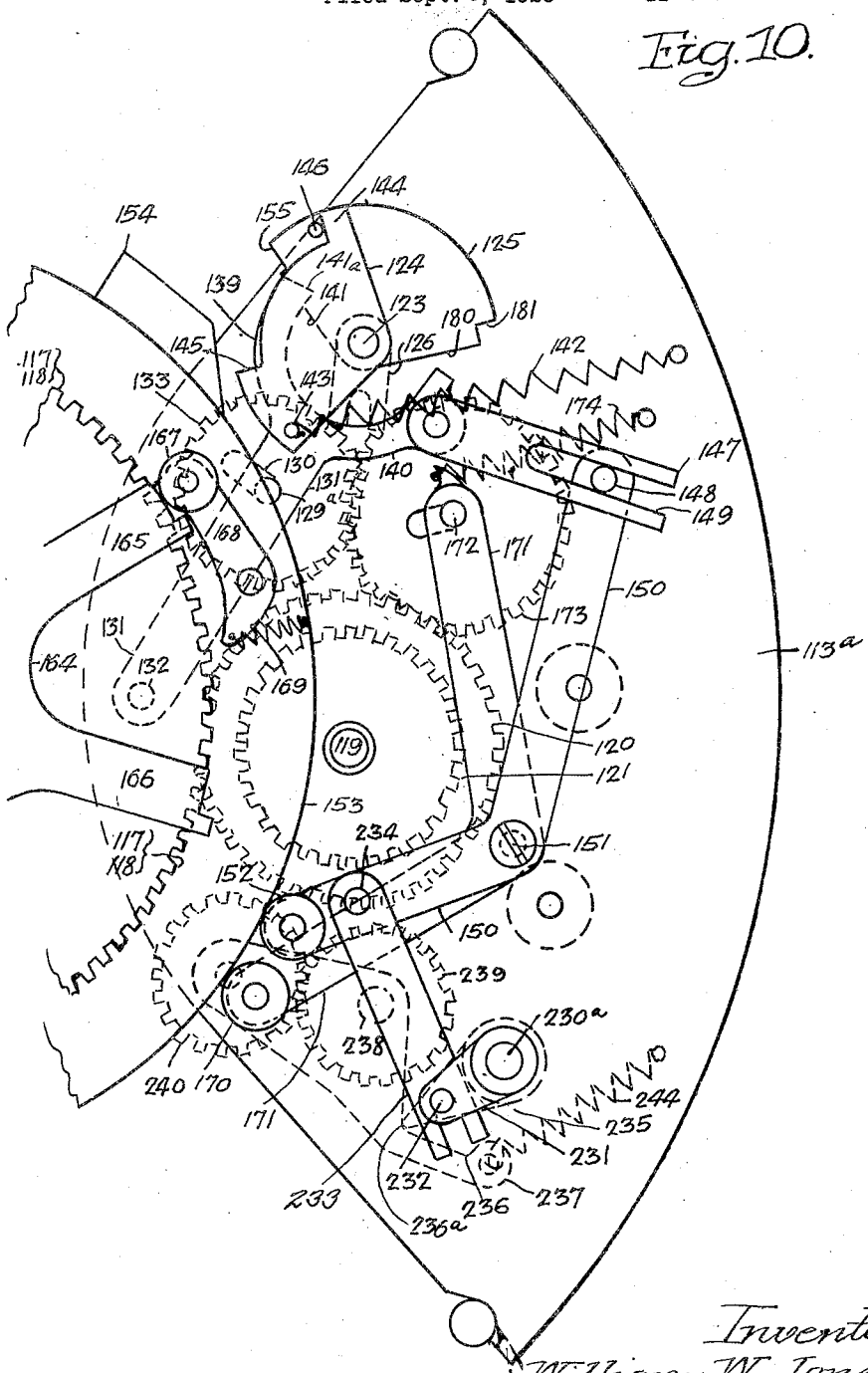
Fig. 10.



Inventors-
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Jan. 1, 1929. 1,697,010

W. W. JONES ET AL

FLAT WASH FOLDER

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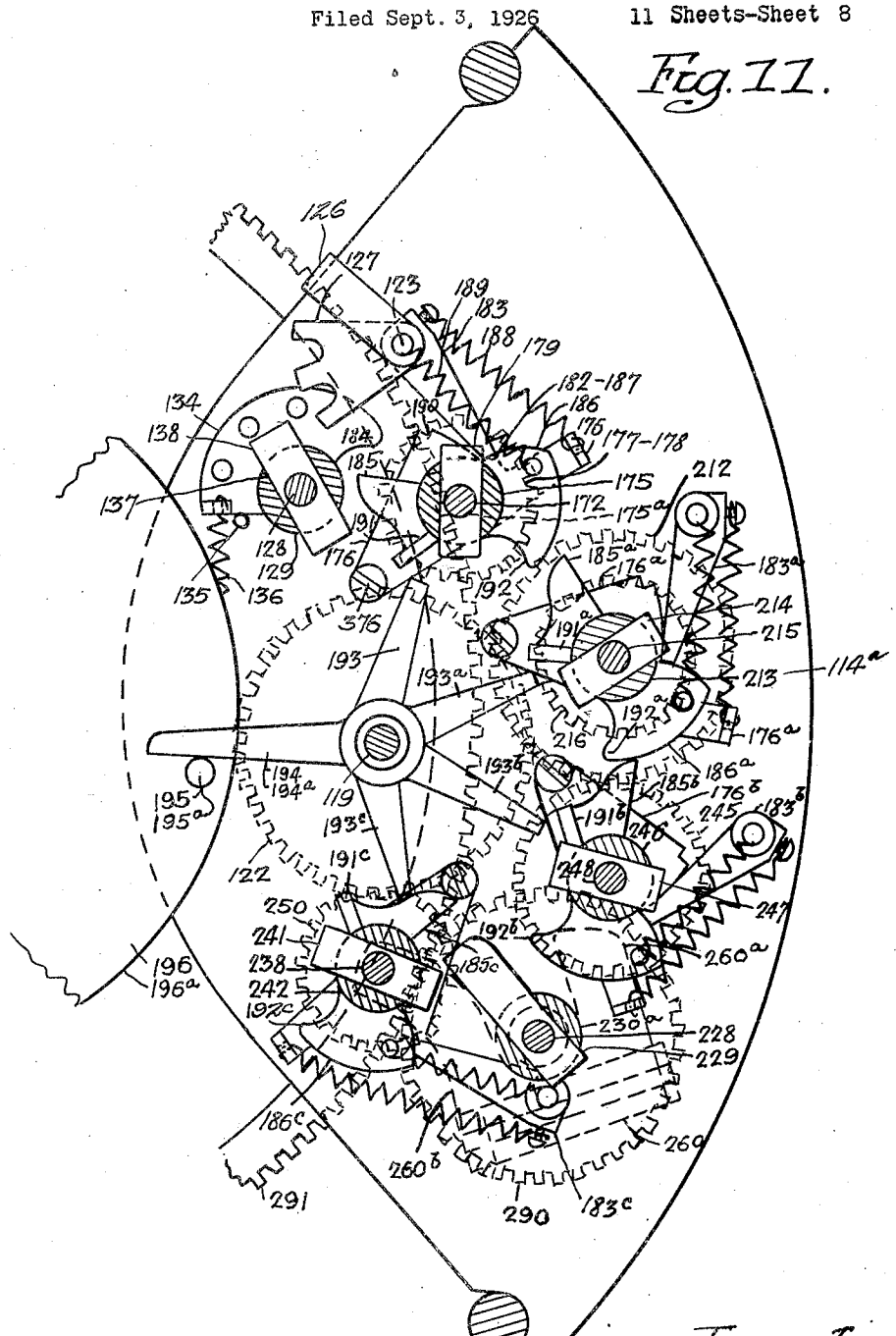
Fig. 11.



Inventors.
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Jan. 1, 1929. 1,697,010

W. W. JONES ET AL

FLAT WASH FOLDER

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Fig. 12.

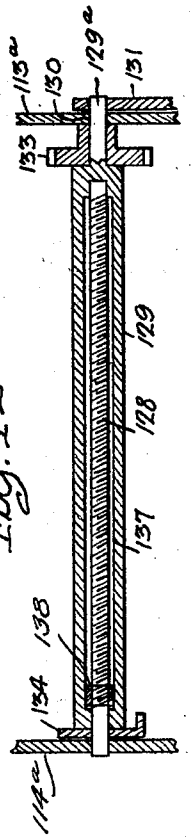


Fig. 15.

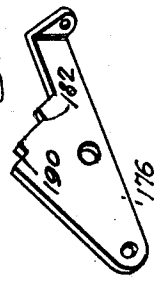


Fig. 16.

