

May 12, 1970

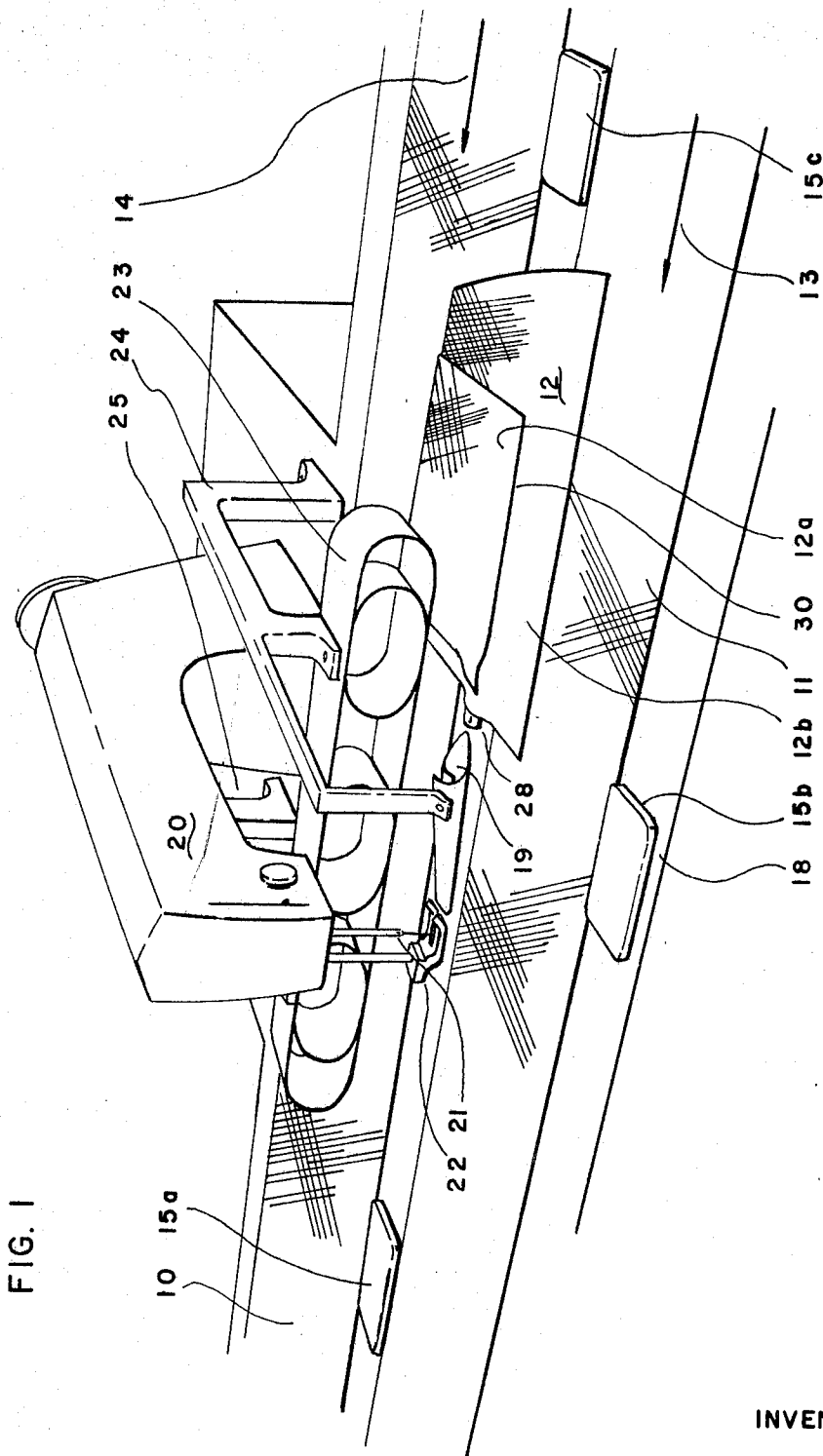
Filed May 10, 1967

C. SZENTKUTI

APPARATUS FOR AUTOMATICALLY SEPARATING THE TOP
LAYER OF A MULTI-LAYER WORKPIECE

3,511,494

4 Sheets-Sheet 1



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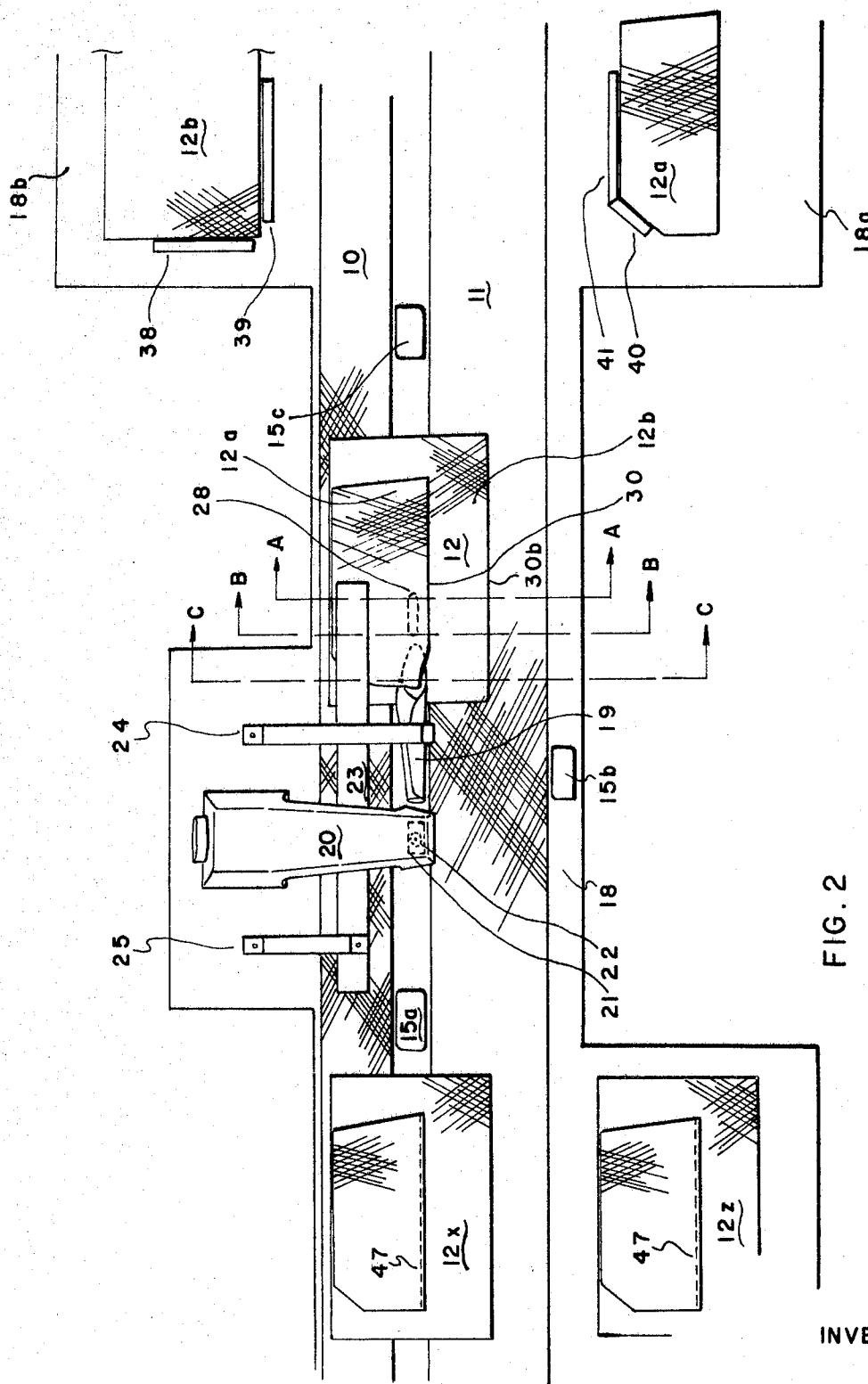
