

Nov. 11, 1969

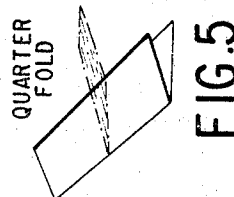
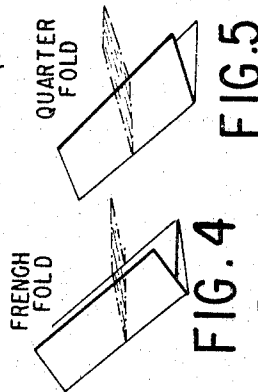
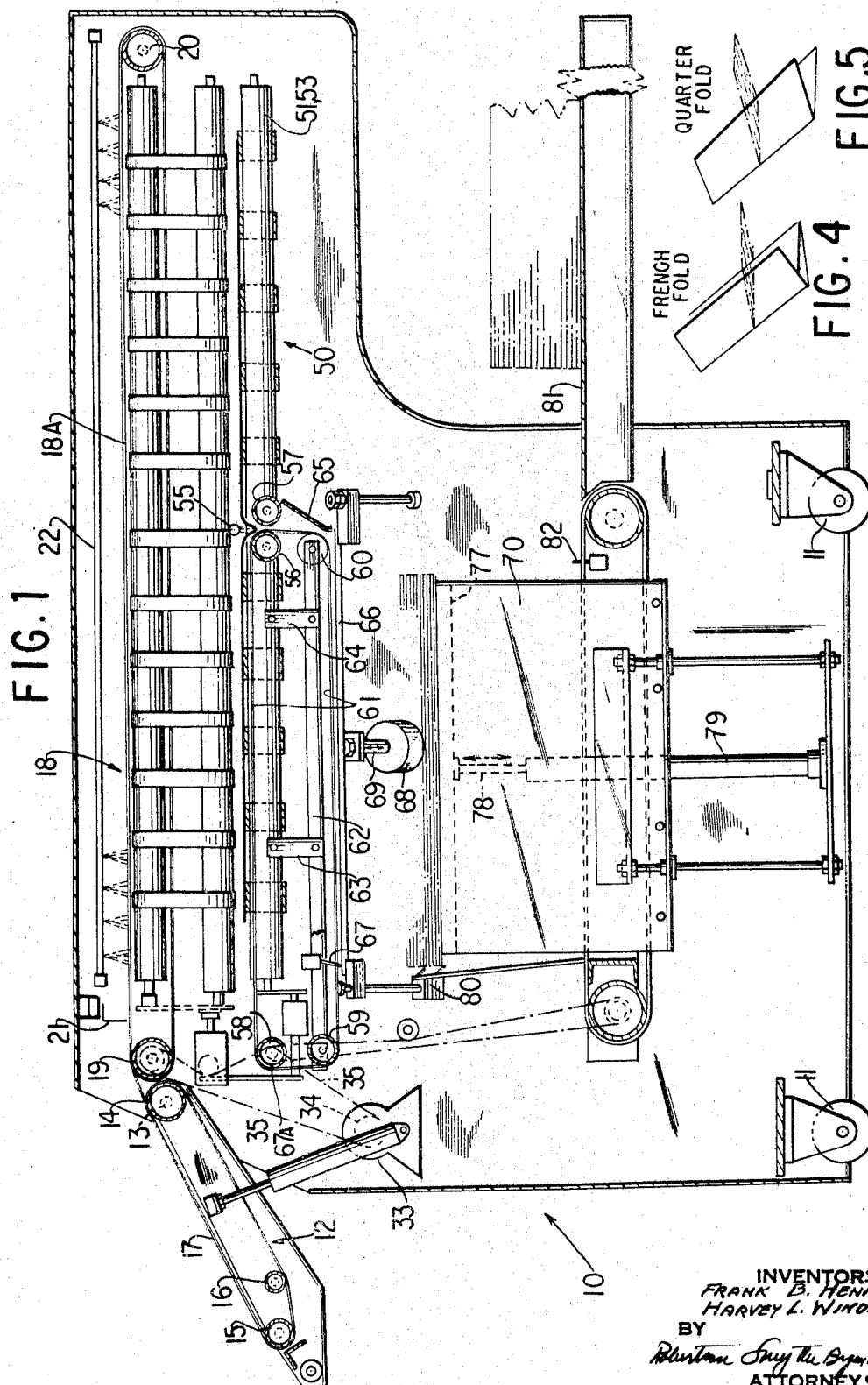
F. B. HENRY ETAL