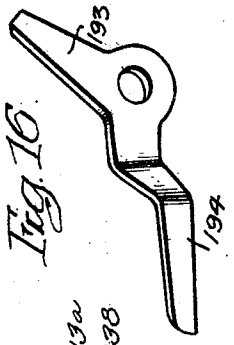


Fig. 14.

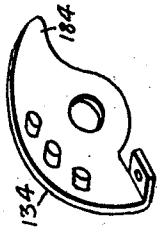


Fig. 13.

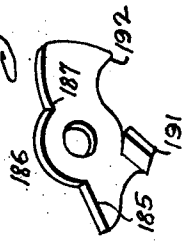
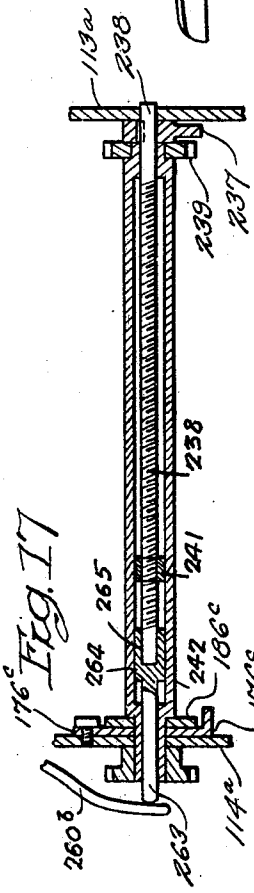


Fig. 17



Inventors.
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Jan. 1, 1929. 1,697,010

W. W. JONES ET AL

FLAT WASH FOLDER

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Fig. 20.

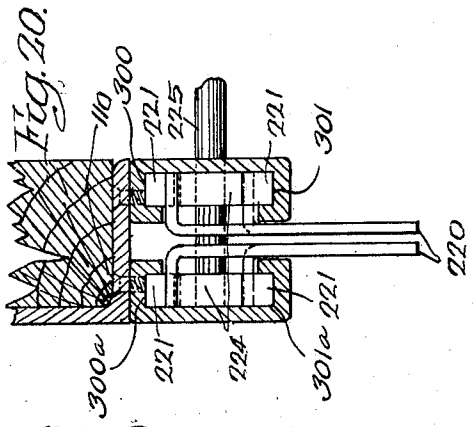


Fig. 19.

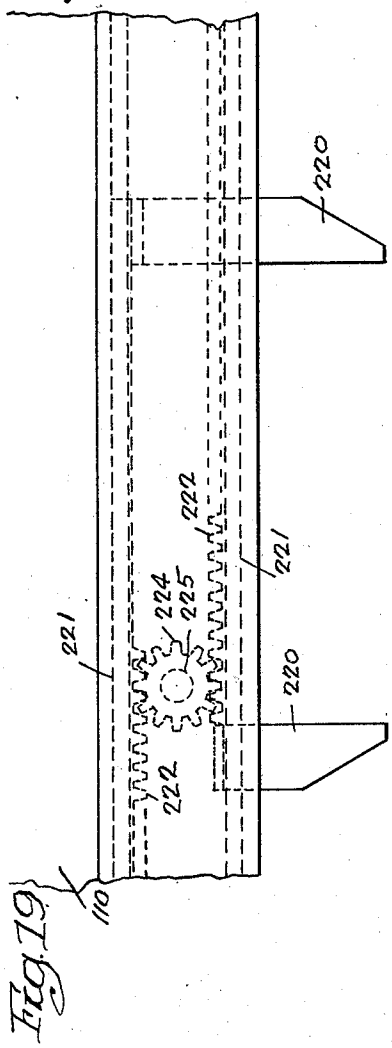
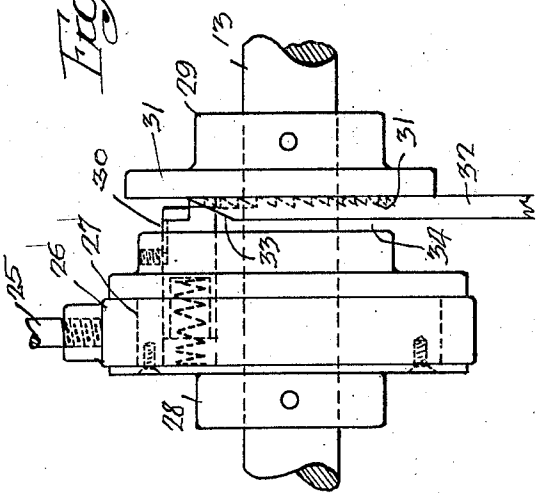


Fig. 18.



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W. W. JONES ET AL

FLAT WASH FOLDER

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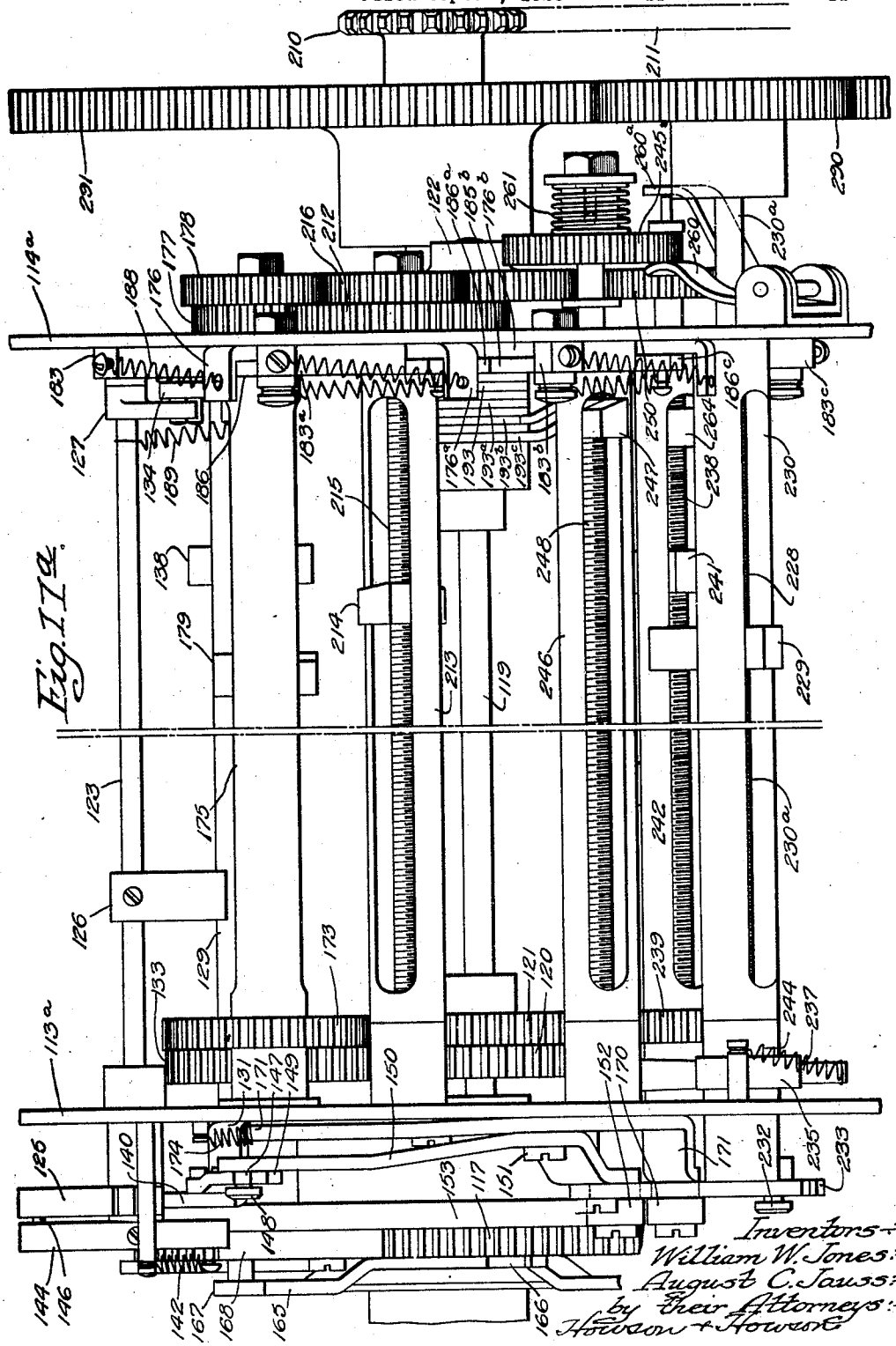

Fig. 11a.

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August C. Jauss:-
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Howson & Howson

Patented Jan. 1, 1929. 1,697,010

UNITED STATES PATENT OFFICE.

WILLIAM W. JONES AND AUGUST C. JAUSS, OF PHILADELPHIA, PENNSYLVANIA.

FLAT-WASH FOLDER.

Application filed September 3, 1926. Serial No. 133,418.

