

[54] **FOLDED SHEET MATERIAL AND METHOD AND APPARATUS THEREFOR**

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[51] Int. Cl. **B65h 1/04**

[58] Field of Search **221/47-55; 270/40; 206/57**

[56] **References Cited**

UNITED STATES PATENTS

1,256,334 2/1918 Lazar 221/48

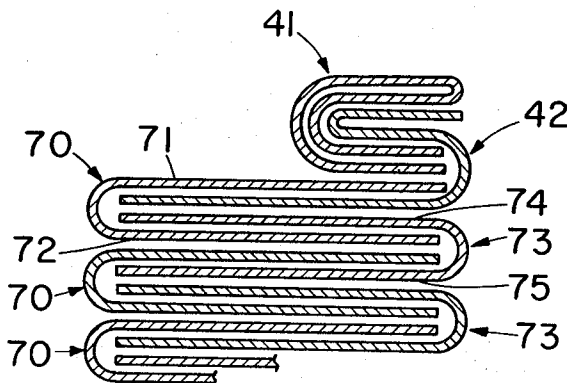
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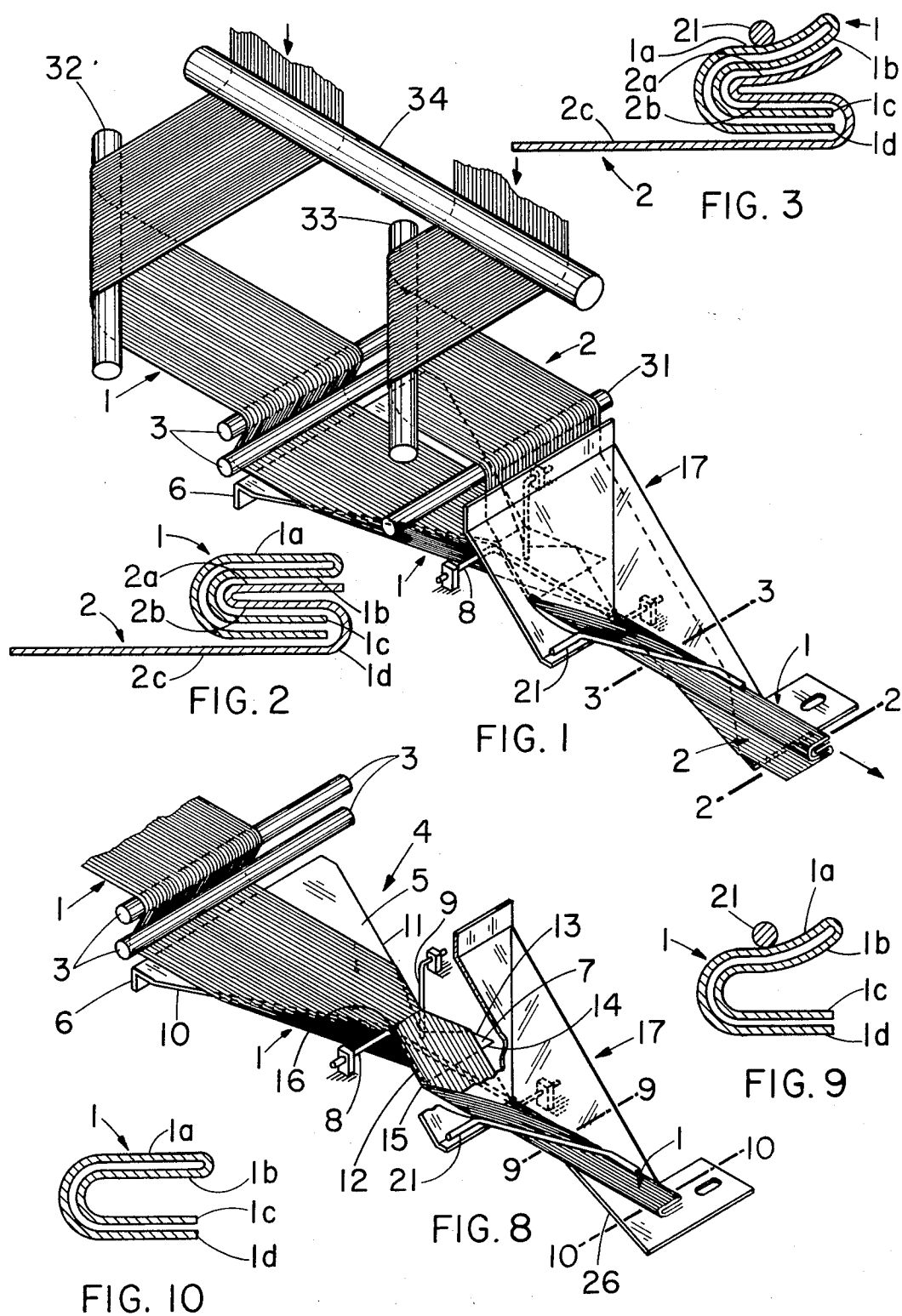
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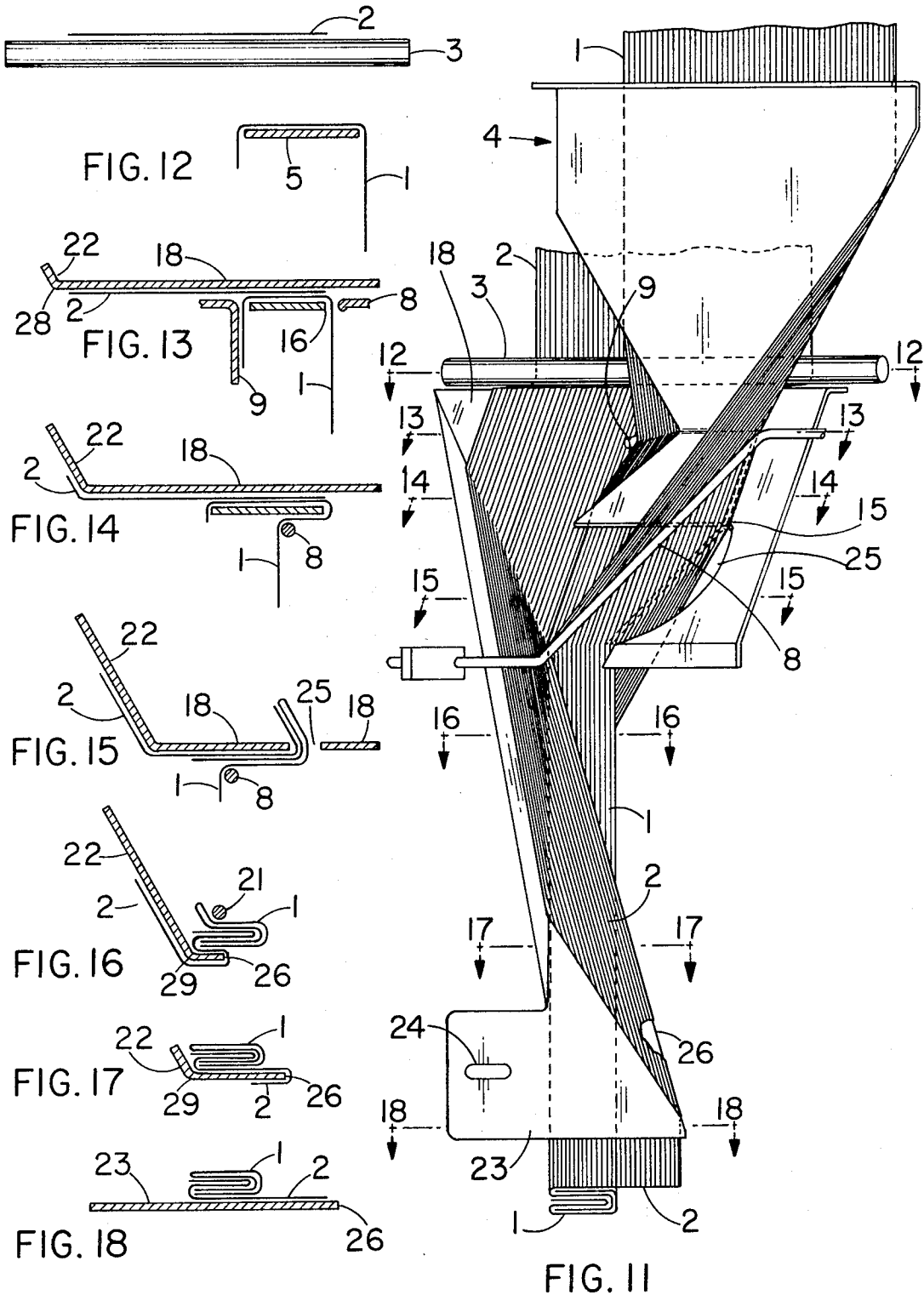
[57] **ABSTRACT**

