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Burton

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[54] **METHOD AND APPARATUS FOR FORMING CLOTH LENGTHS WITH FOLDED HEMS**

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[73] Assignee: **Burton & Noonan,** Duluth, Ga.

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[21] Appl. No.: **213,510**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 43,756, June 5, 1970, Pat. No. 3,640,235.

[52] **U.S. Cl.** **83/23,** 83/79, 83/155.1, 83/160, 83/256, 83/365, 83/367, 83/370, 83/424, 271/76

[51] **Int. Cl.** **B26d 5/38,** B65h 35/06

[58] **Field of Search** 83/23, 79, 101, 155.1, 83/160, 365, 367, 370, 424, 256; 271/76; 112/2, 121.11, 130, 262

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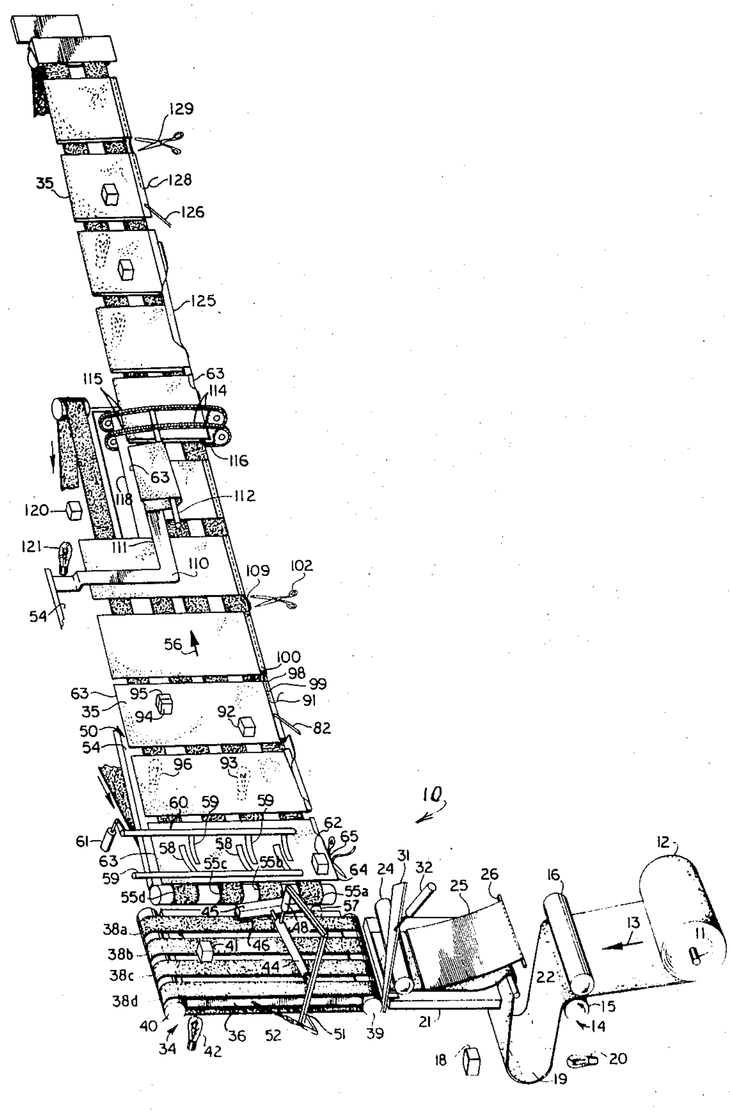
Primary Examiner—Frank T. Yost
Attorney—Harold D. Jones, Jr. et al.

[57] **ABSTRACT**

A method and apparatus for forming cloth lengths with folded hems from a continuous supply of cloth wherein the supply of cloth is intermittently fed along a first path to a cutting and transfer station, a predetermined length of cloth is cut from the supply and transferred to a second path extending approximately normal to the first path, a cut end of the cloth length is double folded and sewn, the cloth length is folded across its length so that its other cut end is positioned on the same side as the hemmed end, and the other cut end is double folded and sewn. The folded and hemmed cloth lengths are folded again and stacked at the end of their second path.

