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Knappe et al.

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[54] **A PROCESS FOR FOLDING SHIRTS OR SIMILAR ARTICLES OF CLOTHING FOR PACKING**

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Nov. 22, 1973 Germany 2358175

[52] **U.S. Cl.** **223/37**
[51] **Int. Cl.** **A41h 33/00**
[58] **Field of Search** 223/37, 1, 2

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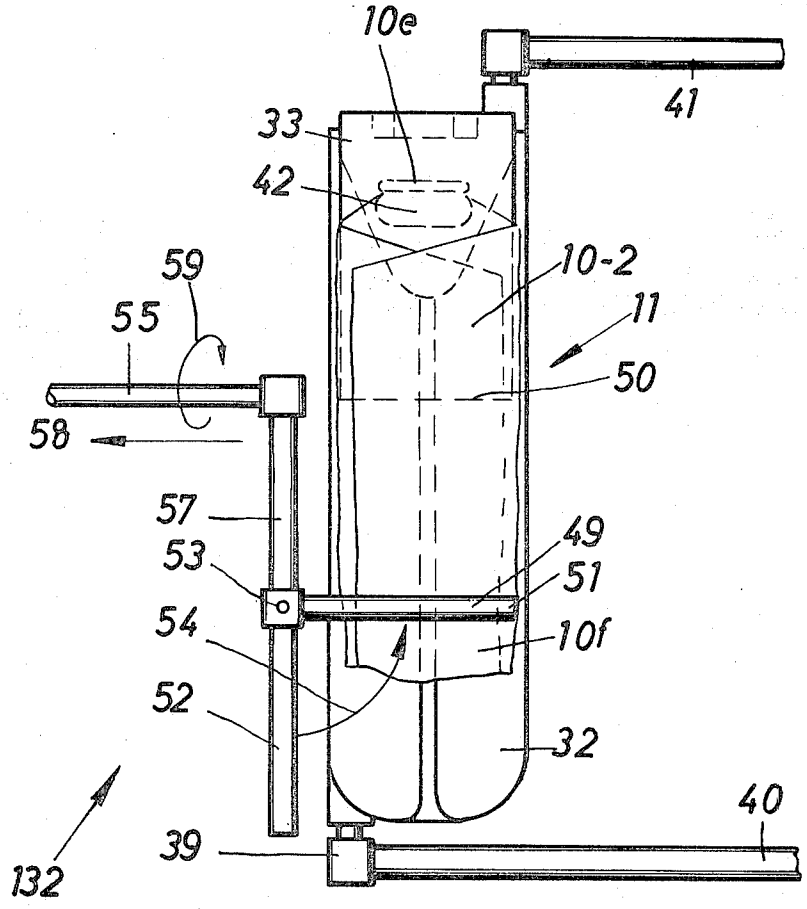
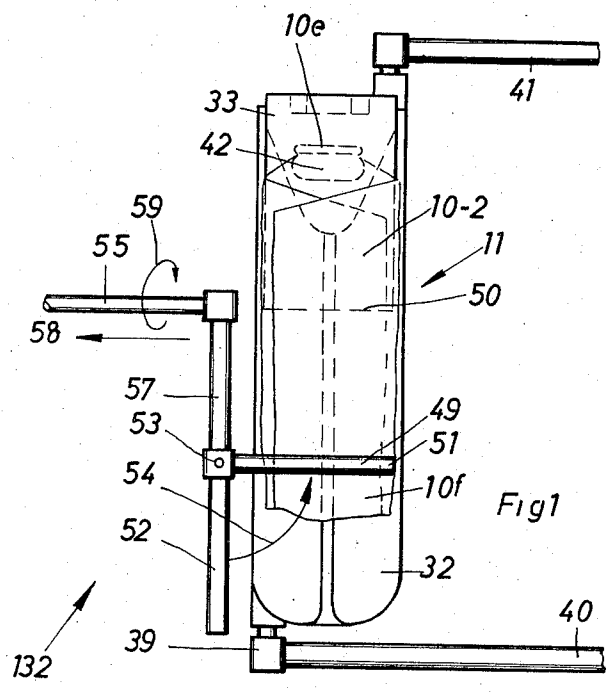
Primary Examiner—Geo. V. Larkin
Attorney, Agent, or Firm—Sughrue, Rothwell, Mion, Zinn & Macpeak