Our invention relates to folding machines for flat articles such as bed sheets, table cloths, napkins, handkerchiefs and other flat articles of various lengths and widths which require folding, after passing through a laundrying or other finishing process and having been dried and preferably, though not necessarily, pressed or ironed.

Our invention is particularly adaptable to public and hotel laundries, but may be used in factories where flat articles of various lengths and widths are manufactured.

The folding of articles of the general class above noted is usually performed by hand, and is therefore necessarily slow. The larger articles require at least two persons to fold each article, and where a great number of flat articles are handled it requires a considerable number of persons to keep pace with the finishing machinery of the establishment.

Our improved folding machine is adapted to fold the finished articles at a considerably increased rate of speed over the hand folding process, under the care of a single operator, one machine being adapted to replace, on an average, ten hand folders, whereby the wage paid to such a number of hand folders is saved by the proprietor of the establishment installing our improved folding machine.

Our improved folding machine may be employed as a separate machine or it may be attached to the delivery end of a mangle, as desired, and it may be built as a single unit or in multiple units, in accordance with the capacity demanded.

Our invention further comprises a control device which is adapted to be attached directly to the folding machine when used as a separate machine or to be attached to the feed end of a mangle when our folding machine is attached to the delivery end thereof, in either instance the article to be folded is required to travel the same distance from the control unit to the folding unit of the machine.

The controlling device is so constructed that a series of relatively small articles can be simultaneously traveling between the control unit and the folding unit, and as each successive article reaches the folding unit it will be dealt with individually thereby.

The details of construction of our folding machine and its control unit will be more fully disclosed hereinafter, reference being had to the accompanying drawings, of which:

Fig. 1 is an end elevation of our folding machine illustrating the position occupied by the control unit when the folding machine is to be used separately;

Fig. 2 is a rear elevation of the folding unit of our invention, comprising in the present instance three distinct folding units;

Fig. 3 is a front elevation of our multiple controlling unit adapted to control the individual folding units illustrated in Fig. 2;

Fig. 4 is a plan view of the controlling unit, shown in Fig. 3;

Fig. 5 is a transverse sectional elevation of the controlling unit, taken on the line 5—5 of Fig. 3;

Fig. 6 is a section on the line 6—6, Fig. 5;

Fig. 7 is an enlarged side elevation of the timing device employed in the controlling unit;

Fig. 8 is an end elevation of the device shown in Fig. 7;

Fig. 9 is a transverse sectional elevation on the line 9—9 of Fig. 7.

Fig. 10 is an end elevation similar to Fig. 8 showing one of the sets of timing elements drawn on an enlarged scale;

Fig. 11 is a sectional elevation similar to Fig. 9 showing one of the sets of timing elements;

Fig. 11ª is a side elevation of one of the sets of timing elements drawn to the same scale as Figs. 10 and 11; and

Figs. 12 to 20 inclusive are illustrations of various details of the invention.

The device illustrated in the accompanying drawings is adapted to fold a flat article four times. Considering the length of the article as extending in the same direction as the initial feed of the article into the machine, the first fold is made on a line extending transversely of the article midway between the opposite ends thereof, which reduces the article to one-half its original length. The second fold is also made on a line extending transversely of the article midway between the ends of the initially folded article, which reduces the article to one-fourth its original length. The third and fourth folds are made at right angles to the first and second folds. The third fold is made on a line extending lengthwise or longitudinally of the article midway between the opposite side edges of the bi-

folded article, which reduces the article to one-half its original width. The fourth fold is made on a line extending longitudinally of the article midway between the opposite side edges of the tri-folded article, which reduces the article to one-fourth its original width.

The first and second folds having to do with the reduction of the length of the article will hereinafter be referred to as the longitudinal folds; and the third and fourth folds having to do with the reduction of the width of the article will hereinafter be referred to as the transverse folds.

Our invention includes a folding unit illustrated in Figs. 1 and 2, which comprises a frame consisting of end frame members 1 and 2 suitably connected and spaced apart by suitable members including an angle beam 3 and supporting beams 4 and 5.

On the end frame 1 is suitably mounted a variable speed motor 6, the armature shaft 7 of which is connected to the drive shaft 8 of a speed reduction unit 9, of any desired type. The speed reduction unit 9 is provided with a driven shaft 10, which supplies the power for the folding machine.

The end frames 1 and 2 are provided with bearings 11 and 12 respectively for a lower folding shaft 13, and with bearings 14 and 15 respectively for an upper folding shaft 16.

A folding blade 17 is provided for effecting the first longitudinal fold along the transversely extending centre of the article. A folding blade 18 is provided for effecting a second longitudinal fold along the transversely extending centre of the single folded article. A folding blade 19 is provided for effecting a transverse fold in the double folded article along the longitudinally extending centre of said article, and a folding blade 20 is provided for effecting a second transverse fold along the longitudinal centre of the triple folded article.

By operating the folding blades in the above stated sequence, a flat article may be folded twice longitudinally and twice transversely, and when the article is of extremely large proportions the process may be repeated in the same manner as above described.

The folding blade 17 is pivotally attached at 21 to one arm of each of a pair of bell-crank levers 22, 22, which are pivoted on a bar 23, mounted in the end frames 1 and 2. The second arm 24 of each bell-crank lever 22 is pivotally attached to a connecting rod 25 extending from an eccentric strap 26 which operatively encircles an eccentric 27 on the lower folding shaft 13, see Fig. 18.

Each eccentric 27 is loosely mounted on the shaft 13 between a pair of collars 28 and 29 secured to the shaft 13. Each eccentric 27 is provided with a spring pressed coupling pin 30 slidably mounted therein, and adapted to engage suitable teeth 31 formed on a flange of the collar 29.

A lever 32 having a wedge shaped end 33 is adapted to ride in a groove 34 formed between the eccentric 27 and the collar 29 for engaging the pin 30, and withdrawing it from the opening 31 in the collar 29. It will be understood that the shaft 13 is continuously rotated by mechanism hereinafter described. The lever 32 is pivoted to a bracket 35 secured to the angle beam 3, and one end of a slidable core 36 of an electromagnetic solenoid 37 is pivotally attached to the lever 32 intermediate the ends thereof. The solenoid 37 is rigidly mounted on the angle beam 3 and is operable by means hereinafter set forth. A lever 38 is secured to the pivot bar 23 adjacent each lever 22, and is connected by a link 39 to the blade 17 as illustrated in Fig. 1, for maintaining the blade in a horizontal plane throughout the reciprocating movement which it receives when the eccentric 27 is operated.

The blade 17 when operated is adapted to engage the article to be folded at the transversely extending longitudinal centre thereof, and to place that particular point of the article between transverse creasing rolls 40 and 41.

The creasing roll 40 is secured to a shaft 42 rotatably mounted in the end frames 1 and 2, and adapted to be driven by means hereinafter set forth. The creasing roll 41 is secured to a shaft 43 rotatably mounted in journal blocks 44 slidably mounted in the end frames 1 and 2, the roll 41 being maintained in operative contact with the roll 40 by means of springs 45 engaging the journal blocks 44.

The rolls 40 and 41 co-operate to feed the single longitudinally folded article to the second folding blade 18 which is mounted in the machine and operated by the lower folding shaft 13 in a manner substantially the same as that described relative to the blade 17.

The blade 18 is adapted to engage the single folded article at the transversely extending longitudinal centre thereof, and to place that particular point of the article between a second pair of transverse creasing rolls 46 and 47.

The creasing roll 46 is secured to a shaft 48 rotatably mounted in the end frames 1 and 2, and driven in a manner hereinafter set forth. The creasing roll 47 is secured to a shaft 49 rotatably mounted in journal blocks 50 slidably mounted in the end frames 1 and 2. The roll 47 is held in operative engagement with the roll 46 by springs 51, as illustrated in Fig. 1.

The rolls 46 and 47 feed the double longitudinally folded article over a table 52, rigidly supported by the beams 4 and 5, be-

ing assisted therein by means of a supplemental roller 54 rotatably mounted on the beam 5.

The double longitudinally folded article is fed under the lower edge of the first transverse folding blade 19 with its longitudinally extending transverse centre in line with said blade. The table 52 is provided with a slot 55 for the folding blade 19, and the double longitudinally folded article to pass through to a pair of creasing rolls 56 and 57.

The folding blade 19 is pivotally attached to the end of each of a pair of bell-crank levers 60 and 61, which are pivoted on bars 62 and 63 respectively, secured in the frames 1 and 2. The other arms 64 and 65 of the bell-crank levers 60 and 61 respectively are operatively connected by a link 66. The arm 64 is pivotally connected to the end of a connecting rod 67 extending from an eccentric strap 68 encircling an eccentric 69 loosely mounted on the upper folding shaft 16 and operable thereby in a manner substantially similar to that described relative to the eccentric 27 and shaft 13, the operating solenoid 37^a in this particular instance being rigidly mounted on the supporting beam 5.