6 Claims, 7 Drawing Figures



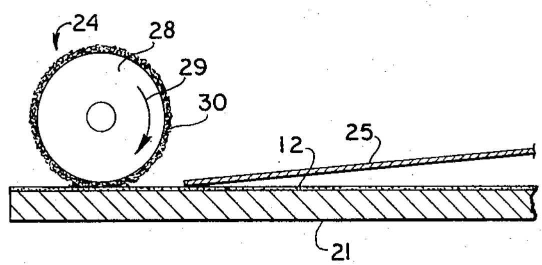

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FIG 2

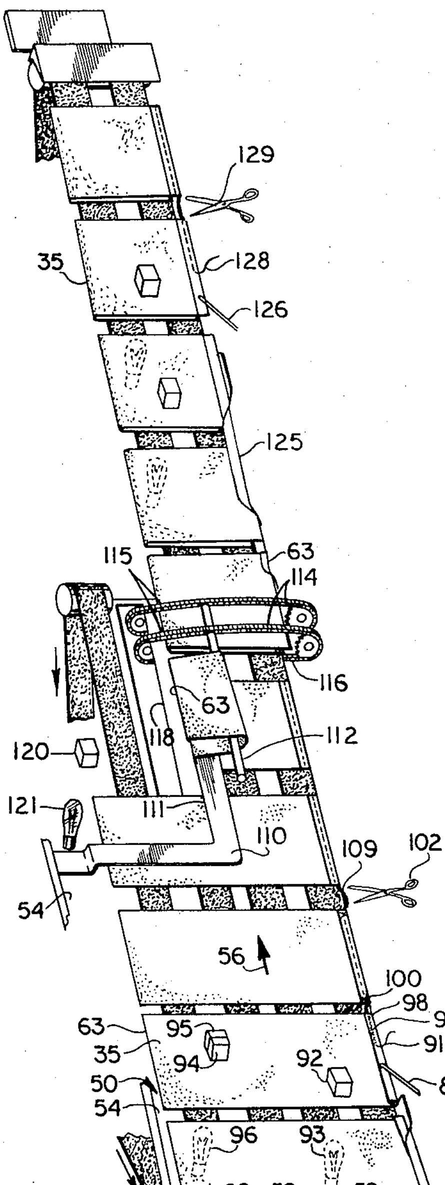
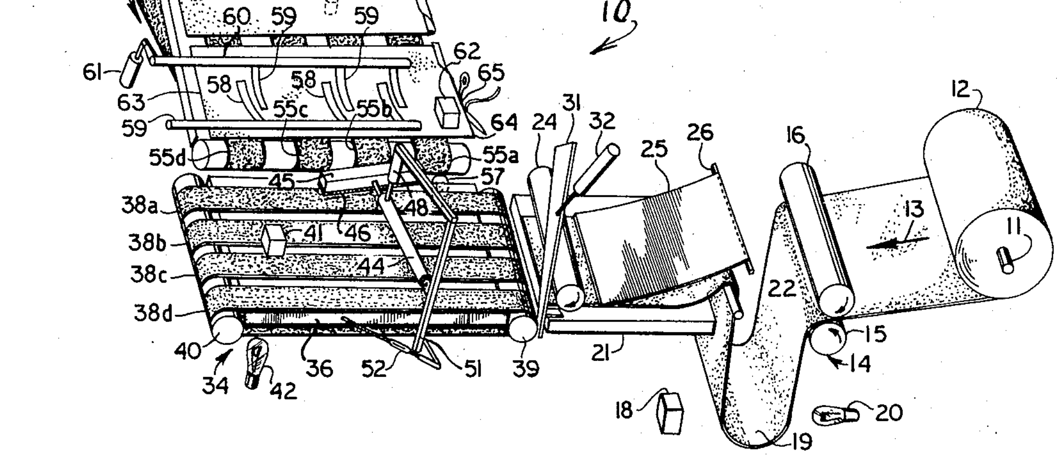
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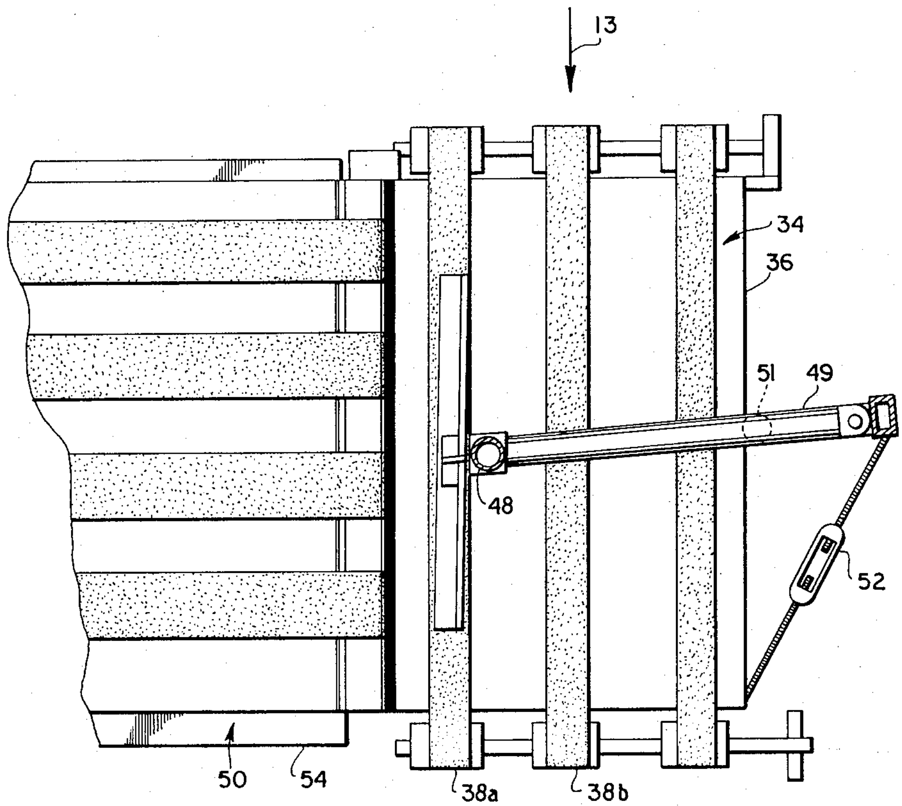
FIG 1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38a
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FIG 3

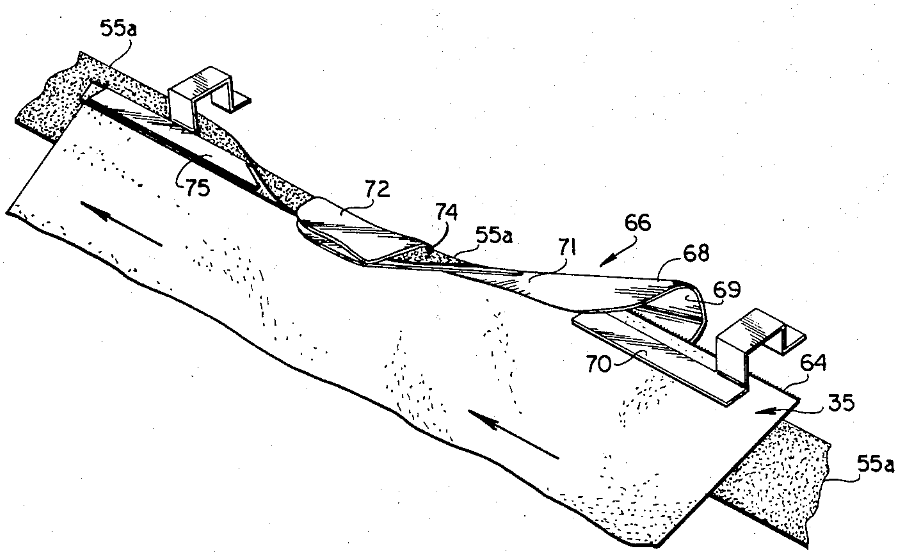
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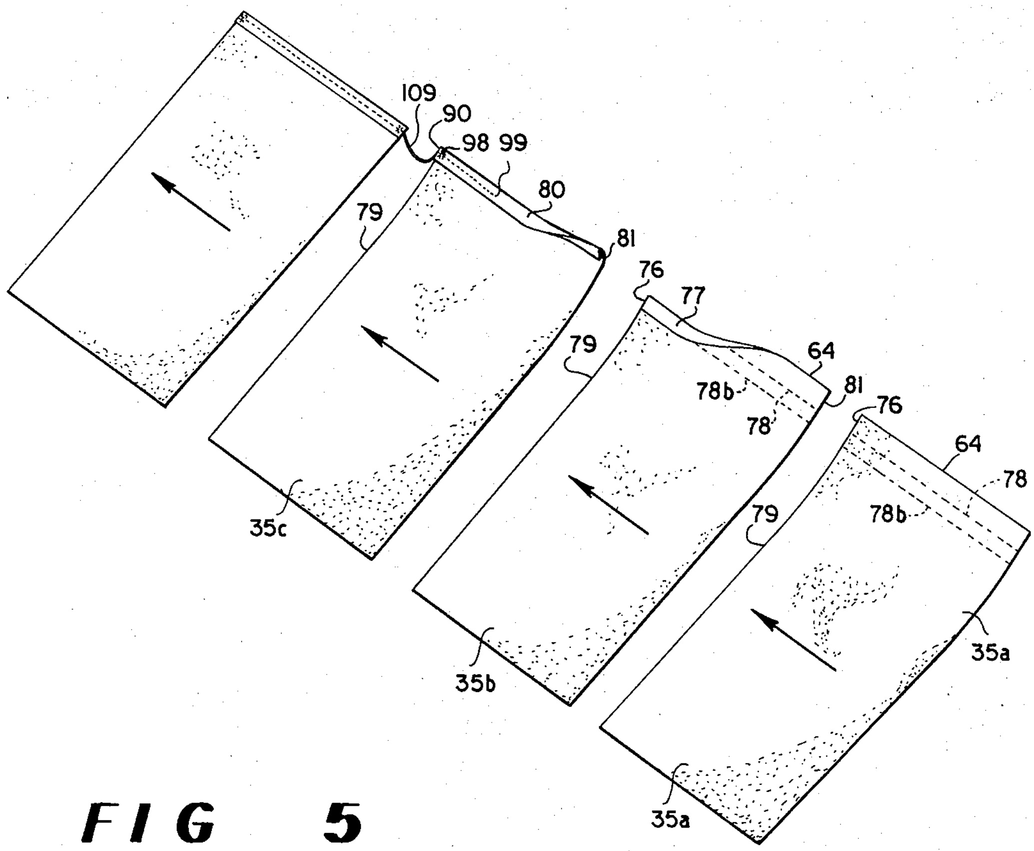
FIG 4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35c
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FIG 5

