Sept. 1, 1953 E. J. HOWLETT 2,650,821

FOLDING MACHINE FOR LAUNDRY PURPOSES

Filed April 10, 1950 4 Sheets-Sheet 1

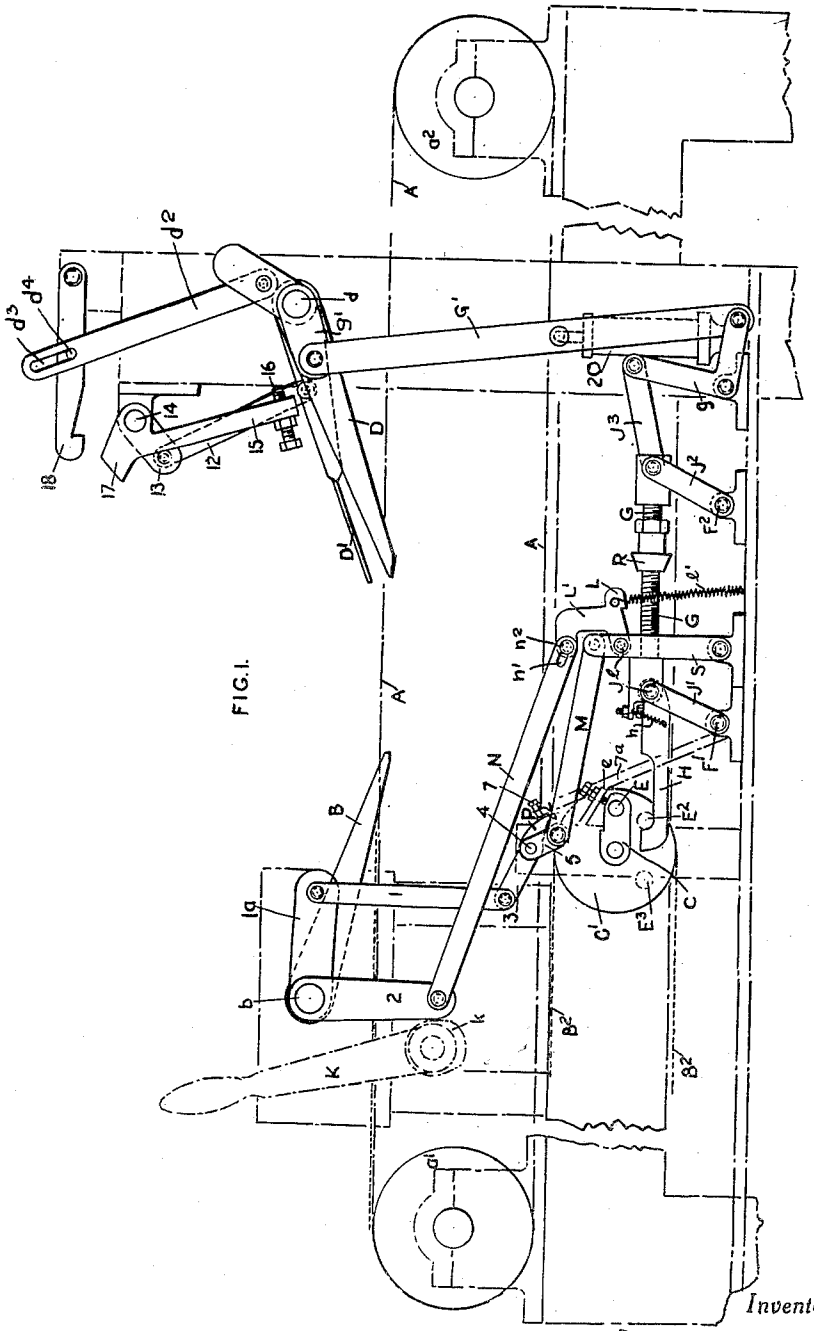


FIG. 1.

