

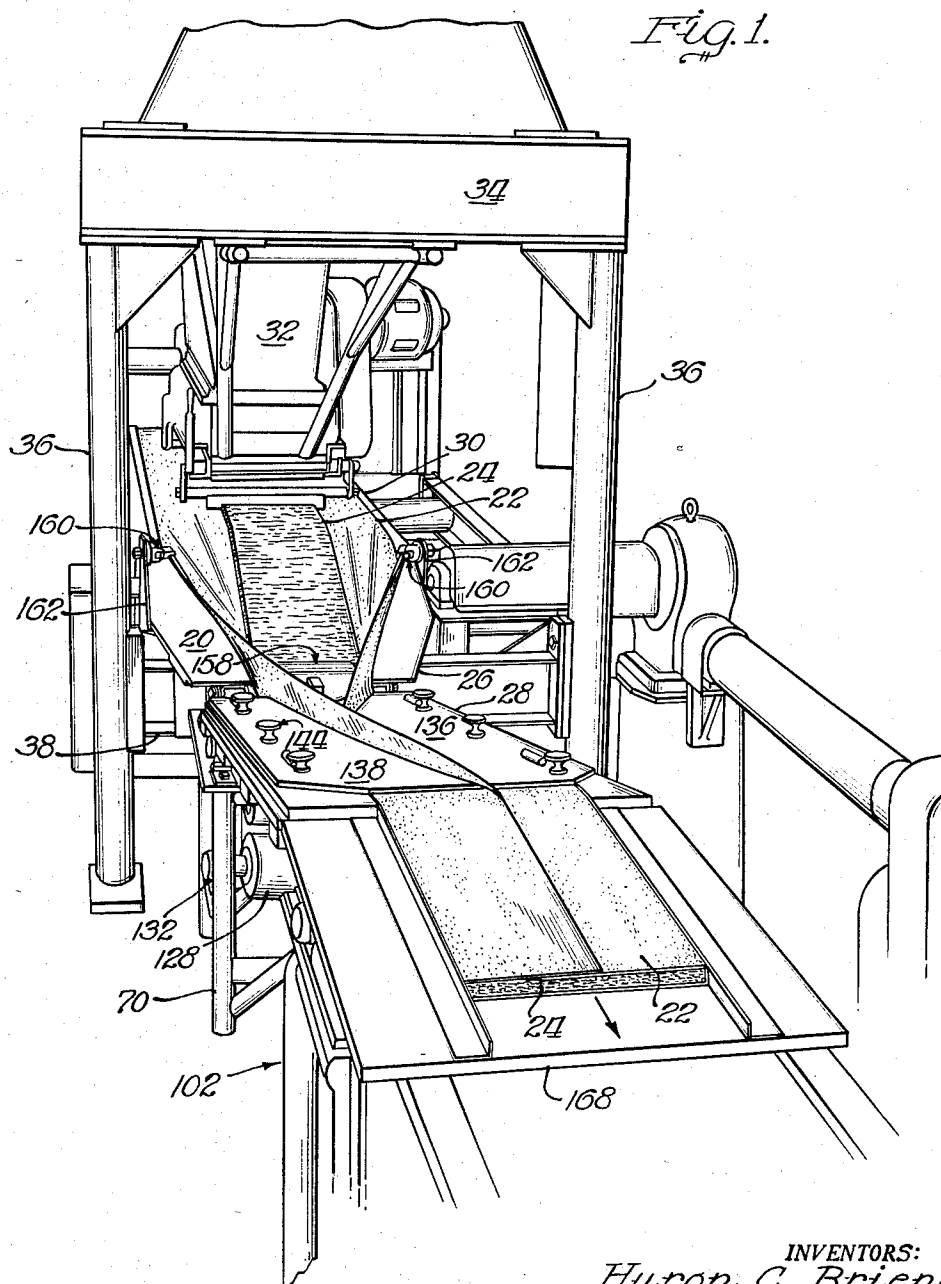
May 12, 1959

H. C. BRIEN ET AL
FOLDING CONVEYOR

2,885,848

Filed Feb. 25, 1954

5 Sheets-Sheet 1



INVENTORS:

Huron C. Brien
David D. Jones

By:

Soans, Klaister & Anderson
Attorneys

May 12, 1959

H. C. BRIEN ET AL

2,885,848

FOLDING CONVEYOR

Filed Feb. 25, 1954

5 Sheets-Sheet 2

Fig. 2.