[57] **ABSTRACT**

A shirt, side-folded about a cardboard insert extending almost half way down the shirt length, is positioned, front side down, on a folding table (**32**). A clamping arm (**51**) then bears down on and holds the lower part of the shirt, the shirt tails (**10f**) are blown over the arm (**51**) toward the collar, and a second clamping arm (**52**) swings over the arm (**51**) to grip the shirt at this lower fold line (**49**). The clamping arms are then rotated about axis (**55**) in the direction of arrow (**59**) to double the shirt back about a middle fold line (**50**). A clamping device (**129**) then moves into position, and its elements (**126**), (**127**) press down on the fold line (**49**) while the arms (**51**), (**52**) are withdrawn and holding clips (**101**) are inserted.

5 Claims, 6 Drawing Figures




10e
41
33
42
59
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10-2
11
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10f
52
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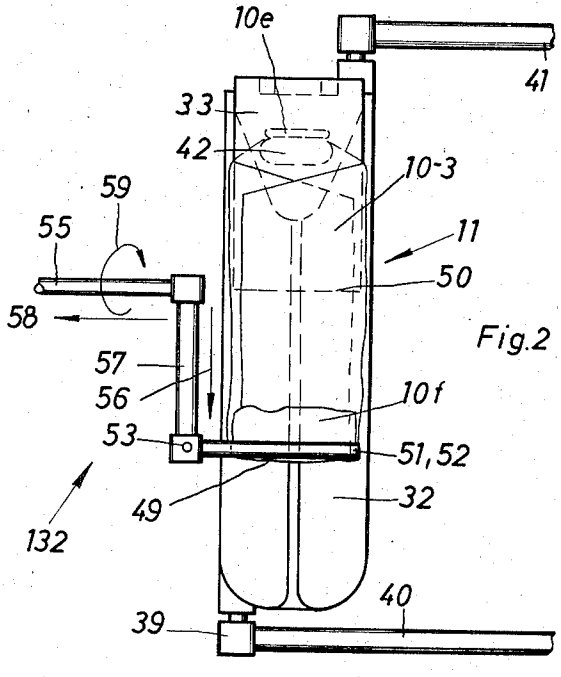
39
132

Fig1


10e
41
33
42
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10-3
11
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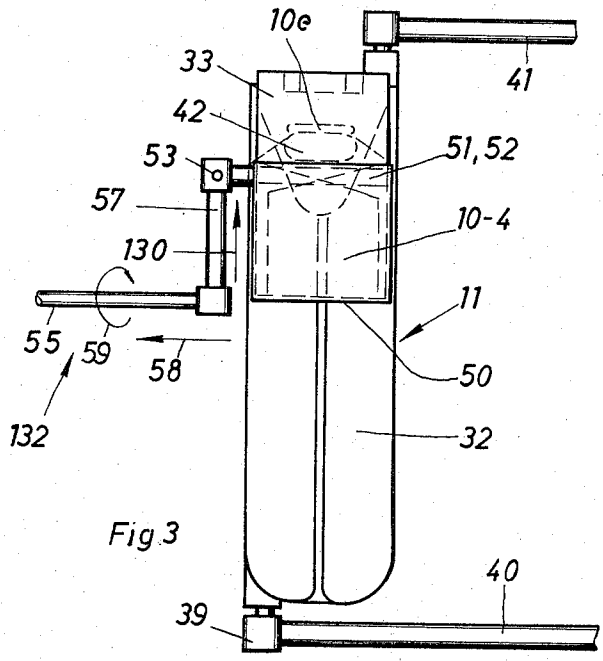
10f
53
51,52
49
32
132
40
39

