

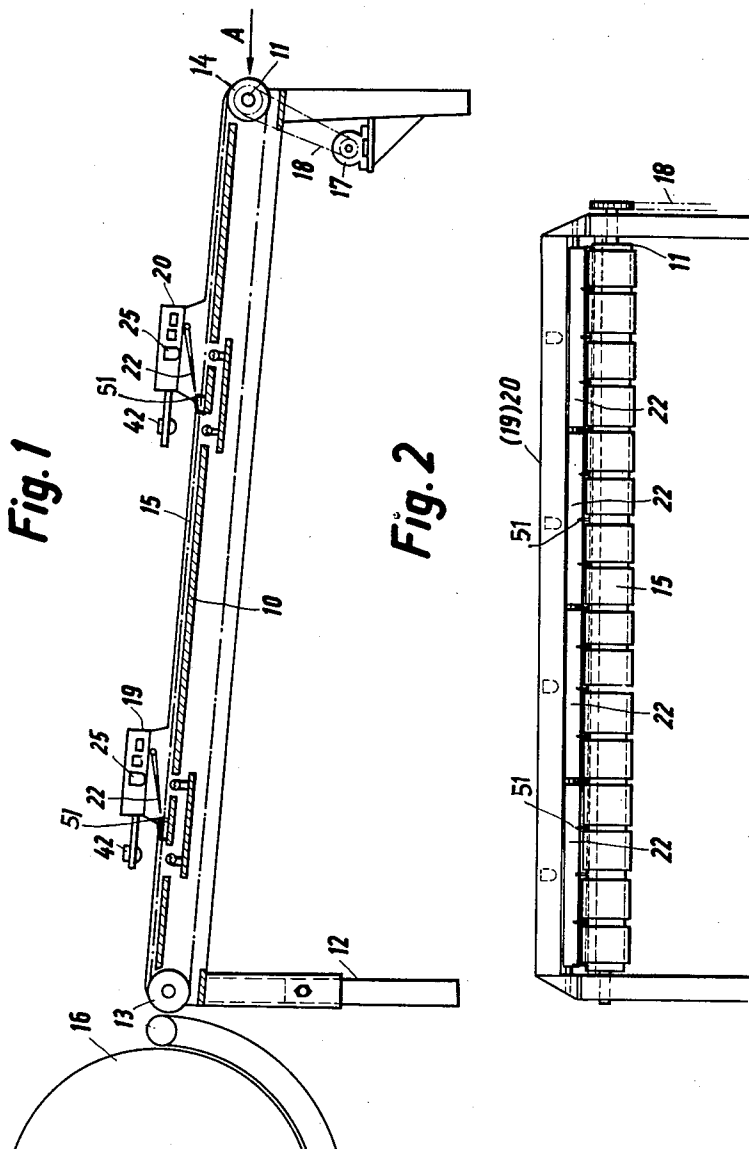
Feb. 26, 1963

E. JENSEN
FOLDING DEVICE FOR TRANSVERSE FOLDING LAUNDRY PIECES
BEHIND LAUNDRY MANGLES AND THE LIKE

3,079,143

Filed June 2, 1961

5 Sheets-Sheet 1



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Fig. 3

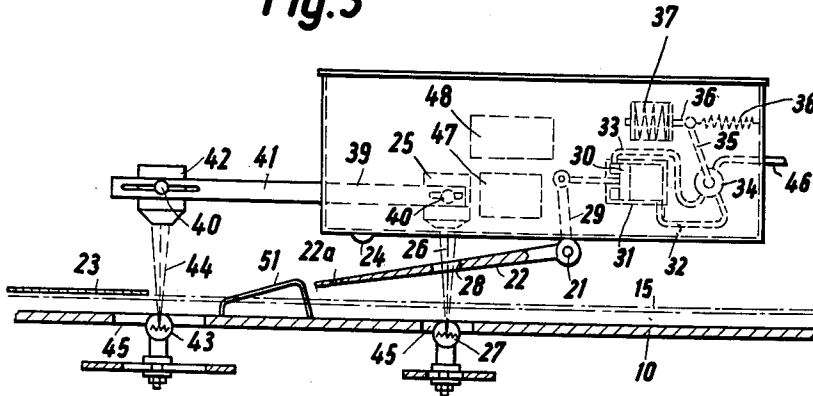


Fig. 4

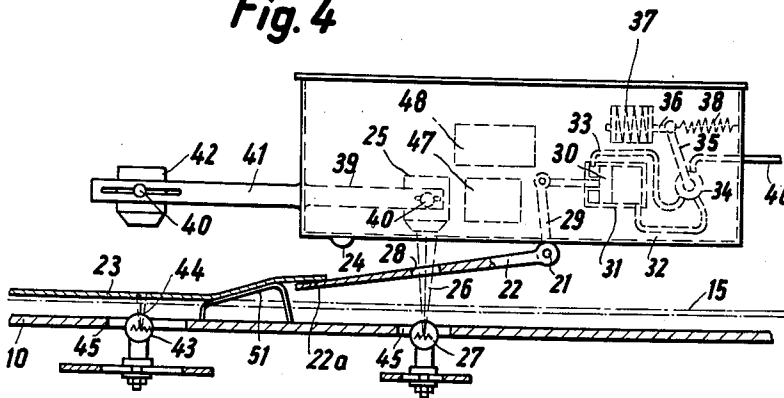
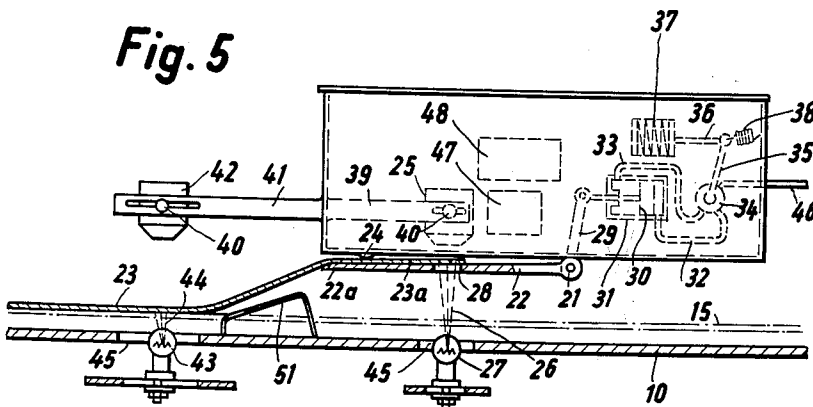


Fig. 5



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Fig. 7

Fig. 8

Fig. 8 is a detailed schematic diagram of a mechanical assembly, likely a valve actuator. The assembly consists of a main rectangular housing (30) containing internal components including a spring (36), a lever (34), and various linkages (33, 35, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48). The housing is mounted on a base (10) via two pivot points (26, 27). A long, thin rod (28) extends from the housing, passing through a series of guides (21, 22, 23, 24) and ending in a lever (25) that is pivoted at point 29. The lever (25) is connected to a spring (36) and a lever (34). The entire assembly is shown in a cross-sectional view, with various components labeled with numbers 1 through 52.

