

Dec. 16, 1952

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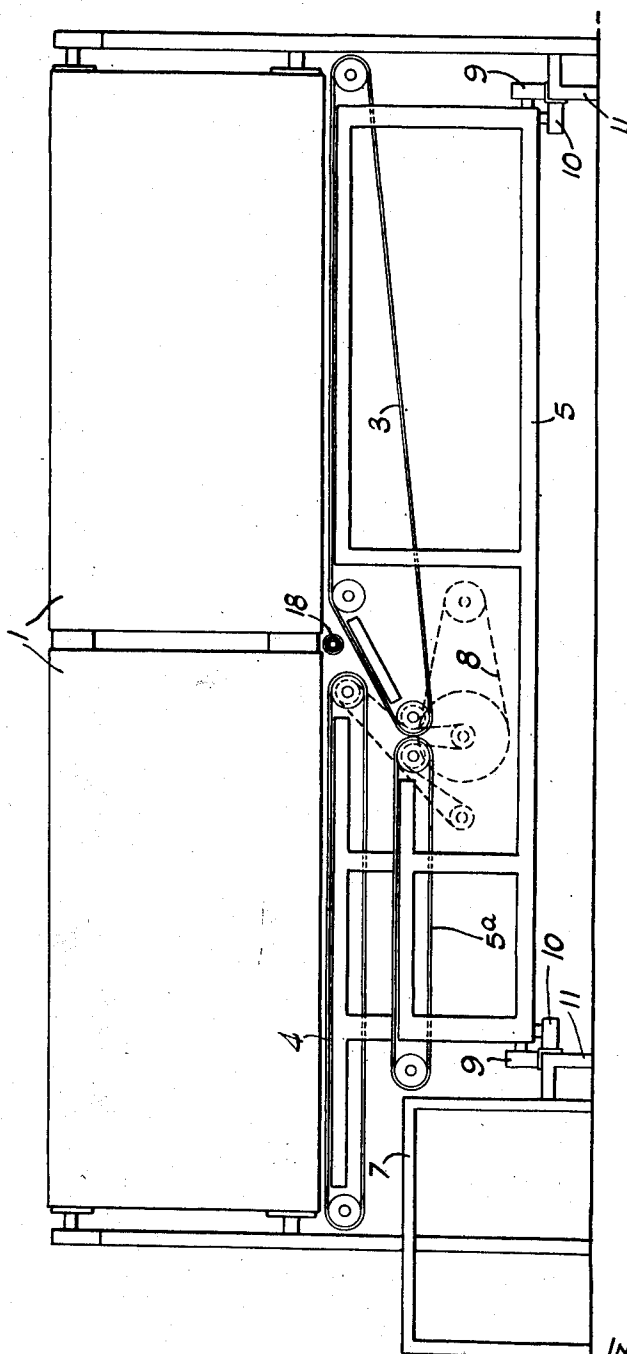
2,621,927

LAUNDRY APPARATUS FOR FOLDING FLAT PIECES OF MATERIAL

Filed July 27, 1949

5 Sheets-Sheet 1

FIG. 1.