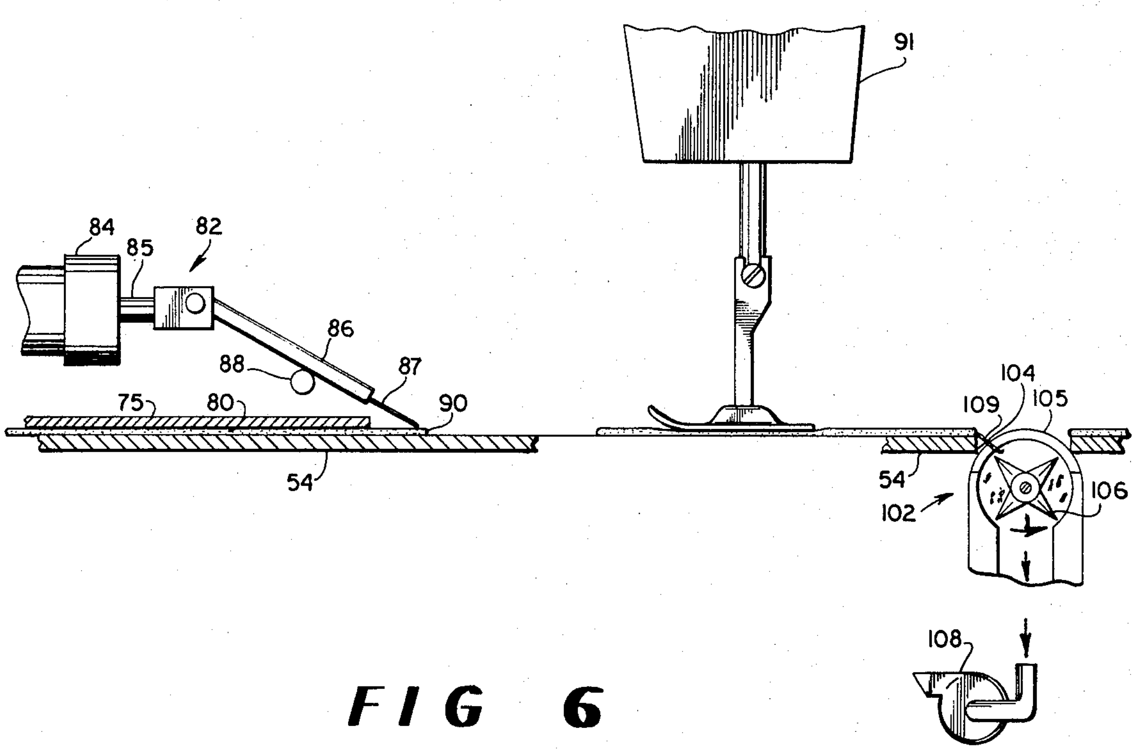
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FIG 6

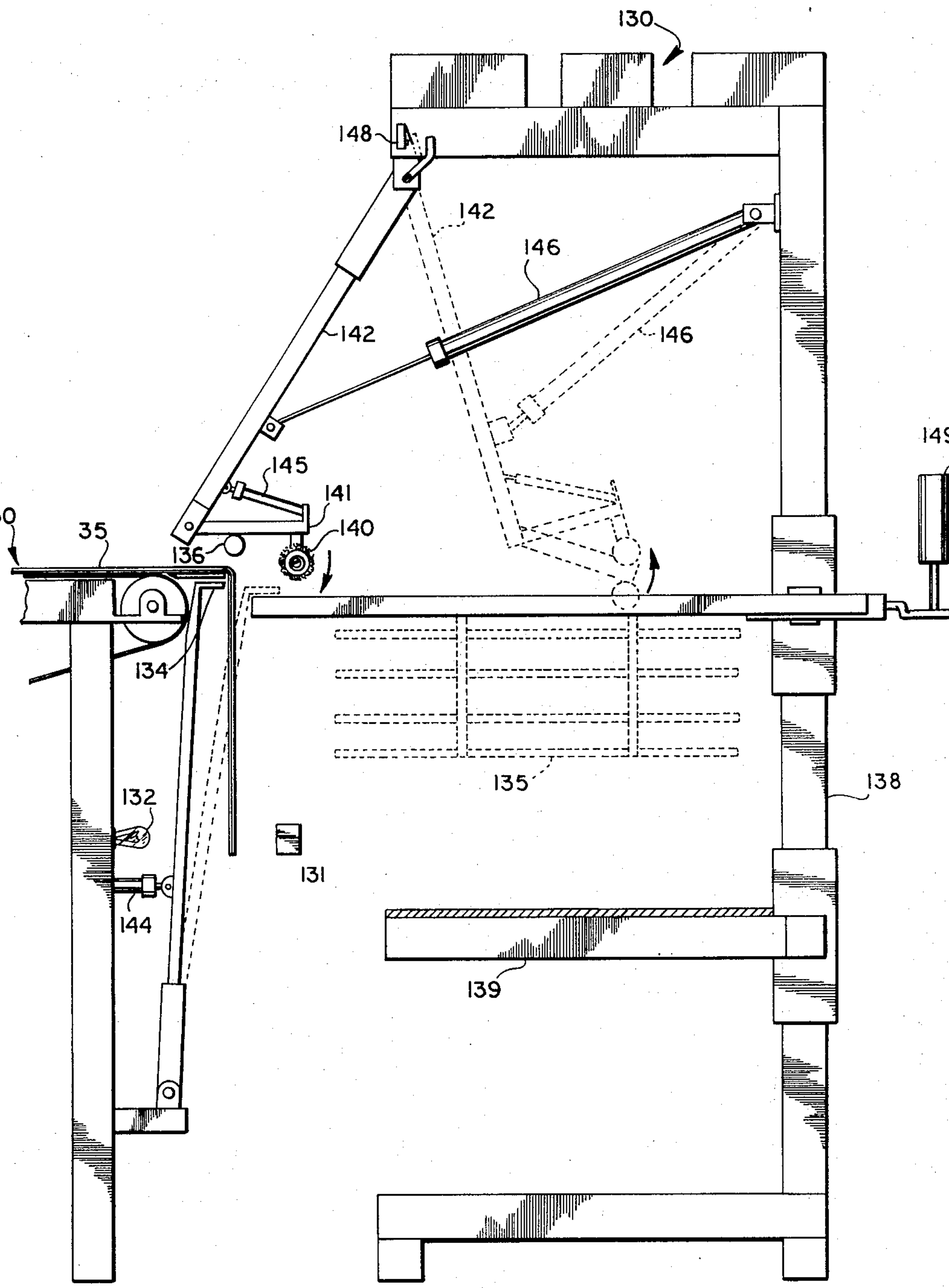
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FIG 7