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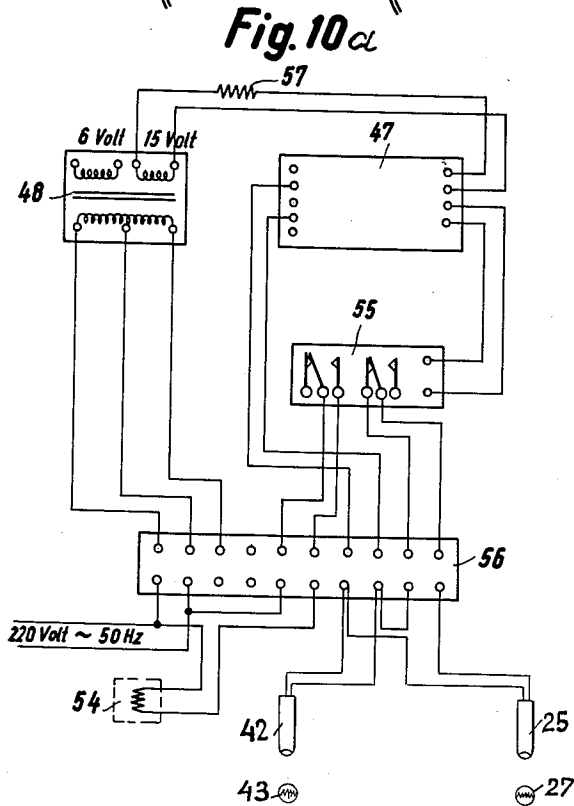
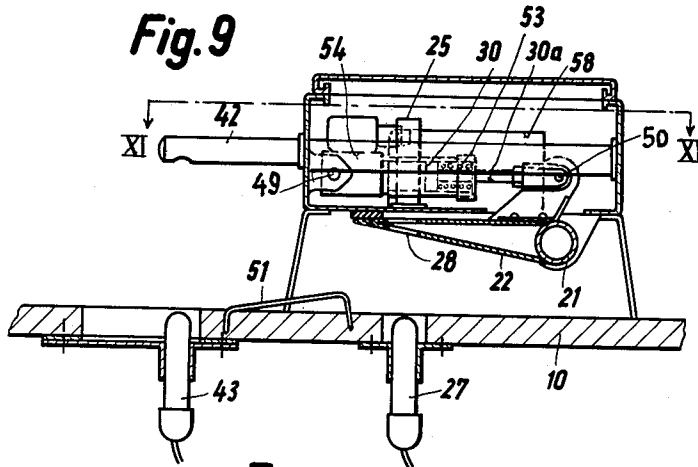
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Fig. 11

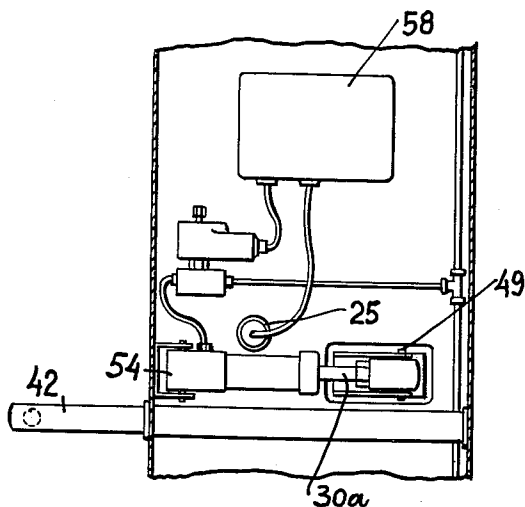
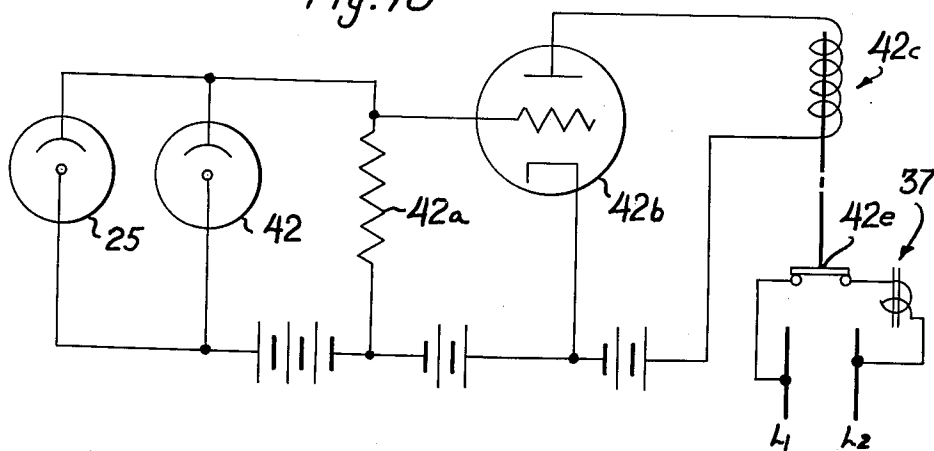