Tissue webs which may be of substantially indefinite length and suitable for cutting to a convenient size for packaging are folded and interfolded. The upper or starter web of the stack is folded in quarters and so arranged that this upper web is readily grasped by the fingers of a hand and easily removed from the stack. The next lower web being interfolded with the upper is partially withdrawn from the stack so that it is presented for easy removal also. Several apparatus arrangements and methods for effecting the folding are described.

3 Claims, 23 Drawing Figures







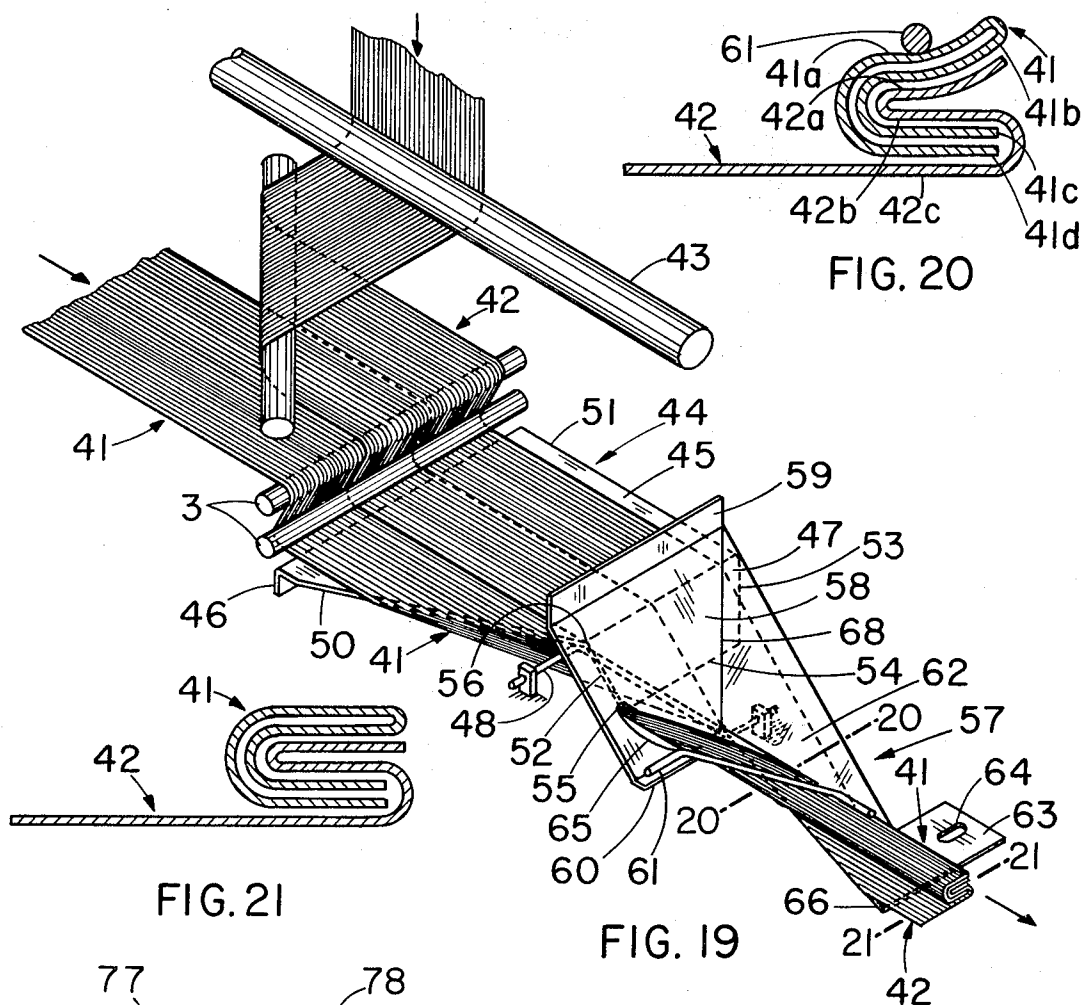
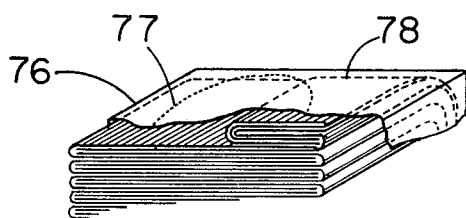