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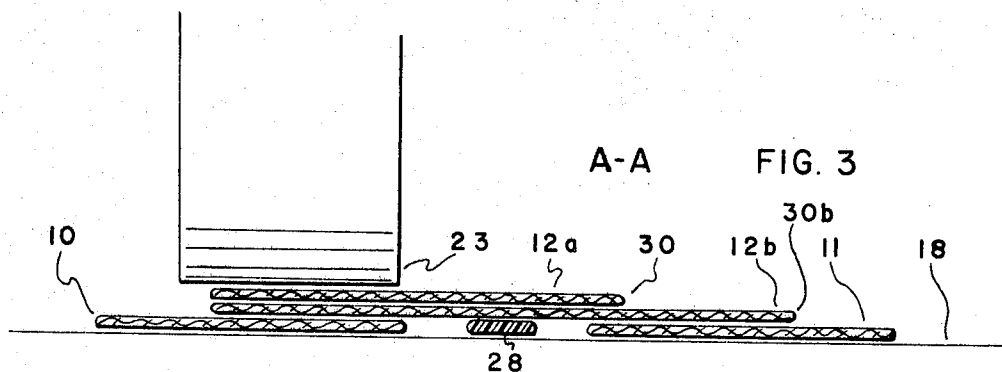
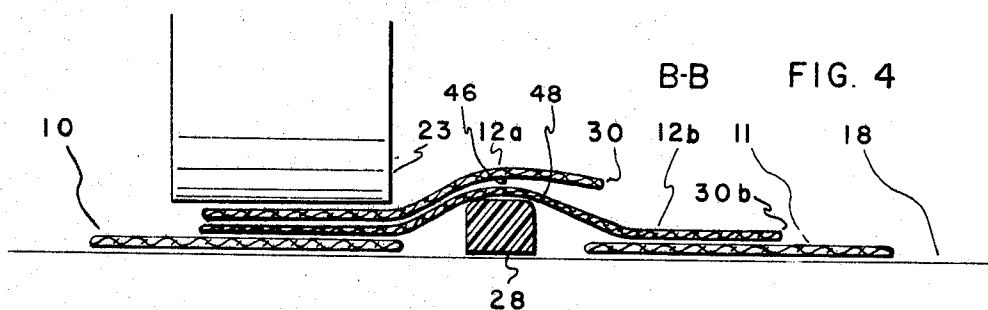
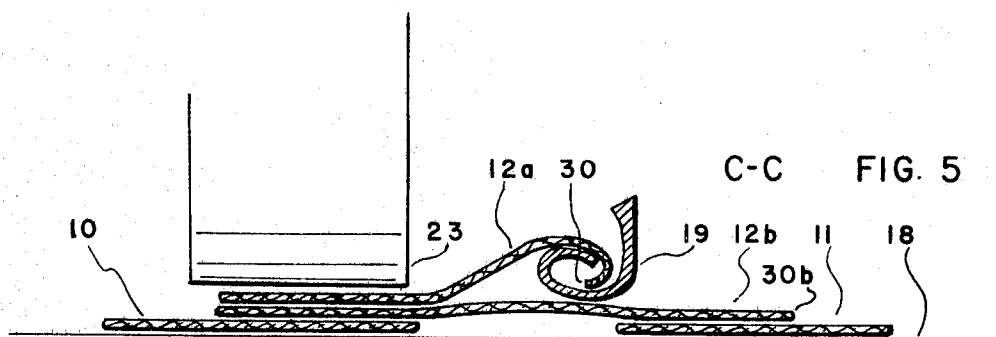
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4 Sheets-Sheet 3