Fig. 10



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FOLDING DEVICE FOR TRANSVERSE FOLDING LAUNDRY PIECES BEHIND LAUNDRY MANGLES AND THE LIKE

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3 Claims. (Cl. 279-68)

The present invention concerns a folding device for transversely folding laundry pieces, especially bed sheets, towels, table cloths, and the like, in which above a folding table having conveying means arranged thereabove bridges are provided which extend transverse and above the said folding table and have movably connected thereto clamping plates for grasping and holding the folding edges of the laundry pieces. The laundry pieces are transversely folded during the advancing movement of said conveying means. Arrangements of this type are well known. In connection therewith it has been suggested to provide switch means preceding said clamping plates and to actuate electromagnets, or the like, by said switch means, which electromagnets cause the clamping plates to move into clamping or releasing position. To this end, tiltable switch lever means designed as keys are mounted ahead of said bridges and are adapted to actuate an electric contact. The movable clamping plates are actuated by electrical switch means, for instance, a lifting magnet, said lifting magnet being made effective by a separate contact lever.

With devices of this type, it has furthermore been suggested to effect the releasing movement with a time delay. To this end, a second lifting magnet which is made effective by a separate contact lever actuates a safety lever, which latter holds the clamping plates in clamping position.

It has furthermore been suggested to serially arrange a plurality of bridges with clamping plates in order to be able to fold the laundry piece in transverse direction a plurality of times.

According to a further suggestion, the switching on of a relay controlling the clamping plate is dependent on a photoelectric cell, but also, in this instance, the switching off of the circuit for purposes of disengaging the clamping plate is effected by means of a separate feeler or switch lever designed as key and mounted ahead of the bridge carrying the clamping device.

The first mentioned heretofore known device has the drawback that a second lifting magnet has to be provided for safeguarding the clamping plates, while, nevertheless, no proper folding of the laundry piece can be obtained in such a way that the starting and end edge of the laundry piece will, following the folding operation, be precisely aligned or be flush with each other. Moreover, with the just mentioned device, and also with other heretofore devices of the type outlined above, there exists the drawback that, by employing a switch lever in form of a key, a friction is exerted upon the laundry piece, which friction is all the more greater the thicker the laundry piece is.

In order to avoid this drawback, attempts have been made to make the switching arrangement elastic.

A further drawback of the above mentioned devices consists in that the distance between the first switching means preceding the switch bridge and the second switching means is not variable. In other words, it is not possible to adjust the device in such a manner that the protruding end piece corresponds to the clamped-in starting piece of the laundry piece. It was rather necessary to provide additional safety levers which had to be actuated electrically and required a third switch lever in

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order to release the laundry piece after disengaging the clamping device when the end edge of the folded laundry piece moves into the neighborhood of the clamped-in starting edge. However, also, such a device has the drawback that control is not possible or that, also, a precise folding of the starting and end edge above each other cannot be obtained.

It is, therefore, an object of the present invention to provide a folding device of the type set forth above, which will make it possible to fold a laundry piece in such a way that the starting and end edges will be precisely one above the other without causing any undue friction on the laundry piece.

It is a further object of this invention to provide a folding device as set forth in the preceding paragraph, in which no separate switch means will be necessary for delaying the initiation of the clamping plates and in which no separate switches are necessary.

It is a further object of this invention to provide a folding device as set forth above, in which any irregularities which might occur during operation of the folding device can easily be corrected.

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 illustrates in side view, partly in section, a folding device according to the present invention with a plurality of folding bridges including the folding mechanism and with conveyor belts.

FIG. 2 is a front view of the apparatus shown in FIG. 1 and seen in the direction of the arrow A.