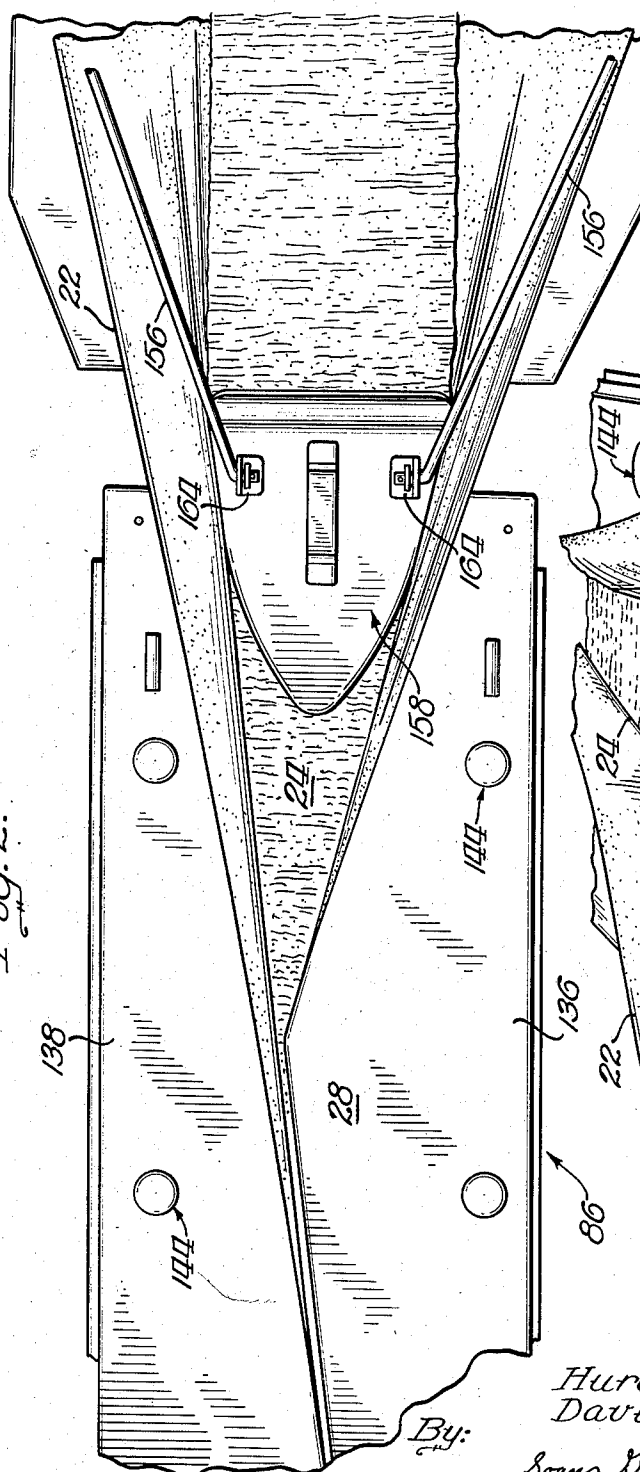
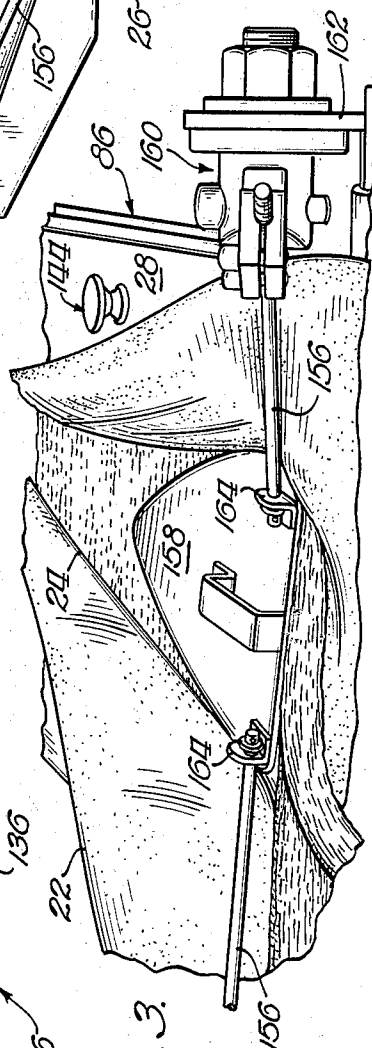


Fig. 3.



INVENTORS:
Huron C. Brien
David D. Jones
By: Soans, Blaister & Anderson
Attys

May 12, 1959

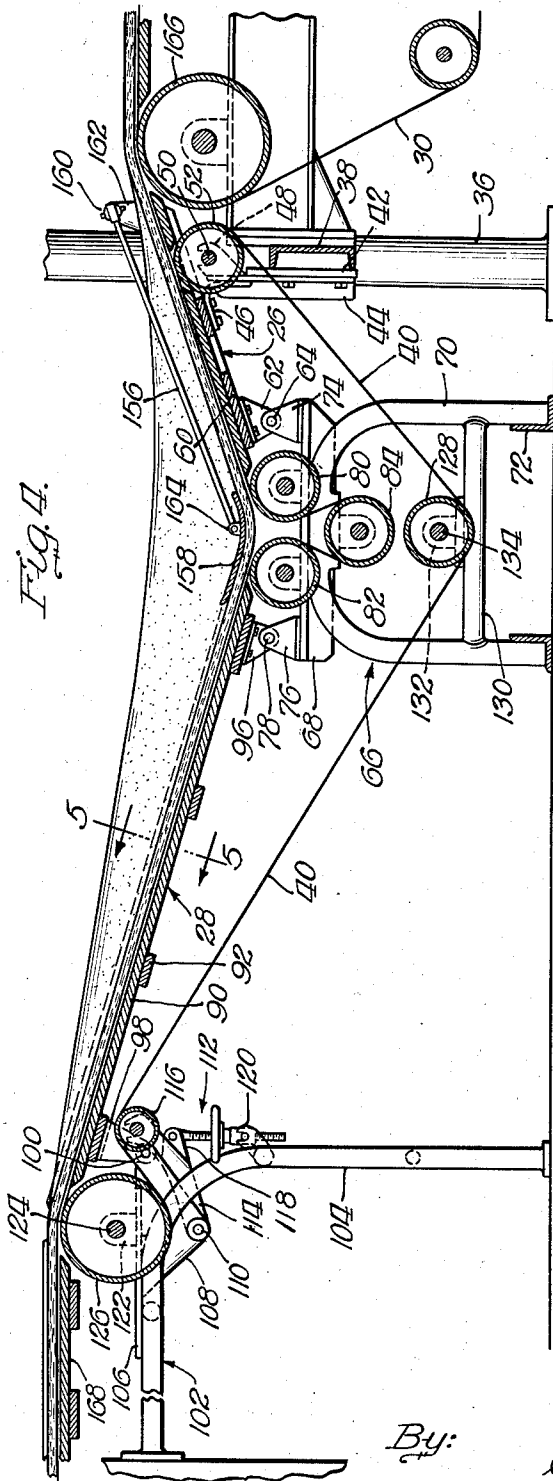
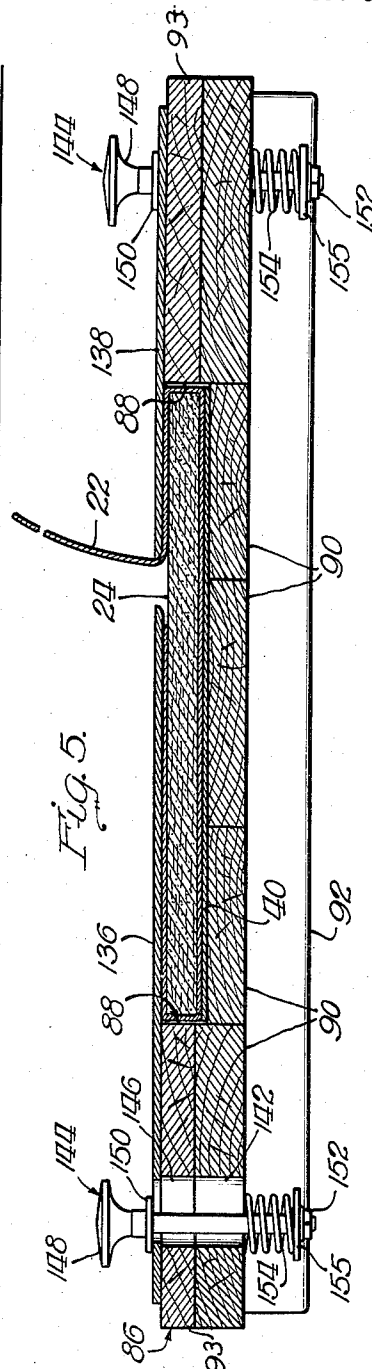
H. C. BRIEN ET AL