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FIG. 7

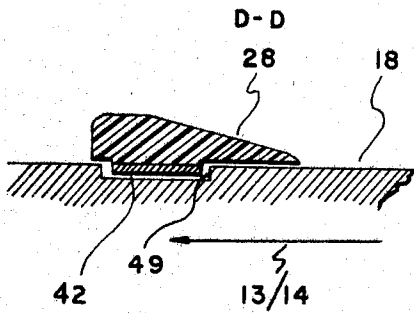


FIG. 8

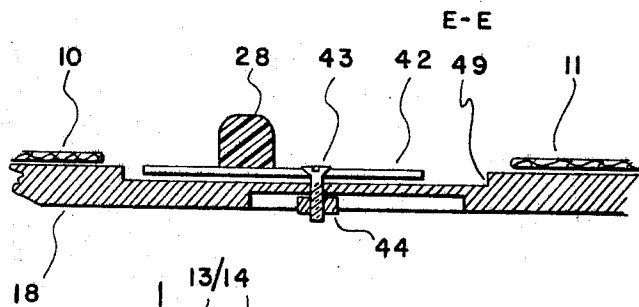
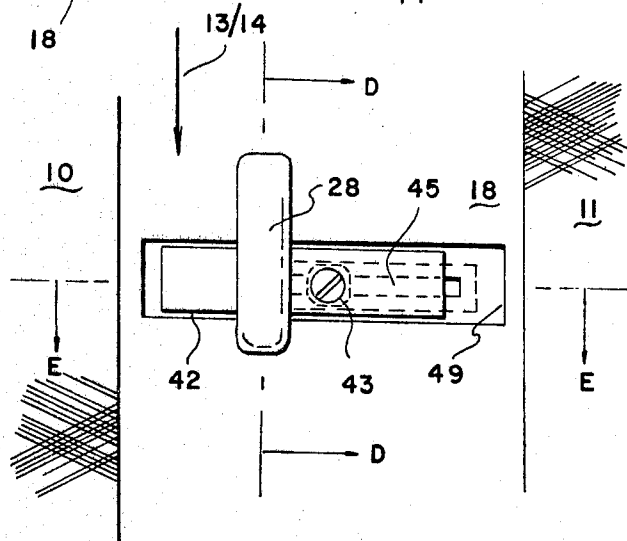


FIG. 6

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APPARATUS FOR AUTOMATICALLY SEPARATING THE TOP LAYER OF A MULTI-LAYER WORKPIECE

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Int. Cl. B65h 37/00 3/00

U.S. Cl. 270—52

8 Claims

ABSTRACT OF THE DISCLOSURE

The present invention relates to apparatus for automatically separating a portion of an unattached top layer of a multi-layer fabric workpiece from the surface of its adjacent layer without disturbing the pre-oriented position of the multilayer workpiece, by passing the workpiece over a lifter-separator positioned to provide a progressively applied peeling effect in which the top layer is progressively peeled from the adjoining layer and to advantageously use the self-supporting strength of the top layer for temporarily maintaining the separation effected. Thereafter, the portion of the top layer so separated may be automatically treated in a work station while the orientation of the several layers is maintained.

RELATED CROSS-REFERENCES

Title: Methods and Apparatus for Automatically Transferring and Registering Fabric Workpieces and for Combining Them, Ser. No. 475,986; inventors: George F. Hawley and John H. Buettner, filed July 30, 1965.

COMPLETE DISCLOSURE

The present invention relates to automatic handling of fabric workpieces in a process of garment manufacturing. In particular, the present invention relates to apparatus for automatically providing separation of part of one fabric workpiece from part of another, without disturbing the pre-positioned relationship of the fabric workpieces.