FIG. 23

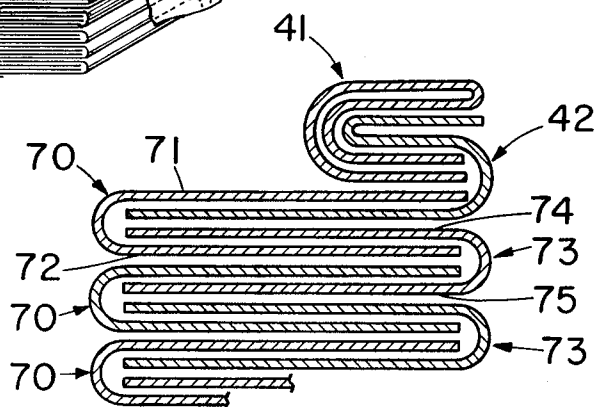


FIG. 22

FOLDED SHEET MATERIAL AND METHOD AND APPARATUS THEREFOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to interfolded webs and particularly to the starter web for a stack of interfolded webs; the invention also relates to apparatus and methods for folding a starter web and combining it with other webs of the stack.

2. The Invention With Relation To The Prior Art

It is common practice in the facial tissue field to provide individual tissues interfolded in a stack in such manner that withdrawal of the upper tissue web will expose a length of the underlying tissue so that it also may readily be removed from the stack. Such tissue stacks are usually retained in a box of convenient size for household consumers and such boxes have a window through which the tissues are removed. In the case of interfolded tissue each upper web, upon its withdrawal by the hand of a user, draws the next succeeding web through the window to present it for easy removal from the stack.

A primary objective of this invention is to so fold an uppermost web of a stack that it will permit a user to pull on it strongly when initiating withdrawals of tissue.

An important object of the invention is to provide a novel folding board arrangement for achieving the novel fold of the uppermost web of a stack.

A further object of the invention is to provide a novel method of interfolding webs.

The practice of the invention is of particular importance in connection with interfolded tissues and similar webs of relatively low tensile and tear strength. The principles are applicable to other materials where interfolding may be desired as in the packaging of paper toweling, napkins and the like.

Briefly, we have found that starter webs of a stack may be conveniently folded to provide four thicknesses of the web. Further, the starter web is folded to permit grasping of the full folded thickness to provide for withdrawal from a stack without injury to the starting web and those webs closely adjacent to it. This arrangement is particularly important in connection with tightly stacked and boxed webs where considerable resistance to web withdrawal may be present. The starter web for our purpose is so folded longitudinally that widthwise quarter folds of the web are in overlying relation. The starter web also has an opening towards a side edge of the stack but is closed along a longitudinal zone intermediate side edges of the stack. The next lower web of the stack has a fold lying in the opening of the uppermost web so that it will be partially withdrawn from the stack when the uppermost web is pulled free. By providing the starter web folded along the intermediate zone, the four thicknesses of web may be readily grasped by the fingers of a user.

The four folds are suitably made by first folding the traveling web into halves longitudinally of the web. This half folded web is then again folded to provide the quarter folds and is simultaneously interfolded with the next lower web of the stack. This latter web is itself conveniently generally folded as described in U.S. Pat. No. 3,401,927, R. H. Frick, inventor, and assigned to the same assignee as the present invention.

