Dec. 31, 1963 E. JENSEN 3,116,059

DEVICE FOR TRANSVERSELY FOLDING LAUNDRY PIECES

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Fig.1

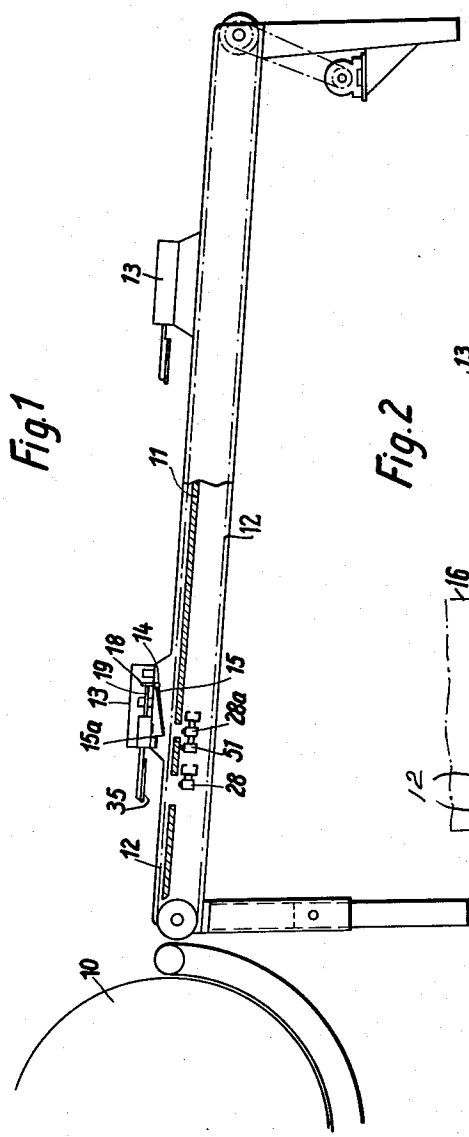
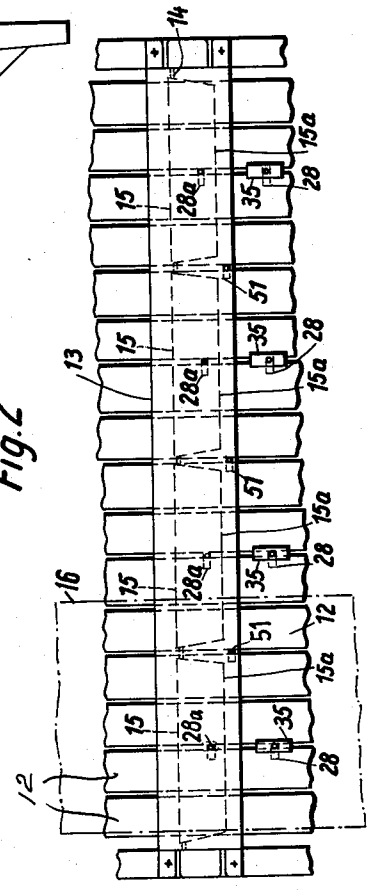


