Feb. 3, 1970 H. J. WEIR 3,493,226

LAUNDRY FOLDING DEVICE

Filed Dec. 15, 1967 4 Sheets-Sheet 1

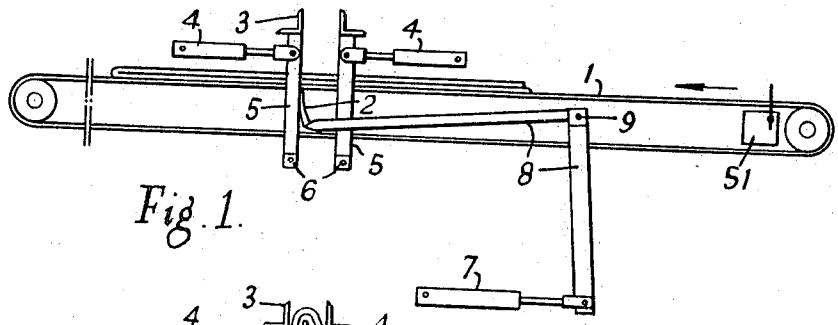


Fig. 1.

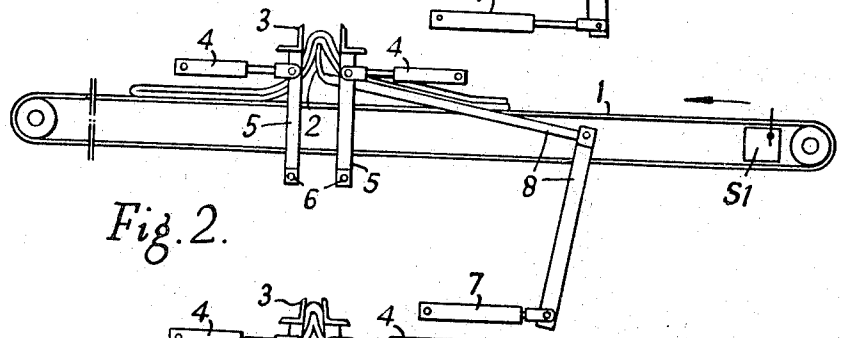


Fig. 2.

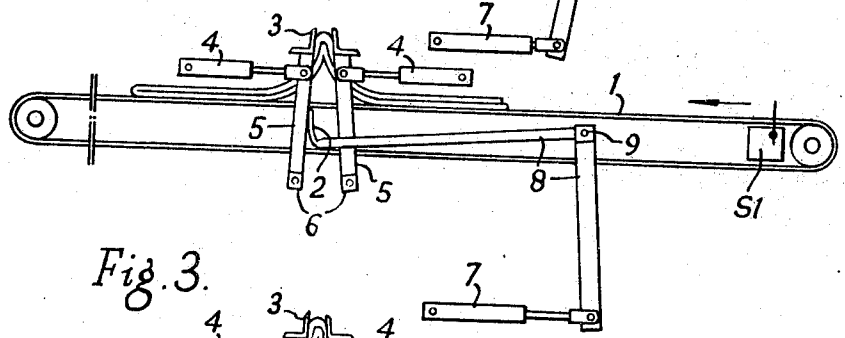


Fig. 3.

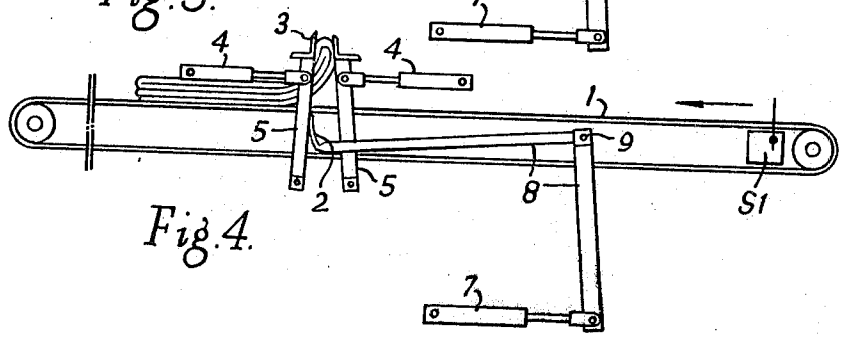


Fig. 4.