FIGS. 3 to 8 diagrammatically illustrate on a larger scale than FIGS. 1 and 2 the feed electric control with solenoid and relay in various phases of folding a laundry piece.

FIG. 9 illustrates, partly in section, a different embodiment of the pressure cylinder while employing a magnetic valve, and

FIG. 10 is a simplified control circuit for use in connection with the present invention.

FIG. 10a represents another electric diagram as it may be used in connection with a folding apparatus according to the present invention.

FIG. 11 is a section along the line XI—XI of FIG. 9.

General Arrangement

The apparatus according to the present invention is characterized primarily in that, for purposes of controlling the solenoid or relay which, in its turn, controls the upward and downward movement of the clamping plate by actuating a valve for the delivery of a pressure fluid to a pressure cylinder, two photoelectric cells are provided in combination with an amplifier and transformer. The arrangement is such that one of said photoelectric cells precedes the clamping plate, whereas the other photoelectric cell is located behind the front edge of the clamping plate when looking in the feeding direction for the laundry piece.

According to a further feature of the invention, the clamping plate when occupying its lower position has its front edge located at a distance above the conveyor belts of the folding table, said distance corresponding approximately to the height of the laundry piece to be folded. Furthermore, ahead of the clamping plate, there is provided a plurality of guiding means or wire yokes, the path of which ends along an incline, whereby the laundry piece is lifted and the released clamping plate is advanced.

Another feature of the present invention consists in that the photoelectric cell for actuating the clamping plate in clamping position is arranged within the range

of the clamping plate in such a way that the solenoid or relay for actuating the clamping plate in clamping position will respond only after the laundry piece has been sufficiently advanced in view of the interruption of the light beam.

According to a further development of the invention, the photoelectric cells are adjustable in the advancing direction of the laundry piece.

Structural Arrangement

Referring now to the drawings in detail, the apparatus shown therein comprises a folding table 10 which may be arranged, for instance, behind a laundry mangle 16 in such a way that the laundry pieces leaving said mangle 16 drop onto the conveyor belts 15. The drive of the conveyor belts 15 may be effected in any desired manner, for instance, by means of a motor 17 and an endless belt 18.

Above the folding table 10 in spaced arrangement thereof and transverse above said table, there are provided box-shaped bridges 19, 20 which are advantageously provided with tiltable lids carrying the folding mechanism. This folding mechanism is shown on a somewhat larger scale in FIGS. 3 to 8.

Below the bridge 19 a plurality of clamping plates 22 tiltable about bolts 21 are provided one adjacent the other one. The front edge 22a of said clamping plates 22 faces toward the feeding direction of the laundry piece 23. The bridge box is furthermore provided with a plurality of abutments 24 for the clamping plates 22. These abutments are preferably made of an elastic material of any desired type as, for instance, rubber.

Behind the front edge 22a of each clamping plate 22 there is provided a photoelectric cell 25 adapted to be controlled by a light beam 26 of a light source 27 arranged below the table 10. The clamping plate 22 is provided with a preferably longitudinal or oval opening 28 for the light beam 26.

The clamping plate 22 is, by means of an arm 29, linked to the connecting rod of a piston 30 to a pressure fluid cylinder 31. Piston 30 is adapted to be actuated by means of a pressure fluid as, for instance, compressed air, and may be reciprocated in its cylinder 31. To this end, conduits 32, 33 are provided which are, for instance, controlled by a multiway valve 34. The actuating lever 35 of valve 34 is connected to a displaceable core 36 of a solenoid 37 and is spring-biased by a spring 38.

The photoelectric cell 25 is arranged within the bridge-box which may be open at the bottom and is longitudinally displaceable for instance on a rod 39 in feeding direction of the laundry piece 23 while being arrestable for instance by means of an adjusting screw 40.

In front of the switch bridge there is advantageously provided a second photoelectric cell 42 which is likewise displaceable on a rod 41 in feeding direction and may be arrested by means of an adjusting screw 40. Also this photoelectric cell 42 is affected by a light beam 44 of a light source 43 arranged below the table 10.