Fig.2



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DEVICE FOR TRANSVERSELY FOLDING LAUNDRY PIECES

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Fig.3

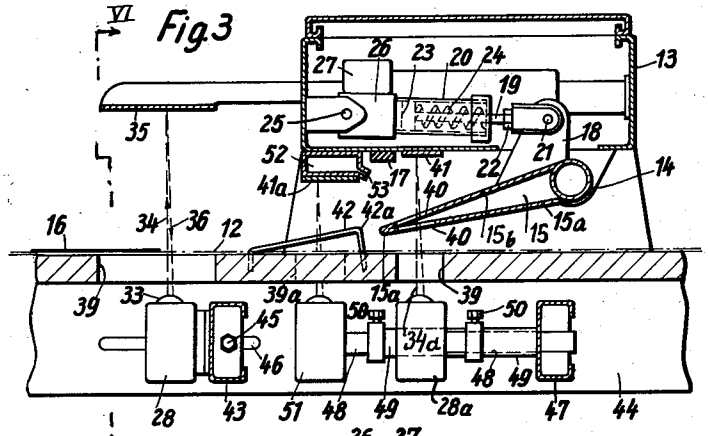


Fig.4

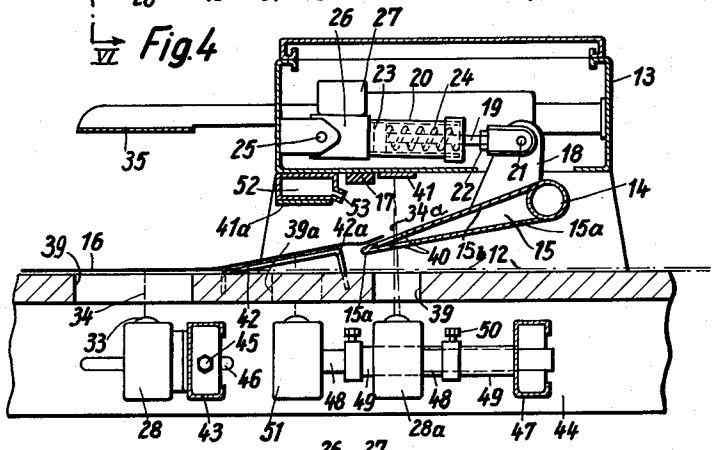
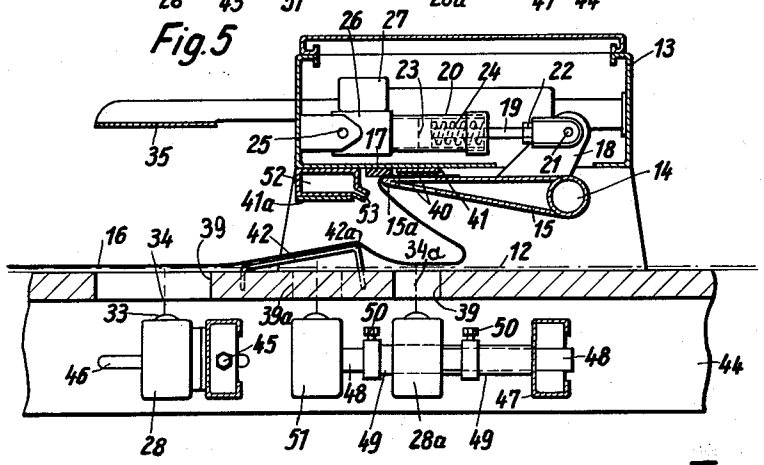


Fig.5



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DEVICE FOR TRANSVERSELY FOLDING LAUNDRY PIECES

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Fig. 6

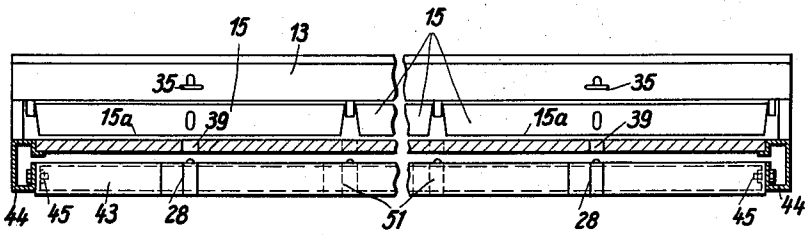
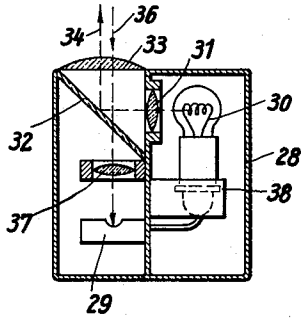


Fig. 7



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DEVICE FOR TRANSVERSELY FOLDING LAUNDRY PIECES

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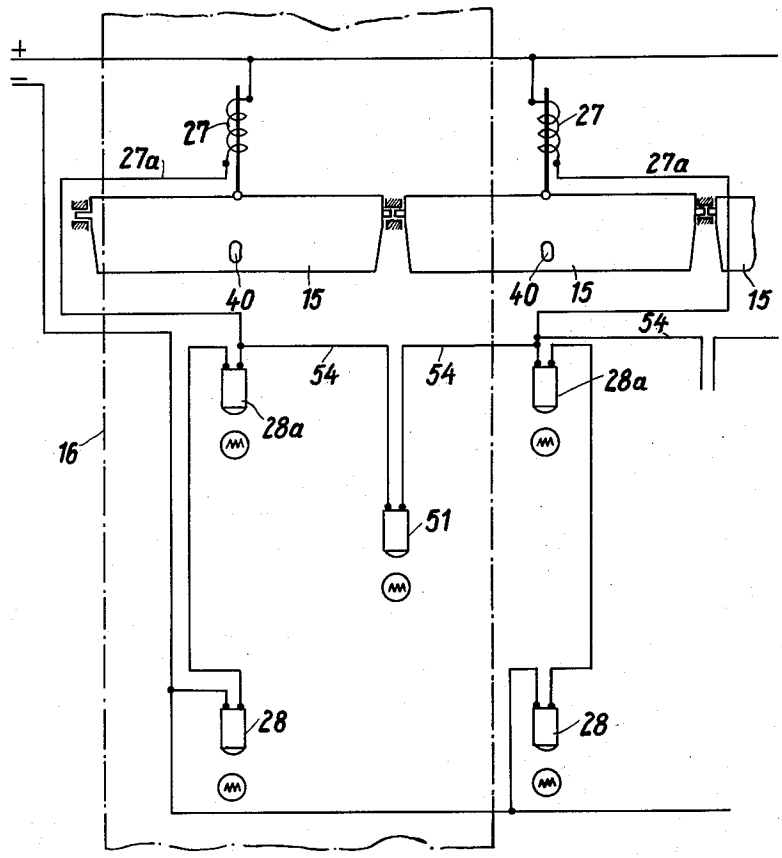