Inventor

Edward John Howlett

By

Sept. 1, 1953 E. J. HOWLETT 2,650,821

FOLDING MACHINE FOR LAUNDRY PURPOSES

Filed April 10, 1950 4 Sheets-Sheet 2

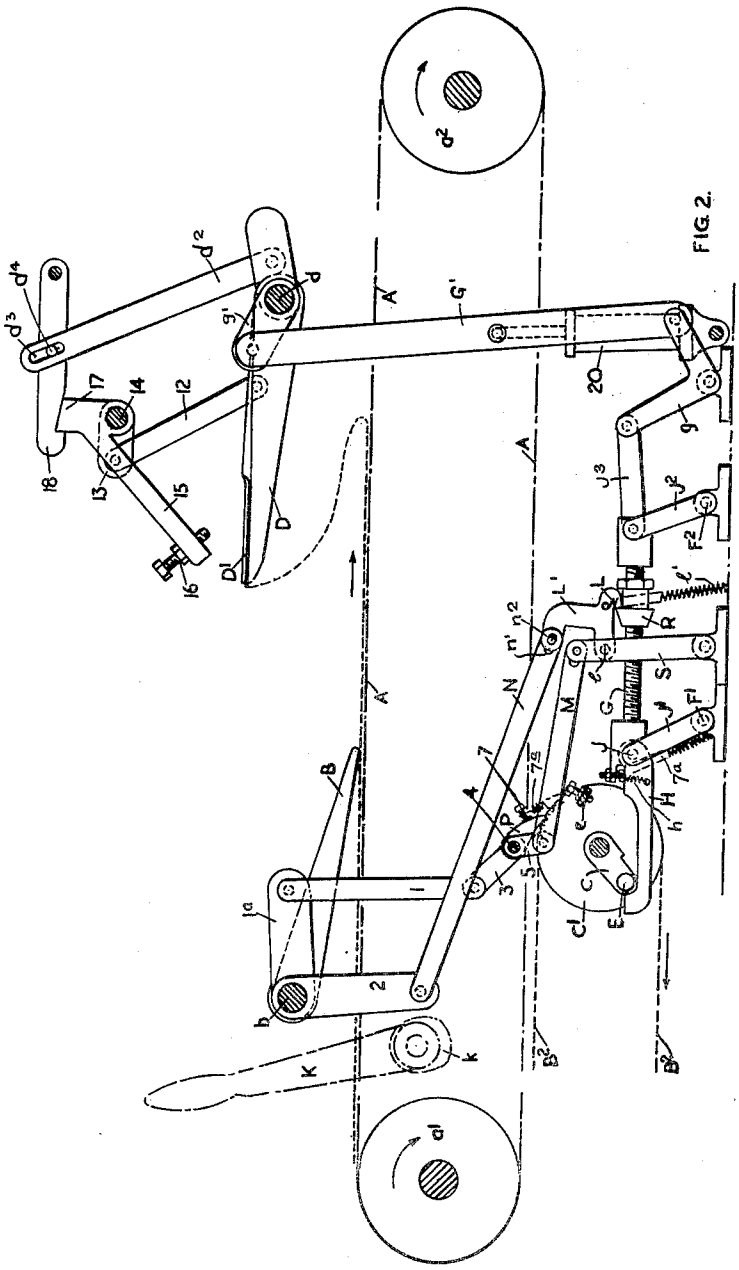


FIG. 2.