3,477,708

LAUNDRY FOLDING MACHINE TO PRODUCE VARIOUS TYPES OF FOLDS

Filed Oct. 24, 1965

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

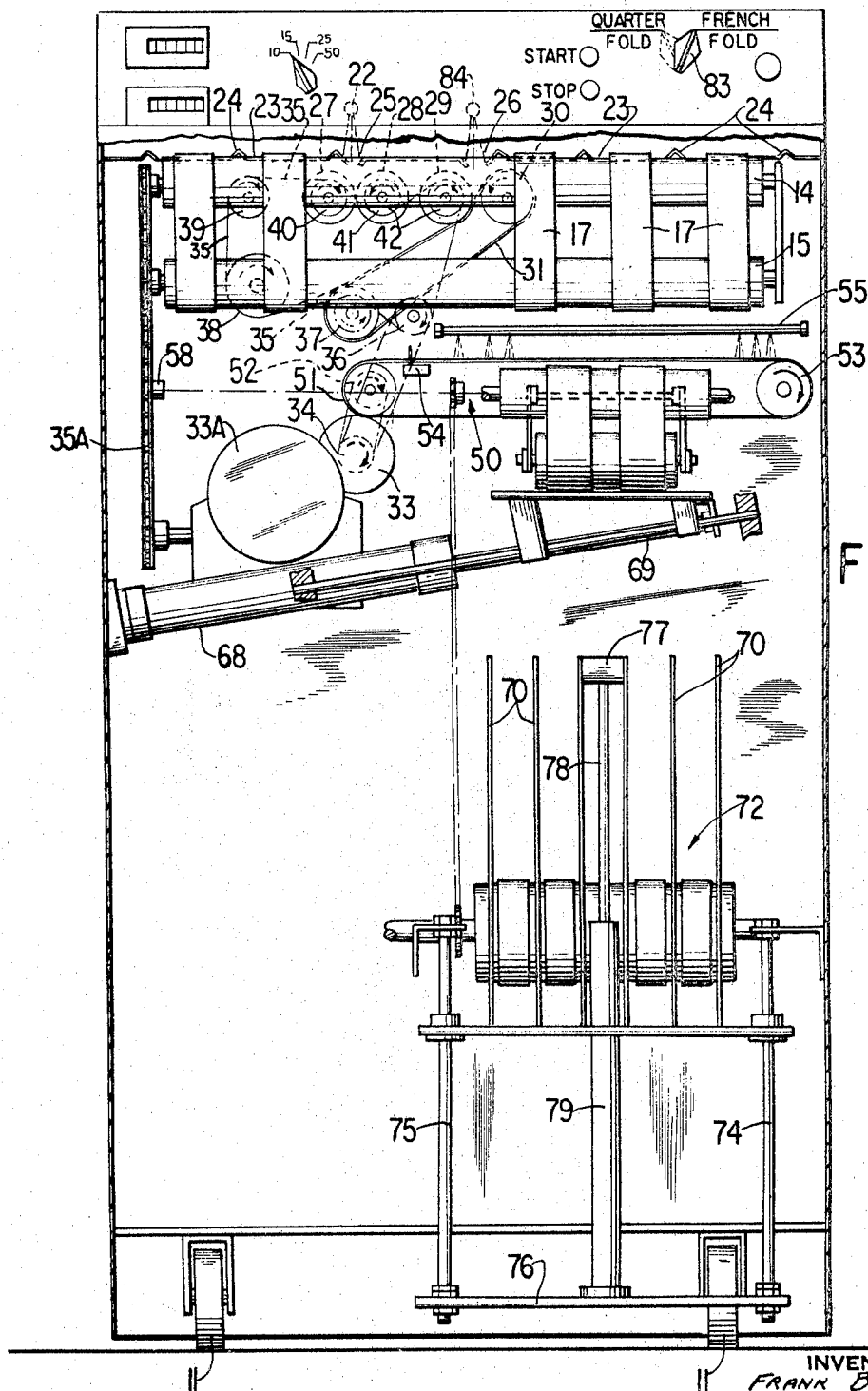