2,885,848

FOLDING CONVEYOR

Filed Feb. 25, 1954

5 Sheets-Sheet 3



INVENTORS:

INVENTORS:
Huron C. Brien
David D. Jones

David D. Jones

Soans, Plaister & Anderson
Ft. Collins

May 12, 1959

H. C. BRIEN ET AL
FOLDING CONVEYOR

2,885,848

Filed Feb. 25, 1954

5 Sheets-Sheet 4

Fig. 6.

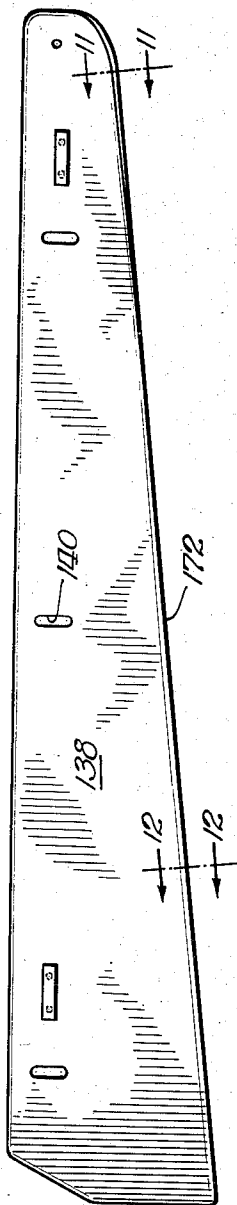


Fig. 7.

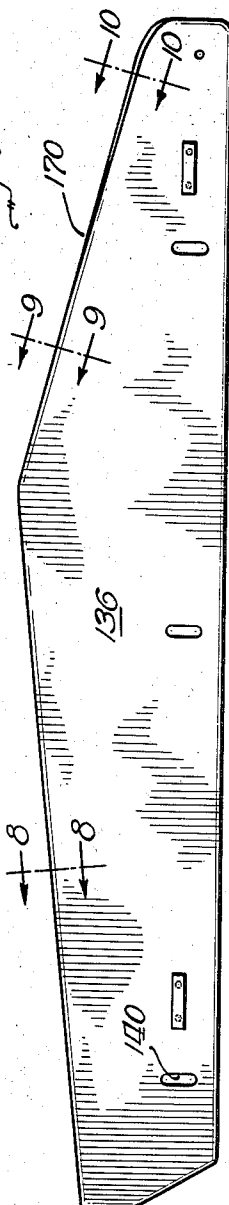


Fig. 8.



Fig. 9.



Fig. 10.

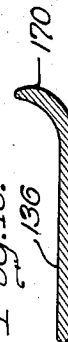


Fig. 11.



Fig. 12.



By:

INVENTORS:
Huron C. Brien
David D. Jones
Soans, Glaister & Anderson
Attys.

May 12, 1959

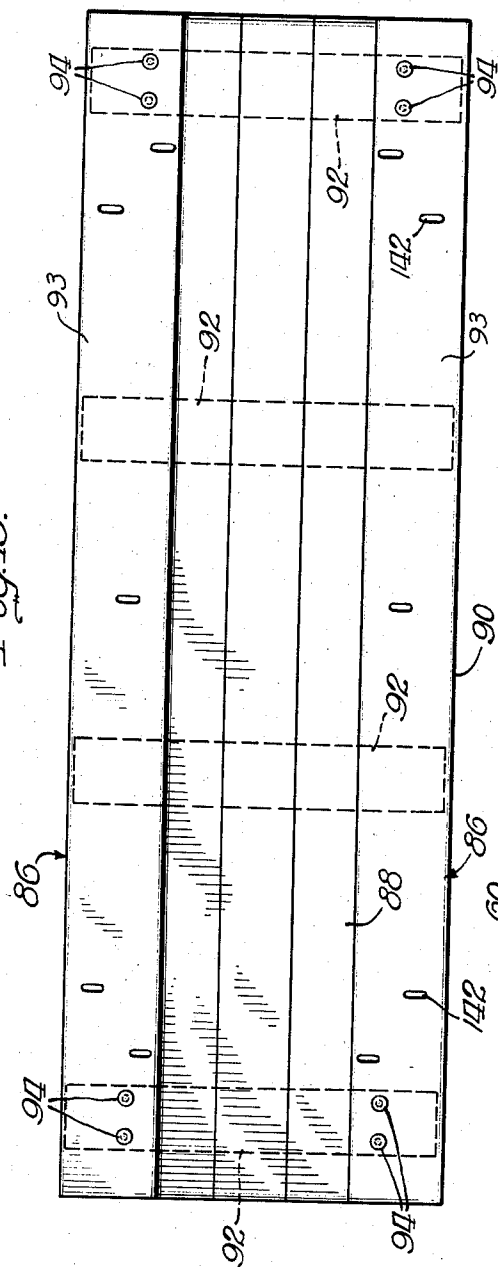
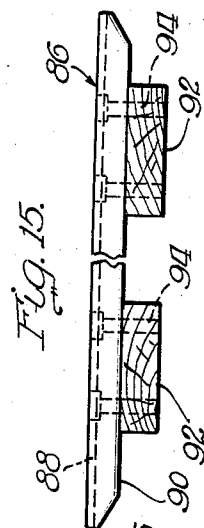
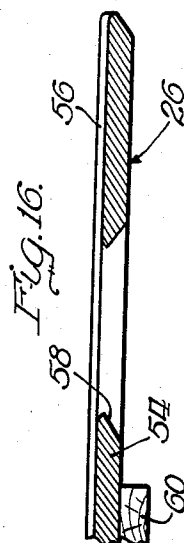
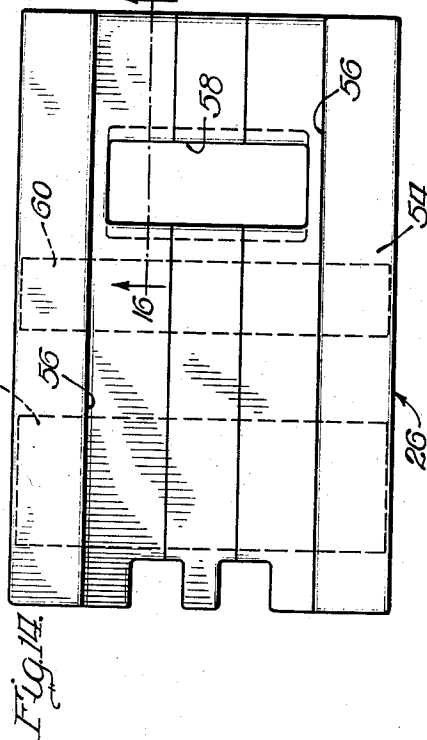
H. C. BRIEN ET AL
FOLDING CONVEYOR