Fig. 8

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3,116,059

DEVICE FOR TRANSVERSELY FOLDING LAUNDRY PIECES

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Claims priority, application Germany Nov. 2, 1961
6 Claims. (Cl. 270—68)

The present invention relates to an apparatus for transversely folding laundry pieces behind laundry calenders and the like.

It is known to provide folding apparatuses of the above mentioned type with conveyors arranged above a folding table and with clamping plates for grasping and holding the front edge of the respective laundry piece and additionally to provide control means which are actuated by the laundry piece and which control the clamping and release movement of the clamping plates. It is also known to provide photoelectric cells which in turn influence the control of the clamping plates while the clamping plates are actuated by electric or pneumatic or hydraulic means.

All of these devices have the drawback that a precise adjustment of the light source with regard to the photoelectric cell is rather difficult. The light source is in most instances arranged below the folding table, whereas the photoelectric cell is adjustable above the folding table in the longitudinal direction thereof. When setting the apparatus, it is necessary very precisely to adjust the photoelectric cells with regard to the light source because otherwise no proper switching on and switching off of the current will be effected. It is thus necessary to adjust two parts individually in the longitudinal direction of the folding table, namely the light source as well as the photoelectric cell. This means that for the release of the clamping plates from their clamping position into the downwardly folded position and for the adjustment of the clamping plates from the downwardly folded position into clamping position, a second control means in the form of a light source and photoelectric cell is required which light source and photoelectric cell have to be adjusted individually in the longitudinal direction of the folding table. Devices of this type are rather cumbersome and very difficult to operate.

It is, therefore, an object of the present invention to provide an apparatus of the above mentioned type which operates with photoelectric cells and light sources, and in which the precise adjustment of the controls in conformity with the conveyor speed of the folding table can be effected by a simple adjustment of the light source and photoelectric cell, uniformly for all clamping plates arranged in series in a row.

It is a further object of this invention to provide an apparatus as set forth in the preceding paragraph in which by control means in the form of light source and photoelectric cells a preselection will be possible in such a way that for switching on and switching off of two adjacent clamping plates, or of three adjacent clamping plates, or of clamping plates arranged in pairs, the simultaneous final switching on of the relays for actuation of the clamping plates is brought about.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

FIG. 1 diagrammatically illustrates a view partially in section of a folding apparatus according to the present invention with a plurality of folding bridges which carry the folding mechanism and are arranged above the conveyor equipped folding table.

FIG. 2 diagrammatically illustrates a top view of a folding bridge with a plurality of clamping plates arranged

adjacent to each other while preselector units are provided between the clamping plates.

FIG. 3 illustrates on a larger scale, partially in section, the folding bridge, the control units and the photoelectric control of the relay while the clamping plate is folded downwardly.

FIG. 4 shows the position of the apparatus after the laundry piece has been moved over the light beam of the first control unit so that the light beam is interrupted.

FIG. 5 shows the apparatus according to the invention in a position according to which the laundry piece has been placed upon the clamping plate and after the light beam for the second photoelectric cell of the second control unit has been interrupted.

FIG. 6 is a cross section taken along the line VI—VI of FIG. 3.

FIG. 7 illustrates a cross section of a control unit equipped with a light source and photoelectric cell.

FIG. 8 illustrates by way of example a control circuit for controlling the control units while employing preselector units.

General Arrangement

The apparatus according to the present invention is characterized primarily in that the photoelectric cell and the light source of each control unit are arranged in a single housing comprising a transparent mirror and lenses and that the control unit housings are arranged underneath the folding table between the conveyor belts, whereas above the table, which is provided with passages for the light beam, there are provided reflector plates, for instance mirrors, which are arranged alongside the feeding direction.