The creasing roll 56 is provided with trunnions 69 rotatably mounted in the supporting beams 4 and 5, and driven in a manner hereinafter set forth. The creasing roll 57 is provided with trunnions rotatably mounted in journal blocks 70, slidably mounted in the beams 4 and 5. The roll 57 is held in operative engagement with the roll 56 by springs 71.

The creasing rolls 56 and 57 feed the triple folded (consisting of a double longitudinal fold and an initial transverse fold) article to the fourth and last folding blade 20 which engages the triple folded article at its longitudinally extending transverse centre thereof, and places that particular point of the triple folded article between the creasing roll 56 and a co-operating spring pressed creasing roll 72 which has trunnions rotatably mounted in journal blocks slidably mounted in the beams 4 and 5.

The blade 20 is slidably and horizontally mounted in guideways formed in the beams 4 and 5, and is provided with a gear rack 73 adjacent each of its ends which meshes with a gear segment 74 secured to a shaft 75 pivotally mounted in the beams 4 and 5. A lever 76 is secured to the shaft 75 and is connected by a link 77 to one arm of a bell-crank lever 78 pivoted at 79 on a bar secured in the end frames 1 and 2. The second arm 80 is connected to the connecting rod 25 of one of the eccentrics 27 on the lower folding shaft 13.

Any suitable receptacle may be provided for receiving the fully folded articles as they are delivered from the creasing rolls 56, 72.

The shaft 10 has a sprocket 81 secured thereon and operatively connected by a drive chain 82 to a sprocket 83 secured to the shaft 13 by means of which said shaft 13 is continuously rotated. A second sprocket 81 secured on the shaft 10 is operatively connected by means of a drive chain 84 with a sprocket 85 secured to the shaft 42 which is provided with a sprocket 86 connected by a drive chain 87 with a sprocket on the upper folding shaft 16 by means of which the shafts 42 and 16 are continuously rotated. A gear wheel 88 secured to the shaft 42 meshes with and drives a gear wheel 89 on the shaft 43 and a gear 90 on the trunnion of the roll 46. A gear wheel 91 on the shaft 49 of the roll 47 meshes with the gear wheel 90. The roll 54 is driven by a sprocket chain 53 from the shaft 48.

A sprocket 92 on the shaft 42 is operatively connected by a drive chain with a sprocket 93 on a shaft 94 rotatably mounted in bearings on the supporting beam 5. A bevel gear 95 is secured to the shaft 94, and meshes with a bevel gear 96 on the trunnion at one end of the roll 56, the trunnion at the opposite end thereof being provided with a spur gear 97 which meshes with a spur gear 98 on the trunnion at one end of the roll 57 and a gear 99 on the trunnion at one end of the roll 72.

The folding machine may be operated as a separate machine or in conjunction with an ironing or finishing machine and in either case an article to be folded is first passed under a control unit 100, for the folding machine, and conveyed from the control unit to the first folding blade 17 by means of a series of spaced tapes 101.

As illustrated in Fig. 1, the tapes pass around rollers 102, 103 and 104 journaled in a supplemental frame 105 attached to the end frames 1 and 2, and a roller 106 rotatably mounted on an extension of the end frames 1 and 2. A series of holding tapes 107 pass around the roller 103 a roller 104^a adjacent the roller 104 and a roller 108 adjacent the roller 106, and co-operate with the tapes 101 to convey the articles from the controlling unit to the first folding blade 17, a guide plate 109 being secured to the end frames 1 and 2 for guiding the articles across the path of movement of the blade 17.

Referring to Figs. 3, 4 and 5, a supporting frame in the form of a plate 110 is provided and three control units 100, 100^a and 100^b are suitably mounted thereon. The frame 110 is adapted to be attached directly to the folding machine, as illustrated in Fig. 1, or it may be provided with standards 111, 111 by means of which it may be mounted at the

feed end of a mangle or other finishing machine.

The control unit, as shown in Figs. 3 and 4, is equipped to govern a folding machine having three distinct folding units, however, when an extremely wide article is to be folded, the control units 100, 100[a] and 100[b] are caused to function as a single control unit under the control of the unit 100 and, in so doing, the three folding units are coordinately and synchronously operated as a single unit, the two outer units being adapted to assist the central unit to properly perform the first and second folds and to remain idle while the central unit performs the third and fourth folds, as will be more fully disclosed hereinafter.

For operating a single folding unit under control of a single control unit, we have chosen the central unit of each series for the purpose of explanation.

Each control unit is equipped, in the present instance, with four complete sets of timing elements which permit four different articles to be passing through the conveying belts from the control unit to the folding unit at one time, and by this means each article will be folded individually when it reaches the folding unit. For the purpose of successively operating the timing elements, each control unit is equipped with a clutch mechanism which is under direct control of a single operating element which is adapted to engage each successively inserted article. The clutch mechanism functions to start the operation of each of the four sets of timing elements in succession, which times the passage of each respective article in transit and subsequently effects the operation of the folding mechanism when the article arrives at a point with its transversely extending longitudinal centre opposite the folding blade 17.

Each control unit comprises sectional end frames 113 and 114 spaced apart by means of tie rods 115. A continuously rotating shaft 116 is suitably mounted in the end fixed central portions of the frames 113 and 114. A gear wheel 117 is secured to the shaft 116 adjacent the outer side of the end plate 113, and a second gear 118 is secured to said shaft adjacent the inner side of said end plate 113.

The four sets of timing elements are illustrated at A, B, C and D on Figs. 8 and 9, and are constructed as identical interchangeable units or sets. Each set is provided with a continuously driven shaft 119, see Figs. 10 and 11, suitably mounted in removable sections 113[a] and 114[a] of the end frames 113 and 114 respectively, and a pair of gear wheels 120—121 is secured to each shaft 119, adjacent the inner side of the end plate 113[a], the gear 120 meshing with the gear 118 on the shaft 116. Each shaft 119 has secured thereto, adjacent the outer side of the end plate 114[a], a gear 122 for purposes hereinafter set forth.

Each timing set is provided with a rock shaft 123 having a segment 124 secured to its end adjacent the end plate 113[a], and a second segment 125 loosely mounted on said shaft intermediate the said end frame and first said segment 124. A trip arm 126 is adjustably secured to the rock shaft 123 intermediate the end plates 113[a] and 114[a], and a toothed segment 127 is secured to said rock shaft adjacent the inner side of the end plate 114[a].

A screw shaft 128 has one of its ends universally mounted in the end frame 114[a], and its opposite end rotatably mounted in a sleeve 129 which surrounds the screw shaft 128. The sleeve 129 is provided with an extension 129[a], Fig. 12, which projects through a segmental slot 130 in the end frame 113[a], and is journaled in a forked lever 131 pivoted at 132 to the end frame 113[a]. The sleeve 129 is provided with a gear 133 which is adapted to mesh with either the gear 118 or the gear 120.

The screw shaft 128 has a toothed segment 134, secured thereto adjacent the end plate 114[a], which is adapted to engage the teeth of the segment 127 on the rock shaft 123. The segment 134 engages a stop pin 135 on the end frame 114[a], and is resiliently held thereagainst by a spring 136. By this means the screw shaft is normally held against rotation in one direction and permitted partial rotation in the opposite direction.

The sleeve 129 is slotted at 137, as shown in Figs. 11 and 12, and a traveling trip block 138 is mounted on the threaded shaft 128 and adapted to be moved therealong when the sleeve is rotated. The normal inactive position of said trip block is adjacent the end frame 114[a], as shown in Fig. 12.

The gear 133 and consequently the sleeve 129 are held in their inactive position, illustrated in set B, Fig. 8, by means of the following mechanism:

The forked lever 131 is provided with prongs 139 and 140. The prong 139 engages one side 141 of the segment 125, which is held against the said prong by a spring 142 in the following manner:

The spring 142 has one of its ends attached to the plate 113[a] and its opposite end attached to a pin 143 on the segment 124 and normally lies at one side of the rotational centre of the rock shaft 123. The segment 124 is provided with projections 144 and 145. The projection 144 engages a pin 146 projecting from the loose segment 125, as shown in set B, Fig. 8, and in Fig. 10.

Pivotally attached to the prong 140 of the lever 131 is a slotted link 147. A pin 148 is adapted to the slot 149 of the link 147,

and is secured to a bell-crank lever 150 pivoted at 151 to the end plate 113a. The opposite end of the bell-crank lever 150 has a roller 152 rotatably mounted thereon which engages the face of a clutch wheel 153.

The clutch wheel 153 is provided with a cam projection 154 which, when the wheel is rotated, is adapted to engage the roller 152 and thereby rock the bell-crank lever 150, whereby the pin 148 engages the end of the slot 149 in the link 147, and in so doing the lever 131 is rocked, moving the end of the prong 139 thereof along the side 141 of the segment 125 until said prong end clears the outer end of said side 141 and enters a notch 155 formed thereon. Movement of the lever 131 carries the sleeve extension 129a into such a position in the slot 130 that the gear 133 on said extension meshes with the gear wheel 118, thereby rotating the sleeve 129 and the trip block 138.