FIG. 2

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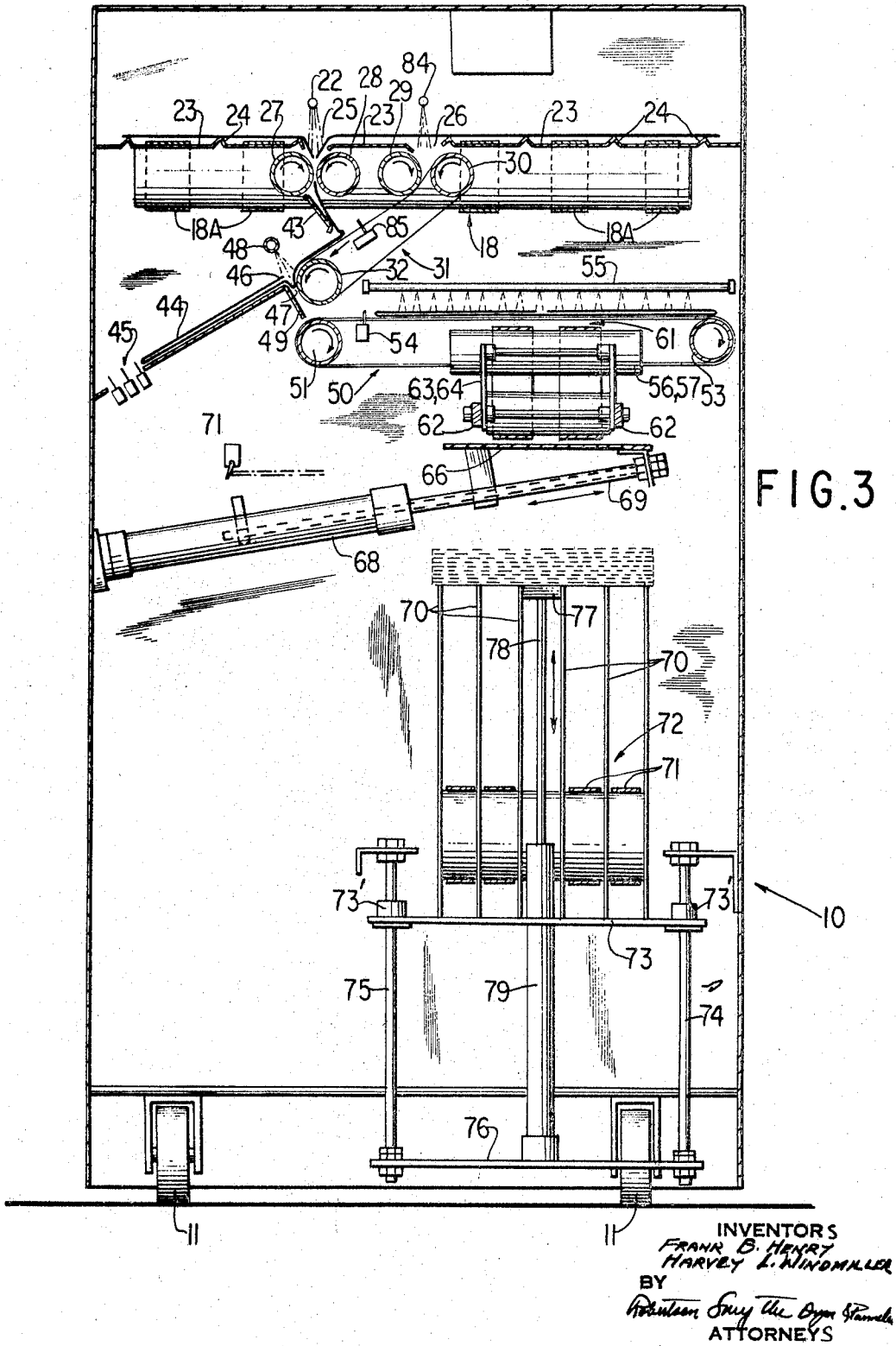
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4 Sheets-Sheet 4