In the manufacture of garments, apparel and the like, manual labor has been used and is still used to a great extent. Attempts at automating some of the manufacturing function ran into the problem of fabric handling. The handling of fabric workpieces by manual labor offers very little problem, since the operator handling fabric combines his senses of sight and feel and coordinates these senses with manual manipulation. However, mechanical duplication of human dexterity and ability in handling limp fabric materials is extremely difficult to accomplish at a cost which is reasonable. This difficulty is mainly due to the characteristics of the limp fabric materials themselves.

The present invention solves some of the problems found in automating a fabric workpiece handling function which may be associated with a step in the manufacture of a garment. Although the present invention has provided a practical and economic solution to an automated manufacturing function such as that described below, it will be understood that the invention herein described is not limited to any particular application.

By way of example, in the manufacture of pockets for garments, some pocket construction includes combining a facing fabric workpiece onto the fabric workpiece used for forming the pocket, and sewing the facing onto the pocket material. The facing workpiece is normally substantially smaller in size than the pocket workpiece. In an automatic process of making the pocket, the pocket workpiece may be positioned on a conveyor with respect to

a sewing station and the facing workpiece is precisely positioned on top of the (larger) pocket workpiece, and may be oriented with respect to the orientation of the pocket workpiece and the sewing station.

The facing workpiece is preferably a pre-cut, flat piece of fabric, without a hem-fold. In the process or function herein described, it is desirable to hem-fold an inside edge of the facing workpiece prior to sewing the facing and pocket workpieces together, but after positioning the workpieces on a conveyor. Thus, after having positioned the two workpieces with respect to each other and each with respect to a third point, it is desirable to separate an edge portion of the facing workpiece edge, which edge portion is located in an off-the-edge position relative to the pocket workpiece, for hem-folding the facing, without disturbing the relative positioning of the two workpieces prior to sewing them together.

It is desired to separate the off-the-edge located edge portion of the facing workpiece from the pocket workpiece so that the particular facing edge portion may be hem-folded under, before the facing is sewn to the pocket workpiece. This provides a finished off-the-edge facing edge sewn into the pocket. In order to separate the edge of the facing workpiece from the surface of the pocket workpiece, any interfacial adherence between the two workpieces must be overcome with an applied force only sufficient to overcome the such interfacial adherence and without disturbing the orientation of the position combined workpieces. It has been found that edge separation may be accomplished by use of a lifter-separator positioned so that the marginal area of the edge to be separated passes over the lifter-separator. As the workpiece, which may for example include at least a top layer and an adjacent layer, passes over the lifter-separator, that portion of the workpiece passing substantially directly over the lifter-separator is progressively elevated due to the passive or lifting force or action of the lifter-separator. As such elevation is effected, the self-supporting strength of the top layer is exerted in cantilever relationship to provide a progressive peeling action such that separation of the two layers along the marginal edge of the top layer is temporarily attained.

From one aspect, the present invention includes the use of novel apparatus for automatically separating the off-the-edge located facing workpiece edge from a pocket workpiece without disturbing the position of the workpieces with respect to each other and without disturbing the position of both workpieces with respect to a third point, which third point may be a folder and/or a sewing or other type of combining station.

From another aspect, the present invention is a novel system for precisely combining two workpieces, for passively separating an edge of one workpiece located at an off-edge location with respect to the other workpiece without disturbing the relative position of the workpieces, for hem-folding the separated edge and for joining, by sewing or otherwise bonding the hem-folded, separated edge to an off-edge part of the other workpiece.

It is therefore, an object of the present invention to provide apparatus for automatically separating the edge and marginal area of a top layer of a multi-layer fabric workpiece without disturbing the interrelated orientation of the layers and the workpiece.

Another object is to provide an automatic system for positioning a first fabric workpiece relative to a point; positioning a second fabric workpiece relative to the first workpiece and the said point; for conveying the positioned workpieces toward said point; for passively separating an off-the-edge located edge and marginal area of the top workpiece from the workpiece beneath the top workpiece during conveyance; for hem-folding the separated edge

of the top workpiece and for combining, as by sewing or other bonding means, the top workpiece and the underlying workpiece along the hem-fold.

These and other objects will become apparent from reading the following detailed description with reference to the accompanying drawings in which:

FIG. 1 is a perspective view of an automatic module for sewing together the layers of a multi-layer workpiece including the function of top layer edge separation;

FIG. 2 is a plan view of the module illustrated in FIG. 1;

FIGS. 3, 4 and 5 are cross-sectional views of portions of FIG. 2, taken along the lines A—A, B—B and C—C respectively;

FIG. 6 is a plan view of a top fabric workpiece edge separator and

FIGS. 7 and 8 are sectional views of portions of FIG. 6 taken along the lines D—D and E—E, respectively.

Before beginning the detailed description of the illustrated embodiment of the present invention, the characteristics of limp fabric should be reviewed and it should be kept in mind that problems in limp fabric handling are unique to fabric because of such characteristics. Fabric, normally used in the manufacture of garments, is flexible, limp, porous and has little self-supporting strength. In addition, the cut or raw edge of a piece of fabric has a great tendency to cling to another fabric surface or other fabric raw edge. This characteristic to cling to another fabric surface is included in what has been referred to as interfacial adherence. These characteristics, in particular, make the problem of automated fabric edge separation from other fabric pieces, difficult.