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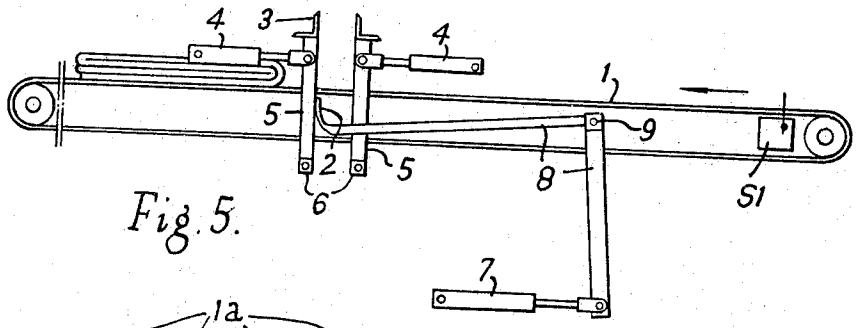


Fig. 5.

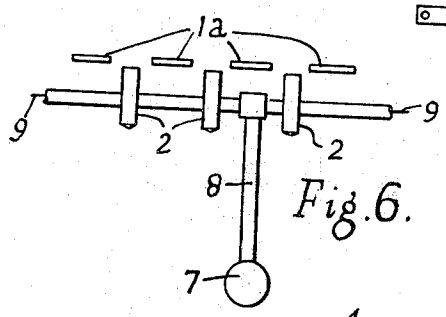


Fig. 6.

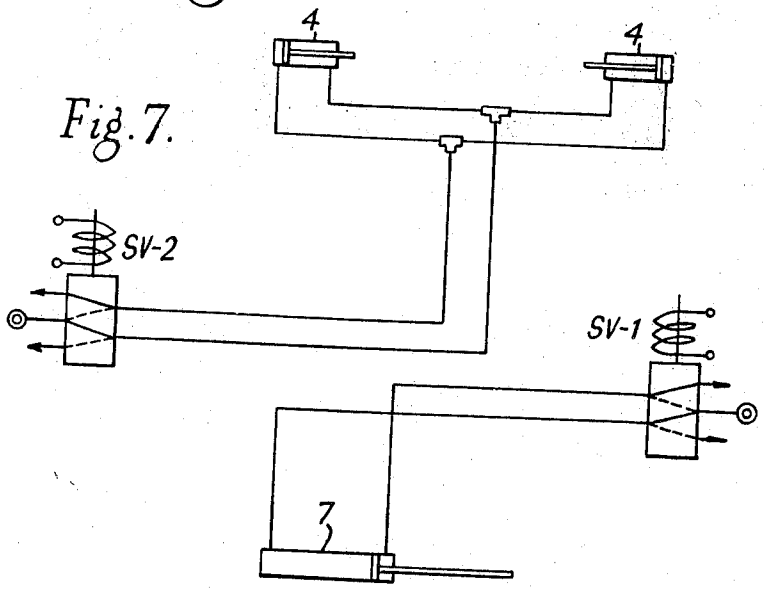


Fig. 7.