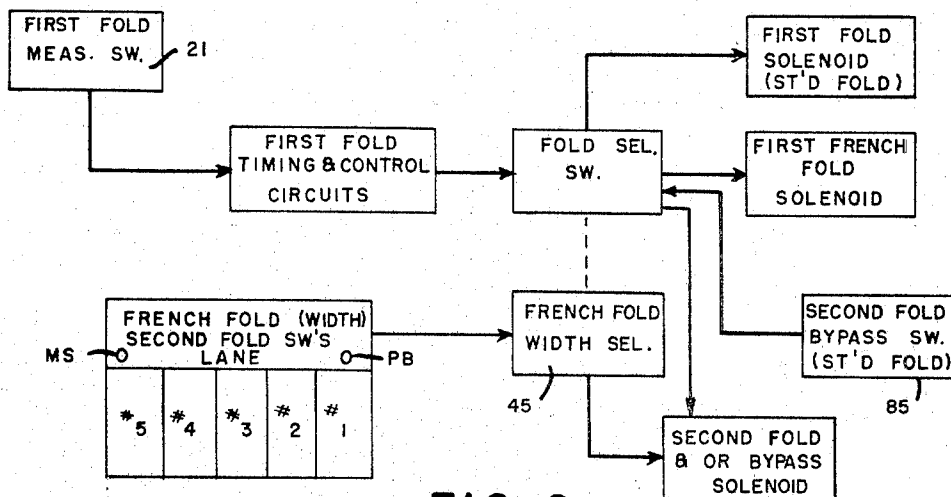


FIG. 6

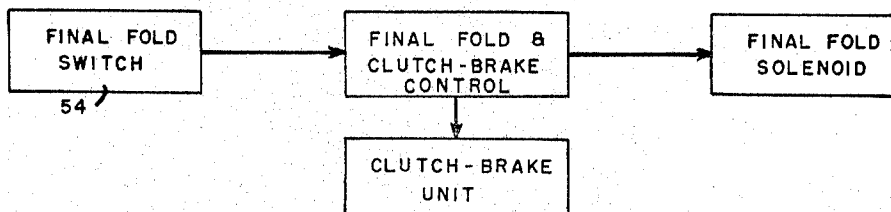


FIG. 7

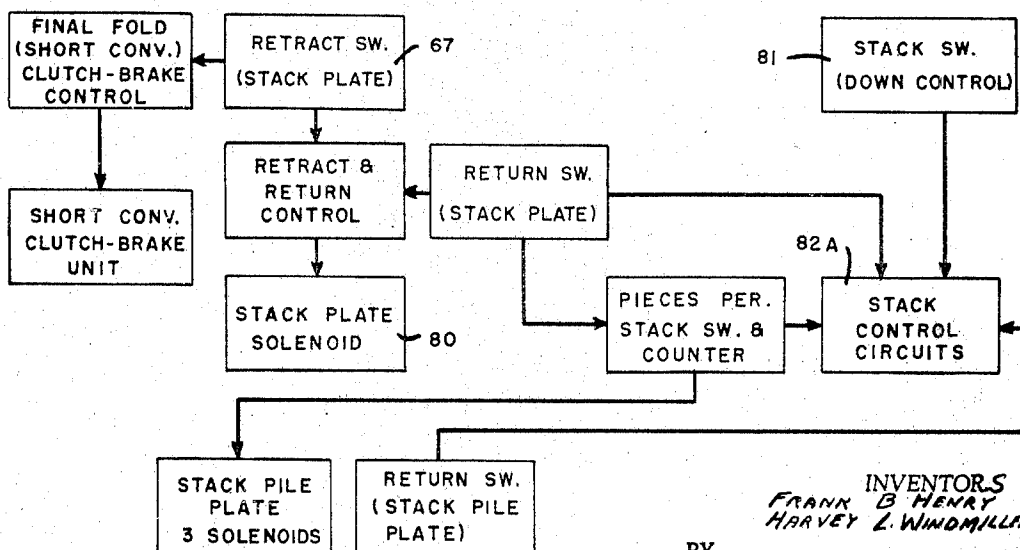


FIG. 8

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3,477,708

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Filed Oct. 24, 1965, Ser. No. 504,774

Int. Cl. B65h 45/00

U.S. Cl. 270—69

3 Claims

ABSTRACT OF THE DISCLOSURE

Laundry folding machine including a belt conveyor having a first air jet means at the longitudinal centerline and a second air jet means parallel thereto, revolving pinch rolls beneath each jet means for receiving an article therebetween and providing a fold in the article according to which jet means is activated, and a second conveyor means below the first one for receiving a once-folded article and air jet means thereover to produce a second fold.

This invention relates to laundry machines and particularly to an improved automatic folding machine for ironed flatwork.