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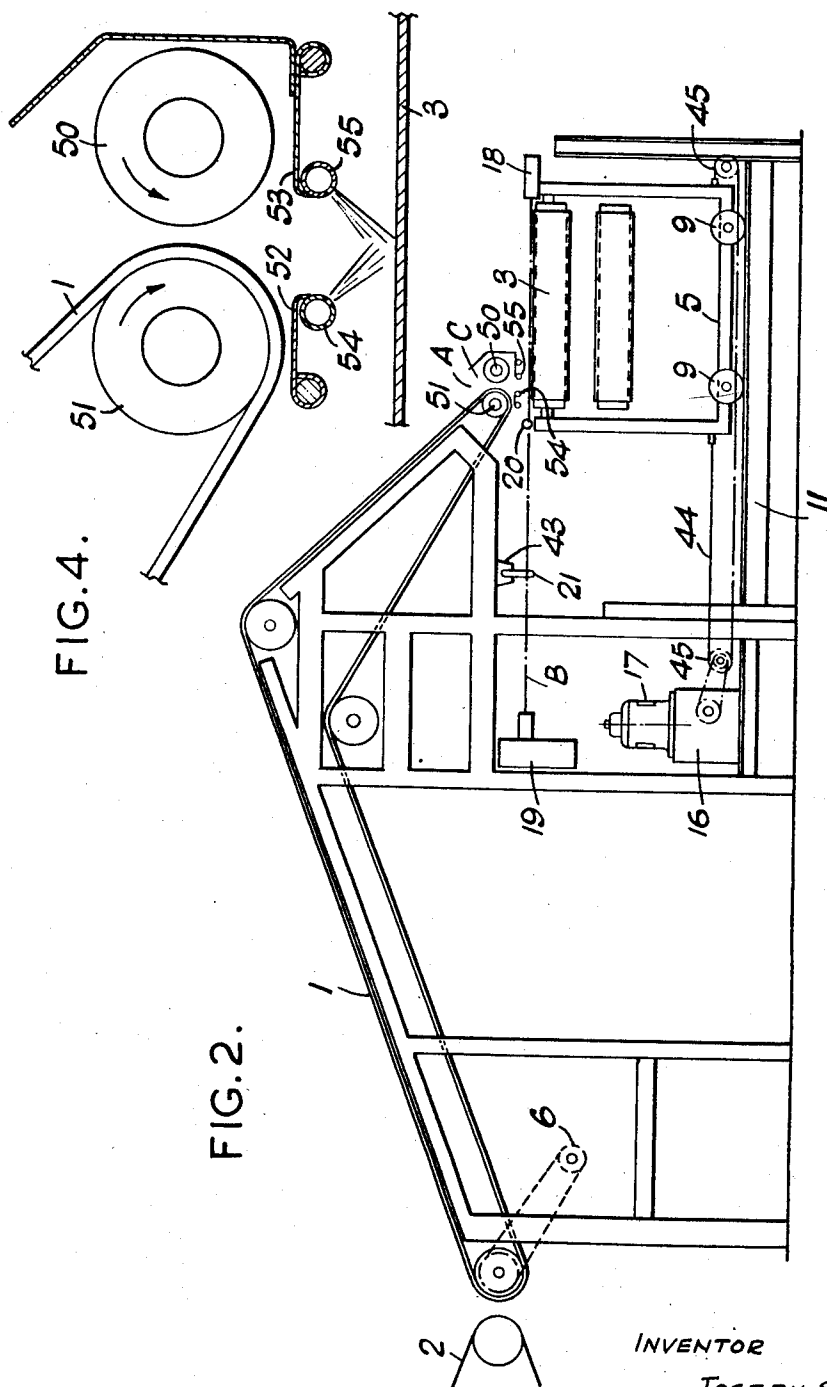


FIG. 4.

FIG. 2.