METHOD AND APPARATUS FOR FORMING CLOTH LENGTHS WITH FOLDED HEMS

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of application Ser. No. 43,756, filed June 5, 1970, entitled "METHOD AND APPARATUS FOR CUTTING AND HEMMING CLOTH LENGTHS," now U. S. Pat. No. 3,640,235.

BACKGROUND OF THE INVENTION

In the manufacture of cloth lengths, such as towels, diapers, wiping rags, etc., the cloth lengths are usually manufactured by cutting cloth in predetermined lengths from a continuous supply of cloth and the cut ends of the cloth lengths are treated to prevent the ends from raveling. The treatment at the cut ends of the cloth lengths can comprise overedging, the application of an adhesive, folding the ends over and forming stitches through the fold to create a folded hem, or various other processes which form a hem structure.

While various automatic machinery has been developed for feeding out and cutting predetermined lengths of cloth, the prior devices have been somewhat unsuccessful in that constant and close attention is required by an operator in order to assure that the cloth is properly aligned with a cutting apparatus, the cut lengths of cloth are substantially equal in length, and the cuts are properly formed at the ends of the lengths of cloth. In the past, the cut cloth lengths were processed through sewing machines by hand with the sewing machine operator guiding the cut ends of the cloth lengths through a sewing machine to form the overedge stitching or to form the folds and stitching through the folds. While some automated machinery has been developed to relieve the machine operators from the continuous close observation and control of the sewing machines used for treating the cut ends of cloth lengths, it usually has been necessary for the cut lengths of cloth to be cut, accumulated in stacks, manually transferred to various sewing stations, then handled by the sewing machine operators in the end treating process, and restacked. The various manual steps require the presence and attention of several workers and cause the cloth lengths to be expensive to manufacture.

SUMMARY OF THE INVENTION

Briefly described, the present invention comprises a method and apparatus for automatically forming hemmed cloth lengths wherein cloth lengths are cut from a continuous supply of cloth, the cut ends are folded over and sewn, and the cloth lengths are folded and stacked for shipment, without requiring the manual handling of the cloth lengths between the various steps of the process. The cloth lengths are cut from a continuous sheet of cloth as the continuous sheet is intermittently fed along a first path to a cutting station, the cut lengths of cloth are then transferred to a second path of movement which is generally normal to the first path of movement of the continuous sheet of cloth, and the cut lengths of cloth move in a path parallel to the cut ends of the cloth. The cut ends are progressively folded, ad the folds are sewn closed in a continuous process. In order than only standard "right handed" sewing machines be utilized to sew closed the folded ends of the cloth lengths, the cloth lengths are folded across their lengths so that the cut ends are placed on the same side of the cloth lengths, and the folding and sewing steps are completed on one side of the second path of movement of the cloth lengths.

Thus, it is an object of the present invention to provide a method and apparatus for expediently and inexpensively forming cloth lengths with folded hems from a continuous sheet of cloth.

Another object of this invention is to provide an inexpensive, durable, versatile, and reliable apparatus for rapidly and accurately cutting, folding and stitching the cut ends of cloth lengths.

Another object of this invention is to provide various individual methods and devices for performing the individual steps in a series of steps required to cut cloth lengths from a continuous sheet of cloth, fold over the cut ends of the cloth length, stitch closed the folds, and stack the cloth lengths in a continuous process.

Other objects, features and advantages of the present invention, will become apparent upon reading the following specification, when taken in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic illustration of the method and apparatus for forming cloth lengths with folded hems.

FIG. 2 is a detailed illustration of the feed roll and its related elements.

FIG. 3 is a top view of the transfer table and transfer arm.

FIG. 4 is a perspective view of the edge folder.

FIG. 5 is a schematic illustration of the cloth lengths as one cut end of each cloth length is folded and sewn closed.

FIG. 6 is an illustration of the crow's foot advancer, sewing head and thread chain cutter.

FIG. 7 is a side elevational view of the stacker.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in more detail to the drawing, in which like numerals indicate like parts throughout the several views, FIG. 1 illustrates the apparatus for forming cloth lengths which is broadly designated by the numeral **10** and which includes support means **11** for supporting a roll or continuous supply **12** of sheet material such as woven cloth, terry cloth, or virtually any textile fabric, plastic, paper or other sheet material. First feed means **14** comprises a pair of rotatable rollers **15** and **16** which are counter-rotatable and arranged to feed the free end of the supply of sheet material therebetween. Rollers **15** and **16** are rotated by an electric motor (not shown), and the on-off condition of the electric motor is controlled by photoelectric cell **18** and the appropriate electrical circuitry (not shown), so that when a free supply of cloth **19** extends from feed means **14** in a downward direction so as to block the light from light source **20** to photoelectric cell **18**, the feed rollers **15** and **16** terminate their rotation and feeding of the cloth.

Feed table or platform **21** is positioned with its upper surface in an approximately horizontal attitude, and the supply of cloth **12** is fed in a single sheet over a horizontal guide bar **22** onto and across the feed platform **21** toward feed roller **24**. A resilient sheet of material **25** is supported at one edge by its support bar **26** above feed platform **21** and slopes downwardly across the feed platform **21** toward feed roller **24**. Support bar **26** is angled so as to bias the resilient sheet **25** down into engagement with the feed platform **21** and the sheet of cloth on the platform, so that the resilient sheet **25** functions as a drag means.

