

March 15, 1949.

F. B. CLARK

2,464,556

MACHINE FOR FOLDING SHEET MATERIAL

Filed June 13, 1947

3 Sheets-Sheet 1

Fig. 1

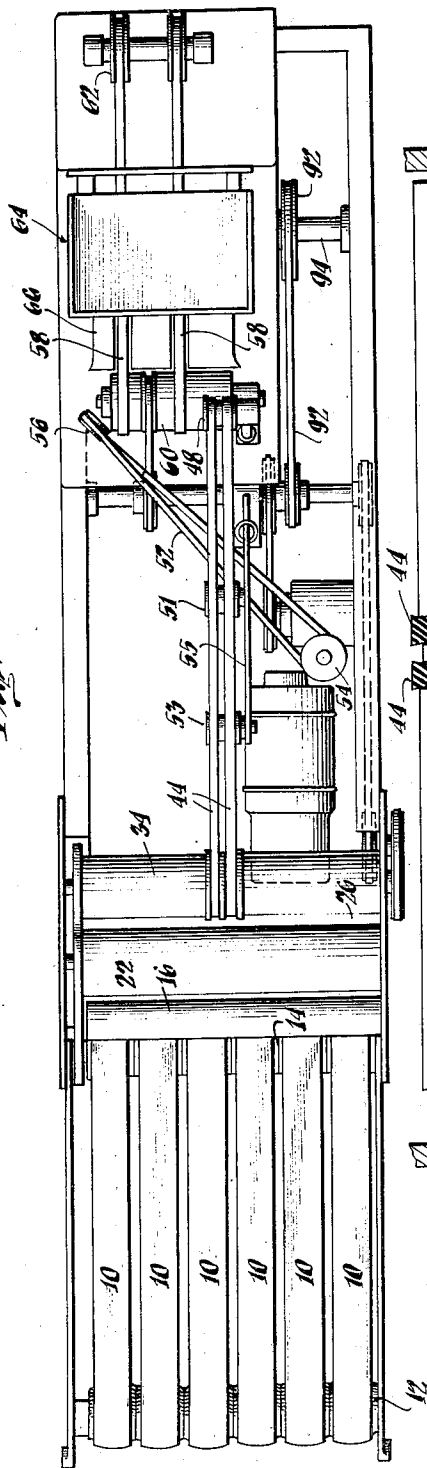
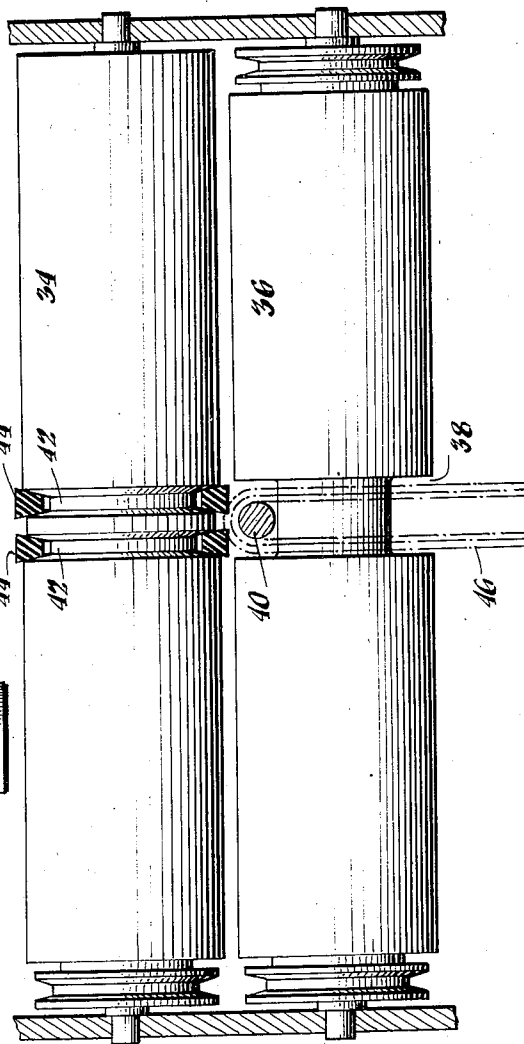