Fig.2


10e
33
42
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130
55
59
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132
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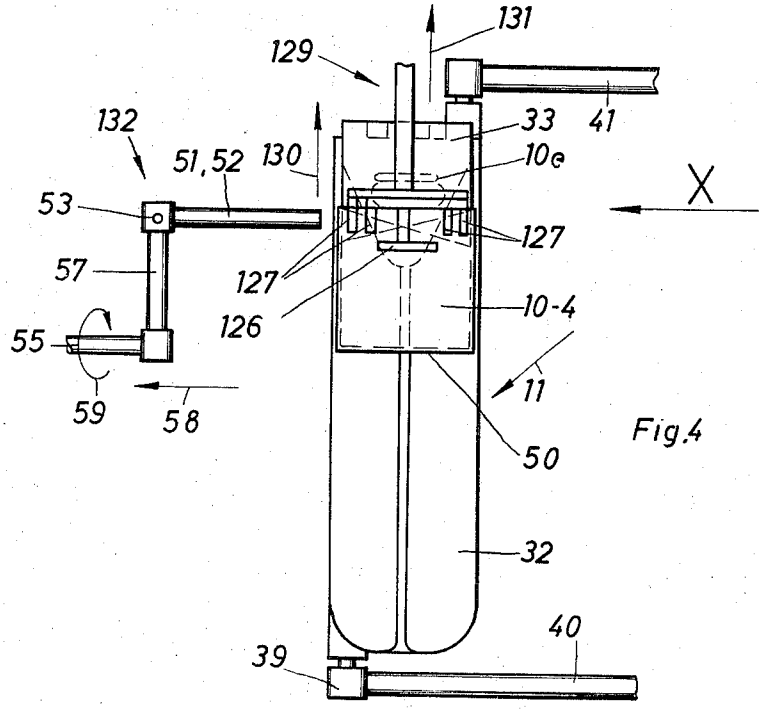
51,52
10-4
11
50
32
40
39

Fig 3


131
129
132
51,52
130
53
57
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59
58
127
126
33
41
10e
X
10-4
11
50
32
40
39

Fig.4

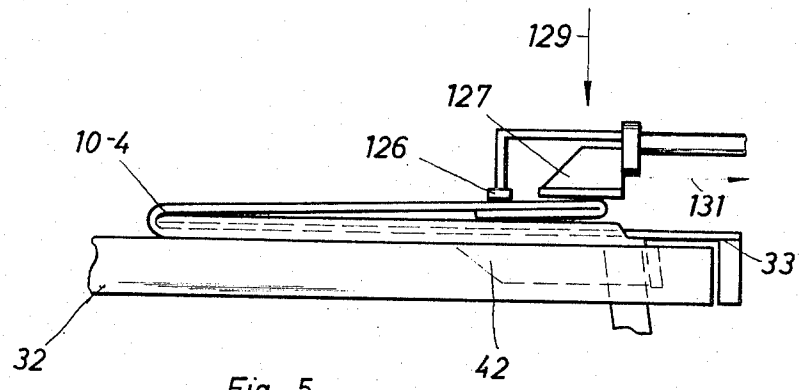

Fig. 5

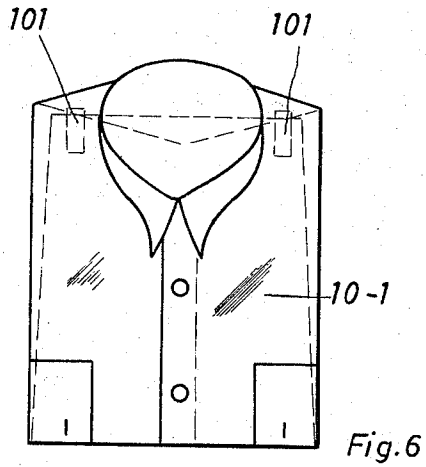

Fig. 6

A PROCESS FOR FOLDING SHIRTS OR SIMILAR ARTICLES OF CLOTHING FOR PACKING

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a process for folding shirts or similar articles of clothing for packing by means of a device wherein a plurality of folding devices are mounted for synchronized rotation and each shirt or similar article of clothing placed on the table plates of the same is folded in the course of its step-by-step processing about a pasteboard insert and prevented from falling apart.