Referring now to FIG. 1, an automatic module or work station, performing a garment manufacturing function is shown in which a conveyor system, represented by the conveyor belts 10 and 11, carry a multi-layer fabric workpiece 12 in the direction indicated by the arrows 13 and 14. The conveyor belts are maintained precisely positioned laterally by use of spacers and guides 15a, 15b and 15c. The spacers are coupled to a supporting surface 18, along which the conveyor belts are driven by a driving means (not shown). The driving means may be an ordinary motor and drive pulley which are coupled to and drive both belts 10 and 11 to move in the same direction at the same speed.

As shown in FIG. 2, a workpiece 12a and a workpiece 12b are precisely positioned on the belts 10 and 11 and the "combined" workpieces are transported toward the top fabric edge lifter separator 28 and the sewing station (including the folder 19). The workpiece 12a may represent a pocket facing workpiece and the workpiece 12b may represent a pocket-body workpiece used in wearing apparel, for example. The combined workpieces are illustrated in FIGS. 1 and 2 as 12 with the sewn workpieces illustrated in FIG. 2 as 12x and 12z.

The supporting surface 18, may be the surface of a module base-mounting which also supports a sewing machine, such as illustrated as 20. The sewing machine 20 may be of the conventional type normally employed in the sew-combining of fabric workpieces. The needle 21 and presser foot 22 are illustrated but other details of the sewing machine have been omitted from the drawing to avoid complicating the drawing.

Also illustrated in FIGS. 1 and 2 is a fabric workpiece hold-down 23 illustrated as a plurality of curved spring strips integrally coupled and supported by a supporting frame 24 and 25 (shown more clearly in FIG. 2). The workpiece hold-down 23 is positioned over and press down upon the conveyor belt 10 and when a combined workpiece, such as 12 is conveyed or transported along the top or supporting surface 18, the workpiece is passed under the hold-down which holds the workpiece 12 tight against the conveyor belt 10 and prevents displacement of the workpiece 12 from its position relative to the folder 19 and the sewing station (formed by the needle 21 and presser-foot 22).

It may be desired to include a second workpiece hold-down positioned over the conveyor belt 11 for holding the underlying workpiece, such as layer 12b against the conveyor belt 11. As seen in FIGS. 1 and 2, the workpiece hold-down 23 will hold both pieces of fabric forming the combined workpiece 12 against the conveyor belt 10. However, if a second hold-down is employed in association with belt 11, the second hold-down would hold that portion of the combined workpiece extending onto the conveyor belt 11 (the underlying workpiece 12b) while the top workpiece 12a would have a free edge. The free edge 30 of the top workpiece positioned at an off-the-edge location on the bottom workpiece 12b is positioned for presentation to the folder 19 so that the raw edge 30 of the workpiece may be hem-folded before the two workpieces are sewn together at the sewing station by the sewing machine 20. The line of stitches along the hemmed edge of the sewn workpiece 12x and 12z is seen at 47.

In order that the off-the-edge positioned edge 30, of the top workpiece be presented to the folder 19, the edge 30 must be separated from the surface of the workpiece 12b. In addition, the edge 30 of workpiece or layer 12a must be maintained separated from the surface of workpiece 12 so that the edge 30 may enter the folder 19 and be hem-folded while that portion of the underlying layer or workpiece 12b which is substantially under the separated portion of workpiece 12a passes progressively under the folder 19 as the pre-oriented workpieces are conveyed along the work surface. This is clearly shown in FIGS. 2 and 5. Further, in order that the sewing or sew-combining may be accomplished with the workpieces 12a and 12b in the physical relationship as desired, separation of the edge 30 from the surface of the workpiece 12b must be accomplished without disturbing the relative position of the workpieces with respect to each other and each with respect to the sewing station.

In order to accomplish such edge separation, a lifter-separator is positioned in the path of travel of workpiece 12 and is substantially aligned to intersect with the marginal area of the edge to be separated. The lifter-separator is located just forward of a workstation. The separator 28 is positionally adjustable (as seen in FIGS. 6, 7 and 8) so that the separator will lie in a position inwardly displaced relative to the edge 30 (referred to as the marginal area) so that the marginal area of the workpiece 12a will pass over the lifter-separator. As seen, the workpiece 12b also passes over the lifter-separator but the portion of the workpiece 12b passing over the lifter-separator is inwardly displaced from the marginal area of edge 30b. As clearly seen in FIGS. 2, 3, 4 and 5, the lifter-separator 28 is positioned under a non-marginal area of workpiece 12b.