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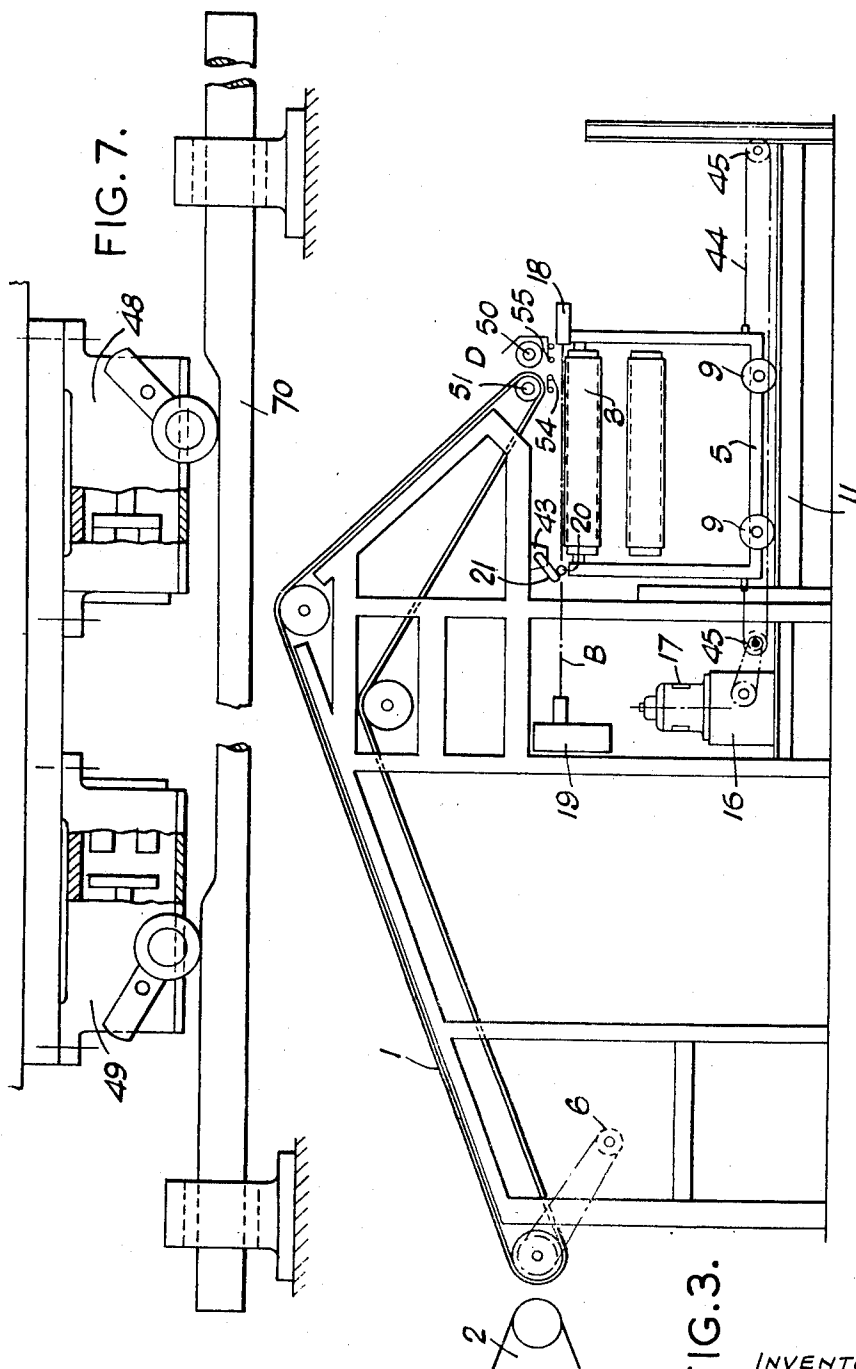


FIG. 3.