2. Description of the Prior Art

The German OS No. 1 760 429 discloses a process for folding and more particularly for preparing shirts or similar articles of clothing for packing which is characterized essentially in that the folding and more particularly the preparation of a shirt for packing takes place in a plurality of folding and preparation steps, preferably of equal duration, and in that each folding and preparation stage is effected in a specific station.

In the embodiment of a device for effecting the above process which is described in the German OS No. 1 760 429 a plurality of folding devices are used in the manner they are normally used as individual folding devices for the manual folding and preparation of shirts for packing, but are adapted to rotate in synchronism. Consequently, the only essential folding and preparation elements which the folding devices comprise are a collar clamping and retaining device and a folding plate about which the shirts to be folded and prepared for packing are folded inserting a pasteboard liner. The folding and preparation of the shirts for packing during the synchronized rotation of the folding devices thus takes place largely manually, five stations with one operator located at each being provided for this purpose.

In the German OS No. 1 760 429 it is further stated with regard to the above-mentioned embodiment that the folding devices of the apparatus can also operate in a known manner more or less fully mechanically, namely as a part of the so-called individual folding devices.

The individual folding device for the mechanical folding of a shirt which is folded both lengthwise and crosswise is described in German OS No. 1 460 823. However, in common with the other known individual folding devices permitting mechanical lengthwise and crosswise folding, this individual folding device does not possess a table plate on which the operator of this folding device can lay the shirt to be folded in its entire length. In the case of this individual folding device the shirt is placed on the folding plate of the same and as a result the lower part of the shirt hangs down below. The shirt folding process proposed on the basis of this technical content is suitable for use in laundries but not for clothing manufacturers, i.e., firms which produce shirts or similar articles of clothing for retail purposes and consequently must pack them in a suitable form for the consumer.

Individual folding devices for mechanically folding a shirt or similar article of clothing in both longitudinal and transverse directions and which cater to the requirements of clothing maufacturers are not known. Only individual folding devices permitting at most the longitudinal folding of a shirt placed on a table plate are known, for example, according to the German GM

No. 1 934 623. There is no device and consequently no process for mechanically folding in a transverse direction a shirt or similar article of clothing placed on a table plate and already folded in a longitudinal direction in a manner which caters to the requirements of clothing manufacturers.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a process with which it is possible within the framework of the process mentioned initially to cater to clothing manufacturers and to mechanically fold crosswise, that is, to complete the folding for the retail market of shirts and similar articles of clothing already folded lengthwise and arranged on the table plates of folding devices rotating in a synchronized manner.

The process according to the invention is characterized in that the shirt arranged on the table plate of the device, having already been folded lengthwise, is clamped to the table plate at a distance which is approximately twice as great as the cross-folded size of the folded shirt — measured from the upper collar piece, the part of the lengthwise folded shirt projecting beyond the clamping point is folded over the clamping point in the direction of the collar piece and then also clamped at the above-mentioned clamping point.

This process enables a shirt or similar article of clothing which has already been folded lengthwise and which is arranged on a folding device rotating in a synchronized manner to be folded once crosswise in an advantageous manner by means of folding elements known in themselves for example, folding rods and/or an air-blower and to be manipulated in such a way that the second transverse fold of the same can also be provided mechanically in an advantageous manner.

A further development of the process according to the invention consists in smoothing in the direction of the collar piece the part of the lengthwise folded shirt projecting beyond the clamping point at its fold point after it has been folded and before and/or while it is being clamped. This development of the process according to the invention is advantageous because it prevents the part of the lengthwise folded shirt which is folded crosswise over the clamping point from being folded again without correction of a not quite perfect fold.

It is also advantageous for the part of the shirt which has been folded lengthwise and approximately double and which is arranged on the table plate to be stretched in a longitudinal direction before and/or while it is being folded again. This development of the process according to the invention is advantageous, inter alia, because it eliminates folds produced during the longitudinal folding process and first transverse folding operation.