Fig. 3



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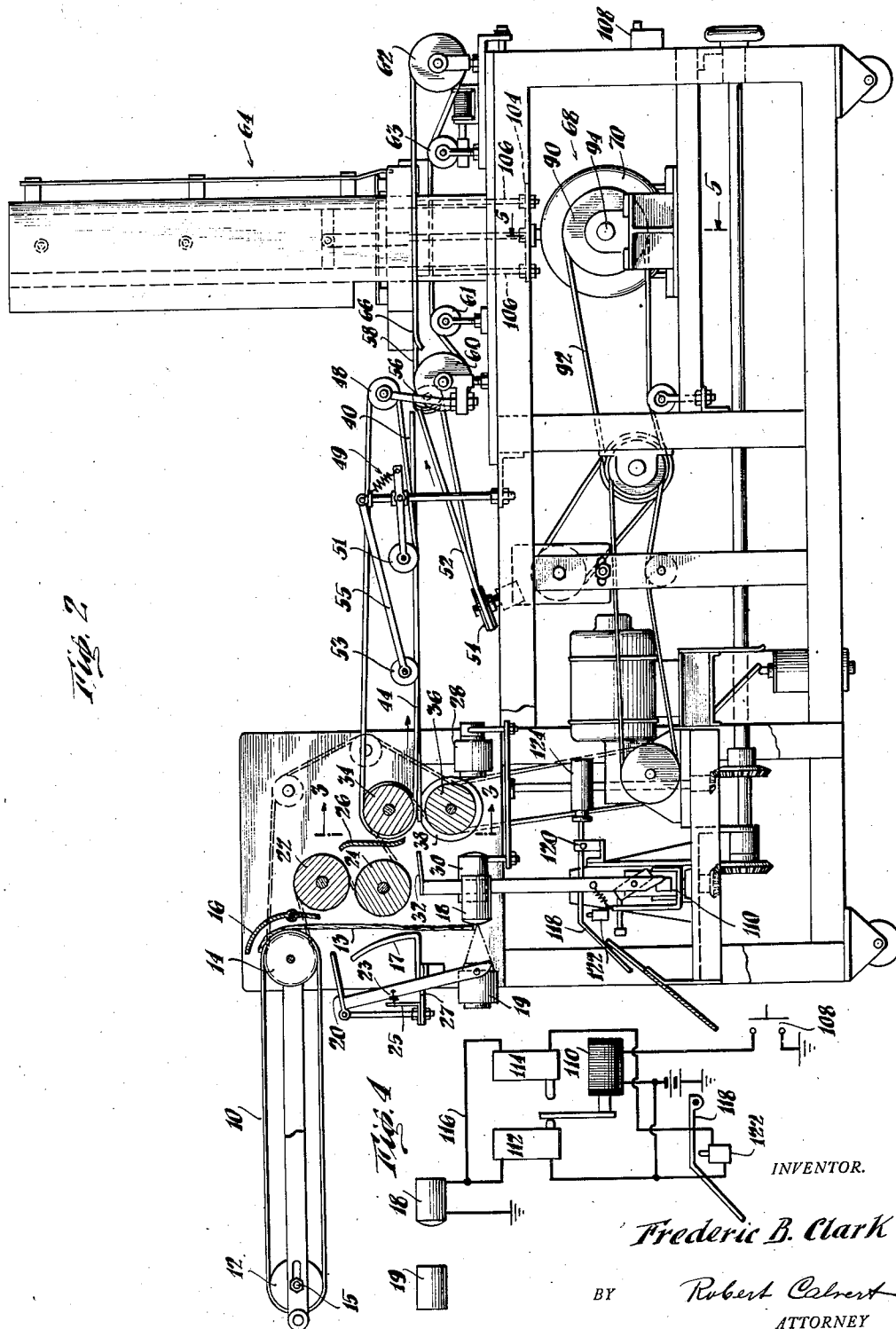
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