The handling of flatwork after it has been ironed requires its being folded into small sized units. Usually, these folds are referred to in the art as "French" folding and "quarter" folding. The former involves first folding the flatwork along a longitudinal line at a point one-third the distance from, say, the lefthand edge; secondly, folding the unfolded portion (longitudinally) over the folded portion; and thirdly, folding the ends at right angles to the longitudinal folds in half. In "quarter" folding, the piece of flatwork is folded in half along a longitudinal centerline, and then the ends at right angles to the line of fold are brought together, finishing the fold.

The principal object of this invention is to provide a folding machine that will automatically provide a "French" as well as a "quarter" fold in flatwork.

Another object of the invention is to provide such a machine that will receive such folded flatwork and deposit it in a manner such that when a predetermined pile has been established, it is conveyed out of the way and the folded work receiver is conditioned to start a new pile.

In one aspect of the invention, an inclined conveyor may convey flatwork with its longitudinal dimension extending along the flight of the conveyor. At the end of the conveyor, fingers may be provided to transfer the work onto another conveyor that moves horizontally and in the same direction as the inclined conveyor moves.

In another aspect of the invention, the leading and trailing edges of the work may actuate a switch in a timing circuit that positions the work along the horizontal conveyor with the midpoint of the work at a predetermined location, at which time, an air jet is activated that is located longitudinally of the work along a line one-third the distance from one edge (for "French" folding).

In still another aspect of the invention, there may be provided a pair of pinch rolls just below the conveyor and the air jet means, said pinch rolls being arranged parallel to the conveyor so that a fold is formed longitudinally of the work at a point one-third the distance from one edge.

In a further aspect of the invention, the one-third folded article is diverted onto another inclined belt conveyor that moves generally transversely to the horizontal and other inclined belt conveyors. At the end of this conveyor, the work passes onto a plate coextensive with the trans-

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verse, inclined conveyor until the folded edge, which is now the leading edge, actuates a switch at a predetermined location when the edge of the folded portion of the article is directly at the end of said conveyor and the medial line of the unfolded two-thirds of the article is directly under an air jet. Actuation of the switch causes the air jet to deflect the article along this medial line between a pinch roll and a deflecting plate, thereby forming the second fold in the article, while it is fed downwardly onto another horizontal belt conveyor.

In still another aspect of the invention, switch means may be provided along the last-mentioned conveyor that is actuated by the leading and trailing ends of the double-folded article to center it thereon at which time the conveyor is stopped. At this point, air jet means is actuated, causing the midpoint, between the ends of the article that are at right angles to the two folds, to be forced between another set of pinch rolls, forming the final fold in the article.

In another aspect of the invention, the finally folded article is diverted onto a plate that is adapted periodically to be lowered and withdrawn very rapidly from beneath the article, permitting it to drop onto a vertically movable pile receiver.

In still another aspect of the invention, as the pile receiver moves downwardly with the addition of succeeding folded articles, the pile is received by a belt conveyor that transfers them onto a receiving platform from which they are removed to storage.

In a further aspect of the invention, when "quarter" folding is desired, the air jet means for "French" folding is de-activated and another air jet means is activated, the latter being located so as to form a longitudinal fold midway of the width of the article. In this aspect, the second fold of the "French" fold is eliminated, and at the point where it would occur, the leading edge (folded line) of the double-folded article is fed to the final fold conveyor, and the steps that follow are the same as those with the "French" fold.

The above, other objects and novel features of the improved folder for flatwork will become apparent from the following specification and accompanying drawings which are merely exemplary.

In the drawings:

FIG. 1 is a side elevational view of a folding machine to which the principles of the invention have been applied;

FIG. 2 is a front end elevational view of the machine shown in FIG. 1;

FIG. 3 is a view similar to FIG. 2, showing other elements of the machine not shown in FIG. 2;

FIG. 4 is a perspective view of an article of flatwork, showing how it is "French" folded;

FIG. 5 is a perspective view of an article of flatwork, showing how it is "quarter" folded; and

FIGS. 6, 7 and 8 are block diagrams of the switch arrangement and operation.