As is illustrated in FIG. **2**, feed roller **24** comprises an inner feed roll **28** which is rotatable in the direction indicated by arrow **29** by an electric motor and clutch (not shown), and the feed roll **28** is covered with a ⅝ inch sheet of flexible foamed polymeric material **30** which is a resilient material that can be crushed and will resume its original configuration. Such foamed polymeric materials include latexes, polyurethanes, natural and syntheticrubbers, and the like. More particularly, a suitable foamed material is polyurethane foam obtainable by the reaction of polyisocyanates with polyhydroxy compounds, such as polyethers and polyesters. A particular foamed material is reticulated polyurethane foam as disclosed in U. S. Pat. No. 3,171,820. The material is cut into sheets of appropriate thickness, preferably into sheets which are ⅝ inch thick, and has approximately **30** pores per square inch. The texture of the sheet **30** is such that the opened cells tend to frictionally engage the woven, knitted or other types of cloth or similar material such as the supply **12** of sheet material, but the sheet does not tend to penetrate, cling to or otherwise significantly frictionally engage the hard, non-porous upper surface of feed platform **21.** Thus, feed roller **24** functions to feed the continuous supply of sheet material across the feed platform without generating enough heat by its sliding friction against the feed platform to damage the feed platform or the roller.

The sheet material **12** can be virtually any material which can be handled by the apparatus, and can include woven and other types of material which has one edge more tightly woven than the opposite edge or central body portion of the sheet material. The edge of sheet material having a tightly woven edge or selvage usually is slightly shorter than the remaining portion of the sheet and when the sheet is fed by hard feed rollers, etc., the longer portions of the sheet become wrinkled as the sheet passes through the rollers, or the sheet tends to ride off the edge of the feed rollers.

An important feature of the arrangement of feed roller **24** is that the material from which feed roller **24** is fabricated has the ability to compensate for the different lengths of the sides of the sheet material, such as woven cloth, etc. The crushing or collapsing of the pore structure of the reticulated foam **30** of the feed roller **24** as the foam engages the feed table **21** or the sheet material being fed across the feed table causes the side of the roller which feeds the tight selvage to allow a limited amount of back slippage during the feeding process. This causes a positive feed of the cloth along the length of the cloth without any accumulation, folding or wrinkling of the cloth along its longer portions by allowing the shorter edge of slip rearwardly with respect to the longer edge across the feed area at the feed roller **24.** Thus, the nonuniform structure of the cloth is compensated for and no accumulation of cloth is allowed to build up at the feed roller and cause the cloth to walk off the side of the feed roller or allow the feed roller to feed wrinkles onto the transfer table **34.**

The arrangement of the feed roller **24** together with the resilient sheet **25** is such that these elements function as a feeding means to feed the sheet material across and beyond feed platform **21,** and the cellular sheet or layer **30** about the feed roll **28** when engaging the sheet material causes the sheet material to accelerate rapidly with only controlled slippage between the feed roller **24** and the sheet material **12,** and when the feed roller rapidly decelerates, the resilient sheet **25** functions as a drag means to assist in the deceleration of the cloth, and the converging angle of the drag means **25** with respect to the feed platform tends to keep any folds or wrinkles from forming in the sheet material at the feed roller **25.**

As is illustrated in FIG. **1,** cutting blade **31** is located at the edge of feed platform **21** and is hinged at its lower end at the feed platform so as to be movable in an upward and downward direction to cut the sheet material. Pneumatic ram **32** functions to oscillate cutting blade **31.**

Transfer table **34** functions as a transfer station to transfer the cut length of material **35** from a first path of movement from the support means **11** over the feed platform **21** to a second path of movement which is approximately normal to the first path of movement. Transfer table **34** comprises table **36** and a plurality of conveyor tapes or belts **38*a*, 38*b*, 38*c*,** and **38*d*** which extend across the top of table **36** and over conveyor rollers **39** and **40** and which pass back beneath the table **36** and form a conveyor belt means. While four conveyor tapes **38*a–d*** are illustrated, it will be understood that more or fewer conveyor tapes can be employed, or a single wide conveyor belt can be employed, if desired. The exposed surface of conveyor tape **38*a*** has a relatively low coefficient of friction with respect to the exposed surfaces of conveyor tapes **38*b*, 38*c*,** and **38*d*.** The texture of conveyor tape **38*a*** is chosen so that it forms a relatively slick moving or "live" smooth surface with respect to the sheet material or length of cloth **35** passing from feed platform **21** onto the transfer table **34.** The conveyor tapes **38*b–d*** therefore form a first surface portion having a relatively high coefficient of friction while tape **38*a*** forms a second surface portion having a relatively low coefficient of friction.

Photoelectric cell **41** is positioned in the vicinity of transfer table **34** and is arranged to detect the presence or absence of light from the surface of the table, as by reading the light **42** from below transfer table **41.** Photoelectric cell **41** together with the appropriate circuitry is arranged to control the rotation of feed roller **24,** the downward movement of cutting blade **31,** and the rotation of transfer table conveyor rollers **39** and **40.** The arrangement is such that when the photoelectric cell **41** sees light from its light source **42,** feed roller **24** rotates to feed the supply of sheet material across feed platform **21,** and conveyor rollers **39** and **40** function to move the conveyor tapes **38*a–d*** across table **36.** Conveyor rollers **39** and **40** function to move the conveyor tapes **38*a–d*** at a linear velocity which is faster than the linear velocity of the sheet material onto transfer table **34,** so that the conveyor tapes tend to stretch out the leading portion of the sheet material away from feed roller **24;** however, since the feed roller **24** positively grips the supply of sheet material **12** against the upper surface of feed platform **21,** the conveyor tapes **38*a–d*** will tend to move out from beneath the supply of sheet material unless the sheet material is folded or wrinkled, whereupon the folds or wrinkles will be stretched out away from feed roller **24** and removed from the cloth. When the photoelectric cell detects darkness by the leading edge of the cloth blocking the light from light source **42**, feed roller **24** will stop its rotation and cutting blade **31** will move under the influence of its ram **32** in a downward direction to cut way that portion of the sheet material extending from the cutting blade over the transfer table, and the conveyor rollers **39** and **40** of the transfer table will decelerate at a rate slower than the deceleration of feed roller **24.** When the cutting blade **31** has moved to its full down position where the sheet material has been cut, its limit switch (not shown) will open and ram **32** will reverse to lift the cutting blade **31** back up to its ready position. The slower deceleration of the conveyor tapes compensates for any folds that might be created in the cloth from any snap back of the cloth on the transfer table which might result when the cloth is cut. As long as the now cut length of material remains on transfer table **34** to block the light from light source **42** to photoelectric cell **41**, no further feeding or cutting of the sheet material will take place.