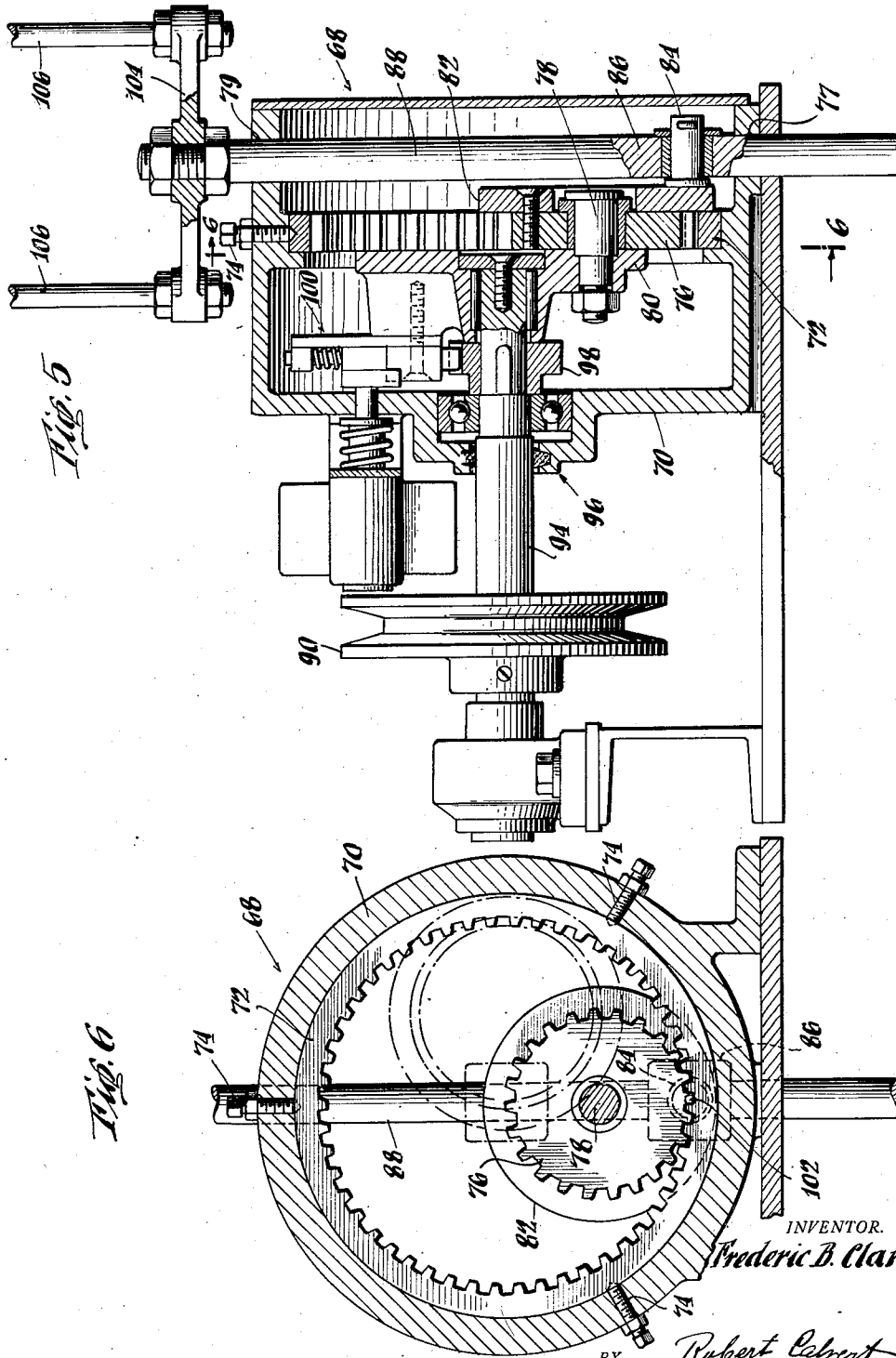
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MACHINE FOR FOLDING SHEET MATERIAL