Inventor
Edward John Howlett
By
Mendall & Stade

Sept. 1, 1953 E. J. HOWLETT 2,650,821

FOLDING MACHINE FOR LAUNDRY PURPOSES

Filed April 10, 1950 4 Sheets-Sheet 3

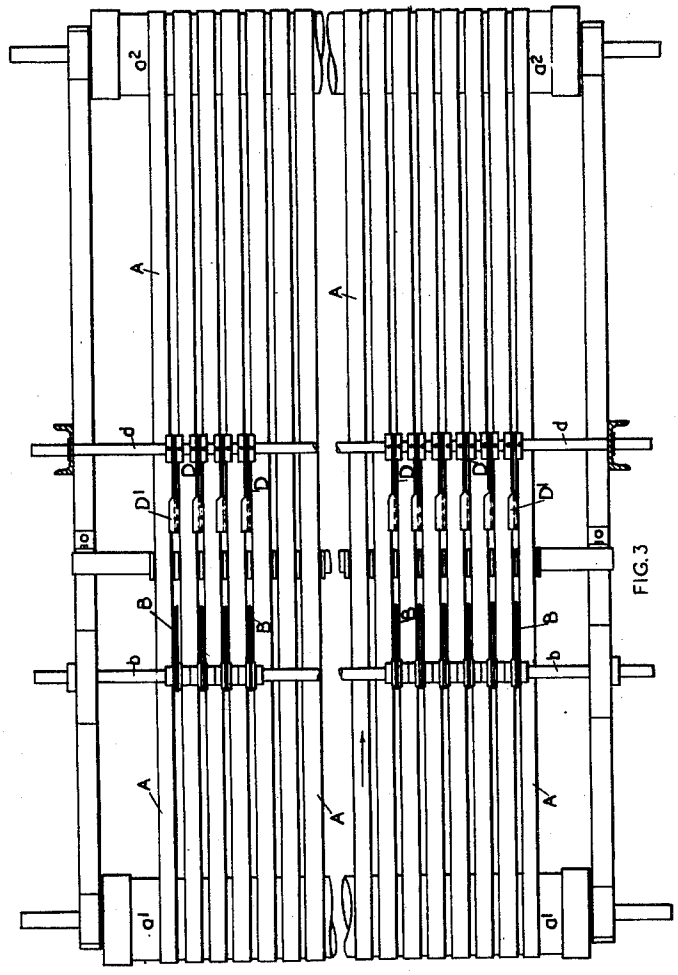


FIG.3

Inventor

Edward John Howlett

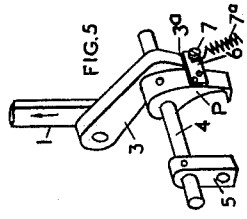
By

Sept. 1, 1953 E. J. HOWLETT 2,650,821

FOLDING MACHINE FOR LAUNDRY PURPOSES

Filed April 10, 1950 4 Sheets-Sheet 4

FIG. 5



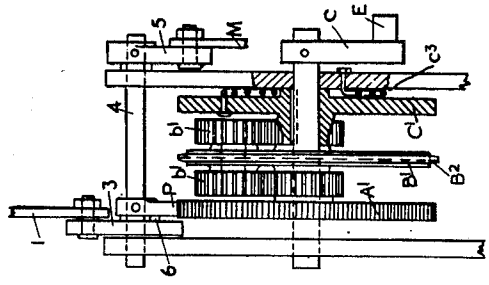


FIG. 4

Inventor

Edward John Howlett

By

Rudall & Rudall
Att'ys

Patented Sept. 1, 1953

2,650,821

UNITED STATES PATENT OFFICE

2,650,821

FOLDING MACHINE FOR LAUNDRY PURPOSES

Edward John Howlett, Edgware, England, assignor to Isaac Braithwaite & Son Engineers Limited, Kendal, England, a corporation of Great Britain

Application April 10, 1950, Serial No. 154,975
In Great Britain April 9, 1949

5 Claims. (Cl. 270—68)

1

This invention relates to improvements in machines for use in laundries for folding sheets, table cloths and similar articles.

The object of the invention is a machine which will receive the article as it leaves an ironing machine, fold it one or more times and deliver it in the desired folded condition.

The folding machine or apparatus according to the invention comprises a ribbon type conveyor arranged to receive the work, a series of pivoted fingers situated between some or all of the ribbons of the conveyor and adapted to be pivoted by contact with the leading edge of the work, a second series of pivoted fingers arranged some distance after the first series and inclined in the direction of travel of the conveyor, the leading edge of the work travelling up the inclined surface of the second series of fingers, means for holding the leading edge of the work onto the second set of fingers and means controlled by the movement of the first set of fingers for operating the second set of fingers to raise them above the conveyor and hold the leading edge of the work after a predetermined time has elapsed from the movement of the first set of fingers by the contact therewith of the leading edge of the work and to retain the second set of fingers in such position until the trailing edge of the work has moved away from the first set of fingers into a position in which it will coincide with the leading edge of the work.

The control of the second set of fingers from the front set may be by mechanical or electrical means and in the accompanying drawings in relation to which the invention will now be described examples of both forms of control are illustrated. In these drawings:

Fig. 1 is a side elevation showing the parts of a mechanical controlling and timing mechanism in their positions before being actuated by the leading edge of the work coming into contact with the first set of fingers;

Fig. 2 is a similar side elevation showing the same mechanism with the parts thereof in their positions after the leading edge of the work has actuated the first set of fingers, the leading edge of the work has passed up the inclined surfaces of the second set of fingers and the controlling and timing mechanism has raised the second set of fingers to hold the leading edge of the work and raise it above the conveyor;

Fig. 3 is a plan of the conveyor and fingers;

Fig. 4 is a sectional view of an epicycle gear which controls the timing of the mechanism; and

Fig. 5 is a perspective view of a pawl mechanism which causes the operation of the epicyclic gear.