The folding device of this invention includes two successively positioned folding boards. A first is for the purpose of half folding the uppermost web of the stack and the second for interfolding the first web with a second while completing the fold of the first web into quarter folds. The second folding board may be similar to the folding board shown in FIG. 6 of the above-mentioned Frick patent and may be threaded in substantially the same manner as the sheet illustrated in that drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be more fully understood by reference to the following detailed description and accompanying drawings which follow. The drawings, for sake of clarity, are somewhat exaggerated in the presentation of folds, fold lines, thicknesses and the like. In the drawings:

FIG. 1 is a fragmentary view in perspective of a folding mechanism in accordance with the invention and illustrating the method of folding and interleaving the two upper webs of a stack;

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1 illustrating the relationship of the two upper webs of a stack;

FIG. 3 is a sectional view taken along line 3—3 of FIG. 1;

FIG. 4 is a fragmentary view illustrating a method of forming the web which interleaves with the uppermost web of a stack in accord with the invention;

FIG. 5 is a view taken along line 5—5 of FIG. 4;

FIG. 6 is a view taken along line 6—6 of FIG. 4;

FIG. 7 is a fragmentary view like that of FIG. 1 but without the webs and with parts broken away illustrating the arrangement of successive folding boards and associated equipment;

FIG. 8 is a fragmentary view illustrating a method of forming the uppermost web of a stack;

FIG. 9 is a view taken along line 9—9 of FIG. 8;

FIG. 10 is a view taken along line 10—10 of FIG. 8;

FIG. 11 is a much enlarged view of the folding mechanism and like that of FIG. 1 but taken from the rear of the folding boards;

FIGS. 12—18 are sectional views illustrating in detail steps in the folding of the two uppermost webs of a stack and taken on section lines of FIG. 11, the section lines corresponding in numerals to the numeral designating the particular figure of the drawing;

FIG. 19 is a view like that of FIG. 1 but illustrating another method of interfolding the upper two webs of a stack in accordance with the invention;

FIG. 20 is a sectional view taken along line 20—20 of FIG. 11;

FIG. 21 is a sectional view taken along line 21—21 of FIG. 11;

FIG. 22 is a sectional and fragmentary view of an upper portion of a completed stack; and

FIG. 23 is a perspective view of tissues as folded and disposed in a carton for individual removal.

PREFERRED EMBODIMENTS OF THE INVENTION

Referring to the drawings and initially particularly FIGS. 1 to 18 inclusive, the numeral 1 (FIG. 1) designates a web which is to be folded as the uppermost web of a web stack. The numeral 2 designates a web which is to be interfolded with web 1 and to be the next lower, that is, the second web of the stack.

For the sake of convenience, the folding of web 1 to the structure of FIGS. 8, 9 and 10 will first be considered; the folding of web 2 to the structure of FIGS. 4, 5 and 6 will then be considered separately; and the formation of the interfolded two webs (FIGS. 1 to 3 and FIGS. 11 to 18) will then be described.

The web 1 is directed by suitably positioned guide rolls 3 to a first folding board 4 (FIGS. 7 and 8). Board 4 has a first surface 5 in the general form of a trapezoid; a support 6 integral with the board depends rearwardly and is adapted for providing support of the board. The board further includes (FIG. 7) a downwardly forwardly directed surface 7 also in the general shape of a trapezoid. A web guide rod 8 projects forwardly beneath and beyond surface 7 angularly to the direction of sheet travel as indicated by the arrow (FIG. 1) and terminates adjacent a forward portion of a second folding board 17 (FIG. 8). A second guide rod 9 projects upwardly above the surfaces 5, 7.

The board 4 has a first lateral edge 10 which is inwardly directed forwardly on surface 5 toward surface 7; the board also has a second fold edge 11 also inwardly directed forwardly toward surface 7 but suitably somewhat less sharply so than edge 10. The surface 7 includes opposed lateral fold edges 12, 13 and forward terminal edge 14 which forms a juncture or corner 15 with lateral edge 12. The numeral 16 (FIGS. 7, 8) designates a common juncture of the board means or of surfaces 5, 7 at a narrow zone of the board 4.

The web 1 is directed under a suitable tension around guides 3 (FIG. 1) and across surface 5. The opposed lateral edge portions of the web are urged downwardly and inwardly of the edges 10,11 of surface 5 (FIGS. 8, 11 and 12). Guide 9 (FIGS. 8 and 13) serves further to direct the lateral edge portions of web 1 toward each other. The angular projecting guide rod 8 (FIGS. 8, 14 and 15) urges the lateral edges of web 1 further toward each other into overlying relation as the web proceeds toward folding board 17.