Rotation of the trip block 138 on the non-rotating screw shaft 128 causes the trip block 138 to move, from its inactive position at the end of the slot 137 adjacent the end plate 114a, longitudinally of the said screw shaft 128 and toward the trip arm 126 on the rock shaft 123, immediately upon the operation the bell-crank lever 150 which occurs at the time the leading edge of the article to be folded passes under the control unit 100, thus the timing of the folding unit is started.

The advance edge of the article to be folded, in passing under the control unit 100, strikes the single operating element of the clutch mechanism, as above stated, see Fig. 6, which comprises a pair of rollers 160 rotatably mounted in the forked lower end of a rod 161 which is pivotally attached to one end of a clutch operating lever 162, pivotally mounted on the end plate 113a.

The operating lever 162 is pivotally attached to the frame member 113a and at 163 to the hub of a wheel 164, having two series radially projecting arms 165 and 166. The arms of each series are disposed in spaced parallel planes relative to each other, and are adapted to be alternately engaged by a roller 167 rotatably mounted on a clutch pawl 168 which in turn is pivoted to the clutch wheel 153.

The clutch pawl 168 is adapted to engage the teeth of the gear wheel 117, and thereby rotate the clutch wheel 153, a spring 169 being provided to hold the pawl in contact with the teeth of the wheel 117, and, prior to the operation of the lever 162, is normally held out of engagement with the wheel 117 by one of the arms 165. When the lever 162 is operated the arms 165 are moved out of the plane of rotation of the roller 167, permitting engagement of the pawl 168 and wheel 117, and the arms 166 are moved into said plane of rotation to disengage the pawl from the wheel and hold it in such position, while the article to be folded is passing under the control unit 100. When the rear edge of the article to be folded passes from under the measuring rollers 160, the operating lever 162 and consequently the wheel 164 are moved in an opposite direction, thereby moving the arms 166 out of the plane of rotation of the roller 167 and the arms 165 again into said plane.

The operation just described effects the operation of one set of timing elements for the particular article which has just passed under the control unit, and when another article is placed on the conveyer belts the clutch will function in the same manner, but on the next successive set of timing elements of the timing unit and so on for each individual article.

The first mentioned release of the pawl 168 and its engagement with the wheel 117 causes the cam wheel 153 to be rotated and the cam 154 thereon to engage the roller 152 on the bell-crank lever 150, and the engagement of the wheel 133 with the wheel 118 as above described. The cam thereafter passes from under the roller 152 and is brought to rest by the arm 166 engaging the pawl roller 167 and disengaging the pawl 168 from the wheel 117, under a cam roller 170 rotatably mounted on a second bell-crank lever 171 which is pivoted at 151 to the end plate 113a.

The second arm of the bell-crank lever 171 rotatably supports one end of a screw shaft 172 which has secured thereto a gear 173 and when the bell-crank lever 171 is rocked as above described the gear 173 meshes with the continuously rotating gear 121 thereby rotating the screw shaft 172 as long as the cam 154 is under the roller 170 of the bell-crank lever. When the rear edge of the article to be folded passes from under the measuring rollers 160 the arm 166 is moved from under the roller 167, as above described, the cam wheel 153 and cam 154 are moved permitting the bell-crank lever 171 to be rocked to its normal rest position by a spring 174 and rotation of the screw shaft 172 ceases.

The opposite end of the screw shaft 172 is rotatably mounted in a slotted sleeve 175 which has a reduced circular extension 175a which is rotatably mounted in a lever 176 and projects through the end plate 114a adjacent the outer face of which a gear wheel 177 and a gear wheel 178 are each secured to the sleeve extension 175a for purposes hereinafter set forth.

Mounted on the screw shaft 172, within the slot in the sleeve 175, is a traveling trip block 179 which normally lies at the end of the said slot adjacent the end plate 114a, and when the screw shaft 172 is rotated the trip block 179 is carried longitudinally of the

screw shaft and stops within the said slot when rotation of the screw shaft ceases. Rotation of the screw shaft 172 begins when the advance edge of the article to be folded passes under the control unit 100 and stops when the rear edge of the article passes thereunder, thus the length of the article is measured by the distance traveled by the trip block 179.

As the article to be folded is conveyed from the timing unit to the folding unit, the trip block 138 continues to move longitudinally of the screw 128 and toward the trip arm 126 which it finally engages and in so doing the rock shaft 123 is turned and with it the segment 124. The projection 145 on the segment 124 strikes the pin 146 on the segment 125 thereby turning said segment 125 until the edge 180 thereof engages the prong 140 of the arm 131, thereby turning the arm on its pivot and disengaging the gear 133 from the gear 118. A camming action between the edge 180 and the end of the prong 140 causes the arm 131 to be moved until the said end of the prong 140 is engaged by a notch 181 formed in the edge 180 of the segment 125. The power for said camming action is supplied by the spring 142 having been moved across the centre of the rock shaft 123 when said shaft was turned and the projection 145 on the segment 124 engaged the pin 146 on the segment 125.

Movement of the prong 140 into the notch 181 causes the arm 131 to move the gear 133 into mesh with the gear 120 which rotates the sleeve 129 in the opposite direction and in so doing the block 138 reverses its direction of travel in the slot 137 of the sleeve 129 along the screw shaft 128, and toward the end of said slot 137. The block 138 finally engages the end of the slot 137 and thereby locks the sleeve 129 and the shaft 128 together as a unit. Rotation of the sleeve and shaft as a unit causes the toothed segment 134 to be turned against the action of the spring 136, which causes the teeth of the segment 134 to engage the teeth of the segment 127, thereby rocking the shaft 123 and the segment 124, the projection 144 of which engages the pin 146 on the segment 125 which turns the segment 125, releasing the notch 181 from the prong 140 of the arm 131 and causing the edge 141 of the segment 125 to engage the prong 139 of the lever 131, thereby moving the gear 133 out of mesh with the gear 121, the prong 139 finally entering a notch 141^a formed in the edge 141 of the segment 125 and thereby maintaining the shaft and the sleeve 129 in a neutral quiescent position.

The above described operation takes place while the article to be folded is being conveyed from the timing unit to the folding unit and the locking of the sleeve 129 and shaft 128 is effected just as the advance edge of the article registers with the folding blade 17 of the folding unit. As above noted, the trip block 179, being driven at a definite speed, has registered the length of the article and stopped. Rotation of the toothed segment now effects operation of mechanism adapted to divide the article at its transversely extending longitudinal centre, thereby effecting the first fold.

The lever 176, in which the extension 175^a of the slotted sleeve 175 is rotatably mounted, is pivoted to the end plate 114^a at 376 and is notched at 182 to receive the end of a latch 183 which is pivoted on the rock shaft 123. The toothed segment 134 has a lip 184 which, when the segment is rotated, engages one end 185 of a lever 186 loosely mounted on the extension 175^a. The other end of the lever 186 is provided with a notch 187 which engages the latch 183. A spring 188 maintains the lever 176 and the latch 183 in position and a spring 189 maintains the lever 185—186 in position.

As the segment 134 is rotated and engages the lever 185, the lever 185—186 is turned, using the notch 187 and the point of the latch 183 as a fulcrum. The lever 176 is also turned on its pivot and carries the extension 175^a and the gear 177 with it until the gear 177 engages the gear wheel 122 at which time the latch 183 engages a notch 190 in the lever 176 and thereby maintains the gear 177 and 122 in operative engagement with each other.

Engagement of the gears 177 and 122 causes the sleeve 175 to be rotated and thereby feed the trip block 179, which has measured the length of the article, in a reverse direction, and at a speed double the measuring speed which causes the measuring trip block to travel the measured distance in half the measuring time, and by this means the position of the first fold in the article is determined.

When the measuring trip block 179 again reaches the end of the slot in the sleeve 175, adjacent the end plate 114^a, it engages a lug 191 on the lever 185 and rotates the lever 185—186 until a lip 192 thereon engages a lever 193, which is pivoted on the shaft 119. The lever 185—186 continues to rotate until the end 185 engages the latch 183 and disengages it from the notch 190 in the lever 176, whereafter the spring 188 returns the lever 176 to a position wherein the latch 183 again engages the notch 182 in the lever 176, and the gear 177 is disengaged from the gear 122.

When the lip 192 engages the lever 193 and rotates it around the shaft 119 a second arm 194 of said lever 193 engages a pin 195 on a wheel 196, loosely mounted on the shaft 116, and thereby rotates the wheel 196 on the said shaft. The wheel 196 has

pivotally attached thereto one end of a push rod 197, the opposite end of which is slidably mounted in a bracket 198 secured to the end plate 114ª, a spring 199 being confined around the rod 197 and between a collar 200 thereon and the said bracket 198, by means of which the said rod 197 and the wheel 196 are returned to their inoperative position.