2,885,848

Filed Feb. 25, 1954

5 Sheets-Sheet 5

Fig. 13.



By:

INVENTORS:
Huron C. Brien
David D. Jones
Loans, Glaister & Anderson
Attys.

1

2,885,848

FOLDING CONVEYOR

Huron C. Brien, Neenah, and David D. Jones, Menasha, Wis., assignors, by mesne assignments, to Kimberly-Clark Corporation, a corporation of Delaware

Application February 25, 1954, Serial No. 412,562

5 Claims. (Cl. 53—180)

The present invention relates generally to a method and apparatus for folding sheet material, and is more particularly concerned with the folding of sheet material while it moves through a given path, as in a continuous wrapping operation.

The mass production of many articles requires a high speed wrapping operation, which consists generally of depositing the articles on a continuous sheet of wrapping material as the latter moves through a fixed path, folding the wrapping material to enclose the articles as the two move through a given portion of the path, and then transversely severing the wrapper at spaced intervals. However, a wrapping operation of this type tends to produce a biased fold, which is objectionable in many instances. The biased fold, wherein the folded portion of the wrapper sheet is lapped over the article-supporting portion in angularly offset relation thereto, is of course due to the fact that, while all parts of the sheet travel at the same rate of speed, the folded portion is moved laterally as well as longitudinally and cannot, therefore, end up even with the article-supporting portion of the wrapper. To attempt to cure this condition by pulling the folded portion into transverse alignment with the article-supporting sheet portion merely results in wrinkles along the folded-over edge portion of the wrapper and/or may cause the wrap sheet to tear.

Generally, the above difficulty has been somewhat satisfactorily overcome by extending the folding operation over a considerable distance along the path of movement, to thereby minimize the angle of offset between the folded sheet portions. With the realization that if the length of the fold is extended to infinity the folded portions will assume a parallel relationship, the above solution readily presents itself. However, it is also recognized that the length of the folding operation necessarily increases as the width of the desired fold increases, if the results of an infinite length fold are to be approached. Consequently, in making a fold of any appreciable width, a considerable length must be devoted to the folding operation.

The extended length of folding equipment is, of course, costly in that it requires the use of a large portion of the available manufacturing space. Furthermore, it places the preceding and succeeding packaging operations at remote positions, which hampers the overall efficiency of the entire procedure. It also exposes the articles to be wrapped for an extended period of time, which is undesirable in circumstances wherein strict requirements as to sanitary handling and the like necessitate a minimum of exposure of the articles to the surrounding atmosphere.

It is the principal object of the present invention to provide an improved method and apparatus for folding moving sheet material in a minimum distance of travel of the sheet. Another object of the invention is to provide an improved means for folding continuously moving sheet material, which results in a smooth, parallel fold longitudinally of the sheet. Other objects and advantages

2

will become apparent as the disclosure progresses with respect to the accompanying drawings, in which:

Fig. 1 is a perspective view of a machine embodying the principles of the present invention.

Fig. 2 is an enlarged plan view of a portion of the apparatus in Fig. 1.

Fig. 3 is an enlarged perspective of the structure in Fig. 2, as seen from the right.

Fig. 4 is a side view of the machine in Fig. 1, with parts broken away and in section.

Fig. 5 is an enlarged, sectional view taken along the line 5—5 in Fig. 4.

Fig. 6 is an enlarged plan view of one of the folding boards seen in the preceding figures.

Fig. 7 is an enlarged plan view of the other folding board.

Fig. 8 is an enlarged sectional view, taken along the line 8—8 in Fig. 7.

Fig. 9 is an enlarged sectional view, along the line 9—9 in Fig. 7.

Fig. 10 is an enlarged sectional view, taken along the line 10—10 in Fig. 7.

Fig. 11 is an enlarged sectional view, along the line 11—11 in Fig. 6.

Fig. 12 is an enlarged sectional view, along the line 12—12 in Fig. 6.

Fig. 13 is an enlarged plan view of a portion of the machine.

Fig. 14 is an enlarged plan view of another portion of the machine.

Fig. 15 is a side elevation of the structure in Fig. 13, with a portion thereof broken away.

Fig. 16 is an enlarged sectional view taken along the line 16—16 in Fig. 14.