Web 2, which is to be folded with web 1, (FIG. 1) is spaced partially laterally of and above web 1 as it moves over guide 31 to the rear face of panel 18 of board 17. Panel 18 (FIG. 4) has an upstanding upper extension mount 19 which may be used to support the board in any convenient mount (not shown). This board 17 is similar to the board shown and described in Frick U.S. Pat. No. 3,401,927 mentioned above but with limited modifications noted hereinafter. The board is here described sufficiently to indicate its functions in the embodiments of this application. Reference may be had to the Frick patent for a more detailed description. Opposite extension 19 of panel 18 is a lip 20 of the board 17. Projecting forwardly from lip 20 in a direction angularly disposed to the direction of web travel indicated by the arrow (FIG. 1) is a rod 21 providing a folding edge.

The board 17 further includes a panel 22 which projects forwardly of panel 18 and upwardly obliquely from horizontally disposed panel 23 lying in the direction of web travel. Panel 23 has a slot 24 adapted for receiving a mounting bolt (not shown). A slot 25 in panel 18 having an edge 27 (FIG. 7) and the edge 26 of panel 23 provide means for effecting folding of the traveling web 2 (FIG. 4). This slot is of somewhat greater dimension than the slot shown in Frick U.S. Pat. No. 3,401,927 to provide for passage of the folded material and one side is curvilinear to aid web threading. The board 17 is suitably of sheet metal and has bend lines 28,29 (FIG. 7) serving respectively to join the panels 18,22 and 22,23.

The web 2 itself as it travels on the board 17, conveniently termed a right hand board, is folded to the configuration of FIG. 6. Specifically, the web 2, to achieve this fold (FIG. 6), is passed over guide 31 downwardly along the rear surface of panel 18 (FIGS. 4, 11 and 14) and its longitudinal center line crosses the intersection of fold edges 29, 28 and 26. The right hand half (FIG. 4) of the web 2 passes around the fold edge 28 on the rear side of the board onto the rear face of the panel 22 (FIG. 15) and makes a turn of 180° on the edge 26 (FIG. 4) so as to form the fold 2c (FIG. 6) on the upper surface of panel 26.

The left hand half (FIG. 4) of web 2 forms the folds 2a and 2b (FIG. 6). For this purpose the outer left quarter of web 2 is drawn through slot 25 over edge 27 (FIG. 7) while the inner left quarter passes under fold edge or lip (FIG. 7) 20. This inner left quarter is drawn directly through the device in the path indicated by the arrow (FIG. 4) to form the fold 2b; the rod 21 urges the outer quarter over the inner quarter fold 2b to form the fold 2a.

The web 2 is threaded as illustrated in the views of FIGS. 11 and 15 with one edge portion passing through slot 25 as shown. The web 1 as it is presented to slot 25 from the surface 7 of board 4 has been largely folded upon itself and interfolding of the two webs is initiated as the web portions pass in the slot (FIG. 15). As illustrated in FIGS. 11 and 15 particularly, a first half of an unfolded width of web 2 is continuously applied to the traveling web 1 which is folded in halves by the combined action of board 4 and rod 8. The web 1 is then folded again on itself (FIGS. 15 and 16) into quarters and to interfold web 2. This interfolding is completed as the webs pass under rod 21 in their movement in the direction of the arrow (FIG. 1). The completion of interfolding is carried out as web 2 is drawn down the rear of panel 22 around fold line 29 (FIG. 16) and around edge 26 (FIGS. 17 and 18). The second web 2 has a remaining half width which is folded as illustrated in FIG. 18 beneath folds of the first web and fold portions of itself.

In the embodiment of the folding device or mechanism shown in FIG. 19 the resultant interfolded webs have the same arrangement as previously described in connection with FIGS. 1 to 3 inclusive. However, in this instance the folding edge or rod 9 is eliminated as is the guide 31. The structures of the folding boards are similar but the feeding of the webs 41,42 involves laterally overlapping the webs.

Referring to FIG. 19, the first folding board 44 has a trapezoidal surface 45, a depending rearward support 46, a forward depending trapezoidal surface 47 and a guide rod 48. Edges 50,51 laterally bound the surface 45 and edges 52,53 bound the surface 47 laterally. The numeral 55 designates the lower left hand corner of surface 47 (FIG. 19) and the line of juncture of surfaces 45,47 is indicated by the numeral 56.