2

The conveyor A which receives the work as it is delivered from an ironing or other machine is of the endless ribbon type passing around rollers a^1 and a^2 one or both of which is driven.

A series of fingers B hereinafter called the timing fingers are affixed on a shaft b extending across the machine above the ribbons of the conveyor A, the shaft b being rotatably mounted in bearings carried by the frame of the machine. The free ends of the fingers B normally project downwards a short distance between the ribbon of the conveyor A until raised by the leading edge of the work to be folded coming into contact with the lower edges of the fingers.

A link 1 is pivotally mounted on an arm $1a$ affixed on the end of the shaft b and movement of this link oscillates a lever 3 pivotally mounted on a short spindle 4 (see Fig. 5), thus when the link 1 is raised by the lifting of the timing fingers B, the end $3a$ of the lever 3 will drop. A pawl P and a lever 5 are affixed on the spindle 4 and attached to the pawl P is a small plate 6 which carries an adjusting screw 7 the end of which bears on the end $3a$ of the lever 3. When the link 1 is raised by the lifting of the timing fingers B and the end $3a$ of the lever 3 is consequently depressed a spring $7a$ attached to the plate 6 pulls the pawl P downwards.

A differential train of three wheels A^1, B^1, C^1 is arranged below the shaft b to which the timing fingers are secured, the wheels A^1 and C^1 being sun wheels and the wheel B^1 carrying the planet pinions b^1. The wheel B^1 is driven by a chain B^2 from a convenient part of the machines so that it rotates at a constant speed depending upon the feed of the conveyor.

The sun wheel A^1 is formed with ratchet teeth on its periphery adapted to be engaged by the pawl P and the sun wheel C^1 carries a laterally projecting pin E which when the first sun wheel is free to rotate is held by the spring c^3 against a stop e and prevents rotation of the wheel C^1. The sun wheel A^1 is free to rotate when the machine is not actually folding, i. e. when the timing fingers B are not raised. When, however an article to be folded is placed on the conveyor A, it is carried forward until its leading edge lifts the timing fingers B, thereby causing the pawl P through the action of the link 1 and lever 3 to move into engagement with the ratchet teeth on the periphery of the sun wheel A^1 and prevents its rotation.

Since the planet pinion carrying wheel B^1

is positively driven by the chain B^2 the stopping of the wheel A^1 causes the wheel C^1 to rotate against spring pressure in a direction to bring the pin E away from the stop *e* and the movement of the pin is employed to operate the second set of fingers hereinafter called the lifting fingers D after the pin E has moved a predetermined angular distance from the stop *e*.

When the pin has moved the predetermined angular distance into the position E^2 it engages a catch H which is fulcrumed at J on the upper end of a lever J^1 which is in turn fulcrumed at its lower end on a fixed pivot F^1 so that the catch is constrained to move forward in a more or less horizontal path until the pin E has reached a position E^3 in which it moves away from the catch.

The lever J^1 on which the catch H is pivoted is connected by a horizontal bar G through a bell crank lever *g* to suitable pull rods which activate the lifting fingers D. One end of the bar G is pivoted on the lever J^1 and the other end is pivoted on the upper end of a second lever J^2 also fulcrumed on a fixed pivot F^2 so that during the movement of the bar it is maintained in a horizontal position.

The weight of the lifting fingers D and their controlling connections is such that it tends to move the horizontal bar G and catch H in the opposite direction to their movement by the pin E and to prevent this when the pin E moves away from the catch A at position E^3 a pawl L carried on a fulcrumed lever S engages a collar R in the rod when the latter is in its forward position.

The pawl L is carried by a plate L^1 which is pivotally mounted on a pin *l* on the arm S. The plate L^1 has a pin n^2 which engages in a slot n^1 in the link N.

The parts j^2 and *g* are connected by a bar j^3 pivoted at one end to j^2 and at the other end to *g*.

The other end of the two-armed lever *g* is pivotally connected to a connecting rod G^1, the upper end of which is connected by the link g^1 to the shaft *d*.