With reference particularly to Fig. 1 of the drawings, it is seen that the apparatus chosen to illustrate the present invention comprises a folding conveyor 20, which is adapted to wrap opposite edge portions of a traveling sheet material 22 in overlying relation to a mat 24 which has been placed along an intermediate portion of the sheet. More particularly, the machine 20 is intended for use in forming the liner of hospital maternity pads from the fluff mat 24 of the cellulosic fibers or the like and a creped wadding, wrap sheet 22. This particular application is believed to be particularly demonstrative of the advantages of the present invention, since the fluff mat 24 is an easily disruptable body, making it difficult to wrap by mechanical means, and since it is extremely important that the wrap be accomplished without any trace of wrinkles on the pad. It is readily apparent, however, from the following description that the present invention is equally adaptable to use with other wrapping materials and for wrapping numerous other articles.

As seen in Figs. 1 and 2, the folding conveyor 20 comprises generally a feed table 26 and a forward folding section 28, which are inclined downwardly toward each other to provide a dip in the path of movement of the material being handled thereby. The feed table 26 is disposed immediately adjacent to and forms a continuation of an endless conveyor 30, which is adapted to move the wrap sheet 22 from a supply roll of the sheet material (not shown) in underlying relation to means for placing the fluff mat material 24 on the wrap sheet. The structural details of the latter means, indicated generally at 32, forms no material portion of the present invention and, therefore, will not be described.

The mat laying means 32 and the endless conveyor 30 are supported on a suitable frame structure 34, which also provides at its forward end a support for the rear end of the feed table 26. More specifically, a pair of column members 36 at the forward portion of the frame

34 have a channel member 38 fixed therebetween (Figs. 1 and 4), which provides a support for the feed table 26 and for one end of an endless conveyor belt 40, which is positioned to move the wrap sheet 22 and the fluff mat 24 across the feed table and the forward folding section.

The channel 38 has a plate 42 (Fig. 4) secured to its forwardly extending flange portions, as by welding, and a pair of vertically extending angle members 44 are detachably secured to the outer face of the plate 42 in spaced relation to each other and for vertical adjustment relative to the plate 42. Each of the angles 44 has fixed at its upper end a forwardly bent, brace member 46 which is disposed in supporting relation to the underside of the feed table 26. Also secured to the upper end of each of the angle members 44 is a rearwardly extending arm 48 having a journal portion thereon for rotatably receiving one end of a shaft 50 mounting a roller 52. The roller 52 provides the rear support for the conveyor belt 40.

The feed table 26 (Figs. 14 and 16) is of suitable material, such as wood, and comprises a main, upper member 54 having a recessed center portion 56 defining a trough for receiving the conveyor belt 40. The center section 58 of the rear of the member 54 is cut away to provide for receiving the roll 52 (Fig. 4) of the conveyor belt 40, and a pair of cross braces 60 are secured to the underside of member 54. The forwardmost of the cross braces 60 has fixed thereto a pair of depending angle members 62 having aligned openings there-through (not shown) affording means for supporting the feed table on a cross shaft 64 for swinging movement relative thereto.

The shaft 64 is carried by a center supporting structure 66 for the conveyor belt 40, which also supports the adjacent ends of the feed table 26 and the folding board 28. The structure 66 comprises a pair of longitudinally extending platform members 68, which are laterally spaced and which are supported on a pair of leg members 70. The legs 70 are preferably fixed to the floor, as by means of an angle member 72 at the base of each leg. The rearward end of each of the platform members 68 has a bearing member 74 suitably supported thereon, and the bearings 74 are laterally spaced and aligned to provide a support for the cross shaft 64 which affords the above mentioned pivot mounting for the forward end of the feed table 26.

The forward ends of the platform members 68 have a similar pair of bearing supports 76 fixed thereto for mounting a cross shaft 78, which provides a pivot mounting for the rearward end of the folding board 28. The intermediate section of the platform members 68 have rotatably mounted thereon a pair of parallel, spaced-apart rollers 80 and 82, and a third roller 84 is rotatably mounted on the underside of the platform members in a position intermediate and parallel to the rollers 80 and 82. It is seen, therefore, that the rollers 80, 82 and 84 constitute idler rollers for directing the upper run of the conveyor belt 40 through a given path in a manner affording a break between the feed table 26 and the folding board 28. The use of a continuous conveyor belt for both the feed table and the folding board insures a uniform rate of travel during the entire folding operation. Furthermore, the described arrangement permits a ready vertical adjustment of the feed table and folding board relative to each other. Of course, separate conveyor belts could also be used for the feed table 26 and the folding board 28 together with suitable means for driving both belts.

It will be understood that in some instances the conveyor belt 40 might be disposed with and other suitable means employed for moving the wrap sheet 22 along the feed table 26 and the folding board 28. Furthermore, it is possible that, with a wrap sheet of sufficient strength to support its own weight in moving through the dip and

into the folding board 28, both the feed table and the folding board might be eliminated. However, the conveyor belt 40 is believed to be particularly important to the effective operation of the apparatus, when the wrap sheet 22 comprises a fragile sheet or web which might break, tear or be undesirably stretched when subjected to tension. In such case, the support afforded by the belt is necessary to maintain the wrapper sheet in its continuous form throughout the wrapping operation.

It will also be apparent that the feed table 26 might be eliminated, and the wrapper sheet 22 carried solely by a moving conveyor belt extending along the downwardly inclined portion of the path of movement. However, the illustrated arrangement includes the feed table since it does provide some advantages, particularly with respect to the guide trough 56 for the conveyor belt 40.

The folding board 28, which is disposed in the illustrated embodiment of the invention at an angle of incline which is approximately equal to the angle of the feed table 26, comprises a table-like structure 86 (Figs. 4, 5, 13 and 15) generally rectangular in form and including means defining a recess or groove 88 longitudinally of the structure, which conforms generally with the width of the conveyor belt 40 and the fluff mat 24 and which has a depth approximately equal to the thickness of the mat to be wrapped. The illustrated folding board is built up of wood members 90 which are secured together in any suitable manner and are additionally braced by a series of spaced-apart transverse members 92. The upper portion of the groove 88 is formed by a pair of side members 93 (Fig. 5), which are preferably laterally adjustable to conform with different width of mats to be wrapped.