Movement of the push rod 197 causes said rod to engage the teeth of gear wheel 201 which is loosely mounted on a shaft 202. The gear 201 is provided with a toothless portion 203 to permit free rotation of a continuously driven pinion 204 and when the gear 201 is engaged by the push rod 197 it is rotated into a position causing engagement between the teeth of the pinion 204 and the teeth of the wheel 201 which is thereafter rotated by the pinion until the said toothless portion 203 again aligns with said pinion.

Secured to the gear 201 is one element 205 of an electric switch. The element 205 is constructed of non-conducting material, and is provided in its face with an insert of conducting material 206. Spring contacts 207, 208 normally engage the non-conducting element 205, and when the gear 201 and switch element 205 are rotated the insert 206 is brought into engagement with the contacts 207 and 208 and an electrical circuit is thereby completed between the two spring contacts 207 and 208.

The element 205 is mounted on the gear 201 in such a manner (see Fig. 9) as to permit circular adjustment therebetween and the position of the insert 206 relative to the spring contacts 207 and 208, when the untoothed portion 203 of the gear 201 is adjacent the pinion 204, is thereby controlled, which controlls the length of time permitted to elapse after the gear 201 starts to rotate and before the insert 206 engages the contacts 207 and 208 to effect the operation of the folding blade 17 by the energization of the electro-magnetic device which operates the blade. In this particular instance the insert 206 would be set immediately adjacent the contacts so that the blade 17 would be operated immediately upon actuation of the gear 201.

The electric circuit just mentioned is a series circuit including a source of electrical energy, the coil of the electro-magnetic device which functions to effect operation of the folding blade 17 and the two spring contacts 207 and 208. Closing of the circuit between these two spring contacts causes the said electro-magnetic device to perform its function and the article thereby receives its first fold at the transversely extending longitudinal centre thereof.

The pinion 204 is driven from the shaft 116 by means of sprockets 209 and 210 and a sprocket chain 211.

During the period of time in which the gear 177 is in mesh with the continuously rotating gear 122 on the shaft 119 the gear wheel 178 is in mesh with and driving a gear wheel 212 secured to an extension on a sleeve 213 in which is another measuring trip block 214 which rides on a non-rotating screw shaft 215 and measures the length of the initially folded article.

The slotted sleeve 213 is provided with a set of levers 176ª, 185ª, 186ª and a latch 183ª identical in construction and operation with those described in connection with the operation of the sleeve 175. When the lever 185—186 is rotated to release the gear 177 from the gear 122 the lip 192 thereof engages the lever 185ª and through the co-operative operation of the lever 186ª and latch 183ª the direction of travel of the measuring trip block 214 is reversed by causing a gear 216, which is integral with the gear 212, to be meshed with the continuously driven gear 122, and thereby rotating the sleeve 213 in a reverse direction at double the speed it traveled in the forward direction. The measuring block thereby approaches and finally engages the lug 191ª of the lever 185ª—186ª and the lip 192ª engage the lever 193ª which, through the lever 194ª and pin 195ª, causes the wheel 196ª to be rotated and consequently operate a switch 205ª, 207ª, 208ª. This switch is similar in construction to the one described relative to the folding blade 17. In this instance, however, the insert 206ª is set a greater distance away from the contacts 207ª, 208ª, which permits the point of the initially folded article at which the second fold is to be made to travel from the gripping line of the first folding rolls 40 and 41 to a point adjacent the second folding blade 18, before the electrical circuit is closed to operate the blade 18. The closing of said circuit effects the operation of the electro-magnetic device which functions to effect the subsequent operation of the second folding blade 18 whereby the initially folded article is folded at the transversely extending longitudinal centre thereof. Continued rotation of the lever 185ª, 186ª causes the gear 216 to be disengaged from the gear 122, and the rotation of the sleeve 213 stopped.

In order to determine the correct longitudinal extending transverse centres of the article, the control unit 100 is provided with adjustable gages 220, 220 which are attached one to one end of each of a pair of slide bars 221, 221. The slide bars are provided with gear rack teeth 222 which mesh with a common pinion 224 on a shaft 225 rotatably mounted in the lower edge of the supporting beam 110, said beam also having suitably formed guideways for the slide bars 221.

The shaft 225 has a mitre gear 226 secured thereto which meshes with a similar gear 227 secured to one end of a measuring screw shaft 228 rotatably mounted in the end plates 113ª and 114ª of the control unit. A trip block 229 rides on the measuring screw shaft 228 intermediate said end plates and within a slotted sleeve 230. The slotted sleeve 230 has a projection 230ª on which is secured a lever 231 having a pin 232 adapted to be engaged by a slotted link 233, the opposite end of which is pivotally attached at 234 on one arm of the bell-crank lever 150.

The folding blade 19, which forms the initial transverse fold in the article, is positioned in alignment with the central shaft 116 of the control unit 100 and, when the operator places an article to be folded on the conveying belts, it is placed equidistantly to each side of the centre and one of the gages 220 is placed at each longitudinally extending edge thereof. It will be understood that movement of one of said gages through the rack 221 thereof and the common pinion 224 will move the other of said gages an equal distance relative to the centre and by this means, when an article is being gaged and is flat on the conveyor belts with a gage at each edge thereof, it is automatically centered relative to the folding blade 19.

It will be understood that the gages 220 are moved manually. The operator in placing an article in the machine, to be folded, grasps the opposite corners of one end of the article and spreads the article on the belts 101. As the operator moves these corners of the article in opposite directions to straighten the forward edge of the article he also grasps the gages 220, 220 and moves them in opposite directions at the same time as the forward edge of the article is being straightened.

Movement of the gages 220 causes the measuring trip block 229 to be moved a definite distance along the screw shaft 228, and when the advance edge of the article passes under the control unit 100, causing a subsequent operation of the bell-crank lever 150, the sleeve extension 230ª is rocked, thereby causing a cam 235 thereon to ride to a high spot 236 on a lever 237. The lever 237 is pivoted on a shaft 238 one end of which is loosely mounted in the end plate 113ª. Loosely mounted on the shaft 238 is a gear 239 which meshes with a second gear 240 rotatably mounted on the lever 237 and when said lever is rocked the gear 240 is brought into engagement with the continuously rotating gear 121 on the shaft 119 and is held in such engagement by the cam 235. The shaft 238 is a screw shaft on which is mounted a trip block 241 and a slotted sleeve 242 in which the block 241 travels. One end of the sleeve 242 is rotatably mounted on the shaft 238 and the opposite end of the sleeve is provided with an extension 242ª mounted in the end plate 114ª in a manner to permit both rotation and lateral movement of the sleeve relative to the said end plate. The second end of the shaft 238 is mounted in the sleeve 242 in a manner hereinafter described. The sleeve 242 is secured to the gear 239 and the shaft 238 is held against rotation in and by the lever 237. The block is moved longitudinally of the screw shaft within the slotted sleeve 242 when the gear 239 is rotated and such rotation of the gear and sleeve and the movement of the block 241 continues until the block finally engages the trip arm 229 on the shaft 228 which rocks the shaft 228 and moves the cam 235 into a depression 236ª in the arm 237. The arm 237 is then turned on its pivot 238 by a spring 244 which disengages the gear 240 from the gear 121, and the sleeve 242 and block 241 thereby are brought to a quiescent state, thereby registering the correct position to make the second transverse fold in the article.

The first transverse fold is formed immediately after the doubly longitudinally folded article is delivered from the creasing rolls 46 and 47 onto the table 52, and the timing of this fold is effected in the following manner: While the trip block 214 is being moved in its reverse direction within and by the slotted sleeve 213, through the gear 216 meshing with the continuously rotating gear 122, the gear 216 is also meshing with and rotating a gear 245 secured to the extension of a slotted sleeve 246 in which is slidably mounted a timing trip block 247 and a non-rotating screw shaft 248. Such rotation of the sleeve 246 moves the block 247 longitudinally thereof until the gears 216 and 122 are finally disengaged by operation of the lever 185ª, 186ª, whereupon the lip 192ª of the lever 186ª engages a lever 185ᵇ rotatably mounted on the extension of the sleeve 246 and through a lever 176ᵇ and latch 183ᵇ the gear 245 is disengaged from the gear 216 and immediately engaged with the continuously rotating gear 122 which reverses the direction of travel of the block 247 in the sleeve 246, and causes said block 247 to travel in reverse until it finally engages the lug 191ᵇ of the lever 185ᵇ causing the lever 185ᵇ, 186ᵇ to rotate until the lip 192ᵇ strikes the lever 193ᵇ and operates a switch 205ᵇ, 207ᵇ, 208ᵇ, and causes the electro-magnetic device, which effects the operation of the folding blade 19, to function in a manner as above described. Continued rotation of the lever 185ᵇ, 186ᵇ causes the lip 192ᵇ to engage the latch 183ᵇ, and return the elements to their normal positions. Thus the first transverse fold is effected.