The table 10 is provided with apertures 45 for permitting the light beams of the two light sources 24 and 43 to pass therethrough.

In disengaging position, i.e. when the clamping plate 22 is moved downwardly, the front edge 22a is adjusted at such distance from the conveyor belts 14 that the laundry piece 23 after having been placed upon the clamping plate 22 can still be advanced below the clamping plate 22 by the conveyor belts 15.

The position of the solenoid 37 for actuating the valve 34 which for instance may be connected to a compressed air conduit 46 is effected through the intervention of an amplifier 48 by means of the two photoelectric cells 25 and 42. Of these photoelectric cells, the cell 42 is arranged ahead of the clamping plate 22, whereas the photoelectric cell 25 is arranged behind the front edge 22a when looking in the feeding direction for the laundry piece. The circuit

has been omitted in the drawing for purposes of clarity.

Ahead of the clamping plates 22 there is provided a plurality of inclined guiding means 51, for instance wire yokes, by means of which the advanced laundry pieces are lifted and are conveyed to the released clamping plate 22, i.e. to the downwardly folded clamping plates. These guiding means 51 are arranged on the table 10, preferably between the conveyor belts 15.

The photoelectric cell 25 is arranged within the range of the clamping plate 22, i.e. at a sufficient distance behind the front edge 22a so that the solenoid 37 for moving the clamping plate 22 into clamping position will become effective by an interruption of the light beam only after the laundry piece 23 has been sufficiently advanced.

As will be evident from the drawing, two folding bridges 19 and 20 may be arranged in series. It would also be possible to add thereto a further folding bridge above the folding table if the latter is sufficiently long.

In conformity with the present invention, when employing a plurality of folding bridges above the folding table, each bridge is detachable individually from the table and, if desired, is exchangeable. Each folding bridge is equipped with a number of clamping plates and the abutments pertaining thereto as well as the pressure means and photoelectric cells.

The arrangement operates in the following manner: FIG. 3 illustrates the laundry piece 23 as having been moved by conveyor belt 15 up to the light beam 44. The clamping plate 22 is in its released position, in other words, is folded downwardly. This was effected by causing the photoelectric cell 42 to actuate solenoid 37 in such a way that against the thrust of spring 38 the actuating lever 35 moves into the position shown in the drawing. Valve 34 then opens the pressure fluid conduit 32 so that the piston 30 in pressure cylinder 31 moves toward the left. Also the photoelectric cell 25 is in this instance effective.

If now in conformity with the showing of FIG. 4 the laundry piece 23 is further advanced, its front edge will through the intervention of the guiding means 51 move onto the clamping plate 22. While now the light beam 44 is interrupted, the light beam 26 for the photoelectric cell 25 is not yet interrupted so that the clamping plate 22 remains in its released position.

FIG. 5 shows the laundry piece 23 advanced to such an extent that also the light beam 26 for the photoelectric cell 25 is interrupted. The solenoid 37 is de-energized and the shift lever 35 will by means of spring 38 shift valve 34 over so that now compressed air will pass through conduit 46 and conduit 33 to the other piston side of the pressure cylinder 31. The clamping plate 22 will now be tilted upwardly and the laundry piece 23 will be clamped in.

During the further advance of the laundry piece 23 the latter will be rolled in conformity with FIG. 6 while forming a fold 52.

When the end edge 23b has been advanced to such an extent that the light source 43 is able through the light beam 44 to act upon the photoelectric cell 42, the solenoid 37 will be energized and valve 34 will be shifted over so that conduit 32 acts upon piston 30 in such a way that the clamping plate 22 will be tilted downwardly whereby the laundry piece 23 will be released (see FIG. 7).

The photoelectric cell 42 is spaced from the photoelectric cell 25 by such a distance that the edge 23a of the laundry piece placed upon clamping plate 22 and clamped in by the latter will be located precisely over the edge 23b at the end of the laundry piece (see FIG. 8).