The second folding board (FIG. 19) is generally indicated by the numeral 57. It includes downwardly depending panel 58 having upper extension 59 and lower lip 60 or fold line 60. Lip 60 has guide rod 61 secured thereto and the rod extends toward panel 62, above horizontally disposed panel 63 and across the line of web travel indicated by the arrow (FIG. 19). Panel 63 includes aperture 64 for receiving a retaining bolt or the like for securing the folding board to a frame (not shown). Opening 65 of panel 68 provides for web passage to the guide rod 61. The panels 58, 62 and 63 may be formed, like board 17, from one piece of metal. The bend line 68 indicates the juncture of panels 58 and 62, the juncture of panels 62 and 63 not being shown.

In this instance the folding of web 41 is much like that of the web 1 of FIG. 1 in that the web 41 passed over surface 45 and its left edge (FIG. 19) is drawn downwardly inwardly over edge 50 of the board 44. This left edge is then guided by guided rod 48 inwardly beneath the opposite edge of the web. The second web 42 (FIG. 19) overlies web 41 in much the same manner that web 2 overlies partially folded web 1 in FIG. 14. The two webs are then presented to the second folding board 57 in the same manner as webs 1,2 were presented in FIGS. 15 through 18.

The interfolded webs, as illustrated in FIGS. 20 and 21, are of the same configuration as the interfolded webs 1,2. These webs are intended, as already indicated, as the upper webs of a stack and such a stack is illustrated in FIG. 22. Therein uppermost web 41 is indicated to have longitudinal quarter folds in overlying relation and such that the web 41 has an opening toward a side of the stack. This uppermost web is also closed along a longitudinal zone intermediate the opposite side edges of the stack so that the complete web 41 is readily grasped on the longitudinal center line rather than separate folds of the web. The web 42 is interfolded with web 41, as already described, and with other webs 70 having conventional folds 71,72 and webs 73 having folds 74,75.

The stacked webs are conventionally cut to length and provided in consumer size cartons in generally known manner. The webs may be provided in the carton in the rectangular arrangement shown in FIG. 22. Alternatively, the arrangement may be as indicated in fragmentary view in FIG. 23, and a fragment of a carton designated at 76 has an oval shaped perforation 37 for the purpose of providing an opening to the stacked tissues 38. In FIG. 23 only the upper webs are shown, and the stacked tissues are in a U shape. The start of the withdrawal is readily accomplished without damage to the individual webs.

In either method of production the resultant webs in the present instance have a stack of folded sheet material webs in which the uppermost web has longitudinal quarter folds, for example, 1a, 1b, 1c, 1d (FIG. 2), in overlying relation. In the stack the arrangement is such that the uppermost folded web has an opening between folds 1b and 1c toward the edge of the stack. This uppermost web 1 is closed intermediate the stack side edges along a longitudinal zone so that all four folds of the upper web may be conveniently grasped. The next lower web has a pair of folds 2,2b which lie in the opening of the folds of the upper web and is partially withdrawn by withdrawal of the upper fold.

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The term "longitudinal" as employed herein and the appended claims is intended to indicate the direction in which the web extends as it is folded but is not intended to be limited to a particular length, that is, cut length or otherwise.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that I do not limit myself to the specific embodiments thereof except as defined in the appended claims.

What is claimed is:

1. A sheet material assembly comprising a stack of longitudinally folded sheet material webs including an uppermost starter web and a next lower web, said uppermost web having longitudinal quarter folds all in overlying relation providing a folded web having an opening toward a side edge of the stack, said next lower web having a fold lying in the said opening of the uppermost web so that withdrawal of the uppermost web

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from the stack also partially withdraws the said next lower web, said uppermost web being closed along a longitudinal zone intermediate side edges of the stack to permit grasping of the folded thickness of the said uppermost web.

2. A sheet material assembly according to claim 1 in which the quarter folds of the central portion of the uppermost web lie in contact, the quarter folds of the opposite edges of the uppermost web lie in contact and the next lower web is interposed between the folds of the said central portion and the folds of the opposite edges.

3. A sheet material assembly according to claim 2 in which the said next lower web has a pair of folds in contact which folds are the portion of the next lower web interposed between the folds of the central portion and the folds of the opposite edges of the uppermost web.

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