Transfer arm **45** is located above transfer table **34**, and its lower surface comprises a layer of the cut foamed material **46** of the type used on feed roller **24.** Transfer arm **45** is normally maintained above the conveyor tape **38*a*** which has the slick exposed surface. Pneumatic rams **48** and **49** control the movement of transfer arm **45**, with ram **48** functioning to move the transfer arm **45** down into engagement with the portion of the cut length of material which covers conveyor tape **38*a***, while ram **49** functions as a transfer ram and urges transfer arm **45** off transfer table **34** and onto sewing table **50.** As is illustrated in FIG. **3**, transfer ram **49** is angled so that its motion off transfer table **34** is less than 90° from the firsth path of movement of the continuous supply of sheet material, as indicated by arrow **13.** The support for rams **48** and **49** is pivotally connected to table **36** by upright support bar **51**, and the angle which transfer ram **49** takes with respect to table **36** is controlled by adjustable turn buckle **52.**

Sewing table **50** comprises a table surface **54** disposed in an approximately horizontal plane, and a plurality of conveyor tapes **55*a***, **55*b***, **55*c***, and **55*d*** extend across the table and return back beneath the table so as to move the lengths of material **35** is a second path **56** which is approximately normal to the first path **13** and which is parallel to the cut ends of the lengths of cloth or sheet material. Conveyor tape **55*a*** is mounted on a roller of slightly larger diameter so that the surface speed of conveyor tape **55*a*** is faster than the surface speeds of the remaining conveyor tapes. A plurality of stationary leaf springs **58** are mounted on a support **59** extending above the sewing table, and the leaf springs are urged down into engagement with the conveyor tapes **55*a–d***. The leaf springs **58** are fabricated from a smooth material so that they slide easily with respect to the conveyor tapes or the cut lengths of material passing over the conveyor tapes. Thus, the leaf springs function to urge the cut lengths of material passing along second path **56** into engagement with the conveyor tapes, so that the higher friction between the conveyor tapes and the cut lengths of cloth functions to cause the lengths of cloth to move in unison with the conveyor tapes across the sewing table. While only one set of stationary leaf springs is illustrated, several sets are used along the length of sewing table **50** as required to urge the cloth lengths to move with the conveyor tapes. In addition, movable leaf springs **59** are supported in cantilever fashion by rotatable support bar **60**, and the movable leaf springs are pivoted by pneumatic ram **61** at the end of bar **60** into and out of engagement with the cut lengths of cloth passing with the conveyor tapes across the sewing table.

Photoelectric cell **62** is located above the table surface and is arranged to detect the presence or absence of light emanating from the table surface, as from light source **64** located beneath the table surface. Photoelectric cell **62** together with the appropriate circuitry functions to actuate transfer arm **45.** More specifically, when photoelectric cell **62** detects the presence of light, pneumatic ram **48** of transfer arm **45** is actuated to urge the transfer arm downwardly toward the smoother conveyor tape **38*a*** of transfer table **34** until it engages the cut length of cloth present on the transfer table, transfer ram **49** is caused to distend and move transfer arm **45** from conveyor tape **38*a*** and transfer table **34** toward sewing table **50** until the transfer arm limit switch (not shown) is engaged, whereupon ram **48** retracts, and ram **49** retracts to return the transer arm to its elevated ready position. The movement of transfer arm **45** is a rectangular movement, first down, then across, then up, then back. When the transfer arm limit switch is closed by the transfer arm **45** having been moved to its furtherest position over on sewing table **50**, the limit switch functions to actuate pneumatic ram **61** and pivot support bar **60** so that movable leaf springs **59** move down into engagement with the cut length of cloth and urge the cloth into engagement with the conveyor tapes **55*a–d*** of the sewing table, thus causing the cut length of cloth to move in unison with the conveyor tapes across the sewing table. As the cut lengths of material move in series with the conveyor tapes, they pass beneath the stationary leaf springs **58** and are therefore continuously urged into engagement with the conveyor tapes. When the photoelectric cell **62** again detects light, pneumatic ram **61** is reversed to lift the movable leaf springs **59** out of engagement with the cut lengths of material and return the leaf springs to their ready positions. Moreover, when the photoelectric cell **62** again detects light, it begins its cycle again to transfer a cut length of material from transfer table **34** from the first path **13** toward the second path **56.**

As the cut lengths of material **35** move along second path **56**, the first cut edge **63** and the second cut edge **64** are approximately aligned with the direction of movement of the cut lengths of material. The second cut edge **64** is trimmed by a conventional edge trimmer **65** so that if any imperfections are present in the cut edge of the length of sheet material they will be remedied. The cloth lengths **35** are then moved further along second path **56**, and second cut edge **64** passes through first edge folder **66.**

First edge folder **66** comprises a first stationary concave guide member **68** having a concave guide surface **69** which converges into and along the path of the second cut edge **64** of the sheet material, and is curved about and around the upper portion of the path of the second edge so as to induce the edge of the cut length of material **35** to form a fold along the edge of the material. Presser foot **70** is positioned along the edge of the path of the cut sheet material **35** at a position displaced inwardly from the edge of the material. Presser foot **70** extends into guide member **68** and presses the cut sheet of material **35** into positive engagement with conveyor tape 55a as the first fold is being created along the edge of the sheet of material.

First guide member extension **71** has a helical configuration and extends beyond first guide member **68.** Second guide member **72** is positioned further down the path from first guide member **68** and is located inwardly toward the middle portion of the path of the sheet material from the first guide member, and is curved about the edge of the path of the sheet and about the first guide member extension **71.** Second guide member **72** is located inwardly of the normal path of travel of the edge of conveyor tape **55***a*, and induces the conveyor tape **55***a* to form a fold in its edge at **74.** First guide member extension **71** extends from first guide member **68** into second guide member **72** and functions to guide the first fold formed in the edge of sheet of material and the edge of conveyor tape **55***a* into second guide member **72,** thus forming a fold in the conveyor tape **55***a* and a second fold in the edge of the sheet material **35.**

When the conveyor tape **55***a* emerges from second guide member **72**, the folded portion of the conveyor tape is allowed to unfold and continue as a flat conveyor tape. Second presser foot **75** is positioned in alignment with second guide member **72** and reaches into the fold of the conveyor tape as it unfolds from the second guide member **72** to contact the double fold in the edge of the sheet of material **35** to cause the double fold to be maintained in the sheet material while the fold in the conveyor tape **55***a* is straightened.

Conveyor tape **55***a* is moved at a greater velocity than the remaining conveyor tapes **55***b–d*. As is illustrated in FIG. **5**, the faster movement of conveyor tape **55***a* causes the cut edge **64** of the cut length of sheet material **35** to move ahead of the remaining portion of the cut length of material. When the second cut edge **64** is passed through first guide member **68,** the friction between the cut edge **64** and the stationary curved surface **69** of the first guide member **68** causes the edge **64** to distort rearwardly of the leading edge of the sheet material, as indicated in sheet **35***b* of FIG. **5.** Thus, the leading end **76** and trailing end **81** of the first fold **77** outside fold line **78** in the sheet material will be displaced at an angle from the fold line **78** which is less than 90° from the fold line; however, the increased velocity of the conveyor tape **55***a* forming the second fold and carrying the edge portion of the length of material advances the second cut edge **64** ahead of the leading end **79** of the sheet of material so that the portion of the leading end **76** and trailing end **81** inside fold line **78** is distorted ahead at an angle approximately equal to the angle made by the leading and trailing ends outside the fold line **78,** so that the ends of the first fold **77** are approximately coextensive with the leading and trailing ends of the sheet of material. Also, when the second fold **80** is completed about fold line **78***b*, the leading ends of the first and second fold will be coextensive with the leading end **79** of the sheet of material, and there will be no hem "hangout" at the leading or trailing ends of the fold.