Due to the fact that the photoelectric cells are longitudinally displaceable, it is possible to precisely adjust the length of the protruding laundry pieces at the start and end of the laundry piece. For instance for this purpose the photoelectric cell 42 may be displaceable by approxi-

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mately 155 millimeters in the longitudinal direction of the folding table 10. For purposes of a precise adjustment, also the photoelectric cell 25 is displaceable to a certain extent. Also the light sources 27, 43 are displaceable upon table 10 in longitudinal direction of said table so that they can be precisely adjusted with regard to the photoelectric cells 25, 42.

FIG. 9 illustrates a similar device with the sole difference that a compressed air cylinder 31 with a piston 30 is rotatable about a bolt 49, whereas the piston rod 30a with joint 50 is connected to the clamping plate 22. With this arrangement, the piston 30 is under the effect of a spring 53. This piston is adapted to be actuated by compressed air through the intervention of a magnetic valve 54. Pressure cylinder 31 and magnetic valve 54 may be arranged coaxially with regard to each other. The photoelectric cell 25 above the clamping plate 22 is in this instance located adjacent the pressure cylinder 30. In addition thereto, an additional relay 58 is provided.

FIG. 10 shows a simplified control circuit for use in connection with the present invention. More specifically, in the said circuit of FIG. 10, the photoelectric cells 25 and 42 are connected in parallel so that the current from either one or from both will be impressed across biasing resistor 42a thereby to bias tube 42b to conduct. When tube 42b conducts, relay 42c is energized thereby opening its blade 42e. When blade 42e opens, the circuit from main line L₁ to main line L₂ through the solenoid 37 is interrupted. When relay 42c is deenergized, blade 42a drops and closes the circuit from L₁ to L₂ thereby energizing solenoid 37.

More specifically, with reference to FIGS. 3 and 5, it will thus be seen that in the position of the parts of FIG. 3 the light from the light source 43 hits the photoelectric cell 42, while the light from the light source 27 hits the photoelectric cell 25. Consequently, a current will be impressed across the biasing resistor 42a to bias tube 42b to conduct and therefore relay 42c is energized and blade 42e is lifted. In the position of FIG. 4 the sheet to be folded has passed over the light source 43 so that the photoelectric cell 42 is dark, whereas the light source 42 still throws its light beam onto photoelectric cell 25. Therefore, since the photoelectric cells 25 and 42 are arranged in parallel, it is of no consequence that the photoelectric cell 25 is dark. In other words, solenoid 42 still remains energized and blade 42 still remains in lifted position.

Now referring to FIG. 5 it will be seen that the material has also passed between the light source 27 and photoelectric cell 25 so that also photoelectric cell 25, in addition to the photoelectric cell 42 is dark, with the result that relay 42c is deenergized and blade 42e drops into its closing position for the circuit L₁—37—L₂. The energization of the solenoid 37 will then tilt the lever 22 about its pivot 21 into the position shown in FIG. 5, thereby clamping the respective section of the material between lever 22 and abutment 24.

Consequently, the oncoming further material will then take the course shown in FIG. 6 with the result that the material is folded as intended. As soon as the fold has been completed where desired, the front end of the material will move out between the light source 43 and the photoelectric cell 42. At the instant this occurs, a current through photoelectric cell 42 is impressed across biasing resistor 42a upon tube 42b so that relay 42c is again energized and blade 42e is lifted off thereby interrupting the energizing circuit for solenoid 37. As a result thereof lever 22 drops as shown in FIG. 8 so that the fold or crease in the folded material will remain where it was in FIG. 2 while merely the upper end of the material between lever 22 and abutment 24 will now slip out during the further advancement of the folded material.

FIG. 10a shows by way of example another control circuit comprising a transformer 48, an amplifier 47, a

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separate control relay 55, a magnetic valve 54, terminals 56, and a fuse 57.