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LAUNDRY FOLDING DEVICE

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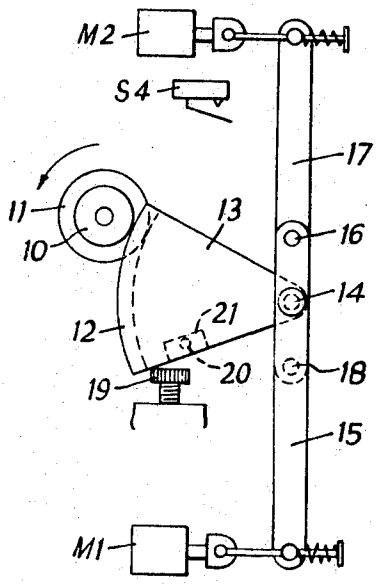
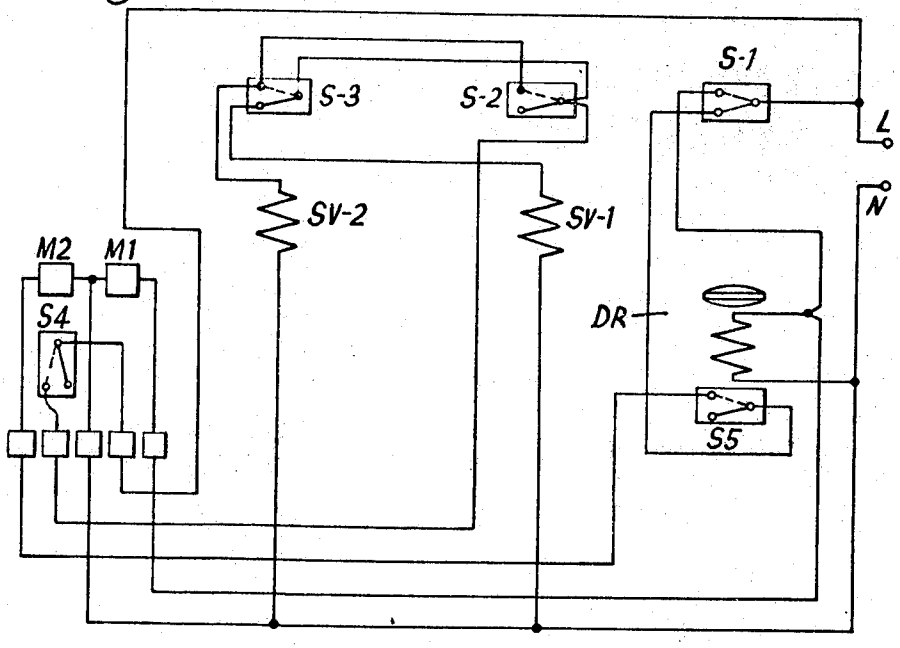


Fig. 8.

Fig. 9.



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LAUNDRY FOLDING DEVICE

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FIG. 10

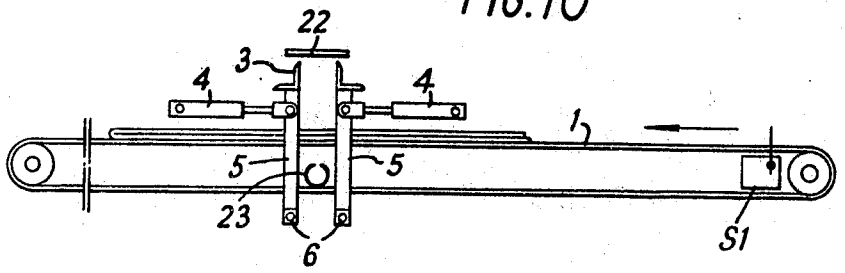


FIG. 11

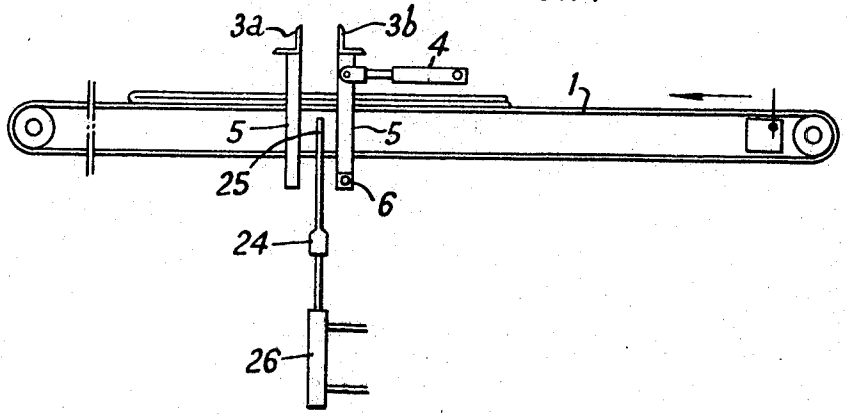
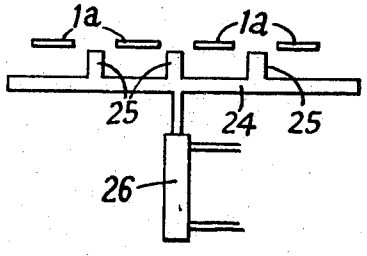