It has been found that fabric, although having little self-supporting strength, has sufficient strength to temporarily hold a portion of itself separated from the surface of another fabric layer so long as interfacial adherence between two fabric layers is overcome by some interceding force applied to the fabric sufficiently close to the edge to be separated. The interceding force employed in the present invention is force passively supplied by the lifter-separator in cooperation with the forward motion of the workpiece 12. The lifter-separator 28 passively lifts both fabric workpieces (12a and 12b) as they are conveyed toward the work station. As the workpiece 12 passes over the lifter-separator 28, that portion of the workpiece passing over the lifter-separator is elevated. As seen in FIG. 4, the area of the underlying workpiece 12b between that portion passing over the lifter-separator 28 and the edge 30b is too heavy to be supported by the self-supporting strength of the region 48 of the workpiece. The workpiece 12b lies essentially humped-up with the edge 30b and its marginal area lying on the conveyor belt 11. The area of the top layer 12a between that portion passing over the lifter-separator 28 and edge 30 (herein referred to as the marginal area) is progressively peeled off the underlying layer and the edge 30 and marginal area of the top layer

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12a is held in cantilever relationship with respect to the lifter-separator 28, by the self-supporting strength of the region 46 of the top layer 12a.

When the fabric to be separated has relatively little self-supporting strength (i.e. is very limp) the lifter-separator 28 is positioned very close to the edge 30 to be separated. When the fabric to be separated has relatively greater self-supporting strength (i.e. the fabric is stiffer) the lifter separator 28 may be laterally displaced further from the edge to be separated.

The fabric edge lifter separator is contoured so as to progressively cause a small section of the fabric to rise as it passes over the separator. Taking advantage of the self-supporting strength of the fabric workpiece and the fabric supporting or lifting effect of the lifter-separator, the interfacial adherence between the two fabrics workpieces is overcome and the self-supporting strength temporarily maintains the edge and marginal region of the top workpiece separated from the surface of the under workpiece. The under fabric workpiece 12b substantially follows the contour of the lifter-separator (i.e. is humped) because the self-supporting strength of the fabric at region 48 is insufficient to maintain elevated the wide area of the fabric workpiece between the lifted section and the edge 30b of the workpiece 12b. This may be seen clearly in FIGS. 3, 4 and 5.

In some cases, the lifter-separator 28 may be positioned sufficiently close to the edge 30b and the self-supporting strength of the region 48 is sufficiently strong to hold the area between the region 48 and the edge 30b in cantilevered relationship to the lifter-separator. In such case, an additional hold-down may be used to hold the underlying layer (12b) down thus overcoming the self-supporting strength of the region 48. The additional hold-down may take the form of hold-down 23 or may be another form of hold-down, such as an inverted separator effecting only the underlying workpiece 12b.

Directing attention to FIGS. 3 and 4, a typical separating operation is illustrated in cross sectional view. FIG. 3 illustrates a cross section view across the line A—A in FIG. 2 while 4 illustrates a cross section view across the line B—B in FIG. 2. In the FIGS. 3, 4 and 5, the hold-down 23 is illustrated over the combined workpiece 12 (12a and 12b). In order to keep the drawings clear, the various components i.e. conveyor belt 10, fabric workpiece 12b, fabric workpiece 12a and the hold-down 23, are shown separated. In practice, the hold-down 23 would hold the combined workpiece 12 relatively tight against the conveyor belt 10, sufficiently so to prevent lateral displacement of the workpieces 12a and 12b when the workpieces are passed over the separator 28.

FIG. 4, in particular illustrates how the top fabric workpiece 12a will maintain physical separation from the underlying workpiece 12b using its self-supporting strength thereby separating the edge 30 from the surface of the underlying workpiece after interfacial adherence has been overcome by the lifting action of the lifter separator 28. The folder 19, seen in FIGS. 1, 2 and 5 is positioned and aligned so that the separated edge 30 will feed into the folder to hem-fold the workpiece 12a before the workpieces are sewn together at the sewing station. FIG. 5, shows the edge 30 and the marginal area of the edge 30 in the folder 19, which illustrates only one use for the separating function described herein.

In the FIGS. 3 and 4, the adjustable features of the fabric lifter separator 28 have been omitted but this feature is clearly seen in FIGS. 6, 7 and 8.

Returning to FIG. 2, it will be seen that a workpiece blank 12a which may represent a pocket facing workpiece is positioned on area 18a of the supporting surface or table. The area 18a may be a registration station, for example, for workpiece 12a. Workpiece blank 12b may represent a pocket body workpiece and is positioned on area 18b. The area 18b may be a registration station, for example, for workpiece 12b. Each workpiece may be

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specifically positioned and located or registered so that its exact position and orientation is known. Registration of workpieces may be accomplished as described in the co-pending application of George F. Hawley et al., Ser. No. 475,986, filed July 30, 1965, and assigned to the same assignee as the present application.

After registration against the stops 38 and 39, the workpiece 12b is in a precisely known location and orientation. The workpiece may then be transferred by a transfer mechanism (not shown) so that after transfer its position and orientation at the remote location from the registration area is still known. In practice, workpiece 12b is registered in the registration station and then precisely transferred so that workpiece 12b is positioned on the conveyor belts 10 and 11. The workpiece 12a is also registered in a predetermined position in registration station 18a. The components 40 and 41 represent stops against which the workpiece 12a may be registered for precisely locating workpiece 12a. After being registered, the workpiece 12a is transferred and positioned on top of the workpiece 12b. Thus, the workpieces 12a and 12b may be positioned and oriented on the conveyor belts 10 and 11.