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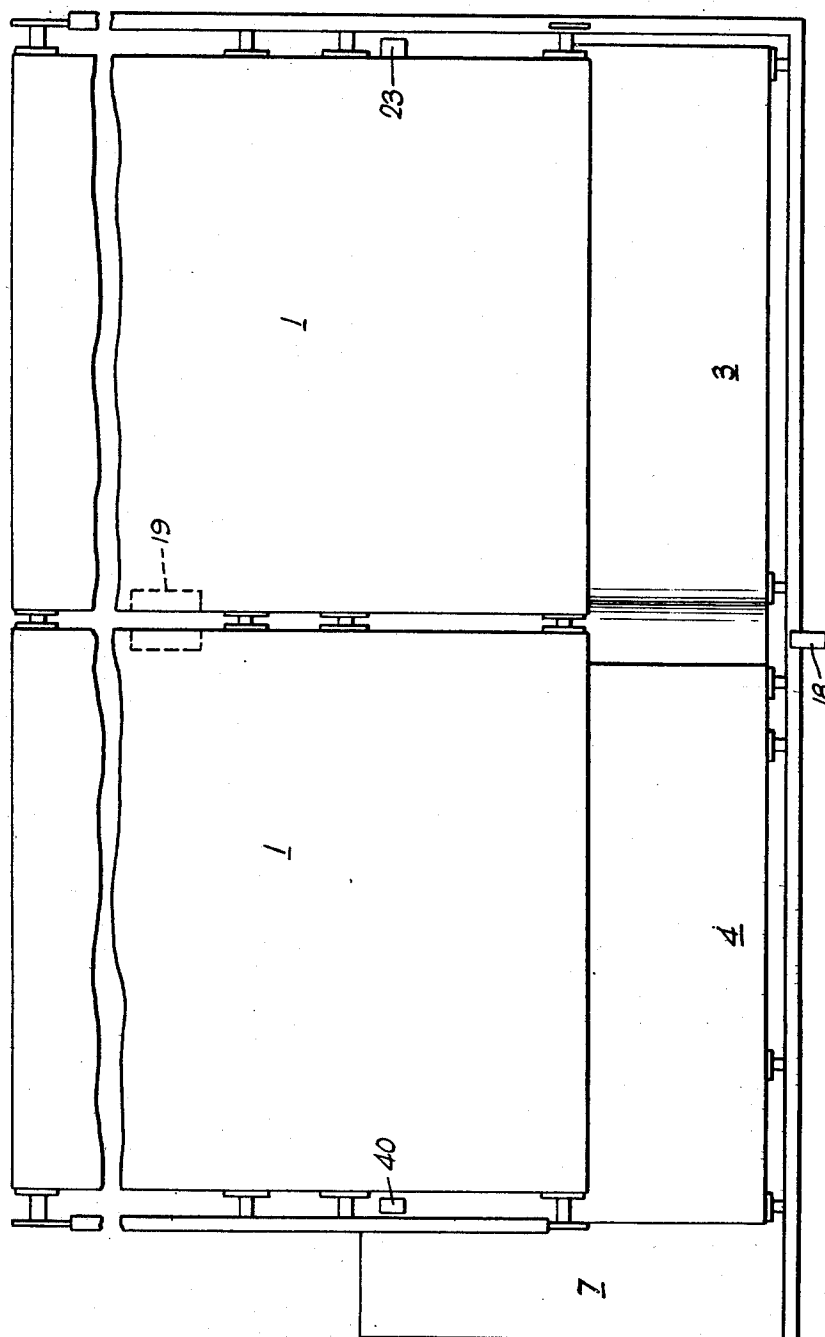
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LAUNDRY APPARATUS FOR FOLDING FLAT PIECES OF MATERIAL

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5 Sheets-Sheet 4

FIG. 5.