Referring to the drawings, and particularly to FIGS. 1 to 3, the principles of the invention are shown as applied to a folding machine for flatwork including a frame 10 having casters 11 at each corner thereof to facilitate its movement from position to position. Certain of the casters 11 are capable of being locked when the machine is in the desired location relative to an ironing machine or other laundry apparatus. A supporting member 12 may be pivotally mounted on a shaft 13 within frame 10, and it may support three rollers 14, 15 and 16 about which spaced straps 17 extend, forming a conveyor belt for feeding flatwork into the folding machine. A hori-

zontally disposed conveyor 18, composed of spaced, continuous strips 18A that extend about rollers 19 and 20 in frame 10 convey the flatwork past a first fold switch 21. Closing of switch 21 by the leading edge of the article energizes a timing or activating circuit (not shown), and the opening of switch 21 by the trailing edge of the article passing therebeyond completes the timing circuit which then energizes a solenoid controlled air jet 22 that extends along the conveyor 18 and is located transversely thereof between two of the continuous strips or belts 18A forming the conveyor 18 and at a point equal to one-third the distance from one longitudinal edge of the article. The timing circuit may, for example, be one having the same principle of operation as the slow and fast timing motors of Patent No. Re. 24,979. An article-supporting plate 23 just beneath the upper flights of belts 18A includes longitudinally extending ridges 24. The plate 23 is recessed at 25 and 26 throughout substantially its length at points between two adjacent belts 18A.

Beneath the French fold recess 25 there are provided pinch rolls 27 and 28 that extend longitudinally of conveyor 18; and beneath recess 26 there are provided rolls 29 and 30 that also extend in the direction of conveyor 18. An inclined conveyor belt means 31 passes around roll 30 and a roll 32, and its top flight is in contact with roll 29.

In order to drive the various rolls and pulleys in the correct direction, a motor 33, mounted on frame 10, has an output sprocket 34 about which a driving chain 35 traverses, traversing also sprockets on roll 19, on three-shafted gear box 38 and shaft at clutch 67A.

From the foregoing it is apparent that pinch roll 27 is rotating clockwise while roll 28 is rotating counterclockwise. Accordingly, when the machine is set for French folding, upon activating air jet 22, a longitudinal line along the flatwork at a point one-third the width thereof is forced between pinch rolls 27 and 28, forming the first fold in the article. A deflector plate 43 guides the folded article onto the conveyor 31, and since sprocket 37 (FIG. 2) is fixed to roll 32, roll 32 rotates counterclockwise and the top flight of belt 31 transfers the folded article leftwardly onto an inclined table 44 having preset switches 45 therealong, a selected one being rendered effective depending upon the width of the article.

When the selected switch 45 is actuated according to the setting for width, the edge 46 of the article will be just beyond the opening 47 between roll 32 for conveyor belt 31. Actuating the selected switch 45 actuates an air jet 48, forcing the article along a longitudinal line therein between the roll 32 for conveyor belt 31, and a plate 49 in close proximity to belt 31 as it passes over roll 32. The result is that a second fold is made in a manner lapping the trailing end of the article over the first third that was previously folded.

Beneath the conveyor belt 31 there may be provided another horizontal belt conveyor 50 that is arranged transversely of conveyor 18. Its one roll 51 has a sprocket 52 (FIG. 2) connected to it that is driven by motor 33. The conveyor 50 is also made up of spaced, narrow, continuous belts that extend around roll 51 as well as around roll 53.

As the double-folded article is picket up by conveyor 50, its leading edge actuates a switch 54 to activate a circuit which is affected by the trailing edge of the folded article actuating switch 54 (FIG. 7) to activate a final fold solenoid to operate an air jet 55 mounted above conveyor 50 and between two of the spaced belt strips forming the conveyor. The location of the air jet 55 is such that the midpoint (longitudinally) of the double-folded article is beneath it when it is activated.

Below conveyor 50 and arranged transversely therewith are two rollers 56 and 57 (FIG. 1). Roller 57 is an idle roller, while roller 56 is one of four, including rollers 58, 59 and 60, about which an endless conveyor belt 61 extends. Rollers 59 and 60 are journaled at op-

posite ends of a bar 62 that is pivotally mounted by rods 63, 64. This permits rollers 59 and 60 to float so as to accommodate varying thicknesses of folded articles.

As the air jet 55 forces the double-folded article between rollers 56, 57, the final fold is made, and a deflector 65 guides the leading edge of the "French" folded article between belt 61 and a plate 66 that receives the folded article.

Referring to FIG. 3, the plate 66 may be connected to an inclined piston rod 69 that is adapted very rapidly to be retracted, and by virtue of its inclination, lowered. When the folded article is properly located on plate 66, its leading edge actuates a switch 67, causing a clutch device 67A (FIG. 1) to become disengaged, stopping belt 61, and causing a piston in a cylinder 68 that is connected to rod 69 to move leftwardly very rapidly. This pulls plate 66 from under the folded article, permitting it to fall downwardly onto the top of a plurality of vertically extending, spaced plates 70.