During the transfer of the workpieces 12b and 12a respectively onto the conveyor belts, the belts are preferably held stopped. Movement of the conveyor belts may be coordinated with the sewing function so that the sewing function, once it starts, continues uninterrupted, the conveyor belts conveying the workpiece 12 through the sewing station. After the facing workpiece is sewn onto the pocket workpiece, the conveyor belts 10 and 11 may be stopped and the next respective workpieces 12b and 12a may be placed on the conveyor belts from the registration stations 18b and 18a in preparation for transfer along the work surface. After the workpieces 12b and 12a are transferred onto the conveyor belts 10 and 11, the combined workpiece 12 is transported toward the work station and goes through the steps of separation of the edge 30 during passage of the workpiece 12 over the lifter-separator 28, hem-folding of the edge 30 in the folder 19 and the sewing of the hem-folded edge 30 of the workpiece 12a to the workpiece 12b at the sewing station. The sewn workpiece represented by 12x is transferred from the conveyor belts to a stacking station where the combined workpieces are stacked (represented by 12z).

As seen in FIGS. 6, 7 and 8, the fabric edge lifter-separator 28 is contoured gradually sloping, so as to increase in height along the travelled direction of the conveyor belts (i.e. the travelled direction of the workpieces). The travelled direction is indicated by the arrows 13/14 in FIGS. 6 and 7.

In practice, a lifter having a length of substantially one inch, a width of approximately $\frac{3}{8}$ of an inch and increasing in height from substantially a point edge (FIG. 3) to approximately $\frac{5}{16}$ of an inch (FIG. 4) has been found to successfully elevate the multi-layer fabric workpiece 12 as it is transported on the conveyor belts and in the elevating action, overcomes interfacial adherence between the top workpiece 12a and the underlying workpiece 12b for effecting the peeling action for separating a fabric edge.

FIG. 6 illustrates in plan view, a fabric edge lifter-separator having an adjustable positionable mounting. The separator 28 is mounted on a bed plate 42 which is secured by a screw 43 and nut 44 to the work surface 18. The screw shank is passed through a slot 45 along which the screw 43 and bed 42 of the separator 28 may be laterally adjusted (within the limits provided). In some cases, the recess 49 in the work surface 18 may be longer and the slot 45 may be made longer so that the fabric edge lifter-separator may be fully adjustable within the limits of the distance between the conveyor belts 10 and 11.

It should be understood that although certain dimensions of the fabric edge lifter-separator have been described, the separator is not limited to such dimensions. In any given application, the dimensions of a fabric edge lifter-separator may depend on the characteristics, including thickness, of the fabric to be separated.

It will also be appreciated that a lifter-separator is preferably smooth and made of low friction material. Stiff plastic, for example, "Plexiglas," has been used with great success, however, other low friction materials may be used if desired.

In describing the present invention, its use and function certain descriptive terms have been employed for convenience and clarity. It will be appreciated that such descriptive terminology is not to be construed as limiting the component described to the descriptive term employed. It will further be appreciated that a "layer" such as "top layer," "underlying layer" or "adjacent layer" may be a single piece layer or a multiple piece layer. The term "interfacial adherence" is used in the general sense and includes any tendency of any part of a workpiece to cling to another workpiece. The term "passive" force or action and/or lifting force or action are employed because the lifter-separator is essentially a stationery component and is ramp shaped. Although there is relative movement between the workpiece and the lifter-separator such movement as described herein is a function of the conveyor transporting the workpiece. In some cases, the lifting action of the lifter-separator may be dynamic action, generated by raising and lowering the lifter-separator. In this concept, the lifter-separator may still be viewed as a passive component with respect to the relative movement in the horizontal direction between the lifter-separator and the workpiece. The term "self-supporting strength" is essentially a cantilever strength or action which is progressively initiated by the lifter separator as the workpiece is progressively elevated. This cantilever relationship results in a progressive peeling effect in which the edge and marginal area of a top layer is separated from its underlying layer.

Thus, a system has been described which employs a low cost, practical and reliable fabric edge lifter separator. Other systems employing the principles embodied herein and other shapes of fabric edge lifter-separators, may be made as will become apparent to those skilled in the art, without departing from the scope of the present invention as defined in the appended claims.

What is claimed is:

1. Apparatus for passively separating a portion of the top layer of a multi-layer workpiece from the surface of the layer adjacent to the top layer without disturbing the orientation of the multi-layer workpiece including:

means for conveying said multi-layer workpiece along a predetermined path, said means for conveying including,

a first conveyor means and a second conveyor means having a region therebetween and said multi-layer workpiece including,

at least a first layer particularly oriented and positioned on said conveyor means and extending across the region between said first and second conveyor means, and

a top layer particularly oriented and positioned on said first layer, said portion of said top layer to be separated positioned interim the edges of said first layer, and said portion of said top layer being positioned above the region between said first and second conveyor means,

hold-down means positioned along said predetermined path for securing a portion of said multi-layer workpiece to one conveyor means of said first and second conveyor means for preventing lateral movement of said workpiece, and

lifter means positioned in the region between said first

and second conveyor means along said predetermined path for progressively elevating said multi-layer workpiece in the area of said portion of said top layer as said multi-layer workpiece is conveyed along said path and over said lifter means.