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3 Sheets-Sheet 3



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MACHINE FOR FOLDING SHEET MATERIAL

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5 Claims. (Cl. 270—61)

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This invention relates to a machine for folding sheet material that bends readily under its own weight and receiving and stacking the folded articles.

The machine is particularly useful in folding laundry articles such as towels, covers for tables generally known as "table tops," and like articles of cloth.

The invention will be illustrated, therefore, in connection with its application to such articles.

There have been proposed many machines for folding laundry articles. Commonly these include means for dropping the article at full width in front of the edge of a horizontally extending knife plate serving as the initial creasing member. When the article falls to a predetermined position, then a microswitch or a photoelectric circuit is activated so as to cause the creasing member to strike forward, contact the article on the line along which the article is to be folded, and feed the fold thus initiated into the bite between coacting rollers. These rollers grip the article along the line of the crease and deliver the thus once folded article to the next stage in the operation. This may be a repetition of the first stage, so as to produce a second fold. Finally the folded article is delivered to a receiver. This is ordinarily in the form of a mechanical stacker in which the folded articles are arranged one above the other.

My invention is an improved machine for giving a fold, suitably the final fold to the article, the machine being used in connection with, or as a substitute for, conventional folding operations described above.

My invention provides a convenient machine for making a fold at a right angle to the horizontal plane, in which an article is ordinarily fed to the folding operation, and delivering the folded article to the stacker. When used after one or two folds by the conventional means described, my machine causes a fold in direction transverse to that of the previous fold or folding. The machine provides also for change of plane of the folded article before delivery to a horizontal receiver or base of a stacking machine.

Briefly stated, my invention comprises a machine including a generally horizontally extending elongated member such as a rod, for delivering the sheet article to be folded upon the rod, so that the article, along the line of the desired fold, hangs upon the rod, and means for sliding the article in thus draped manner along the rod, in the direction of the delivery or stacker end of the machine.

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In the preferred embodiment, the machine includes also means such as an inclined cross belt disposed below the rod for engaging the lower part of the draped article and lifting this lower part of the article until it lies in a plane that is approximately horizontal, so as to facilitate delivery of the article to a horizontal receiving or stacking member.

In one embodiment, the invention comprises also special means for rejecting articles that on inspection are found to be faulty, these rejecting means including a photoelectric circuit actuating means for advancing the article through the machine, a device for breaking the circuit and thus inactivating the means for advancing the article, so that the article is allowed to fall from the usual path of its travel, and an arm of a resetting switch disposed in the path of the fall of the rejected article, so that the article, in striking this arm, closes the circuit and again activates the means for advancing the article to the folding mechanism of the machine.

The invention comprises also the herein described means for moving a reciprocating plunger of the stacking device, in such manner that the plunger is kept vertical at all times.

The invention will be illustrated by description in connection with the attached drawings to which reference is made.

Fig. 1 is a plan view of my machine.

Fig. 2 is a side view of the machine.

Fig. 3 is a sectional view on line 3—3 of Fig. 2, showing particularly the roller, rod, and V-belts assembly of my machine for effecting the final fold before the stacking operation.

Fig. 4 is a diagram of the electrical circuit used in the rejection of faulty articles and the continuing advancement through the machine of articles that pass inspection.

Fig. 5 is a sectional view on an enlarged scale on line 5—5 of Fig. 2.

Fig. 6 is a sectional view on line 6—6 of Fig. 5. The views are in part diagrammatic, details not shown being conventional.

In the general assemblies shown in Figs. 1 and 2, the articles being folded move to the right.

There are shown endless conveyor belts with suitably driven roller mountings 12 and 14 and belt tightener means 15. These belts deliver the article to be folded against the deflecting baffle 16.

Disposed below this baffle and in the path of the falling article 13 is the photoelectric cell with elements 18 and 19. These are so connected in the electrical circuit, as will be described, that,

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when the lower edge of the article to be folded crosses the beam of light between the two elements, the creasing member or blade 20 is caused to strike to the right in Fig. 2, initiating a fold or crease in the article and introducing the fold (not shown) into the bite of the coating driven rollers 22 and 24.

These rollers complete the fold initiated by the blade 20 and advance the article against the baffle 26 which causes it, in once folded condition, to fall until the forward edge strikes the beam of light between photoelectric cell elements 28 and 30. This circuit, at this moment activates the creasing blade 32 which gives the article a second fold and delivers it to the bite between driven rollers 34 and 36.

The machinery so far described is conventional except for certain features of the photoelectric circuits to be described later and except for the particular shapes of the rollers 34 and 36 also to be described.

The roller 36 (Fig. 3) is provided with groove 38 of size to receive the rod 40 which at its one end terminates within this groove and on the upper side of the roller as shown in Fig. 2.

The roller 34 is provided with two grooves 42 to receive the two V-belts 44.

The rod 40 extends from the roller 36 in direction to the right in Figs. 2 and 4, that is, in the direction of the stacker to be described.

The article passed between rollers 34 and 36 drapes itself over the rod 40. When the article delivered to the rod is so spaced on the roller 36 that the mid point of the article meets the end of rod 40, then the article hangs half on one side and half on the other side, as shown at 46 in Fig. 3.