As is illustrated in FIGS. **1** and **6**, crow's foot advancer **82** is positioned above the path of travel of the second cut edge **64** of the cut lengths of material, beyond edge folder **66.** Crow's foot advancer **82** comprises pneumatic ram **84,** ramrod **85,** stem **85** and crow's foot **87.** When the rod **85** of ram **84** is retracted, stem **86** abuts rest **88** and the end of the crow's foot **87** and is slightly retracted above the path traveled by the double fold along the edge of the cut sheet of material. When ram **84** distends its rod **85,** the end of crow's foot **87** will engage the double fold **80** and urge the leading end **90** of the double fold into the needle of first sewing machine **91.** Ram **84** is regulated so that it urges its crow's foot **87** at a velocity approximately equal to the velocity of conveyor tape **55***a*, which is faster than the velocities of the remaining conveyor tapes **55***b–d*. Thus, the distortion in the edge of the sheet material is maintained until the leading end **90** of the double fold **80** reaches the presser foot of the sewing machine.

Photoelectric cell **92** is arranged to detect the presence or absence of light from the surface of the sewing table **50,** as from light source **93** positioned below the table, so that the leading end of a sheet of material passing along the sewing table will block the light from the photoelectric cell. Photoelectric cell **92** and the appropriate circuitry functions to control the operation of crow's foot advancer ram **84** and the timing when the crow's foot **87** reaches down into engagement with the leading end **90** of the double fold **80** in the sheets of material. When the ram **84** has fully distended its rod **85,** a limit switch (not shown) functions to reverse ram **84** and retract the crow's foot.

Sewing machine **91** is a high speed machine arranged to operate continuously and to form a chain of thread between the adjacent ones of the sheets of material passing along the sewing table. Sewing machine **91** is a reversible sewing machine of conventional design, such as Pfaff, model 438-6/01-AS, manufactured in West Germany, or the reversible machine manufactured by Union Special Sewing Machine Company. Photoelectric cells **94** and **95** positioned above sewing table **50** function to detect the presence or absence of light from the surface of the sewing table, as from light source **96** positioned below the sewing table, so that when a sheet of material is moving along the sewing table its leading and trailing edges will be detected. Photoelectric cells **94** and **95** are arranged to momentarily reverse sewing machine **91.** For instance, photoelectric cell **94** is arranged to momentarily reverse sewing machine **91** when it detects the leading edge of a sheet of material **35** so that the sewing machine functions to create a backstitch **98** at the leading end **90** of the double fold or hem **80,** and then continue with a regular stitch **99** along the intermediate portion of the double fold, while photoelectric cell **95** functions to reverse the sewing machine **91** when the trailing end of the double fold is beneath the sewing machine, so as to form a backstitch **100** at the trailing end of the double fold. Since the edge of the sheet material having a double fold hem therein is advanced ahead of the reamining portion of the sheet material by means of the conveyor tape **55***a* of edge folder **66** and then by crows's foot advancer **82,** the sewing machine **91** can momentarily stop the advancement of the folded portion of the sheet material to form the first backstitch **98** without unduly distorting the sheet material. Sewing machine **91** is adjusted to operate at a speed which is faster than the velocity of the sheet material along sewing table **50;** that is, the feeding and stitching mechanism of the sewing machine advances the hem along path **56** at a rate faster than the conveyor tapes **55***b–d* advance the remaining portion of the sheet material, so that by the time the trailing end **81** of the double fold **80** of the sheet of material reaches the sewing machine, the folded end portion of the sheet material is again advanced ahead of the remaining portion of the sheet material and the sewing machine can again be reversed to form double stitch **100** at the trailing end of a hem without unduly distorting the flat sheet material.

As is illustrated in FIGS. **1** and **6**, cutting means **102** is provided in sewing table **50** and defines an opening **104** in the table surface **54**, a slotted cutter head **105**, a plurality of rotatable cutter blades **106**, an air suction means **108**. The slotted head **105** is formed so that the flat sheet material cannot enter the opening **104** and reach the rotating blades **106**; however, the thread chain **109** extending between the adjacent ends of the sewn hem can be received in the slot of the head **105**, and the suction means **108** tends to induce the thread chains to enter the slot. Moreover, since sewing machine **91** operates to move the hem of the sheet material at a faster velocity than the remaining portion of the sheet material, the leading end of the hem will advance toward the trailing end of the hem of the sheet material ahead of it to create slack in the thread chain, so that the thread chain can reach the rotating blades **106** through the slotted head **105** of the cutter **102**. With this arrangement, substantially all of the thread chain extending between the adjacent hems is cut and removed from the vicinity of the sheets of material.

As is illustrated in FIG. **1**, fold bar **110** is supported from table surface **54** and extends above and along the path **56** of the sheet material in a cantilever arrangement. Fold bar **110** is adjustable so that its folding edge **111** can be accurately positioned along path **56**. The sheets of material **35** pass beneath fold bar **102**. Wiper rod **112** extends parallel to path **56** and is mounted on a pair of chains **114**. Chains **114** are endless chains and include upper flights **115** which extend laterally with respect to path **56** above table surface **54**, and lower flights **11** which extend beneath the table surface. A slot **118** is provided in the table surface so that wiper rod **112** can travel in a closed continuous path and emerge up through slot **118** in the table surface, then move in a lateral direction above and laterally across the table surface and fold bar **110**, and then pass with the lower flights of the chains back beneath the table surface. Photoelectric cell **120** is positioned above the table surface so as to detect the presence or absence of light emitted from the table surface, as by light emanating from light source **121** beneath the table surface, so that the presence or absence of the leading edge of a sheet **35** will be detected. Photoelectric cell **120** together with the appropriate circuitry controls the movement of wiper rod **112**, and when photoelectric cell **120** detects the absence of light from the presence of sheet material passing between photoelectric cell **120** and it light source **121**, wiper rod **112** will emerge through its slot **118** and then move upwardly and over fold bar **110** and table surface **54** and wipe or fold over the first cut edge **63** of the sheet material so that the first cut edge **63** overlaps or extends beyond the first hemmed edge of the sheet material. When the wiper rod **112** moves along its return flight beneath the sewing table, it engages its limit switch (not shown) so that its movement is terminated until photoelectric cell **120** initiates its movement again.