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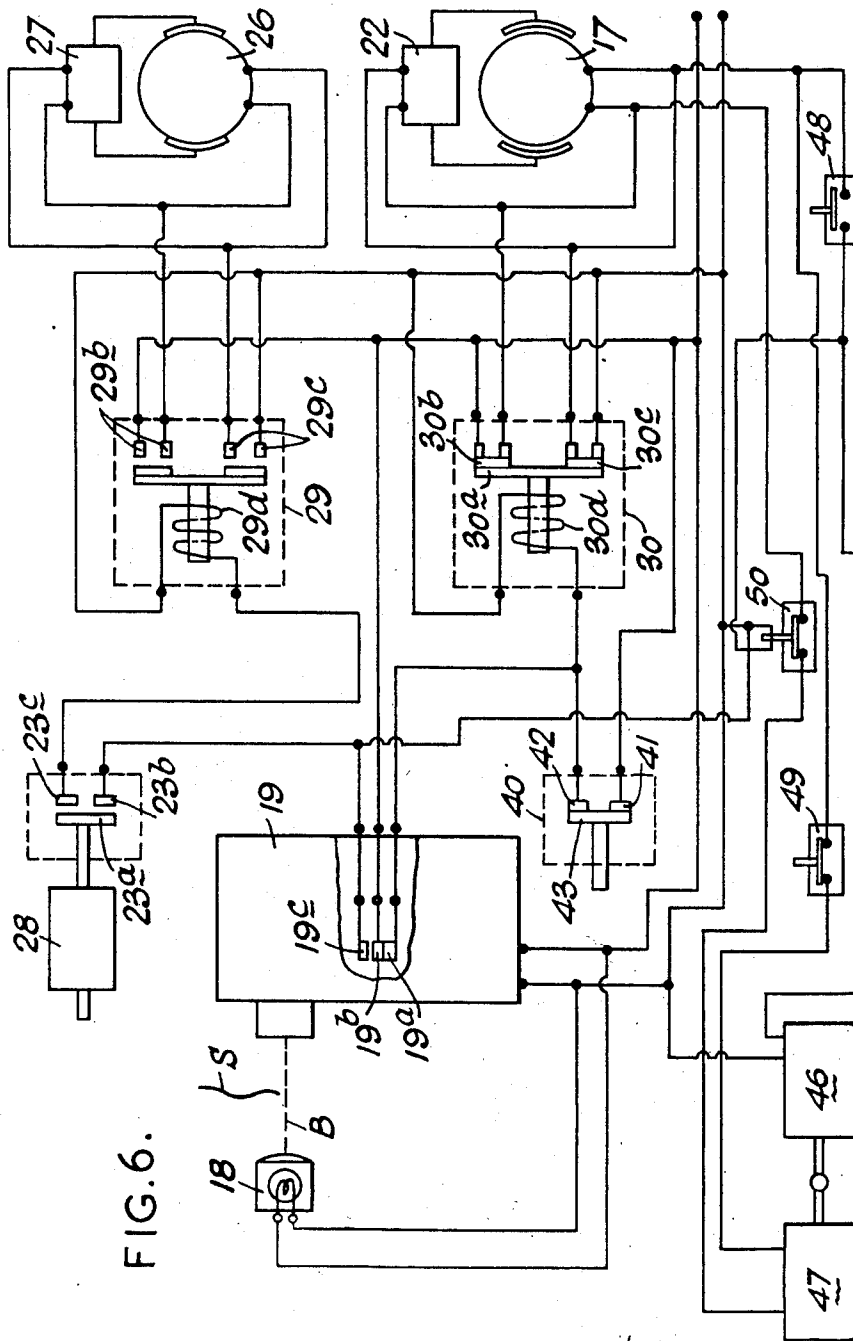
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LAUNDRY APPARATUS FOR FOLDING FLAT PIECES OF MATERIAL

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5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

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LAUNDRY APPARATUS FOR FOLDING FLAT
PIECES OF MATERIALJoseph Swift, Spitalcroft, Knaresborough, Eng-
land, assignor to A. & C. Jenner Limited,
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1

The present invention relates to apparatus for folding flat pieces of material such as sheets and other fabrics of definite length.

The operation of folding sheets, tablecloths and the like, known in the laundry trade as flatwork is a major operation in a large laundry and is very burdensome.

Objects of the present invention are to provide apparatus which will fold by mechanical means work of this kind thus eliminating tiring manual operations; to provide apparatus whereby the flatwork of definite length may be folded in one direction only or it may be folded in more than one direction; and to provide apparatus whereby the folding is carried out without the use of blade folders.

Although the invention is described in connection with the ironing or other hot pressing apparatus, it is applicable to other laundry apparatus or machines involving folding of the work at some stage in the laundering process.

There will now be described with reference to the accompanying drawings an embodiment of the invention in which the work of definite length is folded in more than one direction and in which the objects aforesaid are attained.

In the drawings:

Fig. 1 is a diagrammatic elevational view.

Figs. 2 and 3 diagrammatic and elevational views of Fig. 1, each showing some of the parts in different operational positions.

Fig. 4 is a detail view of guiding means at the end of the delivery conveyor.

Fig. 5 is a plan view partly broken away for convenience of illustration.

Fig. 6 is a diagrammatic view of an arrangement of wiring system for the automatic control of the operation of the apparatus, and

Fig. 7 is a detail view showing an example of mechanically interconnected switches.