Before striking the lever 193ᵇ, the lip 192ᵇ

engages a lever 185[c] rotatably mounted on the extension of sleeve 242 and through the train of levers 185[c], 186[c], and latch 183[c] a gear 250, which is secured to the extension of the sleeve 242, is caused to mesh with the continuously driven gear 122, whereby the block 241 is moved from the quiescent position, above described, in a direction toward the lever 185[c], 186[c], finally engaging the lug 191[c] on the lever 185[c] and rotating it into contact, first with a lever 193[c] and subsequently into contact with the latch 183[c] which disengages the gear 250 from the gear 122 and restores the elements to their normal positions. Engagement of the lip 192[c] with the lever 193[c] effects the operation of a switch 205[c], 207[c], 208[c], and the subsequent operation of the electro-magnetic device which effects the operation of the folding blade 20, thus the second transverse fold is formed in the article which completes the folding thereof. However, if the article is extremely large it may be passed through the folding machine a second time to receive an additional four subsequent folds, as above noted.

We have described above the operation of the central control unit 100 which controls the central folding unit of the folding machine. It will be understood that each of the control units 100[a] and 100[b], positioned at either side of the control unit 100, function in a manner identical with that above noted, and by means of which the folding units, positioned at each side of the central folding unit, are likewise identically operated relative to the central folding unit.

In some instances, it may be desired to fold an article which is of a width greater than the extreme length of the folding blades of any one single folding unit, and in order to fold such an article, mechanism is provided whereby the three folding units function as a single folding unit in effecting the first and second longitudinal folds, and the central folding unit alone functions to effect the first and second transverse folds. In such instance, the three folding and timing units function synchronously to effect the first and second longitudinal folds, each in a manner identical with the description of operation above noted, and thereafter the mechanism of the two side folding units and the two respective control units 100[a] and 100[b] therefor, which effects and controls the transverse folding of the article, are each caused to become ineffective, and the mechanism of the central units functions alone to effect the said transverse folds in the article.

Referring to Fig. 3, it will be noted that the slide bars 221—221 of the central control unit 100 extend to each end of the supporting beam 110, which will permit the gages 220—220, attached thereto, to be correspondingly moved to each end of the supporting beam 110, and thereby permit an article of a width substantially equal to the length of said supporting beam to be folded. The bars 221, 221 of the central unit 100 are respectively mounted in upper and lower guideways 300, 301 carried by the supporting beam 110 adjacent one longitudinal edge thereof; and the bars 221, 221 of the units 100[a] and 100[b] respectively are mounted in similar guideways 300[a], 301[a] carried by the supporting beam 110 adjacent the opposite longitudinal edge thereof, (see Fig. 20). The slide bars of the control units 100[a] and 100[b] are relatively short, and permit the gages 220 to be extended into relative position including a width substantially equal to the length of one of the folding blades 17. The respective bars 221 of the units 100[a] and 100[b] being short and at no time extending beyond the center of the beam 110 are conveniently carried in the opposite ends of the guideways 300[a], 301[a] without interfering with each other.

In addition to the mechanism above described, each of the control units 100[a] and 100[b] are provided with a double armed lever 260 pivoted to the end plate 114. One of the arms 260[a] of the lever 260 lies intermediate the gear wheel 245 and the end plate 114[a], and engages the inner side of said gear. The gear 245 is splined to the circular extension of the slotted sleeve 246, and a spring 261 encircles said extension and is confined between the outer face of the gear 245 and a collar 262 secured to the outer end of the said circular extension, which maintains the gear 245 in a plane consistent with the plane of the gear wheels 122 and 216 with which the gear 245 alternately meshes.

The second arm 260[b] of the lever 260 engages the outer end of a rod 263, see Fig. 17, which is positioned and adapted to slide in a counter-bore formed in and concentrically with the circular extension of the sleeve 242. A head 264 is formed on the rod 263 and is positioned in the slot of the sleeve 242, intermediate the block 241 therein and the end of said slot adjacent the end plate 114[a]. The adjacent end of the screw shaft 238 is journaled in a counter-bore 265 in the head 264, the counter-bore being of sufficient length to permit relative longitudinal axial movement between the rod 263 and the end of the shaft 238.

Upon each operation of the block 241 in the sleeve 242, and as it approaches the end of the slot therein and the lug 191[c] on the lever 185[c] during its reverse travel in the sleeve, the block 241 first engages the head 264 and slides the rod 263 longitudinally outward, thereby turning the lever 260 on its

pivot and causing the arm 260[a] to move the gear 245 out of the plane of the gears 112 and 216, against the action of the spring 261.

If an article of extreme width is to be folded, the gages 220 of the side control units 100[a] and 100[b] are moved toward each other as far as possible, which causes the trip arm 229 controlled thereby to occupy a position immediately adjacent the inner face of the end plate 114[a]. When the bell-crank lever 150 of each of the three control units 100, 100[a] and 100[b] are each synchronously operated by the advance edge of article passing under the said control units at one and the same time, the sleeves 230 of the three units are synchronously rocked, causing rotation of the sleeves 242. It will here be noted that the gages 220 of the central control unit have been moved to the outer longitudinal edges of the article and the trip 229 controlled thereby has been moved along its screw shaft 228 a corresponding distance, while the gages 220 of the outside control units have been moved to a central position, and therefore the trip 229, controlled by each set of gages of these outside units, has not been moved from its position adjacent the end plate 114. Initial rotation of the sleeves 242 of the outside units causes the block 241 thereof to immediately strike the corresponding trip arm 229, and thereby arrest the rotation of the sleeve 242 which consequently does not permit the gear 245 to be moved to the plane of the gears 112 and 216 by the spring 261, which prevents subsequent operation of the transverse folding blades 19 and 20 of each of the side folding units. The sleeve 242 of the central control unit, however, continues to rotate and thereby advance the trip block toward the remotely positioned trip arm 229, and the central control unit thereby functions to effect the transverse folding of the article as above described.

It will be here understood that when the three units are operating independently the block 241 of each sleeve 242 moves away from the head 263 of the rod 262 and toward the trip arm 229, which has been moved to a remote position on the screw shaft 228, by operation of the gages 220 of that particular unit in gaging the width of the particular article that the unit is independently handling, at the time. This action permits the rod 262 to slide inwardly, the lever 260 to be rocked on its pivot and the gear 245 to be moved into the operating plane of the gears 112 and 216, under the influence of the springs 261.

To prevent sagging of the article to be folded, between the tapes or conveyers 101, 101 where the article is engaged by the rollers 160, we provide a pair of presser rollers 275, 275, one at each side of the rollers 160 and in engagement each one with one of the tapes 101, as shown in Fig. 6. The rollers 275 are rotatably mounted in the forked end of a lever 276 pivoted to the supporting beam 110, as shown in Fig. 5. Each of the rollers 275 is composed of material having high frictional qualities, such as rubber or the like and prevent the said sagging under the weight of the operating rollers 160, 160 by frictionally gripping the adjacent portions of the article between the tapes 101 and said rollers 275.

The main shaft 116 of each of the control units 100, 100[a] and 100[b] is provided with a mitre gear 277 adapted to mesh with a similar gear 278 secured to a shaft 279 rotatably mounted in bearings 280, 280 secured to the supporting beam 110. A sprocket 281 is secured to the shaft 279, and is driven, in the present instance, by a sprocket chain 282 from a sprocket 283 secured to the shaft 284 on which the conveyer roller 106 is secured. The shaft 284 is driven, in the present instance, from the shaft 43 by suitable chain and sprockets 285, 286 and 287 respectively.

The screw shaft 228 of each timing set A, B, C and D has a gear 290 secured thereto, adjacent the outer face of the end plate 114[a], which meshes with a gear 291 loosely mounted on the main shaft 116 and whereby rotation of the main screw shaft 228 is transmitted to the screw shaft 228 of each of the timing sets.

We claim:

1. In apparatus for folding flat articles, a folding unit adapted to receive said flat articles and comprising a folding blade adapted to fold a flat article upon itself at its transversely extending longitudinal centre; a second folding blade adapted to fold the initially folded article at the transversely extending longitudinal centre of the folded article; a third folding blade adapted to fold the doubly longitudinally folded article at the longitudinally extending transverse centre thereof; a fourth folding blade adapted to fold the trifolded article at the longitudinally extending transverse centre of the first transverse fold; and a single timing device for effecting the operation of the said folding blades successively at the points and in the order above noted and in timed relation to each other.