The ends of the fingers D are pivotally connected to links d^2 slotted at d^3 at their upper ends and a pin d^4 on the catch 18 is located in the slot d^3. The pin E is carried by the arm C.

The spring *h* tends to maintain the part H in engagement with the pin E as the latter rotates so that part H will be pulled over from the position shown in Fig. 1 to the position shown in Fig. 2. The spring l^1 tends to keep the pawl L in engagement with the surface of the part R until the pawl is lifted against the pressure of the spring to allow the movement of the parts from Fig. 1 to Fig. 2.

Directly the pawl L engages a collar R the pull of the lifting fingers D tends to move the pawl and the lever S on which it is mounted in the opposite direction to the direction in which the rod has been moved by the pin E. The lever S is connected by a link M to the lever 5 on the short spindle 4 to which the pawl P is secured. Thus the link M rotates the spindle 5 in the opposite direction to that in which it is moved by the weight of the pawl P and the pawl is lifted out of engagement with the ratchet teeth on the wheel A^1 so that the latter is no longer held. The wheel C^1 is consequentially no longer constrained to rotate and it will be moved back by its spring control until the pin E returns to engagement with the stop *e*.

At this stage of the operation the differential wheel C^1 has returned to its starting position but the lifting fingers D are still raised because the pawl L is still engaging collar R on the horizontal rod G. As soon as the trailing edge of the work has moved clear of the timing fingers B the latter fall and the shaft *b* returns to its normal position. As arm 2 is affixed on the end of the shaft B and this arm is connected by a link N to the tail of the pawl L. The movement of the arm 2 and link N moves the pawl L about its pivot and releases it from the collar R so that the lifting fingers are free to fall and release the end of the work held thereby and the work will be delivered from the conveyor in a folded condition with its original leading edge in alignment with the trailing edge. The falling of the lifting fingers D returns them to the position shown in Fig. 1 ready to be engaged by the leading edge of the next article of work to be folded.

The lifting fingers D are affixed to a rotatably mounted shaft *d* and normally project downwards between the ribbon of the conveyor A so that the forward end of the work will ride up the inclined surfaces of the fingers. Above each lifting finger D is a resilient stop in the form of a lever D^1 loosely pivoted on the shaft *d* but prevented by a fixed stop from falling onto the finger when the latter is in its bottom position. The first part of the upward movement of the lifting fingers D brings them against the resilient stops D^1 with the front edge of the work between them and the further movement of the fingers D carries the work and stops D^1 with them. In the final position each lifting lever D and its stop are approximately horizontal, and the article being folded passes beneath. When the lifting fingers D are released due to the trailing edge of the work leaving the timing fingers B it is desirable for the lifting fingers to drop to the lower position but for the resilient stop levers D^1 to remain in the upper position until the lifting fingers D are almost in their lowest position. This is accomplished by limiting the downward movement of each stop D^1 by a link 12. The link 12 is attached at its upper end to a lever 13 mounted on a shaft 14 extending across the machine. Also mounted on the shaft 14 is a lever 15 carrying an adjustable stop 16. This stop determines the clearance between the lifting finger and its resilient stop when in the lower position. When the lifting fingers D and their resilient stops D^1 are in the upper position a detent 17 on the shaft 14 is engaged by a catch 18 and when the lifting fingers are allowed to drop the catch 18 holds the detent 17 until rotation of the shaft *d* raises a link 19 and so lifts the catch out of engagement with the detent, where resilient stop levers D will fall until arrested at their lowest position by the stop 16.

A suitable form of "dash pot" shown at 20 may be connected into the lifting fingers operating mechanism to control their descent if desired.

Referring to the position shown in Fig. 1 with the top side of the conveyor A assumed to be moving from left to right, the leading edge of the article to be folded lifts the timing fingers B, thereby causing the pawl P, Fig. 5, to engage the ratchet wheel A^1, Fig. 4, and arrest rotary movement of this wheel. Continued rotation of the chain wheel B^1 acting through the differential train then causes the crank E to rotate in a clockwise direction away from the stop *e*.

During the passage of the leading edge of the article and the fingers B to the lifting fingers D the crank pin E continues to rotate to the position E^2, Fig. 1. As the leading edge of the article

slides up the inclined top surface of the fingers D the crank pin E engages the hooked end of the catch H and commences to pull this catch towards the left. This movement through the link already described raises the lifting fingers D and grips the leading edge of the article between the upper surfaces of these lifting fingers and the lower surface of the resilient stop fingers D^1. The leading edge of the article is thereby prevented from further movement to the right and is lifted further by the continued upward movement of the fingers D which carry with them the resilient stop fingers D^1. This continued movement of the fingers D corresponds with the movement of the crank pin E from the position E^2 to the position E^3.