The two driven V-belts 44 are mounted at the one end in grooves 42 in roller 34 as described and at the other end in corresponding grooves of pulley 48. Pulley 51 is forced, by spring 49 under tension caused by pulley 53 acting through arm 55, against the lower reaches of the V-belts so as to hold the belts in firm contact against the article draped over the rod 40.

It will be seen that the V-belts are mounted just above and one to each side of the center line of rod 40. They contact the article draped over the rod and serve as the means to slide the article upon the rod and finally off the right end thereof in the arrangement shown in Figs. 1 and 2.

Disposed below the rod at a short distance is the continuous cross belt with upper reach 52, the belt being mounted on driven pulleys 54 and 56. This upper reach of the belt extends transversely, at an oblique angle to the direction of length of the rod 40, and inclines upwardly in direction of movement of the upper reach as shown by the arrow in Fig. 2. The speeds of movement of the upper reach 52 of this belt and the lower reach of the V-belts 44 are synchronized; the component of the speed of the upper reach 52 of the cross belt, measured parallel to the direction of movement of the V-belts 44, for best results, is equal to the speed of the V-belts. Furthermore the upper reach 52 of the cross belt terminates at approximately the level of the underside of rod 40.

This in turn, is at the level of the belts 58 passing over the driven rollers 60 and 62, with tighteners 61 and 63, these belts 58 serving to deliver the folded article to the stacker.

The stacker is indicated generally at 64 and shown only diagrammatically as to those parts of it that are conventional.

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In operation, the upper reach 52 of the cross belt contacts first the forward edge of the folded article advancing on rod 40 under the influence of frictional contact of the V-belts 44. As the forward edge of the folded article makes this contact with the cross belt, the article is gradually and regularly raised at the forward edge until the edge comes to lie in a horizontal plane. As additional parts of the article advance to the position of striking the belt, they in turn are also elevated to the horizontal plane.

Because of synchronizing the speeds of belts 52 and 44, there is no substantial amount of either slipping of the folded article by the horizontalizing belt 52 or wrinkling of the article by that belt.

Once the folded article is thus horizontalized, it is delivered to the supporting platform 66 of the stacker. There the article is stacked with other articles in manner that, except for the plunger mechanism for raising and lowering parts of the stacking device, is conventional. The stacker, therefore, will not be described in detail.

Except as stated, the stacker may be constructed in accordance with U. S. Patent 2,025,246, issued to Preston on December 24, 1935, or in accordance with other customary design of stackers for folded papers or the like.

The stacker illustrated in part in the drawings is of the bottom stacker type. In this class of stacker, the article last delivered to the stack becomes the lowest member of the stack. Each time an article is delivered to the stacker, the mechanism raises the stack previously formed, inserts the latest arrival under the previously stacked articles, then delivers the latest article upward, against the previously stacked towels, and repeats this sequence of steps each time a newly folded article is delivered to the support or floor at the bottom of the stacker.

The new feature of my stacker which will now be described involves the part illustrated generally at 68 (Figs. 2, 5 and 6).

Unit 68 includes a housing 70 carrying an internal gear ring 72 mounted in non-rotatable manner in the housing, by set screws 74. Mounted within the internal gear 72 is a planetary gear 76, in mesh. This gear is carried on a stud 78 screwed into a flange portion 80 of the frame. The face of gear 76 is mounted on disc 82 which carries a stud pin 84. This pin engages the cross head portion 86 of the oscillating rod 88 serving as the reciprocating plunger of the stacking device.

A pulley 90 is driven by belt drive 92 mounted onto shaft 94 in bearing 96 of housing 70. On the same shaft is a notched disc 98 engaging a one-revolution clutch 100 of any standard construction.

The purpose of this arrangement for plunger 88 is to avoid any side thrust exerted on the plunger and produce an exactly vertical thrust on the plunger.

For this purpose it is essential that the pitch diameter of gear 76 be exactly equal to half the pitch diameter of the internal gear 72.

Pin 84 mounted on the disc 82 is fixed exactly at the distance of the pitch radius of gear 76 from pin 78. In other words, the pin at its center is in line with the pitch circumference (bottom of the gear teeth) in the planetary gear and extends at a right angle to the general plane of the face thereof. Therefore, rotation of shaft 94 and pin 78 causes the planetary gear 76 to be carried around center shaft 94. Being engaged to gear 72, the planetary gear during that motion

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rotates in such way that the imaginary point 102 on its pitch circumference (at the center of the pin mounting the plunger to the planetary gear) always remains in the vertical center line of the drive unit, that is, in the line of reciprocation of the plunger 88. It will be noted that the housing 70 is provided with holes mounting the plunger 88 vertically and movably and serving at positions 77 and 79 (Fig. 5) as guides for the plunger.