FIG. 12



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Patented Feb. 3, 1970

3,493,226

LAUNDRY FOLDING DEVICE

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Filed Dec. 15, 1967, Ser. No. 690,969
Claims priority, application Great Britain, Dec. 19, 1966, 56,811/66
Int. Cl. B25h 45/14
U.S. Cl. 270—68 6 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for cross-folding a laundry article carried on a conveyor wherein the article is projected upwards at the fold line to be held thereby in a clamp above the conveyor, allowing the trailing part of the article to be drawn by the conveyor to lie beneath the leading part, whereupon the clamp is released.

This invention relates to laundry folding apparatus and has particular application in folding a laundry article which has already been folded a number of times and which is therefore relatively thick and stiff.

Methods of folding laundry articles hitherto have been principally of two kinds. In the first kind, the article is fed forwards on a conveyor and the leading edge is clamped in a pair of clamps while the trailing part is allowed to move forward beneath the leading edge which is subsequently dropped on the trailing edge. With this arrangement it is difficult to effect proper timing of the dropping of the leading edge and this difficulty is particularly acute when the article has been folded several times and is stiff and thick. The second kind of fold involves tucking the intended fold line of the article into the nip between a pair of contra-rotating rollers which subsequently draw the article therethrough. With this arrangement it is found that if the article has been folded before several times and is therefore thick, there is a tendency for the rollers to crease the article at the fold line. The invention seeks to overcome these disadvantages.

According to the invention there is provided apparatus for folding a laundry article comprising a conveyor on which the article is laid to be conveyed in a forward direction; raising means at a fold position on the conveyor for raising the article from the conveyor at a fold line in the article transverse to the direction of travel; timing means effective to activate the raising means when a desired fold line is at the fold position; clamping means disposed above the conveyor and actuated to clamp the article at the fold line when it is raised, the position of the clamping means being such that the trailing part of the article is drawn by the conveyor beneath the clamped fold line to lie under the leading part of the article; and release means for releasing the clamping means to drop the article when the trailing part thereof has been so drawn forward.

The raising means may comprise an air jet arrangement but preferably comprises a set of fold fingers beneath the conveyor which, on being raised, extend between the bands of the conveyor (the conveyor being of the kind having spaced parallel bands moving along together). The timing means for timing the initiation of the fold operation on, say, the half-way line of the article, conveniently comprises a timing device arrangement of the general kind described in co-pending Patent No. 1,081,871. More particularly there may be an actuating member which is driven a predetermined distance

to actuate a fold switch, actuation of which operates the raising means, the actuating member being driven initially at a slow speed in synchronism with the conveyor and finally at a fast speed in synchronism with the conveyor and a sensor switch on the conveyor rearward of the fold position responsive to the passage of the leading edge of an article to initiate the slow speed drive and responsive to the passage of the trailing edge of an article to initiate the fast speed drive.

The invention will further be described with reference to the acompanying drawings of which:

FIGURES 1 to 5 are diagrams illustrating schematically five successive stages in the folding of a laundry article in accordance with the invention;

FIGURE 6 shows the nature of the folding blade used in the arrangement of FIGURES 1 to 5;

FIGURE 7 is a pneumatic circuit diagram of the apparatus;

FIGURE 8 is a diagram of the timing device of the apparatus;

FIGURE 9 is an electrical circuit diagram of the apparatus;

FIGS. 10 and 11 are views similar to FIG. 1 showing a modification of the apparatus of the invention; and

FIG. 12 is a view similar to FIG. 7 showing a pneumatic circuit diagram for the embodiment of the apparatus shown in FIG. 11.