While the article to be folded continues to be carried by the conveyor A towards the right, owing to the leading edge being lifted and held, a loop is formed as indicated in Fig. 2. When the trailing edge of the article passes away from fingers B, the latter fall back to their lower position thereby moving the pawl L out of engagement with the collar R, so allowing the lifting fingers D and the resilient stop fingers D^1 to fall and when the fingers D have fallen away from the fingers D^1 the leading edge of the article is free and falls down on to the trailing edge so that the article has been folded.

Adjustment of the fold, i. e. ensuring that the leading and trailing edges are folded into contact is made by means of the adjusting stop *e*. A further adjustment for the same purpose is possible by varying the stop **16** thereby varying the clearance between the lifting fingers D and the resilient stop fingers D^1. This varies the time before the leading edge is held and at which it is released. The adjustment by the stop **16** is, however, not normally required once the machine has been initially set.

The time interval between operation of the timing fingers B and raising of the lifting fingers D may be easily and quickly adjusted by altering the position of the stop *e*, with which the pin E on the sun wheel C^1 engages. In the drawing the stop *e* is shown as an adjustable screw. Moreover, the interval between the operation of the timing fingers B and the raising of the lifting fingers D depends upon the speed of the conveyor. If, therefore, the speed of the ironing machine with which the folding machine is working should be varied there is no need to make any adjustment to the timing of the lifting fingers, as this timing is a function of the speed of the driving chain which itself depends upon the speed of the conveyor.

In order that the timing fingers B and the lifting fingers D may be held in the raised positions to allow of the conveyor A being used merely for conveying work from an ironing machine without folding it a cam *k* adapted to engage the arm 2 on the shaft *b* is carried on a rotatable shaft controlled by a handle K. If the handle K and cam *k* are moved from the positions shown in dotted lines in Fig. 1 to those shown in dotted lines in Fig. 2 the arm **2** will be moved into the position which it occupies when the timing fingers B are raised and consequently these fingers will be raised above the conveyor A. The movement of the arm **2** will also bring into operation the mechanism causing the raising of the lifting fingers D and these will also be moved into their raised positions. The fingers B and D will continue to be held in their raised positions until

the cam *k* is returned to the position shown in Fig. 1.

The machine may have a timing mechanism on one side only in which case it would operate one article at a time. It may, however be divided in the centre so as to be equivalent to two machines placed side by side, with a timing mechanism on each side of the machine. Wide articles e. g. sheets, would occupy the whole width but smaller articles would be fed through the machine in two rows.

If more than two divisions is required e. g. for laundries specialising in towels and similar sized articles, the machines could be divided into four or more sections each with its own timing gear.

I claim:

1. In an apparatus for folding sheet material including a support, conveyer means, folding means to which a sheet material is fed by said conveyer means, and a set of pivoted fingers located above said conveyer means and adapted to be pivoted from a lower position to a raised position by contact with a piece of sheet material transported by said conveyer means, a time delay mechanism, comprising in combination, an epicycle gear mounted on said support and including a first sun wheel, a second sun wheel, and planet wheel means; drive means for rotating said planet wheel means; means urging said second sun wheel to turn in one direction; an adjustable stop limiting turning of said second sun wheel in said one direction; stop means mounted on said support movably between inoperative position and operative position, and in operative position engaging and arresting said first sun wheel, and operatively connected to said set of pivoted fingers so as to be moved to said operative position when said set of pivoted fingers are pivoted to said raised position by a piece of sheet material, arresting of said first sun wheel causing said planet wheel means to rotate said second sun wheel in an opposite direction against the action of said spring means; a pin connected to said second sun wheel eccentric to the axis of rotation thereof so as to rotate therewith; a rod mounted on said support movably in a substantially horizontal direction from a first to a second position; a catch on one end of said rod adapted to be engaged by said pin during rotation of the same so as to move said rod from said first to said second position; holding means engaging and holding said rod in said second position; operating means operatively connecting said rod to said folding means and actuating said folding means when said rod is moving to said second position, the weight of said folding means tending to retain said rod in said first position: first release means releasing said stop means when said holding means hold said rod causing said second sun wheel and said pin to rotate in said one direction to their initial position; and second release means operatively connected to said set of pivoted fingers and actuated by the same to release said holding means permitting return of said rod to said first position when said piece of sheet material has passed from said set of pivoted fingers and said set of pivoted fingers move to said lower position.