It is also advantageous if that part of the lengthwise and twice crosswise folded shirt which is folded in the direction of the collar piece at the second transverse fold point is stretched in the direction of the collar piece by elements of a stretching and clamping device which are pressed onto the fold edge and/or adjacent parts formed at the point of the first transverse fold and located in the region of the lengthwise folded shoulder parts of the shirt and which are then moved in the direction of the arrow **131**. This development of the process according to the invention is advantageous, inter

alia, because creases produced in the course of the second transverse folding operation are eliminated.

It is also advantageous if the elements of the stretching and clamping device grip the fold edge and/or adjacent parts of the shirt until these parts are prevented from falling apart, for example, by the mechanical pressing of clips onto these parts and onto the lengthwise folded shoulder parts of the shirt located below these parts. The mechanical fastening or inserting of the clips is an advantage, inter alia, not only because this is possible but also because it can be effected without adversely affecting the quality of folding and preparation obtained hitherto.

The process comprising all the above-mentioned features, in the first instance, enables a shirt of similar article of clothing already folded in a lengthwise direction and arranged on the table plate of a folding device rotating in a synchronized manner to be mechanically folded and packed attractively for sale, that is rapidly and in conformity with the requirements of clothing manufacturers and with uniform folding and preparation quality.

Other objects, features and advantages of the process according to the invention will be made apparent from the following detailed description of an embodiment of a novel and especially advantageous device for the mechanical transverse folding of shirts or similar articles of clothing which is represented diagrammatically in the accompanying drawings in combination with an embodiment of a device according to patent application Ser. No. 440,610 filed Feb. 7, 1974 in the names of Martin Kannegiesser and Heinrich Knappe and entitled "Apparatus For Folding And More Particularly For Preparing Shirts and Similar Articles of Clothing."

The stretching and clamping device represented diagrammatically in the drawings is also novel and advantageous.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of the above-mentioned devices showing a lengthwise folded shirt arranged on the table plate of the folding device of the same and clamped on this table plate at a distance which is approximately twice as great as the cross folded size of the folded shirt.

FIG. 2 shows a plan view according to FIG. 1 — but after the first transverse folding of the lengthwise folded shirt and the renewed clamping of the same at the first transverse fold point.

FIG. 3 is a plan view according to FIGS. 1 and 2 after the second transverse fold has been made.

FIG. 4 is a plan view according to FIG. 3 showing a different view of the folding elements and a view of the stretching and clamping device.

FIG. 5 is an enlarged scale view in the direction of the arrow "X" in FIG. 4.

FIG. 6 is an enlarged scale view of a folded shirt which is prevented from falling apart by means of clips. The reference numbers in the drawings relate to the following:

10-1 = Shirt (folded and prepared for packing)
10-2 = Shirt (folded lengthwise)
10-3 = Shirt (folded lengthwise and once in a transverse direction)
10-4 = Shirt (folded lengthwise and twice crosswise)
10*e* = Collar piece (upper) of **10-2** to **10-4**
10*f* = Part (lower end) of **10-2** and **10-3**
11 = Folding device
32 = Table plate
33 = Folding plate
39 = Frame
40 = End of the arm of a turnstile
41 = End of the arm of a turnstile
42 = Collar gripping and clamping device
49 = First transverse fold
50 = Second transverse fold
51 = Clamping bar
52 = Clamping bar
53 = Swivel axis of **52**
54 = Arrow (direction of movement of **52**)
55 = Swivel and displacement axis of **57**
56 = Arrow (stretching direction of **10-3**)
57 = Swivel arm
58 = Arrow (direction of displacement of **57** and **132**)
59 = Arrow (pivoting direction of **57**)
101 = Clips
126, 127 = Elements of **129**
129 = Stretching and clamping device
130 = Arrow (stretching direction of a part of **10-4**)
131 = Arrow (direction of displacement of **129**)
132 = Transverse folding device

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The part of a station represented in FIG. 1 for the mechanical transverse folding of a shirt **10-2** already folded lengthwise about a folding plate **33** with insertion of a pasteboard liner and arranged on the table plate **32** of a folding device rotating in a synchronized manner is provided with a transverse folding device **132** comprising, in particular, two clamping bars **51**, 52, adapted to be moved in a plurality of directions.