Referring to FIGURES 1 to 5 there is provided a conveyor **1** constituted by a number of spaced bands moving continuously in the direction indicated by the arrow. Articles to be folded are fed on to the conveyor to pass over a set of fold fingers **2** which are normally beneath the level of the upper run of the conveyor. Above the fingers which comprise curved metal tubes flattened at their ends, is arranged a pair of co-operating clamp plates **3** which are movable towards and away from each other under control of pneumatic rams **4**. The clamp plates are mounted on support arms **5** passing between the conveyor bands and pivoted at **6**.

The article A, in travelling along the conveyor passes microswitch S1 to the rear of the fold position and thus controls a timing device coupled with the conveyor which, at the appropriate time, actuates a valve which admits air to a ram **7** which, through a linkage **8** pivoted at **9**, lifts the fold fingers **2**. When the member carrying fingers **2** has reached its uppermost position it actuates a further switch S2 which opens a valve to admit air to rams **4** and closes the clamp plates **3**. Fingers **2** are then withdrawn from the clamp fold by reversal of the air supplied to double-acting ram **7** (FIGURE 3).

The clamp plates are held together while the trailing part of the article is allowed to be drawn forwards beneath the leading part. Finally, the trailing part is drawn entirely beneath the leading part and the position is as illustrated in FIGURE 4. At this time, a timing delay device which was set on actuation of switch S1 releases and reverses the air pressure supplied to rams **4** and opens clamps **3** so that the article is droped on to the conveyor and carried away (FIGURE 5).

FIGURE 6 shows the fingers **2** in end elevation and illustrates the maner in which they are projected through the conveyor, the conveyor comprising bands **1***a* spaced apart and the fingers extending between the bands. The use of curved fingers of the kind shown allows a particularly neat pick-up of the article since, on being raised, the curved part of the fingers engage the trailing part of the article smoothly and prevent it being bunched up against the raised fingers by the action of the conveyor.

FIGURE 7 shows the details of the pneumatic circuit of the apparatus, air-rams **4** being double-acting and op-

erated to open the clamps (in the position shown) and close the clamps by a solenoid-operated valve SV2. Similarly, air-ram 7 is double acting and is controlled by a solenoid-operated valve SV1.

FIGURE 8 is a diagram of the timing device, which comprises a pair of driving wheels 10, 11 rotated together in the direction shown by the arrow in synchronism with the conveyor, the wheels being coupled thereto. A pair of arcuate driven members 12 and 13 are capable of being engaged respectively with the edge of wheels 10 and 11. Member 13 lies behind member 12 in the drawing but it is to be understod that they are independently engageable with their driving wheels and are independently rotatable about their pivot axes which in the drawing are colinear at 14. Member 12 is engaged with wheel 10 by energisation of a solenoid M1 which acts on an arm 15 carrying member 12 and pivoted at 16. Similarly, an arm 17 carries member 13 and is pivoted at 18, solenoid M2 operating on arm 17 on being energised to engage member 13 with wheel 11.

Members 12 and 13 normally rest against an adjustable stop 19. When solenoid M1 is energised member 12 is engaged with wheel 10 and is driven upwardly thereby at a slow speed determined by the relation between the radius of wheel 10 and the radius of member 12. At this time member 12 carries with it member 13, coupling being provided by a peg 20 on member 12 which engages in a recess 21 in member 13. After a time, solenoid M2 is energised and solenoid M1 de-energised, thereby allowing member 12 to drop back to the stop 19. Member 13 is driven on and the relation of the radii of wheel 11 and member 13 is such that member 13 is now moved at twice the former speed. At the end of its travel member 13 actuates a switch S4 which operates the lift valve SV1.