2. In an apparatus for folding sheet material including a support, conveyer means, folding means to which a sheet material is fed by said conveyer means, and a set of pivoted fingers located above said conveyer means and adapted to be pivoted from a lower position to a raised position by contact with a piece of sheet material

transported by said conveyer means, a time delay mechanism, comprising in combination, an epicycle gear mounted on said support and including a first sun wheel having ratchet teeth on its perimeter, a second sun wheel, and planet wheel means; drive means for rotating said planet wheel means; spring means urging said second sun wheel to turn in one direction; an adjustable stop limiting turning of said second sun wheel in said one direction; stop means mounted on said support and including a pawl movably between inoperative position and operative position, and in operative position engaging said ratchet teeth and arresting said first sun wheel, and operatively connected to said set of pivoted fingers so as to be moved to said operative position when said set of pivoted fingers are pivoted to said raised position by a piece of sheet material, arresting of said first sun wheel causing said planet wheel means to rotate said second sun wheel in an opposite direction against the action of said spring means; a pin connected to said second sun wheel eccentric to the axis of rotation thereof so as to rotate therewith; a rod mounted on said support movably in a substantially horizontal direction from a first to a second position; a catch on one end of said rod adapted to be engaged by said pin during rotation of the same so as to move said rod from said first to said second position; a collar secured to said rod; spring loaded holding means engaging said collar on said rod in said second position of said rod and holding said rod in said second position; operating means operatively connecting said rod to said folding means and actuating said folding means when said rod is moving to said second position, the weight of said folding means tending to retain said rod in said first position; first release means releasing said stop means when said holding means hold said rod causing said second sun wheel and said pin to rotate in said one direction to their initial position; and second release means operatively connected to said set of pivoted fingers and actuated by the same to release said holding means permitting return of said rod to said first position when said piece of sheet material has passed from said set of pivoted fingers and said set of pivoted fingers move to said lower position.

3. In an apparatus for folding sheet material including a support, conveyer means, folding means to which a sheet material is fed by said conveyer means, said folding means being movable between a lower and raised position, and a set of pivoted fingers located above said conveyer means and adapted to be pivoted from a lower position to a raised position by contact with a piece of sheet material transported by said conveyer means, in combination, an epicycle gear mounted on said support and including a first sun wheel having ratchet teeth on its perimeter, a second sun wheel, and planet wheel means; drive means for rotating said planet wheel means; spring means urging said second sun wheel to turn in one direction; an adjustable stop limiting turning of said second sun wheel in said one direction; stop means mounted on said support and including a pawl movably between inoperative position and operative position, and in operative position engaging said ratchet teeth and arresting said first sun wheel, and operatively connected to said set of pivoted fingers so as to be moved to said operative position when said set of pivoted fingers are pivoted to said raised position, arresting of said first sun wheel causing said planet wheel means to rotate said second sun wheel in an opposite direction against the action of said spring means; a pin connected to said second sun wheel eccentric to the axis of rotation thereof so as to rotate therewith; a rod mounted on said support movably in a substantially horizontal direction from a first to a second position; a catch on one end of said rod adapted to be engaged by said pin during rotation of the same so as to move said rod from said first to said second position; a collar secured to said rod; spring loaded holding means engaging said collar on said rod in said second position of said rod and holding said rod in said second position; operating means operatively connecting said rod to said folding means and actuating said folding means to move to said raised position when said rod is moving to said second position, the weight of said folding means tending to retain said rod in said first position; first release means releasing said stop means when said holding means hold said rod causing said second sun wheel and said pin to rotate in said one direction to their initial position; second release means operatively connected to said set of pivoted fingers and actuated by the same to release said holding means permitting return of said rod to said first position when said set of pivoted fingers move to said lower position; and manually operable means for moving said set of pivoted fingers to raised position and for holding it in such position whereby said folding means are moved to said raised position.