The clamping bars **51, 52** are capable of moving in a plurality of directions because they are secured to a swivel arm **57** which is adapted to be moved by way of the swivel and displacement axis **55** about 180° in the direction of the arrow **59** and back again in the direction of the arrow **58.** The drive elements for the swivel and displacement axis **55** are not shown in the drawings.

The movement of the clamping bars **51, 52,** in the direction of the arrow **58** and back again by way of the swivel and displacement axis **55** may be totally or partially eliminated if the entire transverse folding device **132** is adapted to move in the direction of the arrow **55** and to return to its starting position. This can be effected by means of known drive and guide elements which are not shown in the drawings.

The clamping bar **52** is also adapted to swivel in the direction of arrow **54** about the swivel axis **53** and to return to its initial position. It is also vertically displaceable on the swivel axis **53.** The necessary means for this are not represented in the drawings.

The clamping bars **51, 52,** are also mounted on the swivel arm **57** by way of means not represented in the drawings but which are known in themselves. They are mounted in such a way as to be mobile in the longitudinal direction of the swivel arm.

The table plate **32** of the folding device **11** which rotates in a synchronized manner is secured to a frame **39** which is arranged at its two front sides on the ends of the arms **40, 41** of two multi-armed turnstiles which are not shown in the drawings. The two multi-armed turn-

stiles are arranged adjacent to each other with mutual spacing and are adapted to rotate in a synchronized manner about two horizontal axes staggered with respect to each other.

The table plate **32** of the folding device **11** also comprises a collar gripping and clamping device **42.**

The stretching and clamping device **129** comprises an element **126** and four elements **127** adapted to press onto the fold edge and its adjacent parts formed at its first transverse fold point **49** in the region of the lengthwise folded shoulder parts of the shirt **10-4** (FIGS. **4** and **5**).

Two of the four elements **127** are always arranged adjacent to each other spaced slightly apart. The aforementioned distance between the two elements **127** is such that after they have been pressed onto the abovementioned fold edge of the shirt **10-4,** a clip **101** can be mechanically pushed between these elements **127** onto the fold edge and the parts of the shirt **10-4** located directly therebeneath without adversely affecting the folding quality. The position of the clips **101** on the folded and prepared shirt **10-1** is shown in FIG. **6.**

The method of operation of the transverse folding device **132** and the stretching and clamping device **129** shown in FIGS. **1 – 5,** and thus the essential course of procedure is the following:

For the transverse folding of the shirt **10-2** located on the table plate **32** of the folding device **11** and already folded lengthwise about the folding plate **33** with insertion of a pasteboard liner, the transverse folding device **132** is moved from a position outside the path of rotation of the folding device **11** into a position according to FIG. **1** and then the clamping bar **51** of the same is pressed at the point of the first transverse fold **49** onto the lengthwise folded shirt **10-2.** Immediately thereafter, the part **10***f* or the lower end of the lengthwise folded shirt **10-2** projecting beyond the clamping points is folded by means of known folding elements which are not represented, preferably by means of an air blowing device, over the clamping point in the direction of the collar piece **10***e*. When this has been effected, the clamping bar **52** is moved in the direction of the arrow **54** (FIG. **1**) about the swivel axis **53** until it is situated above the clamping bar **51** including the part **10***f* of the shirt **10-2** (FIG. **2**). As the clamping bar **52** is pressed onto the first transverse fold point **49** it smooths that paart of the lengthwise and once transversely folded shirt **10-3** and if if is suitably constructed it can even smooth the entire part **10***f* of the same. The part of the lengthwise and once transversely folded shirt **10-3** arranged on the table plate **32** is then stretched in its lengthwise direction by the movement of the clamping bars **51, 52** in the direction of the arrow **56** (FIG. **2**).