FIGURE 9 is an electrical circuit diagram of the apparatus. When the leading edge of an article to be folded passes switch S1 the switch is changed to the position shown in broken line whereupon a delayed-break relay DR is energised and its contacts S5 are made. At the same time solenoid M1 is energised to start the slow speed cycle of the timer. When the trailing edge of the article passes switch S1 it reverts to the position shown in full line, thereby de-energising M1 and energising, through S5, solenoid M2 to start the fast speed cycle of the timer.

At the end of the fast speed cycle contacts S4 are made and the lift solenoid valve SV1 is energised through a switch S3. The folding fingers 2 are thereby lifted. At the top of the stroke of the lift fingers a switch S2 is operated thereby to energise the clamp solenoid SV2. When the clamp plates are at their innermost position clamping the article they operate switch S3, thereby de-energising solenoid SV1 and causing the lift fingers to be withdrawn.

Finally, after a predetermined delay during which the folding sequence of the sheet described with reference to FIGURES 1 to 4 has taken place, relay DR drops out and contacts S5 open, thereby de-energising solenoid M2, opening switch S4 and de-energising solenoid SV2 so that the clamp opens, the folded article is dropped, and the circuit reverts to the condition shown in FIGURE 9 ready for the next article.

The invention is not restricted to details of the foregoing description of one embodiment thereof. For example, the upward projection of the article at the fold line may be accomplished by a jet of air instead of the fold fingers illustrated. Thus in FIG. 10 there is provided a perforated air tube 23 which, when supplied with high pressure air, blows a series of jets upwardly to raise the article. In this case it is preferable to include, above

the clamp plates 3, a horizontal plate 22 which limits the upward movement of the article. Alternatively, a flat fold plate provided with upstanding fingers may be situated beneath the conveyor in a vertical plane transverse thereto, the plate being raised in a linear manner to project the fingers between the bands by an air ram. Such an arrangement is illustrated in FIGURES 11 and 12 where the plate is shown at 24 with fingers 25, the air ram being shown at 26. Furthermore, one of the clamp plates may be fixed, only the other plate being movable, this being shown in FIGURE 10, where clamp 3*a* is fixed and clamp 3*b* is movable.

I claim:

1. Apparatus for folding a laundry article comprising a conveyor on which the article is laid to be conveyed in a forward direction; raising means at a fold position on the conveyor for raising the article from the conveyor at a fold line in the article transverse to the direction of travel; timing means effective to activate the raising means when a desired fold line is at the fold position; clamping means disposed above the conveyor and actuated to clamp the article at the fold line when it is raised, the position of the clamping means being such that the trailing part of the article is drawn by the conveyor beneath the clamped fold line to lie under the leading part of the article; and release means for releasing the clamping means to drop the article when the trailing part thereof has been so drawn forward.

2. Apparatus as claimed in claim 1 wherein the clamping means comprises a pair of clamp plates each the same distance above the conveyor and extending transverse to the forward direction of the conveyor, the plates being movable towards each other to clamp the article therebetween and away from each other to release the article.

3. Apparatus as claimed in claim 2 wherein both plates are moved by pneumatic ram means.

4. Apparatus as claimed in claim 1 wherein the conveyor consists of a number of spaced parallel conveyor bands and the raising means comprises a set of fingers normally disposed beneath the upper run of the conveyor which carries the article to be folded, the fingers being projected up between the conveyor bands at the appropriate time to engage the fold line of the article and raise it.

5. Apparatus as claimed in claim 1 wherein the timing means comprises a timing device having an actuating member which is driven a predetermined distance to actuate a fold switch, actuation of which raises the raising means, the actuating member being driven initially at a slow speed in synchronism with the conveyor and finally at a fast speed in synchronism with the conveyor and sensor switch on the conveyor rearward of the fold position responsive to the passage of the leading edge of an article to initiate the slow speed drive and responsive to the passage of the trailing edge of an article to initiate the fast speed drive.

6. Apparatus as claimed in claim 5 adapted to fold articles in half, the fast speed being twice the slow speed.

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