As noted particularly in Fig. 15, the end brace members 92 include bolt receiving openings 94 therethrough for securing two pairs of angle members 96 and 98 in depending relation at the rearward and forward end, respectively, of the folding board. The spaced-apart pair of angle members 96 have aligned openings (not shown) therethrough for receiving the shaft 78 to thereby afford a pivot support for the rear end of the folding board. The angle members 98 at the front end of the folding board 28 provide means for support of the forward end of the board on a transverse shaft 100, which is disposed through aligned openings in the depending flange portion of the angles 98. Although shown as being fixed relative to its supporting frame 102, the shaft 100 might be mounted for vertical adjustment in a manner similar to that illustrated and described with respect to the support 44 for the rearward end of the feed table 26. Then too, the center supporting frame structure 66 might readily be mounted on vertically adjustable legs to provide further adjustment for the angular relationship between the table 26 and the folding board 28.

The shaft 100 (Fig. 4) is supported by a forward frame structure 102, which includes a pair of laterally spaced, tubular side members 104 having a horizontal plate 106 extending therebetween astride the top of the frame. Depending from each side of the plate 106 and secured thereto is a triangular plate 108, and these plates are provided with aligned openings at their rearwardly extending apexes for supporting the shaft 100. The depending apex portions of the triangular plates 108 also have a pair of aligned openings therethrough for mounting a cross shaft 110, which supports a belt tightener 112 for the conveyor belt 40.

The belt tightener 112 comprises a pair of arms 114 fixed to the shaft 110 for rotation therewith, and these arms extend rearwardly from the shaft 110 to present aligned journal portions for rotatably receiving a roller 116. The shaft 110 also has another arm 118 secured thereto, which extends rearwardly to a pivotal connection with the upper end of an adjusting screw mechanism 120, to thereby provide for vertical adjustment of the roller 116 to adjust the tension of the conveyor belt 40.

The plate 106 (Fig. 4) also mounts suitable bearing members 122 for rotatably supporting opposite ends of the center shaft 124 of the forward roller 126 for the conveyor belt 40. The intermediate portion of the lower run of the belt 40 is guided by another roller 128 which is rotatably mounted on a lower portion of the center supporting structure 66 (Fig. 4). More particularly, a pair of side brace members 130 for the legs 70 have secured thereto upwardly extending bearing members 132, which present aligned openings (not shown) for receiving the center shaft 134 of the roller 128.

Looking particularly at Figs. 2, 5 and 6-12, it is seen that the folding board 28 also includes a pair of folding members 136 and 138 for directing the free edge sections of the wrap sheet 22 into folded, overlying relation to the fluff mat 24. The folding member 136 which effects the lower flap of the fold will be referred to as the front folding member, while the member 138 will be designated hereinafter as the back folding member. Each of the folding members include transverse, slotted openings 140 (Figs. 6 and 7) to provide means for adjustably positioning the folding members in fixed relation to the supporting board structure 86. These openings are alignable with a series of openings 142 (Fig. 13) in the board 86, and a fastening means 144 (Fig. 5) is inserted therethrough to secure the folding member in position.

The fasteners 144 (Fig. 5) comprise a bolt 146 having a knob 148 and a collar portion 150 at the upper end, and a threaded lower end for receiving a nut 152. A coil spring 154 may be interposed between the under side of the board 90, as illustrated in Fig. 5 and a washer 155 disposed above the nut 152, to thereby yieldably hold the folding member in position on the board 86. The slotted openings 140 in the folding members provide for lateral shifting of these members, upon sufficient release of the pressure of springs 154, to permit lateral adjustment of the position of the fold created by these folding members.

It will also be noted (Figs. 6-12) that the rearward, inner edge of each of the folding members 136 and 138 includes an upwardly flared portion for initially guiding the material to be folded into a position overlapping the mat 24. Additional guide means for the outer edge portions of the wrap sheet 22 is provided for by a pair of rods 156, which extend from laterally spaced positions adjacent the edges of the wrap sheet 22 at the rear of the feed table 26 to a curved restraining part 158 disposed on top of the fluff mat 24 at the dip in the conveyor path.

The rear end of each of the guide rods 156 is fastened by a swivel connector 160 (Figs. 3 and 4) to the upper end of a bracket 162 which is carried by the rear portion of the feed table 26. The forward end of each of the rods 156 includes a laterally bent portion, which is pivotally connected with a bracket 164 secured to the restraining part 158. As seen particularly in Figs. 2, 3 and 4, the restraining part 158 is generally triangular in shape and is curved to fit the dip of the conveyor 40 between the feed table and the folding board. The weight of the part 158 and the disposition of the rods 156 is such that the fluff mat or insert 24 and the center portion of the wrap sheet 22 are retained in position without exerting any excessive downward pressure thereon. Also, it is preferred in the illustrated embodiment to make the part 158 substantially the width of the mat 24, in order to maintain the latter in position along its width and to facilitate folding of the wrap sheet in close relation to the mat without disturbing the side edges of the mat.

The disposition of the guide rods 156 is such that they provide the proper guidance for the wrapper in its movement to the folding board 28 and, also, provide some lateral support for the side portions of the wrap sheet 22. The latter feature may be particularly important in connection with a wrap sheet made of a material having

insufficient strength to support itself. It is possible that with certain types of material and for other reasons, the guide rods 156 might be desirably disposed and/or adaptable to be shaped to substantially conform with the normal disposition of the side portions of the wrap sheet during its downward movement toward the restraining part or plow 158. Also, the restraining part 158 and its associated parts may be adjustably mounted on the machine so as to control the amount of pressure on the fluff mat 24.

It is seen from the foregoing, therefore, that as the wrap sheet 22 and the fluff mat 24 are carried to the end of the conveyor 30 and pass over a roller 166 (Fig. 4), they enter onto the feed table 26 where they are picked up by the conveyor 40. The fluff mat 24 and the underlying portion of the wrap sheet 22 are guided along the center of the feed table by the recess 56 for the conveyor belt 40, while the edge portions of the wrap sheet pass along the outside of the guide rods 156 and thence to the inner edge portions of the folding member 136 and 138. It should be understood, of course, that the leading end of the wrap sheet is suitably fed into the folding board 28, by hand or otherwise, where it is folded over the fluff mat and guided onto the table section 168 at the forward end of the folding board. Once the materials have thus been positioned in the machine the folding of the succeeding materials is automatically accomplished through the operation of the conveyors 30 and 40. The center of the wrap sheet 22 and the mat 24 move along the downwardly curved path of the conveyor belt 40, while the side portions of the wrap sheet pass along the outside of the guide rods 156, at a level above the dip in the conveyor belt, and then into the folding members 136 and 138 where they are finally folded over the mat 24.