2. Apparatus for passively separating a portion of the top layer of a multi-layer workpiece as in claim 1 and in which:

said lifter means is relatively narrow with respect to the width of said workpiece, and

said lifter means positioned in the region between said first and second conveyor means is ramp shaped, progressively increased in height in the direction of travel of said workpiece.

3. Apparatus for passively separating a portion of the top layer of a multi-layer workpiece as in claim 1 and in which:

said portion of said top layer includes an edge of said top layer and the marginal region of said edge, and

said lifter means positioned in the region between said first and second conveyor means is ramp shaped, progressively increasing in height in the direction of travel of said workpiece.

4. Apparatus for passively separating a portion of the top layer of a multi-layer workpiece as in claim 1 and in which:

said portion of said top layer to be separated includes an edge of said top layer and the marginal region of said edge,

said lifter means is positioned along said predetermined path so that a portion of said marginal region passes over said lifter means.

5. Apparatus for automatically separating an edge portion of the top layer of a multi-layer workpiece comprising:

a conveyor system including,

a base,

a pair of conveyor belts mounted on said base,

said pair of conveyor belts moving in the same direction in spaced parallel relationship,

registration means for registering a first and a second workpiece blank into known positions with respect to said conveyor system with said first workpiece blank positioned on both said conveyor belts and extending across the region between said belts and said second workpiece blank positioned on top of said first workpiece blank to provide the multi-layer workpiece with an edge portion of said second workpiece blank positioned above said region between said pair of conveyor belts, and

lifter means positioned between said pair of conveyor belts and engaging the bottom of said first workpiece blank for lifting the area of said first workpiece blank between said conveyor belts and also lifting said edge portion of said second workpiece blank in cantilever relationship up off from said first workpiece blank for separating said edge portion therefrom.

6. Apparatus for automatically separating the edge and marginal region of the top layer of a multi-layer workpiece from the surface of the layer adjacent to the top layer without disturbing the orientation of the multi-layer workpiece including:

conveyor means for supporting said multi-layer workpiece and for conveying said workpiece along a predetermined path,

said multi-layer workpiece including at least a first layer positioned on said conveyor means, in flat condition, for traveling along said path at a predetermined orientation, and

a top layer positioned in flat condition to top of said first layer,

means for urging at least an edge of each of said first and top layers against said conveyor means along at least part of said predetermined path for preventing lateral displacement of said multi-layer workpiece

during travel of said workpiece along said at least part of said path, said top layer having at least one edge free, and

lifter means positioned in said path for intersecting with said multi-layer workpiece under the marginal region of said top layer adjacent said free edge for progressively elevating said marginal region of the top layer and that portion of said first layer adjacent said marginal region for overcoming interfacial adherence between said first layer and said top layer for progressively separating said first layer in cantilever relationship to said lifter means.

7. Apparatus for overcoming the interfacial adherence between the edge and marginal region of a top layer and the adjacent surface of the underlying layer of a multi-layer fabric workpiece and for separating the edge and marginal region of the top layer from the surface of the adjacent layer without disturbing the orientation of said workpiece including:

supporting surface means for supporting said workpiece, means for conveying said workpiece along the top of said supporting surface means in a predetermined path,

said workpiece including at least an underlying layer positioned on said conveying means for traveling along said predetermined path in a pre-oriented position, and

a top layer positioned on said underlying layer and particularly oriented with respect to said underlying layer and said predetermined path,

means for securing at least one edge each of said underlying and top layers to said conveying means for maintaining the pre-oriented position of said workpiece, said top layer having at least one free edge, and

ramp means positioned in said predetermined path, said ramp means being positioned to allow the workpiece to pass over said ramp means sloping upwardly and being aligned with said marginal region for progressively causing said marginal region of said top layer and the region of said underlying layer in contact with said marginal region to rise progressively up in elevated relation away from said supporting surface means, as said workpiece passes over said ramp means for cooperating with the self-supporting

strength of the fabric in the marginal region of said top layer expressed in cantilever relation, for overcoming interfacial adherence and for separating said free edge and a portion of said marginal region of said top layer from said surface of said underlying layer.

8. A method of separating an edge and marginal region of a top layer of a multi-layer workpiece from the surface of the adjacent layer of said workpiece without disturbing the orientation of the workpiece including the steps of:

positioning a first layer in generally flat horizontal relationship on a conveyor means,

positioning a top layer in generally flat horizontal relationship on said first layer with an edge portion of said top layer overlying an intermediate portion of said first layer,

conveying said first and top layers along a predetermined path while maintaining them in their generally flat horizontal relationship,

holding an edge of said first and top layers secured to said conveyor during at least part of the conveyance, and

progressively elevating the intermediate portion of said first layer and also elevating the edge portion of said top layer in self-supporting cantilever relationship by passing the intermediate portion of said first layer over a ramp means positioned in said predetermined path for cooperating with the self-supporting strength of the top layer acting in cantilever relation with respect to the said ramp means.

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U.S. Cl. X.R.

112—2, 153; 270—58, 93; 271—18