According to a further feature of the invention, the control unit housings arranged below the folding table are adjustable and arrestable in the feeding direction. Furthermore, the control units arranged in housings below the clamping plates are adjustable individually in the longitudinal direction of the folding table for releasing all clamping plates arranged adjacent to each other.

A still further feature of the invention consists in that between each two control units arranged below the clamping plates, preferably in front of said control units when looking in feeding direction, there is provided a photoelectric control unit serving as preselector, by means of which a photoelectric cell controlling a clamping plate is connected with a current supply line which behind the relay pertaining thereto leads to the respective directly adjacent photoelectric cell controlling a clamping plate. These so-called preselectors or key heads make it possible so to adjust the clamping plates that for instance two bed sheets of identical size, a narrow laundry piece, as for instance a towel, together with a particularly wide laundry piece, especially bed sheet, or also three narrow laundry pieces of approximately the same width, as for instance towels, can be folded adjacent to each other. A further feature of the present invention consists in the supply of air between the laundry pieces folded upon each other in order to space the same from each other by means of an air cushion.

Structural Arrangement

Referring now to the drawings in detail, the apparatus shown therein comprises a calender 10 behind which there is arranged a folding table 11 having mounted thereabove endless conveyor belts 12 for conveying the laundry pieces to be folded. The folding table 11 is advantageously adjustable so as to be able to occupy various inclined positions.

The laundry pieces 16 discharged from the calender 10 move onto the conveyor belts 12 and are folded on the same. To this end, above the folding table 11 and

spaced in transverse direction over the folding table there is provided a plurality of advantageously box-shaped bridges 13 which carry the folding mechanism. Expediently, these bridges 13 are adjustable in the longitudinal direction of the folding table.

Below the bridge 13 there is provided in adjacent arrangement a plurality of clamping plates 15 which are tiltable about bolts 14 and the front edges 15*a* of which face the feeding direction of the laundry piece 16. The bridge box is furthermore provided with a plurality of abutments 17 for the clamping plates 15 (see FIGS. 1, 3, 4 and 5), the abutments 17 preferably consisting of elastic material, as for instance rubber.

The clamping plates 15 are by means of their arm 18 and bolt 21 pivotally connected to the piston rod 19 of a fluid pressure cylinder 20. A longitudinal adjustment of the piston rod 19 may be effected by a counter nut 22. The piston 23 of the pressure fluid cylinder 20 is continuously acted upon by a spring 24. The pressure fluid cylinder 20 is tiltable about a bolt 25 of a bearing for the folding bridge 13. The actuation of piston 23 by means of compressed air is controlled by a magnetic valve 26 of any standard design. Pressure fluid cylinder 20 and magnetic valve 26 are arranged preferably coaxially with regard to each other. The adjustment of the magnetic valve 26 is effected by a relay 27 which in its turn is controlled by a control unit comprising a photoelectric cell and a light source. To this end, the photoelectric cell 29 and a light source 30 (FIG. 7) are arranged in a housing 28 below the folding table 11. The light source 30 emanates its light beams through a lens 31 to a transparent mirror 32. By means of a further lens 33 in the direction 34 the light beams are passed to a reflector plate 35 (FIG. 3) arranged above the folding table 11. From said reflector plate 35, for instance a mirror, the light beams, as indicated in FIG. 7 by the arrow 36, are passed through the transparent mirror 32 and through a lens 37 to the photoelectric cell 29. Preferably, lens 37 is provided with a red filter.

The light source 30, for instance an incandescent lamp, is mounted on a socket plate 38 which is likewise adjustable. The table is provided with openings 39 for the passage of the light beams 34 and for the reflected beams 36.

While the control unit arranged in housing 28 and comprising the light source, photoelectric cell and lens is arranged ahead of the clamping plate 15, a similar unit arranged in housing 28*a* is arranged below the clamping plate 15 and the table opening 39 pertaining thereto.

In addition thereto, the clamping plate 15 has passages in the form of slots 40 for the light beam emanated from the light source. Above these slots 40 there is provided a reflector plate 41 in the folding bridge 13.

The clamping plate 15 may by two superimposed plates 15*b* be designed as hollow body so that it will be torsion resistant.

The control unit in housing 28 serves for turning off relay 27. In other words, as long as the light beams 34, 36 are not interrupted, photoelectric cell 29 of the control unit 28 turns off the circuit for relay 27. As a result thereof, when the magnetic valve 26 is closed, spring 24 tilts the clamping plate 15 downwardly.