4. A folding machine for folding sheet material, comprising in combination, a ribbon-type conveyer for transporting the sheet material, a first set of pivoted fingers located above said conveyer in a lower position and having their ends projecting between the ribbons of the conveyer, said set of pivoted fingers adapted to be pivoted to a raised position by contact with the leading edge of a piece of sheet material transported on said conveyer; a set of pivoted folding fingers movable between a lower position and a raised position and located above said conveyer spaced from said first set of pivoted fingers and inclined upward in the direction of travel of the conveyer so that the leading edge of the piece of sheet material may travel up the inclined upper surface of said folding fingers; an epicycle gear mounted on said support and including a first sun wheel, a second sun wheel, and planet wheel means; drive means for rotating said planet wheel means; means urging said second sun wheel to turn in one direction; an adjustable stop limiting turning of said second sun wheel in said one direction; stop means mounted on said support movably between inoperative position and operative position, and in operative position engaging and arresting said first sun wheel, and operatively connected to said set of pivoted fingers so as to be moved to said operative position when said set of pivoted fingers are pivoted to said raised position by a piece of sheet material, arresting of said first sun wheel causing said planet wheel means to rotate said second sun wheel in an opposite direction against the action of said spring means; a pin connected to said second sun wheel eccentric to the axis of rotation thereof so as to rotate therewith; a rod mounted on said support movably in a substantially horizontal direction from a first to a second position; a catch on one end of said rod adapted to be engaged by said pin during rotation of the same so as to move said rod from said

first to said second position; holding means engaging and holding said rod in said second position; first release means releasing said stop means when said holding means hold said rod causing said second sun wheel and said pin to rotate in said one direction to their initial position; second release means operatively connected to said set of pivoted fingers and actuated by the same to release said holding means permitting return of said rod to said first position when said piece of sheet material has passed from said set of pivoted fingers and said set of pivoted fingers move to said lower position; operating means operatively connecting said rod to said set of folding fingers and moving the same to said raised position and holding the same in said raised position while said rod is in said second position until the trailing edge of said piece of sheet material has moved away from said first set of pivoted fingers into a position in which said trailing edge coincides with the leading edge of the piece of sheet material; a set of pivoted elongated stop fingers mounted movably between a raised and a lowered position above said set of folding fingers and cooperating with said set of folding fingers to grip the leading edge of the piece of sheet material during upward movement of said set of folding fingers to raised position; means for adjusting the relative position of said set of folding fingers and said set of stop fingers in lowered position; catch means engaging said set of stop fingers in raised position and holding the same in raised position during return of said set of folding fingers to said lowered position thereof; and means for releasing said catch means permitting return of said set of stop fingers to said lower position thereof when said set of folding fingers have dropped to said lowered position thereof.

5. In an apparatus for folding sheet material including conveyor means, a set of pivoted fingers located above said conveyor means and adapted to be pivoted from a lowered position to a raised position by contact with leading edge of a piece of sheet material transported by said conveyor

means, and a time delay mechanism operatively connected to said set of pivoted fingers, a gripping arrangement, comprising in combination, a set of folding fingers operatively connected to said time delay mechanism so as to be raised to a raised position when said set of pivoted fingers are lifted to a raised position by the leading edge of a piece of sheet material transported on said conveyer means, and to be lowered to a lower position after a predetermined period when the trailing edge of said piece of sheet material has moved away from said first set of pivoted fingers; a set of pivoted elongated stop fingers mounted movably between a raised and a lowered position above said set of folding fingers and cooperating with the same to grip the leading edge of the piece of sheet material during upward movement of said set of folding fingers; means for adjusting the relative position of said set of folding fingers and said set of stop fingers in lower position; catch means engaging said set of stop fingers in raised position and holding the same in raised position during return of said set of folding fingers to said lowered position thereof; and means for releasing said catch means permitting return of said set of stop fingers to said lower position thereof when said set of folding fingers have arrived at said lower position thereof.

EDWARD JOHN HOWLETT.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,581,753	Mayer	Apr. 20, 1926
1,670,974	Mayer	May 22, 1928
2,022,351	Kahn	Nov. 26, 1935
2,222,075	Kahn	Nov. 19, 1940
2,458,544	Watson	Jan. 11, 1949

FOREIGN PATENTS

Number	Country	Date
587,593	Great Britain	Apr. 30, 1937
618,157	Great Britain	Feb. 17, 1949