The stretching in the direction of the arrow **56** (FIG. **2**) of the lengthwise and once transversely folded shirt **10-3,** i.e., which has been folded crosswise at approximately the double cross-fold size is effected simultaneously with the beginning of the second transverse folding operation.

The second transverse fold is produced by moving the clamping bars **51, 52** together with the clamped part of the lengthwise and once transversely folded shirt **10-3** (FIG. **2**) in the direction of the arrow **59.** The path of movement of the clamping bars **51, 52** is selected in such a way that the part of the lengthwise and once transversely folded shirt **10-3** crossing the second transverse fold point **50** or the edge of the folding plate **33** located there is stretched.

When the second transverse fold has been made (FIG. **3**), the stretching and clamping device **129** which cooperates with a clip insertion device not represented in the drawings is moved from a position outside the path of rotation of the folding device **11** into a position according to FIG. **4** and the element of the stretching and clamping device **129** is then firmly pressed on the shirt **10-4.** When this process is terminated, the entire transverse folding device **132** is moved from the position according to FIG. **3** to a position according to FIG. **4** and thus the clamping bars **51, 52** are withdrawn from the folded shirt **10-4.** When this process has also been terminated the elements **127** of the stretching and clamping device **129** which are arranged in pairs are pressed firmly onto the fold edge of the shirt **10-4** formed during the first transverse folding operation and thus the part of the shirt folded crosswise over the second transverse fold point **50** in the direction of the collar piece **10e** is stretched in the direction of the arrow **130** or the collar piece **10e.** This is effected by displacing the entire stretching and clamping device **129** in the direction of the arrow **131.**

When the stretching operation in the direction of the arrow **130** has been terminated, the elements **126, 127** remain pressed on the above-mentioned parts of the shirt **10-4** for a sufficient length of time until these are prevented from falling apart by means of the abovementioned clip insertion device, for example, by pushing clips **101** onto these parts and the lengthwise folded shoulder parts of the shirt **10-4** located directly beneath these.

When the operation for preventing the parts of the shirt from falling apart has been terminated, the elements **126, 127** are raised from the above-mentioned parts of the shirt **10-4** and the entire stretching and clamping device **129** is pushed in the direction of the arrow **131** until the folding device **11** can be moved into the next station which is not shown in the drawings.

What is claimed is:

1. A process for transversely folding an article of clothing having a collar piece, for example a shirt, after the article of clothing has been longitudinally folded about a pasteboard insert and placed on a table plate movable between a plurality of operating stations comprising the steps of:

a. moving a first clamping device into operative position adjacent to said table plate;

b. clamping said article of clothing to said table plate with a first transverse clamping element at a distance from the collar piece approximately twice as great as the final transversely folded size of the article;

c. folding the portion of the article extending beyond the first transverse clamping element in the direction away from the collar piece over said first clamping element to form a first transverse fold;

d. moving a second transverse clamping element into position adjacent to said first clamping element so as to clamp the article of clothing therebetween;

e. moving said first and second transverse elements in a semi-circular path so as to form a second transverse fold in said article of clothing;

f. clamping said article of clothing at the first transverse fold with a second clamping device;

g. removing said first and second clamping elements from said article of clothing; and

h. unclamping said second clamping device.

2. The process of claim **1** comprising the further step of smoothing the first transverse fold in the direction of the collar piece after the portion of the article of clothing has been folded over said first clamping element.

3. The process of claim **1** comprising the further step of stretching the article of clothing in a first longitudinal direction before forming the second transverse fold and after clamping said article of clothing between said first and second clamping elements.

4. The process of claim **3** comprising the further step of stretching the article of clothing in a second longitudinal direction after clamping said article with the second clamping device.

5. The process of claim **4** comprising the further step of inserting retaining clips over the first transverse fold after said first clamping means has been removed from said article of clothing and after said article has been stretched in said second longitudinal direction.

* * * * *