Since the endless chains **114** which support wiper rod **112** completely surround the folded sheet material, the sheet material is therefore free to pass between the upper and lower chain flights and move through and beyond the folding mechanism. The sheet material uses the edge **111** of fold bar **110** as a reference point, and the fold in the sheet material is formed about the edge **111**. When the sheet material reaches the end of fold bar **110** it drops off the fold bar and continues on its path **56** through chains **114**. Wiper rod **112** can be supported on chains **114** so that it rotates about its longitudinal axis and therefore rolls about its axis as it wipes a fold into the sheet material and therefore minimizes the frictional engagement with the sheet material, or wiper rod **112** can be formed as a bent rod, somewhat crescent or banana-shaped with the center portion of the rod as it moves across and above the sewing table leading the end portions, so that the middle portion of the end of the sheet material being wiped or folded tends to lead the corners during the wiping movement, and the corners will then come rest in a flat, unwrinkled position. This reduces any tendency of the corners from becoming wrinkled, folded or otherwise distorted in the folding function.

Once the sheet material has been folded by fold bar and wiper rod **112** as previously described, the first cut end **63** of the sheet material is double folded and the double fold is sewn closed in a manner similar to that previously described and illustrated in FIGS. **4, 5** and **6**. For instance, as illustrated in FIG. **1**, a second edge folder applies a double fold to the first cut edge at **125**, a second crow's foot advancer **126** advances the second double fold to a second sewing machine **128**, and a second thread chain cutter **129** cuts the thread chain between the adjacent hems.

When the hemmed and folded sheets **35** reach the end of sewing table **50**, the sheets are folded again and stacked by stacker **130**. As is illustrated in FIG. **7**, the sheets **35** are allowed to flow off the end of the sewing table and in a downward direction until the leading end of the sheets reaches the vicinity of photoelectric cell **131** and blocks the light emanated from light source **132**. At this point, a tucking blade **134** is pivoted from beneath the table surface of the sewing table and extended over and above the top surface of a grate **135** of stacker **130**. A stream of air from air tube **136** assists the downward movement of the leading edge of the sheet **35** between the sewing table **50** and stacker **130**. Photoelectric cell **131** together with the appropriate circuitry functions to actuate stacker **130**. Stacker **130** comprises a framework **138**, horizontal platform **139**, collapsible grate **135**, transfer arm **140**, and arm support levers **141** and **142**. Collapsible grate **135** is formed in two door sections hingedly supported on opposite sides so as to function as a trap door in that it opens in its center portion in a downward direction, as illustrated in the dashed line position of FIG. **7**. When photoelectric cell **131** detects the presence of the leading end of a sheet **35**, pneumatic ram **144** distends to move tucker blade **145** to its dashed line position and the tucker blade forms a second fold in the sheet material and carries the second folded portion of the sheet over onto the grate **135**. Pneumatic ram **145** then distends to pivot support arm **141** in a downward direction with respect to support arm **142**, causing transfer arm **140** to move downwardly into engagement with the fold created in the sheet **35** about tucker blade **134**. Pneumatic ram **146** contracts to pivot support arm **142** about its upper end, thus moving transfer arm **140** across grate **135** until support arm **142** reaches its broken line position. When in this position, support arm

142 engages its limit switch 148, whereupon pneumatic ram 149 opens grate 135 and allows the now folded sheet 35 to drop from the grate 135 onto horizontal platform 139. Also, pneumatic ram 145 lifts support arm 141 and transfer arm 140 with respect to grate 135, while pneumatic ram 146 distends to return transfer arm 140 back to its start position. When grate 135 has completely opened, its limit switch will function to reverse pneumatic ram 149 to return the grate to its closed position and to reverse ram 144 to return tucker blade 134 to its ready position.

If desired, tucker blade 134 can be deactuated, framework 138 of stacker 130 can be moved closer to the sewing table so as to eliminate the space between the end of the sewing table and the stacker, and photoelectric cell 131 can be moved to detect the leading end of the sheet material 35 as it first moves off the surface of the sewing table and onto grate 135. This allows transfer arm 140 to be energized as soon as the leading edge of the sheet material moves onto grate 135, so that the second fold formed in the sheet 35 with the previous arrangement will be eliminated.

While this invention has been described in detail with particular reference to preferred embodiments thereof, it will be understood that variations and modifications can be effected within the spirit and scope of the invention as described hereinbefore and as defined in the appended claims.

I claim:

1. Apparatus for cutting and transferring cloth lengths or the like from a continuous supply of cloth movable along a first conveyor path to a second conveyor path approximately normal to the first conveyor path comprising a transfer platform, conveyor belt means extending parallel to the first conveyor path across said transfer platform and defining a first surface portion extending along the length of said conveyor belt means having a relatively high coefficient of friction and a second surface extending along the length of said conveyor belt means having a relatively low coefficient of friction, feed means for feeding a continuous supply of cloth along the first conveyor path onto said transfer platform, cutting means arranged to cut across the continuous supply of cloth at a position between said feed means and said platform whereby cloth lengths are moved by said feed means from the continuous supply of cloth extending along the first conveyor path onto said conveyor belt means and said transfer platform and are cut from said continuous supply of cloth by said cutting means, and cloth engaging means for engaging a cut length of cloth on said transfer platform at the second surface portion of said conveyor belt means and for urging the cloth lengths across said platform toward the second path.

2. The apparatus of claim 1 and wherein said conveyor belt means comrises a plurality of separate endless conveyor belts and said first surface portion comprises at least one conveyor belt and said second surface portion comprises at least one conveyor belt.

3. The apparatus of claim 1 and wherein said cloth engaging means comprises resilient means movable first in a downward direction toward engagement with said second surface portion of said conveyor belt means, then in a lateral direction toward the second conveypr path, and then in an upward and return direction toward a position above said second surface portion.

4. The apparatus of claim 3 and wherein said resilient means is movable in its lateral direction across said second surface portion toward the second conveyor path at an angle less than 90° from the direction of movement of said conveyor belt means, and further including means for adjusting the direction of movement of said resilient means across said second surface portion.

5. A method of cutting and transferring cloth lengths or the like from a first path of travel to a second path of travel approximately normal to the first path of travel comprising moving the free end of cloth from a continuous supply of cloth along a first path of travel over a horizontal surface including a relatively high coefficient of friction on one side of the center line of the first path of travel and including a relatively low coefficient of friction on the other side of the center line of the first path of travel, moving the horizontal surface approximately in the same direction of movement as the first path of travel and at a velocity faster than the velocity of the free end of cloth on its first path of travel, terminating the movement of the free end of cloth after a predetermined length of cloth has been moved onto the horizontal surface, cutting across the supply of cloth at a predetermined distance from the free end of the cloth to form a cloth length on the horizontal surface, engaging the portion of the cloth length on the side of the horizontal surface having the low coefficient of friction and urging the cloth length off the horizontal surface toward the second path of travel.

6. The method of claim 5 and further including the step of slowing the movement of the horizontal surfaqe before engaging the cloth.

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