As plate 66 moves leftwardly (FIG. 3), it actuates a switch 71 that reverses the flow of air to cylinder 68 to restore plate 66 to its position beneath conveyor 61. Plates 70 pass between adjacent belts 71 of a conveyor 72. The plates 70 are mounted on a horizontal cross member 73 having bearings 74 that slide along vertical rods 73', 75 that are mounted in a base plate 76.

A plate 77 is located at the top of, and connected to the two inner plates 70. It is connected to a piston rod 78, the piston of which reciprocates within a cylinder 79 mounted on base plate 76.

As the pile of folded articles builds up on the top of plates 70, piston rod 78 descends due to a bleeding of air from cylinder 79. When a predetermined pile of articles has accumulated, switch 80 is actuated, causing the piston 78 to descend, depositing the pile onto the continuously moving conveyor 72 which delivers the pile of folded articles onto a receiving table 81. When the pile of folded articles has moved clear of plates 70, 71, a switch 82 is actuated to render effective a timer, so that as the trailing edge of the pile again actuates switch 82, air is admitted beneath the piston in cylinder 79, raising plates 70 to their article receiving position. The schematic showing in FIGS. 6, 7 and 8 illustrates the sequence of operations.

The foregoing describes the apparatus for producing "French" folded flatwork. When it is desired to "quarter" fold flatwork, a switch 83 is moved to its dotted line position in FIG. 2. This de-activates the air jet 22 and supplies air to the line leading to a jet means 84 (FIG. 3). As the leading and trailing ends of the article act on switch 21, the article is located on the conveyor 18 so that its longitudinal centerline is beneath jet 84, and the latter is activated. This produces the first fold, but in this case (for "quarter" folding), it extends along the longitudinal centerline of the article. The folded leading edge is engaged by belt 31 and roll 29, causing it to move downwardly toward the end of belt 31. During its travel, its leading edge actuates a switch 85 that times the activation of air jet 48 just as the leading edge arrives beneath it. This forces the leading edge downward between the leading end of conveyor belt 31 and plate 49, so that it is picked up by conveyor 50. From this point to the end, the operations are identical to those for "French" folding, thus producing a "quarter" folded article.

Summarizing the operation of the switches, the main drive motor is activated after setting the various type of fold, width and stack number settings. Work will travel into the machine and strike switch 21 which will cause folding thereof in the center or off center in accordance with whether the machine is set for "quarter" fold or "French" fold. The air blast 84 or 22 respectively will be actuated. If the piece is too long, an overlength switch (not shown) could be provided. The work now enters the second fold area and is either diverted to the final fold

if a "quarter" fold pattern is to be effected or is given a second longitudinal fold if a "French" fold is to be accomplished. Switches 85 or 45 are used for this purpose. The work then passes across final fold switch 54 which activates a circuit to stop the conveyor 50 through a final fold clutch brake unit and operates an air blast solenoid (not shown). As the trailing edge of the work passes the final fold switch 54 and it returns to its normal position, a clutch solenoid (not shown) is de-energized and the brake energized to stop the conveyor. The air blast jet 55 also is activated. After a short time delay, the brake is deenergized and the clutch again energized. The work travels onto stack plate 77 and as it nears the far side of the stack, it operates switch 67, operating the stack plate to perform the stacking function. Energizing the stack plate retract switch will result in the stack plate being retracted quickly so as to drop the work onto the stack pile plates. When the stack plate reaches the end of its retract stroke, the plate actuates a return switch and the stack plate begins its return stroke. Actuation of the stack plate return switch also causes a pulse to enter a pieces folded counter (not shown) and also a pulse is sent into a suitable stack control circuit where they are accumulated for controlling the functioning of the stack pile plates upon reaching the preset number of pieces per stack setting. As the piece drops onto the stack pile plate, it actuates a stack pile plate down control switch and such causes a stack pile plate down solenoid 80 to become energized. The stack pile plate will now continue to lower until the piece on the plate clears and releases a stack down control switch 81. When the number of pulses (one pulse per piece) received by the stack control circuit 82A is equal to the number of pieces set by the operator by the positioning of the number of pieces switch, the stack pile plates will be lowered completely. Near the end of the downward stroke, the pieces riding on the stack pile plates, will be deposited on the outfeed conveyor ribbons 72 and the plates will continue to lower until they are below the conveyor ribbons, thus insuring transfer of pieces onto the outfeed conveyor. The outfeed conveyor ribbons run continuously during machine operation and therefore as soon as the pieces come in contact with the conveyor ribbons, the pieces will be conveyed out of the stack pile plate area. As soon as the outfeed conveyor has moved the pieces forward approximately three inches, the leading edge of the pieces will actuate the stack pile plate return switch 82 which in turn sets up a circuit to control the return of the stack pile plates to a raised position. As soon as the piece clears the return switch and allows its actuator to return to its normal position, the stack pile plates will return to their usual operation.