At the top of the plunger there is a cross head 104 mounting and supporting the stacker operating rods 106.

During the normal operation of the machine, the article to be folded enters the beam of light between photoelectric cell elements 18 and 19. For rejecting faulty articles, a push button 108 (Fig. 2) is mounted on the frame in any conventional manner. When the button is pushed in, it closes a circuit and thus energizes the solenoid 110 (Fig. 4) in the primary photoelectric circuit. This solenoid operates two microswitches 112 and 114.

During normal operation of the machine microswitch 112 is always closed. In rejecting an article, the current is caused to go through switch 108, thus energizing solenoid 110. This interrupts the current to the photoelectric cell element 18 and at the same time closes the circuit including shunt wire 116 leading to microswitch 114, thereby reestablishing a part but only a part of the circuit to the element 18. The rejected article, in this state of the circuits, will not register in the photoelectric cell and will continue to fall, until it strikes the pivoted platform 118 and thereby tilts same around pivot 120. This platform is in effect an arm of a switch in a secondary circuit.

The switch 122 itself is mounted underneath this platform. Tilting of the platform 118 under the impact of the falling article, closes the switch 122, reenergizes the secondary circuit including solenoid 110, thereby restores the circuit to microswitch 112, and interrupts the current through microswitch 114.

The platform 118 is reset by a counter-weight 124. Articles to be folded will now be creased by the creasing member 20 and advanced through the machine. This will continue until the operator discovers another faulty article or for other reason pushes the key 108 and thus again discards an article. The machine is now ready to operate normally again.

The solenoid 110 actually represents a relay, other conventional parts of which are not illustrated.

The operation of the machine will be largely evident from the description of it that has been given.

Articles to be folded are fed serially into the machine at the left of the set up as shown in Figs. 1 and 2, suitably by the feed belts 10. The articles fall one by one in front of the creasing knife 20 and in front of the guide 17 until the leading edge of each article enters the light beam of the photoelectric cell. This causes the knife edge 20 to strike to the right, crease the article, and push the crease between the first pair of folding rollers 22 and 24. The creasing knife is then returned to the left (in Fig. 2) by spring 23 on bracket 25 mounted on frame member 27.

The operation is repeated with the creasing knife 32 and rollers 34 and 36.

Then the article is fed over rod 40 over which the article drapes under the influence of gravity. The V-belts 44, pressing upon the upper surface

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of the article suspended on the rod, slide the article along the rod until the article strikes the cross belt 52. This cross belt picks up, first the forward edge of the article, and then the following parts and transfers the article, in a generally horizontal plane, to the stacker feed belts 58.

These stacker feed belts, in turn, convey the article under the folded articles previously collected in the stacker 64. Then the article is lifted upward, by means of the plunger 88, with special reciprocating drive mechanism, under the bottom of the previously formed stack and is itself retained by conventional means above the level of the support or platform 66 of the stacker, so that a new folded article may be delivered directly upon such support.

When the operator, serving as the inspector of a machine notes a faulty article coming through in advance of the creasing knife 20, he simply presses the key 108. This cuts out the primary circuit including the photoelectric cell element 18, so that the rejected article falls, through the space below the baffle 16 and below the creasing member, until the article strikes the arm 118 of the other circuit of the photoelectric system. This arm is so sloped, that the article slide off it. The article, in striking this arm, closes the secondary circuit, so that the photoelectric cell 18 is again activated and caused to operate the creasing knife 20 as soon as the downward edge of the next succeeding article strikes the beam of light in the photoelectric cell 18.

This system of rejecting articles makes it possible to discard an article entering the machine. As soon as the discarded article has fallen upon the arm 118 above the switch 122 of the secondary circuit, the photoelectric cell is again activated so as to pass the next succeeding article through the machine in the direction of the folding mechanism and stacker.

Materials of construction may be and suitably are those which are usual in constructing parts of the kind illustrated, as, for instance, iron or steel for metal parts except electrical wiring which is of usual kind such as copper or aluminum. For the various belts, rubber compositions are suitable.