The photoelectric cells of each control unit are through amplifiers, transformers and possibly transistors connected to relay 27 which in its turn actuates the magnetic valve 26. As long as no laundry pieces are moved, the circuit for the relay 27 is interrupted (FIGS. 3 and 4) by a control unit in housing 28*a*, which control unit comprises the light source 30 emanating the light beam 34 and also comprises the photoelectric cell 29 and lenses and the light beam emanated by cell 29 onto the reflector mirror 41. When the laundry piece 16 has been moved sufficiently far on the clamping plate 15, due to the interruption of the light beam 34 for the photoelectric cell 29 of

control unit 28, the circuit for relay 27 will be partly closed. However, at this time the circuit for relay 27 is still interrupted by the second control unit 28*a*. Only when the laundry piece 16 has been moved further on clamping plate 15, as illustrated in FIG. 4, the light beam 36 of the photoelectric cell 29 of the second control unit 28*a* is interrupted whereby the control circuit for relay 27 is completely closed. As a result thereof, magnetic valve 26 is opened by relay 27, and compressed air acts upon piston 23 so that, as illustrated in FIG. 5, the laundry piece 16 is now clamped in and during the further advance by the conveyor belt 12 will be folded.

Ahead of clamping plate 15 between the conveyor belts 12 there are provided inclined wires 42 by means of which the advanced laundry pieces are lifted. This makes it possible to convey the thus lifted laundry pieces 16 to the downwardly folded clamping plates 15. The clamping plates 15 have their front edges 15*a* in their lower portion arranged at a distance above the conveyor belts 12 of the folding table 11, which distance corresponds to at least the thickness of the laundry piece to be folded. The front edges 42*a* of the wires 42 are located approximately at the height of the front edges 15*a* of the clamping plates and are arranged ahead of the front edges 15*a* of the clamping plates at a distance corresponding approximately to the thickness of the respective laundry piece.

The control units respectively associated with each of the clamping plates 15 and arranged in housing 28 are mounted on a transverse beam 43 which is located below the folding table 11 and is displaceable, adjustable and arrestable in the longitudinal direction of the folding table 11. The arresting or locking may be effected on side beams 44 of the folding table 11 by means of set screws 45 engaging slots 46.

Also the control units in housings 28*a* which likewise comprise light sources, transparent mirrors, lenses and photoelectric cells, are adjustable in longitudinal direction of the folding table 11. The said control units in housings 28*a* are mounted on a transverse beam 47 which is displaceable and arrestable in the longitudinal direction of the table. To this end, the said control units engage guiding pipes 49 by means of supporting bolts 48. By means of set screws 50 it is also possible after adjustment of folding table 11 in longitudinal direction thereof to arrest the control units 28*a* arranged below the clamping plates 15, after said control units have been precisely adjusted with regard to the reflector plates 41.

In addition thereto, between the control units 28, 28*a* below table 11 there are provided a photoelectric cell and light source unit 51 each of which serves as preselector (FIGS. 2–6). Said unit 51 is by means of an electric conductor connected with the other control units 28, 28*a* controlling the clamping plate 15, in such a way that when the laundry piece 16 moves above the preselector unit 51, the light beam of which acts through passages 39*a* on reflector plates 41*a*, the turning on and turning off of the relay 27 for each two or more adjacent clamping plates 15 will be controlled.

FIG. 8 illustrates a circuit diagram showing the connecting lines between the control units 28, 28*a* and the preselector units 51. As will be evident from said diagram, the preselector unit 51 is through a conductor 54 connected to the photoelectric cell 28*a* of two or more adjacent clamping plates 15, while the connecting line 54 is respectively connected to line 27*a* connected to relay 27. The diagram of FIG. 8 also shows that the preselector unit 51 will become active when a laundry piece 16—indicated by dot-dash lines—is to be folded which laundry piece is only so wide that it merely covers one clamping plate 15. By means of the preselector unit 51 now also laundry pieces of a width less than two or three or more adjacent clamping plates may be clamped in.

As illustrated in FIG. 6, the control of relay 27 either for two adjacent or three adjacent or more clamping plates

15 arranged adjacent to each other in pairs may be actuated by each preselector unit 51, so-called key head. This is made possible by the fact that a plurality of clamping plates 15 is made effective or ineffective by the key heads 51 in the circuit of relay 27. In this way it is possible, as already mentioned above, simultaneously to fold either two laundry pieces of the same size, as for instance bed sheets, a narrow laundry piece, such as a towel, together with a particularly wide bed sheet, or also three laundry pieces of approximately the same width, as for instance three towels.