Although the various features of the folding machine have been shown and described in detail to fully disclose one embodiment of the invention, it will be evident that changes may be made in such details and certain features may be used without others without departing from the principles of the invention.

What is claimed is:

1. In a folding machine for flatwork, the combination comprising conveyor means including spaced belts passing around rollers at each end of said conveyor means; first jet means above said conveyor means and located along its longitudinal centerline; other jet means parallel with said first jet means and spaced from said first jet means a predetermined portion of the width of said conveyor means; revolving pinching means beneath said conveyor means below each of said jet means and in vertical alignment with each of said jet means, control means connected to each of said jet means and having selectively operable means, whereby when only one of said jet means is activated, a first fold of a first folding pattern is made in an article passing along said conveyor means along its longitudinal centerline, and when said other jet means only is activated, a longitudinal first fold

of another folding pattern occurs along the article at a point that is said predetermined portion of the width of the article; and manual means for said selectively operable means for rendering effective either one of said jet means; and means below said revolving pinching means selectively responsive to the passage of an article from either said first jet means or said other jet means to selectively form therein a second fold of a first folding pattern or a second fold of another folding pattern.

2. In a folding machine for flatwork, the combination comprising first conveyor means including spaced belts passing around rollers at each end of said conveyor means; first jet means above said first conveyor and located along its longitudinal centerline; revolving pinching means beneath said first conveyor means and in vertical alignment with said first jet means whereby, when said first jet means is activated, a fold is made in an article passing along said first conveyor means along its longitudinal centerline; a second conveyor means including spaced belts passing around rollers and extending downwardly from said first conveyor means for receiving said once folded article; second jet means above the lowermost roller thereof and extending transversely of the top flight of said second conveyor means; a third conveyor means including spaced belts passing around rollers at each end thereof, said third conveyor means extending below and spaced from said first and second conveyor means, and extending generally at right angles relative to said first conveyor means; switch means intermediate the rollers of said second conveyor means and engageable by the leading edge of said once folded article for activating said second jet means and diverting said once folded article onto said third conveyor means to produce a second fold in said article thereby forming a "quarter" folded article; and a third jet means above said third conveyor means and located along its longitudinal centerline; and switch means engageable by the leading edge of said "quarter" folded article for actuating said third jet means and causing said "quarter" folded article to be finally folded into compact size.

3. In a folding machine for flatwork, the combination comprising first conveyor means including spaced belts passing around rollers at each end of said conveyor means; first jet means above said first conveyor means and located along a longitudinal line spaced from the centerline thereof a distance equal to one-sixth of the width of said conveyor means; second jet means above said first conveyor means for making a fold along its longitudinal centerline; dual revolving pinching means beneath said first conveyor means and in vertical alignment with said first and second jet means whereby, when said first jet means is activated, a fold is made in an article passing along said first conveyor means along a line one-third of its width from one edge; a second conveyor means including spaced belts passing around rollers and extending downwardly from said first conveyor means for receiving articles folded selectively by either of said pinching means and for transferring the folded portion onto a table in line with, but slightly spaced from, the leading end of said second conveyor means; second jet means at the juncture of its leading end and one end of said table and extending transversely of the top flight of said second conveyor means; switch means associated with said table and responsive to the leading end of said folded article reaching a predetermined point on said table for activating said second jet means to cause the unfolded portion of said article to overlap the folded portion and thereby produce a "French" folded article; a third conveyor means including spaced belts passing around rollers at each end thereof, said third conveyor means extending below and spaced from said first and second conveyor means, and extending generally at right angles relative to said first conveyor means; and a third jet means above said third conveyor means and located along its longitudinal centerline; and switch means engageable by the

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leading edge of said "French" folded article for actuating said third jet means and causing said "French" folded article to be finally folded into compact size.

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U.S. Cl. X.R.

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