The folding machine comprises a feeding conveyor 1 arranged to receive the work, i. e. flat articles of definite length from a calender or other machine. The work is delivered from this conveyor on to the folding apparatus at a station A. The folding apparatus consists of a set of folding conveyors 3 and 4, mounted upon a carriage 5. This carriage is arranged to be reciprocated in a direction at right angles to the direction of the bands on the folding conveyors 3 and 4.

The feeding conveyor 1 is driven from a separate variable speed drive 6 which is controlled to run at a speed to suit delivery of the work from the calender.

2

The folding conveyor bands 3 and 4 are arranged to run towards each other. The conveyor 3 can either deliver on to conveyor 5a which in turn delivers on to a receiving table 7 or it can be extended to deliver direct to a selected position.

The folding conveyors are driven by means of a drive 8 mounted on the carriage 5. This latter is supported on rollers 9 and 10 which also serve as laterally locating members.

The reciprocating movement of the carriage 5 is on a rail 11 and is effected by means of a chain 44, attached at each end of the carriage and guided over sprockets 45 which are driven from a gear box 16 of the motor 17 used for reciprocating the carriage 5.

As stated the work is delivered from the feeding conveyor 1 on to the folding apparatus at a station A. When the leading edge of the work arrives at this station it serves to actuate a light sensitive device. One way of doing this is by the interruption of a light ray or beam B from a light source, for example that projected from a lantern 18. The interruption of the ray or beam causes a photocell amplifier 19 serving as a master control to energise the motor 17 which in turn actuates the parts 45, etc., referred to above and the folding apparatus commences to reciprocate at the same speed as the work is being fed on to the folding conveyors. The folding conveyor bands are stationary during this movement.

When the tail end of the work approaches the station A aforesaid mentioned the light ray or beam B ceases to be obscured from the photocell amplifier 19 and the latter is again illuminated and this source of current is cut off from the motor 17.

The motor 17 however receives independently through a limit switch 40 or equivalent device a supplementary supply of current. The result is that although the ray or beam is no longer interrupted the motor continues to run. This continues until a roller 20 or other means on the folding apparatus strikes an arm 21 or the equivalent on the main frame which through appropriate means serves to cut off the supplementary supply of current to the motor. With this interruption in current a magnetic brake 22 comes into operation and stops the folding apparatus in the position shown in Fig. 3. A second limit switch 23 is operated simultaneously with the first limit switch 40 and this operating through a timing relay or the equivalent starts a motor 26 which runs the bands or conveyors.

As the conveyors are running towards each other the folded work is again folded and delivered on to a further conveyor 5a and thence on to a receiving table 7 or to some other place. Meanwhile a further piece of work is conveyed to the receiving station A and the cycle repeated and this further work of definite length folded.

The folded work may be given further folds if necessary to make it ready for parcelling by an operation at the receiving table.

The work may be fed on to the transverse folding apparatus at various points by suitably arranging the starting switch. For example it can be fed at "C" Fig. 2 or at "D" Fig. 3.

The gap between the folding or pleating conveyors and the delivery conveyor should be kept to a minimum. Means are provided see Figs. 2, 3 and 4 by which the article is led more effectively off the delivery conveyor, and inter alia should the article at high speeds tend to be thrown off the end of the delivery conveyor and a false start be made or a ballooning of the article commenced these objections are overcome. The means referred to consist of a roller 50 fitted parallel and adjacent to the delivery conveyor roller 51, the roller 50 being driven by gearing at the same speed as the roller 51 but in the opposite direction. By this means the article is positively fed off from the delivery conveyor 1.

It may happen that as the article leaves the delivery conveyor and when the folding apparatus is moving away from its base position and the article is being dragged away from the delivery conveyor, or when the said conveyor is moving towards the base position, the article tends to wrap around the end of the roller 51 so that uneven folding occurs. To overcome this two polished metal guides 52, 53 are mounted below the rollers equidistant from the centre line between rollers. The guides are so shaped that irrespective of the direction in which the folding or pleating apparatus moves, the article conforms to the bend or shape of the guides.