Also the control units 51 serving as preselectors are adjustable individually on the transverse beam 47 and in the longitudinal direction of the table. The preselector unit 51 may be so arranged that only after a final advance of the laundry piece 16 onto the clamping plates 15, the final switching on and switching off of the relay for the clamping position will be effected.

FIG. 3 additionally illustrates that ahead of the clamping plates 15 there is provided an air pressure passage 52 with nozzles 53 through which air is blown between the folded laundry pieces in order slightly to space the superimposed folded portions of the laundry piece by an air cushion.

The adjustability of the transverse beam 43 carrying the control units 28, similar to the adjustability of the control units 28*a*, makes possible a precise adjustment of the apparatus. In this way it is possible precisely to adjust the length of the protruding portions of the laundry pieces at the front and end of the laundry piece, even during the operation of the apparatus. It is merely necessary to adjust the control units below table 11 whereby photoelectric cells and light sources are adjusted together because the reflector plates 35, 41 are made so long that in each instance a reflection of the respective light beams will take place.

It is, of course, to be understood that the present invention is, by no means, limited to the particular construction shown in the drawing but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. A folding apparatus for transversely folding laundry articles, which comprises: a folding table provided with a plurality of groups of passage means therethrough for the passage of light beams, a plurality of conveyor means arranged above said table and spaced from each other in transverse direction thereof for receiving and conveying laundry articles to be folded, the individual passage means in each said group of passage means in said table being spaced from each other in the direction of movement of said conveyor means and being located laterally between said conveyor means, a plurality of laterally aligned independent clamping means respectively arranged above said conveyor means for temporarily grasping and holding the front portion of the laundry article to be folded, each said clamping means also being provided with passage means therethrough about midway the ends thereof for the passage of light beams, and aligned with one of the individual passage means of one of said groups of passage means, a control unit associated with each of said individual passage means and controllable by laundry articles on said conveyor means in the region of the respective clamping means for controlling the respective one of said clamping means, said control units being respectively arranged below said passage means in said folding table and between said conveyor and each including a photoelectric cell and a light source and also a transparent mirror and lens means, and reflector means respectively arranged above the said individual passage means.

2. An apparatus according to claim 1, in which an additional control means is provided in the region between each two adjacent individual clamping means and operable in response to movement of a laundry piece into the said region to cause actuation of both of said adjacent individual clamping means in response to the detection of a laundry piece by the control unit of either of the said clamping means.

3. An apparatus according to claim 1, in which at least some of the control units below the passage means in said table are adjustable in the direction of movement of said conveyor means and are arrestable in their respective adjusted position.

4. An apparatus according to claim 1, in which the control units below the passage means in said clamping means are individually adjustable in longitudinal direction of said table.

5. A folding apparatus for transversely folding laundry articles, which comprises: a folding table provided with passage means therethrough for the passage of light beams, a plurality of conveyor means arranged above said table and spaced from each other in transverse direction thereof for receiving and conveying laundry articles to be folded, said passage means in said table being spaced from each other in the direction of movement of said conveyor means, a plurality of clamping means respectively arranged above said conveyor means for temporarily grasping and holding the front portion of the laundry article to be folded, said clamping means also being provided with passage means therethrough for the passage of light beams, a plurality of control units associated with said clamping means and controllable by laundry articles on said conveyor means for controlling said clamping means, said control units being respectively arranged below said passage means in said folding table and between said conveyor means and including a photoelectric cell and a light source and also a transparent mirror and lens means, some of said passage means in said table being in alignment with the passage means in said clamping means, reflector means respectively arranged above the passage means in said table and in said clamping means, and nozzle means connectable to a supply of compressed air and respectively arranged near said clamping means for blowing air between folded portions of a laundry article held by said clamping means for blowing air into the folds.

6. An apparatus according to claim 1, in which the photoelectric cell and the light source as well as the transparent mirror and the lens means of each control unit is mounted in a single housing below the folding table.

References Cited in the file of this patent

UNITED STATES PATENTS

2,740,627	Woodward et al.	Apr. 3, 1956
2,811,350	Cran et al.	Oct. 29, 1957
2,949,294	Cran	Aug. 16, 1960
3,005,630	Bergman et al.	Oct. 24, 1961

FOREIGN PATENTS

706,093	Great Britain	Mar. 24, 1954