While the machine has been described in connection with the folding of laundry articles, it may be used with other cloth objects, newspapers, or like sheet material that is so easily bent as to fold under the influence of gravity when the article is supported over a narrow elongated member.

In place of the rod 40 there may be used a bar, pipe, or blade, the term "rod" being used herein to include any such thin long elongated member suitable for draping the article to be folded over the member and allowing it to be slid by V-belts 44 or like means in the direction of the stacker 64.

Where driven rollers are referred to, it is to be understood that in a pair of pulleys, one pulley may drive the other so that only one need be positively driven.

If accurate synchronization is desired, the pulleys and belts may be replaced by conventional sprocket wheels and chains, the terms pulleys and belts being used to include such optional conventional driving mechanism.

The machine of the present invention is dependable and certain and rapid in its operation.

It will be understood that it is intended to cover all changes and modifications of the example of the invention herein chosen for the purpose

of illustration which do not constitute departures from the spirit and scope of the invention.

What I claim is:

1. In a folding machine for an article that bends under the influence of gravity, the improvement comprising a stationary rod extending approximately horizontally, means for depositing the article to be folded upon the rod, so that the article drapes over the rod and folds on the line of support upon the rod, an article sliding member disposed adjacent to the rod so as to contact the article when draped on the rod, means mounting the article sliding member in non-rotatable manner but movably in direction approximately parallel to the direction of extent of the rod, and driving means causing the said member to move lengthwise of the rod so that the folded article is slid along the rod and finally off the end of the rod to a receiver for the folded article.

2. In a folding machine for an article that bends under the influence of gravity, the improvement comprising a stationary rod extending approximately horizontally, means for depositing the sheet article to be folded upon the rod, so that the article drapes over the rod and folds on the line of support upon the rod, a continuous belt with the lower reach thereof disposed adjacent to and approximately parallel to the rod so as to contact the article when draped on the rod, and driving means causing the said lower reach of the belt to move lengthwise of the rod so that the folded article is slid along the rod and finally off the end of the rod to a receiver for the folded article.

3. In a folding machine for an article that bends under the influence of gravity, the improvement comprising a stationary rod extending approximately horizontally, means for depositing the sheet article to be folded upon the rod, so that the article drapes over the rod and folds on the line of support upon the rod, a pair of V-belts with the lower reaches thereof disposed adjacent to, approximately parallel to, and slightly above the rod, with one belt on each side thereof, so as to contact the article when draped on the rod, and driving means causing the said lower reaches of the belts to move lengthwise of the rod so that the folded article is slid along the rod and finally off the end of the rod to a receiver for the folded article.

4. In a folding machine for an article that bends under the influence of gravity, the improvement comprising a stationary rod extending

approximately horizontally, means for depositing the article to be folded upon the rod, so that the article drapes over the rod and folds on the line of support upon the rod, an article sliding member disposed adjacent to the rod so as to contact the article when draped on the rod, driving means causing the said member to move lengthwise of the rod so that the folded article is slid along the rod and finally off the end of the rod to a receiver for the folded article, an endless cross belt having an upper and a lower reach, a stacker for folded articles at approximately the terminus of the upper reach of the cross belt in the direction of movement thereof, means mounting the cross belt so that the upper reach thereof is disposed below and adjacent to the said rod, at an oblique angle to the length of the rod, and inclined upwardly in the direction of the stacker, and additional driving means causing the upper reach of the cross belt to move in the direction of the stacker, the cross belt serving to contact the folded article as the article is advanced along the rod, changing the general plane thereof to horizontal, and delivering the folded and thus horizontalized article to the stacker.

5. A machine as described in claim 4, the said additional driving means for the cross belt being of speed to give to the upper reach of the cross belt a velocity having a component measured in direction parallel to the length of the said rod that is approximately equal to the speed of the said article sliding member in the same direction.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,004,376	Cotoli	Sept. 26, 1911
1,044,449	Funck et al.	Nov. 12, 1912
1,499,254	Rocklin	June 24, 1924
1,844,152	Funck	Feb. 9, 1932
1,865,945	Monforts et al.	July 5, 1932
2,175,560	Friden	Oct. 10, 1939
2,214,857	Clegg	Sept. 17, 1940
2,282,127	Gabbert	May 5, 1942
2,307,822	Clegg	Jan. 12, 1943

FOREIGN PATENTS

Number	Country	Date
521,310	Great Britain	May 17, 1940