With a heavy article or one having a fluffy texture or a springy texture the article may not lie flat when the folding or pleating operation is occurring, and air is trapped between the folds with the result that the combined thickness of the folds is excessive. To overcome this perforated tubes 54 and 55 may be provided to direct blasts of air on to the article which flattens the folds and prevents the article from fouling the guides.

Fig. 6 illustrates an example of electrical system which may be used. The light ray or beam being interrupted by the work S causes two contacts 19a and 19b in the photoelectric amplifier 19 to close. This energises a coil 30d in a contactor device 30 causing the contact 30a to close the contacts 30b and 30c which energises the motor 17 and a magnetic brake 22.

This motor 17 drive the gearing reciprocating the framework and during this time the work is being folded transversely, until the work no longer obscures the ray or beam and the photocell is re-illuminated. This results in the two contacts 19a and 19b in the cell 19 opening and a further contact 19c and one of the first pair 19b closing.

In one lay out of wiring unless the carriage is at the base position the limit switch 40 is left in the normal "on" position and contacts 41 and 42 are kept closed by contact 43. When the carriage reaches the base position it opens these

contacts and the motor ceases to run and the brake 22 comes into operation. Simultaneously the timing relay 28 is tripped and contacts 23a, 23b and 23c, associated with the second limit switch 23, closed, which energises a coil 29d of a contactor 29 which closes contacts 29b and 29c and starts motor 26 running the folding conveyors and the final fold is produced. Simultaneously a brake 27 for this motor is released.

Fig. 6 also includes means by which a delay which may ensue if the folding conveyor was allowed to complete its cycle when the tail end of an article had left the delivery conveyor and the light was no longer obscured is eliminated. That is to say should the article be in process of being folded and the tail end of the article just coming off the delivery conveyor whilst the folding conveyor is short of the base position and the light is no longer obscured, the complete cycle, that is away from base and back, must be completed before the holding conveyor functions and delivers the article on the table or receiving conveyor. The method by which this delay is overcome is to operate clutches electrically and arrange that where the light ray is not obscured, current is fed to a solenoid operating the clutch in the base position so that irrespective of the direction in which the folding conveyor is moving it is brought back to base. Thus when 43 and 41 close current is fed to solenoids 46 and 47 through limit switches 48 and 49. The solenoid 46 is the one which operates the clutch bringing the folding apparatus to base, and 47 is the one which brings conveyor in the other direction. These solenoids can either operate the clutches directly or work air valves feeding a double acting pneumatic ram which in turn operates the clutches. Limit switches 48 and 49 are interlocked so that if one is closed the other is open and vice versa. They are actuated by the movement of the folding apparatus itself. By suitably adjusting the positions of the limit switches the stroke of the folding apparatus and hence the final width of the folded article can be varied. Whilst the light ray is obscured the folding apparatus will run in the direction governed by the limit switch last operated by the conveyor. By placing the limit switch contacts 48 in parallel with contacts 41 and 42 the following will occur when the light ray is not obscured. Current will flow in solenoid 50 which will open the circuit feeding solenoid 47. At the same time current will flow in solenoid 46 which therefore becomes master and irrespective of the position of the folding apparatus it must return to its base when limit switch 48 opens and limit switch 23 closes and the final fold completed. When the next article comes over the cycle recommences.

The switches 48 and 49 may be mechanically interconnected as shown in Fig. 7. A control rod 70 common to both switches is worked by the reciprocating carriage or folding apparatus through an operating lever. It will be seen that with this control one switch is on and the other off.

Usually there is yet one more final fold needed, and this is done by the operator while waiting for the succeeding sheet to be folded on the apparatus.

Flatwork articles are preferably folded with polished side out, that is the side which is in contact with the ironing bed; because of this the sheet must be fed onto the conveyors in such a way as to ensure a polished-side out fold.

When small articles such as towels, pillow slips,

5

etc. which need no mechanical aid to fold, are coming through the calender, the conveyors are left at base, and made to run, but the delivery feed is raised to allow the small articles to fall onto the small articles folding table to be folded by hand, and then placed on the moving conveyors for delivery to the operator.

The transverse conveyors are independently driven and easily removable with their carriage from the framework.