As noted particularly in Fig. 1, the downwardly inclined disposition of the feed table 26 and the upward incline of the folding boards allows the side edge portions of the wrap sheet 22 to travel the same horizontal distance longitudinally of the folding conveyor, in the same time, as the center portion underlying the material to be wrapped, while also moving transversely through the distance necessary to accomplish the desired fold. The underfold is achieved by the front folding board 136 and, by virtue of the relatively sharp angle formed by the inner edge 170 thereof with respect to the line of travel, is completed early in the ascent of the mat 24 up the folding board. The back folding board, which has an inner edge 172 making a more gradual angle with respect to the line of travel, takes substantially the remainder of the folding board length to achieve the upper fold of the wrap.

The above described foreshortening of the distance of travel for the sections of the wrap sheet 22 which are to be folded, provides for transverse alignment of the leading edges of the folded wrap sheet at the forward end of the folding board. Consequently, the biased fold otherwise encountered with the conventional horizontal or straight line folding board, in a similar length of travel, is eliminated. Where the folding is done in virtually a single plane, the outer edges of the wrap sheet travel the same distance as the center portion plus the amount of transverse movement necessary to achieve the fold. Consequently, the outer edge lags behind the center portion at the finish of the fold and results in a biased fold. With the present invention, the amount of longitudinal travel of the side portions of the wrap sheet is less than the amount of longitudinal travel of the center portion of the wrap sheet, because of the vertical diversion of the latter, and the transverse movement of the side portions necessary to achieve the fold is approximately equal to the difference in longitudinal travel. As a result, all points across the wrap sheet are transversely aligned at the end of the fold.

This particularly novel manner of achieving a fold not only results in a straight fold, with the overlapping

edges parallel and smooth, but also makes it possible to achieve an excellent fold in a much shorter distance than was thought possible heretofore. The latter feature is of particular importance where economy in space is necessary, but is also a factor in the overall efficiency of the packaging operation since it condenses the operation into a space which can be easily watched by the operator.

As indicated previously, the illustrated machine has been very successfully used in connection with the wrapping of an easily compressible fluff mat of cellulose fibers with a fragile web of creped wadding material for the manufacture of hospital maternity pad fillers. In this embodiment, it is extremely important that the fluff mat retain its original shape and fluffiness, and that the wrap be made without leaving a trace of any wrinkles. The illustrated machine fulfills both of these requirements in that the fluff mat 24 is directed through the machine without any altering of its shape or bulk throughout, and the final disposition of the folded over, outer edge portions is one of precise alignment, both longitudinally and horizontally, leaving no loose material to cause wrinkles to appear.

The creped wadding material used for the wrap sheet 22 in the illustrated embodiment has been found to be easy to work with in the described operation, probably because of the resiliency of such material and its lightness in weight. Then too, the fact that such material is very light in weight not only makes it easy to handle during the wrapping operation, but also avoids the problem of possibly having to support the edges of the sheet when they are disposed in a generally vertical plane at the beginning of the folding operation.

And, although shown with respect to a particular angular disposition of the feed table 26 and the folding board 28, it is recognized that this relationship might well vary with other applications, without departing from the principles of the present invention. It is believed that the characteristics of the wrap sheet, as well as the width of the folds to be achieved, will generally influence the selection of the most desirable angle of dip for the conveyor. Furthermore, the type of material being wrapped, whether very fragile, compressible etc. will affect the decision as to choice of the angle of dip. Of course, in the case of a wrap wherein two folds are to be accomplished, as in the described instance, the angle of dip is dependent upon the desired distance to the first fold.

It seems fairly apparent, however, that in order to achieve a fold in a given distance of travel the angle of dip should increase with the width of the fold to be effected. Also, in some instance it might be desirable that the two folded over portions of the wrap sheet be of different widths. In such instances, the material to be wrapped can be placed in off-center relation to the wrap sheet or the folding members 136 and 138 shifted laterally, or both, to achieve a difference in the widths of the two folds being made. And, although described with respect to an overlapping fold, it will be obvious that the principles of the present invention are equally applicable in effecting a single fold, a wrap fold wherein the two folded-over edges abut each other, or a wrap wherein the inner edges of the folded material are spaced apart.

It is also possible that in some instances the angle of dip requirement for one fold is considerably in excess of that for the other fold. This variation might be accommodated by tilting the feed table 26, the center supporting structure and folding board with respect to the horizontal, in order to achieve a difference in the angle of dip for the two sides of the wrap sheet. As a practical matter, however, it is believed more desirable to accommodate the wider fold with the necessary angle of dip and leave the conveyor structure in a horizontal position.

Then too, the present invention is not limited to the

described generally horizontal folding arrangement. It is conceivable that the principles disclosed herein might well be applied to a similar folding arrangement wherein the transverse portions of the wrap sheet are disposed in a plane other than horizontal. Furthermore, although the dip in the wrapper sheet is described as being composed of a single angle formed between the feed table 26 and the folding board 28, a particular application might well dictate the use of one or more additional breaks in the path of movement to form two or more angles therealong. For example, the feed table 26 might be formed of two or more sections disposed in vertically, angular relation, or the folding board 28 might comprise two or more sections inclined at different angles with respect to the horizontal, or a combination of these arrangements, without departing from the principles of this invention.

Although described with respect to the wrapping of a continuously formed filler pad for a sanitary napkin, it will be understood that the principles of the present invention are equally applicable to the wrapping of other types of articles whether such articles are of a continuous form or disposed in spaced relation.