2. In apparatus for folding flat articles, a folding unit adapted to receive said flat articles and comprising a folding blade adapted to fold a flat article upon itself at its transversely extending longitudinal centre; a second folding blade adapted to fold the initially folded article at the transversely extending longitudinal centre of the folded article; a third folding blade adapted to fold the doubly longitudinally folded article

at the longitudinally extending transverse centre thereof; a fourth folding blade adapted to fold the trifolded article at the longitudinally extending transverse centre of the first transverse fold; a single timing device for effecting the operation of the said folding blades successively at the points and in the order above noted and in timed relation to each other; and means for conveying the article through the folding operations.

3. In apparatus for folding flat articles, a battery of folding units capable of independent operation upon individual articles to be folded, whereby said articles are folded twice longitudinally and twice transversely; a separate control unit for each of said folding units, by means of which the said folding operations are effected; means for coordinating the operation of said control units, whereby the entire battery of folding units may be caused to perform the longitudinal folding operations of a single article, as a single unit; and means for causing the transverse folding elements and the respective control units of all but one of the battery of folding units to become inactive and the transverse folding of said articles to be effected by the one remaining folding unit.

4. In apparatus for folding flat articles, a folding unit adapted to receive and to fold, individually and in succession, separate articles; a control unit for said folding unit; means for conveying the articles in succession from the control unit to the folding unit; a series of timing mechanism sets in each control unit; clutch mechanism in said control unit adapted to operate said timing sets in succession; and a single operating element for said clutch mechanism adapted to be successively engaged by the articles to be folded as they are fed to the apparatus.

5. In apparatus for folding flat articles, a folding unit adapted to receive and fold, individually and in succession, a plurality of separate articles; a remotely situated control unit for said folding unit; mechanism for gaging the longitudinal dimension of the individual articles and mechanism for gaging the transverse dimension of the individual articles, as they pass said control unit; a series of interchangeable timing mechanism sets in said control unit, adapted to be successively operated by said gaging mechanism to register the gaged proportions of the said articles; means for conveying the articles in succession from the control unit to the folding unit; means in each set of timing mechanism for timing the travel, of the article registered thereby, from the control unit to the folding unit; and mechanism in each timing mechanism set for effecting the operation of the elements of the folding unit in successive timed relation to each other, to fold the registered article.

6. The combination with mechanism for folding a flat article longitudinally and transversely, of means for gaging the length of the article, means for gaging the width of the article, a single timing device for said longitudinal and transverse folding mechanisms comprising means for registering the length of said article operable by said length gaging means, means for registering the width of the article operable by said width gaging means, and means controlled by said registering means for timing the successive operations of said folding mechanisms in accordance with the registered proportion of the article.

7. In apparatus for folding flat articles the combination of a folding unit comprising a plurality of blades adapted to fold an article delivered to said unit, a timing unit comprising a plurality of screw shafts, a plurality of blocks adapted to travel respectively on said screw shafts for timing the folding operations of said blades, and means associated with each screw shaft and its cooperating block for controlling the operation of another of said screw shafts and its cooperating block to effect successive operation of said folding blades in timed relation to each other.

8. In apparatus for folding flat articles the combination of a folding unit comprising a plurality of blades adapted to fold an article delivered to said unit, a timing unit comprising a plurality of screw shafts, a plurality of blocks adapted to travel respectively on said screw shafts for timing the folding operations of said blades, means associated with each screw shaft and its cooperating block for controlling the operation of another of said screw shafts and its cooperating block to effect successive operation of said folding blades in timed relation to each other, means for conveying an article from said timing unit to said folding unit, an element adapted to engage the article as it passes said timing unit, and means operatively connecting said element with one of said screw shaft mechanisms for timing the passage of the article from the timing unit to the folding unit prior to starting the operation of the next successive screw shaft mechanism.

9. In apparatus for folding flat articles the combination of a folding unit comprising a plurality of blades adapted to fold an article delivered to said unit, a timing unit comprising a plurality of screw shafts, a plurality of blocks adapted to travel respectively on said screw shafts for timing the folding operations of said blades, means associated with each screw shaft and its cooperating block for controlling the operation of another of said screw shafts and its

cooperating block to effect successive operation of said folding blades in timed relation to each other, means for conveying an article from the timing unit to the folding unit, a gaging element adapted to engage the article as it passes said timing unit and to remain in contact therewith throughout the length of the article, means controlled by said gaging element for effecting the operation of one of said blocks in one direction relative to its cooperating screw shaft for registering the length of the article, means operatively connecting said gaging element with another of said screw shaft mechanisms for timing the travel of the article from the timing unit to the folding unit whereby the travel timing block is moved in one direction relative to its screw shaft, and means for reversing the direction of movement of said travel timing block whereby said block will effect operation of said registering block in a reverse direction, said registering block in turn effecting operation of the next succeeding screw shaft mechanism and the remaining screw shaft mechanisms will be successively operated to effect operation of said folding blades in like succession.

10. In apparatus for folding flat articles the combination of a folding unit comprising a plurality of blades adapted to fold an article longitudinally and transversely, means for gaging the length of the article, means for gaging the width of the article, a timing unit comprising a plurality of screw shafts, a plurality of blocks adapted to travel on the respective screw shafts for timing the folding operations of said blades, means operatively connecting said gaging element with one of said screw shaft mechanisms for timing the travel of the article from the timing unit to the folding unit, means operatively connecting said length gaging element with another of said screw shaft mechanisms for registering the length of said article, means operatively connecting said width gaging means with another of said screw shaft mechanisms for registering the width of said article, and means associated with each of said screw shaft mechanisms adapted to effect operation of an adjacent screw shaft mechanism at the completion of its own operation, and means operatively connecting said screw shaft mechanisms with said folding blades, whereby said blades are operated in succession and in timed relation to each other to fold said article substantially as described.

11. In apparatus for folding flat articles, the combination of a folding unit comprising a plurality of folding blades, a solenoid adapted to operate each respective blade, a timing unit comprising a plurality of screw shafts, a plurality of blocks adapted to travel respectively on said screw shafts, means for gaging the length of an article to be folded, means for gaging the width of the article to be folded, means operatively connecting the length gaging means with one of said screw shaft mechanisms for registering the length of the article, means operatively connecting the width gaging means with another of said screw shaft mechanisms for registering the width of the article, means associated with each of said screw shaft mechanisms for effecting operation of another of said screw shaft mechanisms whereby said screw shaft mechanisms are operated in predetermined succession, an electric switch associated with and operated by each of said screw shaft mechanisms and connected to the respective solenoids for effecting operation of said folding blades successively and in timed relation to each other, and means connected to said length gaging means for starting the said succession of operations when an article is fed to the apparatus.

12. In apparatus for folding flat articles, the combination of a folding unit comprising a plurality of folding blades, a solenoid adapted to operate each respective blade, a timing unit comprising a plurality of screw shafts, a plurality of blocks adapted to travel respectively on said screw shafts, means for gaging the length of an article to be folded, means for gaging the width of the article to be folded, means operatively connecting the length gaging means with one of said screw shaft mechanisms for registering the length of the article, means operatively connecting the width gaging means with another of said screw shaft mechanisms for registering the width of the article, means associated with each of said screw shaft mechanisms for effecting operation of another of said screw shaft mechanisms whereby said screw shaft mechanisms are operated in predetermined succession, an electric switch associated with and operated by each of said screw shaft mechanisms and connected to the respective solenoids for effecting operation of said folding blades successively and in timed relation to each other, each switch comprising a pair of fixed contacts, a rotary element, a movable contact carried by said rotary element and adapted to be moved into engagement with said stationary contacts, means for adjusting said movable contact relative to said rotary element whereby the time of engagement of said movable contact with said fixed contacts may be varied to vary the time of operation of the respective folding blades, and means connected to said length gaging means for starting the said succession of operations when an article is fed to the apparatus.

13. In apparatus for folding flat articles, a folding machine comprising a plurality

of folding units adapted to function independently each folding unit comprising a blade for folding an article longitudinally and a blade for folding the article transversely, a timing device comprising a plurality of timing units each of which is adapted to control one of said folding units and comprising a plurality of screw shafts, a plurality of blocks adapted to travel respectively on said screw shafts for timing the operations of said folding blades, means associated with each screw shaft mechanism for effecting the operation of another of said screw shaft mechanisms whereby the said screw shaft mechanisms are successively operated to effect successive operation of said folding blades, a length gaging element associated with each of the cooperating folding and timing units for gaging the length of an article and operatively connected to one of the screw shaft mechanisms thereof whereby the longitudinal folding of the article is controlled, means associated with each of the cooperating folding and timing units for gaging the width of the article and operatively connected to one of the screw shaft mechanisms thereof whereby the transverse folding of the article is controlled, and means controlled by each of said width gaging means adapted to render the transverse fold timing screw shaft mechanism of the respective timing unit inactive, whereby the longitudinal folding blades of the entire machine may be operated as a unit to fold an article of extreme width, and the transverse folding of the article may be performed by the transverse folding blade of but one unit of the machine while the transverse folding blades of the remaining folding units remain quiescent.

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