It may be arranged that the folding machine conveyor speed will be faster than that of the calender or other machine for which it is taking delivery so that the space between the articles on the folding machine conveyor will be greater than that between the articles on the calender or other machine.

The drives for the various parts of the apparatus may be started or stopped by a machine operator, or be automatically controlled.

The conveyor may be cranked in order to provide as much length in as little floor area as possible.

The feeding conveyor may be driven direct from the laundry machine or apparatus delivering the work, or from a separate variable speed drive which is controlled to run at a speed to suit the delivery of the work from the machine or apparatus.

As many embodiments of the present invention may be made, and as the parts herein described may be varied in many ways, all without departing from the scope of the invention, it is to be understood that all matter herein set forth or shown in the drawings is to be interpreted as illustrative and not in a limiting sense.

What I claim is:

1. Laundry apparatus for folding flat pieces of material of definite length in more than one direction comprising a feeding conveyor adapted to receive and deliver said material, a work support including a pair of peripherally cooperating conveyors mounted for rotation in opposite directions transverse to the feeding direction to advance material between them, said conveyors being arranged beneath the end of the delivery conveyor, means for reciprocating said work support in a direction parallel to the feeding direction at uniform speed over substantially the whole of its stroke to impart transverse folds to material fed thereon and means responsive to the completion of the transverse folding of the material to set in motion said peripherally cooperating conveyors to impart a longitudinal fold to the material as it is advanced between them.

2. In laundry apparatus according to claim 1, an electric motor arranged to reciprocate said work support and means responsive to the commencement of delivery of material to said support to start said motor and responsive to the completion of said delivery to stop said motor.

3. In laundry apparatus according to claim 2, a light sensitive device including a light source and a photo-cell amplifier disposed adjacent said support in spaced relation to accommodate delivery therebetween of material of said support, and circuit means connecting said amplifier and said motor, whereby interruption of light from said source by delivery of material to said support effects said amplifier to start and stop said motor.

4. Laundry apparatus for folding flat pieces of

6

material of definite length in more than one direction, comprising a feeding conveyor arranged to deliver material to a work support mounted upon a carriage, said work support including a pair of peripherally cooperating conveyors mounted for rotation in opposite directions transverse to the direction of feed of the material, between which the said work is advanced and folded, said conveyors arranged beneath the delivery end of said feeding conveyor, means for reciprocating said carriage in a direction parallel to the feeding direction at constant speed over substantially the whole of its stroke to impart transverse folds to the material fed to the work support and means responsive to the completion of the transverse folding to set in motion the peripherally cooperating conveyors to impart a longitudinal fold to the work.

5. Laundry apparatus according to claim 4 in which the peripherally cooperating conveyors consist of endless conveyor bands.

6. Laundry apparatus according to claim 4 in which the feeding conveyor is made up of a set of power driven feed bands disposed along the full width of the conveyor.

7. Laundry apparatus according to claim 4 comprising a delivery conveyor on to which the peripherally cooperating conveyors deliver the folded work.

8. In laundry apparatus according to claim 4, a delivery conveyor on to which the peripherally cooperating conveyors deliver the folded work and a receiving table for receiving the work from the said delivery conveyor.

9. The combination, in laundry apparatus for folding flat pieces of material of definite length in more than one direction and in which work is fed from a feeding conveyor, of a pair of peripherally cooperating folding conveyors mounted for contra-rotation transversely to the direction of feed of the feeding conveyor with a carriage upon which they are mounted beneath the delivery end of said feeding conveyor, the said carriage being reciprocated at substantially constant speed over the whole of its stroke to impart folding to the work transverse to the direction of feed of the feeding conveyor, the said folding conveyors being subsequently set in motion toward each other to advance and fold the work between them, and means for leading the work off the feeding conveyor onto said folding conveyors.

10. The combination according to claim 9 in which the means for leading the work off the feeding conveyor comprises metal guides arranged between said feeding conveyor and said folding conveyors.

11. The combination according to claims 9 including means to direct blasts of air downwards onto the work as it is folded transversely.

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