We claim:

1. Means for folding sheet material along its length as it moves through a predetermined path, comprising a frame structure, a conveyor supported on said frame for moving said sheet material, said conveyor having a first section thereof inclined downwardly and a second section extending forwardly from the lower end of said first section in an upwardly inclined position, a folding board in adjacent, overlying relation to said second section having a side edge portion angularly disposed with respect to the direction of travel of said conveyor, a sheet restraining means disposed in closely overlying relation to said conveyor at the intersection of said first and second sections, and means for supporting said restraining means including a guide member connected to said restraining means and extending rearwardly to a connection with said frame adjacent to and above the rear of said first section of said conveyor, said sheet restraining means having a width less than the width of said conveyor sections and said guide member extending rearwardly from said sheet restraining means in diverging relation to the longitudinal center line of said conveyor, whereby the central portion of the sheet material being folded is restrained against vertical movement at the intersection of said first and second conveyor sections while the outer edge portion of said sheet is free to extend upwardly from said restrained central portion.

2. Apparatus for folding sheet material, comprising a conveyor for moving the sheet material through a predetermined path, said conveyor including a pair of generally horizontal sections disposed in longitudinally spaced relation, a downwardly inclined section extending forwardly from the rearward one of said horizontal sections, and including an upwardly inclined section extending forwardly from a position adjacent said downwardly inclined section to a position adjacent the forward one of said horizontal sections, whereby said sections comprise a substantially continuous travelling conveyor surface having a dip therein, a pair of folding boards supported on said upwardly inclined conveyor section in overlying relation thereto, said folding boards being positioned in generally coplanar relation and having inwardly facing side edge portions disposed in angular relation to the direction of travel of said conveyor, a sheet restraining means disposed in overlying relation to said conveyor at the intersection of said inclined sections, and a pair of sheet guiding members connected to said restraining means for supporting same and extending rearwardly therefrom in diverging relation to a position adjacent to and above the forward edge of said rearward, horizontal conveyor section said sheet restraining means having a width less than the width of said down-

wardly inclined conveyor section and said sheet guiding members being disposed in spaced relation at their rearward ends a distance substantially equal to the width of said downwardly inclined conveyor section, whereby the central portion of the sheet material being folded is restrained against vertical movement at the intersection of said inclined conveyor sections while the outer edges of the sheet are free to extend generally upwardly with respect to the restrained central portion of the sheet along the position of said downwardly inclined conveyor section.

3. Apparatus for folding sheet material comprising, a conveyor for moving the sheet material through a predetermined path, said conveyor including a generally horizontal section, a downwardly inclined section extending forwardly from said horizontal section, an upwardly inclined section extending forwardly from a position adjacent said downwardly inclined section, and including an endless belt supported on said sections to provide therewith a travelling surface which dips downwardly from the initial horizontal path portion and then rises along said upwardly inclined section, a pair of folding boards supported on said upwardly inclined conveyor section in overlying relation thereto, said folding boards being arranged in generally coplanar relation and having inwardly facing side edge portions each disposed in different angular relation to the direction of travel of said conveyor, to thereby direct the folding of material carried by said endless belt over said upwardly inclined conveyor section, means for securing each of said folding boards to said inclined conveyor section in laterally adjustable relation thereto, a sheet restraining means disposed in overlying relation to said conveyor at the intersection of said inclined sections, and means for mounting said sheet restraining means for swinging movement relative to a position of rest at the dip in said conveyor, said mounting means including a pair of elongated members which are pivotally connected at one end to said restraining means and extend rearwardly therefrom in laterally diverging relation to a position adjacent the upper end of said downwardly inclined conveyor section.

4. Apparatus for folding sheet material, comprising a conveyor for moving the sheet material through a predetermined path, said conveyor including a generally horizontal section, a downwardly inclined section extending forwardly from said horizontal section, and an upwardly inclined section extending forwardly from a position adjacent the lower end of said downwardly inclined section, whereby said sections comprise a substantially continuous travelling conveyor surface having a dip therein, a pair of folding boards supported on said upwardly inclined conveyor section in generally coplanar relation to each other, said folding boards having inwardly facing side edge portions disposed in different angular relation to the direction of travel of said conveyor to direct the folding of sheet material carried by said conveyor as the sheet moves along said upwardly inclined section, one of said side edge portions extending across the path defined by said other side edge so as to effect an overlap-

ping of the opposite sides of the sheet material being directed thereby, and a sheet restraining means positioned at the dip in said conveyor for holding the sheet material in position, said sheet restraining means comprising a part having a smooth bottom surface which is curved to conform generally with the dip in said conveyor and having a width no greater than the distance between the folds made by said folding boards, a pair of elongated members pivotally connected at one end to said restraining part in a manner affording vertical swinging movement of said part about an axis which is transverse to the direction of travel of said conveyor, said elongated means extending rearwardly in laterally diverging relation to each other, and means mounted on said conveyor adjacent the junction of said horizontal and downwardly inclined sections for pivotally supporting the other ends of said elongated members.

5. Apparatus for folding sheet material, comprising a conveyor for moving the sheet material through a predetermined path, said conveyor including a feed table which is inclined downwardly, a generally plane member extending forwardly from adjacent the lower end of said feed table in an upwardly inclined position, a pair of folding boards mounted on said plane member for directing the folding of sheet material carried by said conveyor, a center supporting structure for the adjacent lower ends of said feed table and member including means affording swinging movement of said table and member, respectively, about a pair of horizontal, transverse axes, a pair of vertically adjustable means for supporting the rearward portion of said feed table and for supporting the forward portion of said member, respectively, an endless conveyor belt having its upper run disposed on top of said feed table and said member, and means for drivingly supporting said conveyor belt including a pair of rollers supported on said center supporting structure at the lower end of said feed table and said member in spaced relation to each other, and an idler roller positioned intermediate and below said pair of rollers, whereby said conveyor belt is maintained in position on top of said vertically adjustable feed table and member, in a manner affording a uniform rate of speed for the sheet material handled thereby and permitting vertical adjustment of said feed table and said member.

References Cited in the file of this patent

UNITED STATES PATENTS

50	1,313,234	Jones	Aug. 12, 1919
	1,501,499	Swift	July 15, 1924
	1,703,456	Potter	Feb. 26, 1929
	2,139,039	Salfisberg	Dec. 6, 1938
	2,190,823	Cloud	Feb. 20, 1940
55	2,298,363	Ganz	Oct. 13, 1942
	2,506,182	Toubhans	May 2, 1950
	2,540,844	Strauss	Feb. 6, 1951
	2,555,758	Noble et al.	June 5, 1951