Sometimes it occurs that when the clamping plate 22 is moved upwardly, the laundry pieces 23 will be pulled back to a certain extent so that the light beam 26 again passes to the photoelectric cell 25. If this occurs, the clamping plate 22 would naturally begin to flutter. In order to prevent such a situation, there is, in conformity with the present invention, provided a retarding relay for the photoelectric cell 25. In this way, the clamping plate 22 will once the photoelectric cell 25 has been darkened, remain in its upper position until the next impulse is initiated by the photoelectric cell 42. The great adjustability of the photoelectric cell 42 is necessary only for the adjustment in order to adapt the same to the speed of the conveyor. The adjustability of the photoelectric cell 25 is necessary only for the length of movement on the clamping plate 22. Therefore, an adjustability over a short distance of 30 millimeters will suffice in this instance.

The folding table and the bridges may have such a width that for instance two large bed sheets may be folded simultaneously one adjacent the other. Behind the table there is provided a second folding table not shown in the drawing where an operator may fold the laundry pieces once more in longitudinal direction.

The arrangement according to the present invention makes it possible to fold simultaneously laundry pieces of different sizes, for instance on one section of said device large bed sheets or the like may be folded whereas on the other section of the device smaller pieces, such as towels, napkins, pillow cases, or the like may be folded.

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

What I claim is:

1. In a folding apparatus for transversely folding laundry pieces: a folding table, conveyor means supported by said table for receiving the laundry piece to be folded and advancing the same, clamping means arranged above said conveyor means for grasping and temporarily holding the front edge of the laundry piece to be folded, said clamping means including a clamping plate movable from a lower non-clamping position into an upper clamping position and vice versa, said clamping plate having a front edge pointing in a direction opposite to the advancing direction of a laundry piece on said conveyor means, a plurality of inclined guiding means arranged laterally of said conveyor means and in front of said clamping plate, the uppermost point of said inclined guiding means substantially corresponding to the level of said front edge when said clamping plate occupies said lower position, pressure fluid cylinder piston means operatively connected to said clamping plate for controlling the movement thereof, valve means associated with said cylinder piston means for controlling the supply of pressure fluid to and from said cylinder piston means, electric control means for controlling said valve means, said electric control means including two photoelectric cells, one of said photoelectric cells being arranged ahead of said clamping plate, the other one of said photoelectric cells being located behind the front edge of said clamping plate, and a source of light for each photoelectric cell arranged in spaced relation to said cells on the opposite side of the path of pieces to be folded therefrom, said clamping plate in the region of said other photoelectric cell being provided with a passage to permit a light beam to pass therethrough when said passage is not covered up by a laundry piece.

2. A folding apparatus according to claim 1, in which said electric control means includes relay means for actuating said valve means, said relay means being operable in response to the interruption of a light beam through said clamping plate by a laundry piece.

3. In a folding apparatus for transversely folding laundry pieces: a folding table, a plurality of conveyor means arranged alongside each other with a slight gap therebetween, said conveyor means being supported by said table for receiving the laundry piece to be folded and feeding the same, clamping means including a clamping plate arranged above said conveyor means for grasping and temporarily holding the front edge of the laundry piece to be folded, said clamping plate having a passage therethrough and being movable from a lower non-clamping position into an upper clamping position and vice versa, inclined guiding means arranged in said gaps in front of said clamping plate when looking in feeding direction to thereby move a laundry piece on said conveyor means up to the clamping plate when the latter occupies its lower position, actuating means operatively connected to said clamping plate for actuating the same, electric control means controlling said actuating means and comprising a first photoelectric cell and a first light

source for sending a light beam to said first photoelectric cell, said first light source and said first photoelectric cell being arranged ahead of said guiding means when looking in feeding direction, said first light source being adapted to pass a light beam through said gap, and a second photoelectric cell and a second light source for sending a light beam to said second photoelectric cell through said passage, said first and second photoelectric cells and the light sources pertaining thereto being adjustable in longitudinal direction of said conveyor means.

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