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Elsas

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[54] **CLOTH CUTTING AND HEMMING METHOD AND APPARATUS**

[75] Inventor: **Norman E. Elsas**, Atlanta, Ga.

[73] Assignee: **Nemo Industries, Inc.**, Atlanta, Ga.

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[52] **U.S. Cl.** **112/121.11,** 112/130, 112/262

[51] **Int. Cl.** **D05b 19/00**

[58] **Field of Search**.....112/130, 10, 121.29, 262, 121.11, 112/121.15

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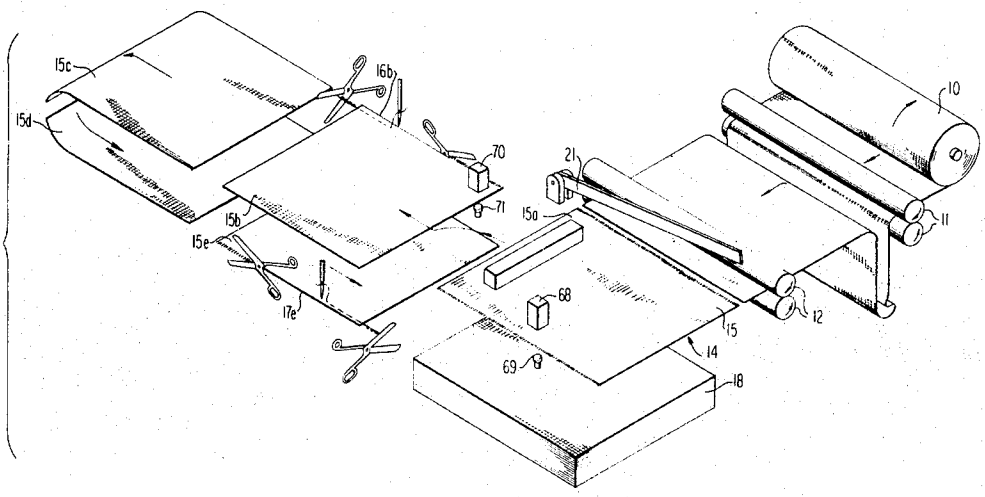
Primary Examiner—H. Hampton Hunter

Attorney—Jones & Thomas

[57] **ABSTRACT**

The method and apparatus for fabricating lengths of cloth from a continuous supply of cloth wherein the free end of the supply of cloth is moved onto a cutting platform, prescribed lengths of the continuous supply are cut, and the cut lengths of cloth are then moved in a lateral path with the cut ends disposed generally parallel to the path of travel. One cut end of each of the cut lengths of cloth is hemmed, and the lengths of cloth are then inverted as they are moved through a U-shaped path, and the other end of each length of cloth is hemmed. The hemming function at both ends of the cut lengths of cloth are performed by right handed sewing machines.

7 Claims, 3 Drawing Figures



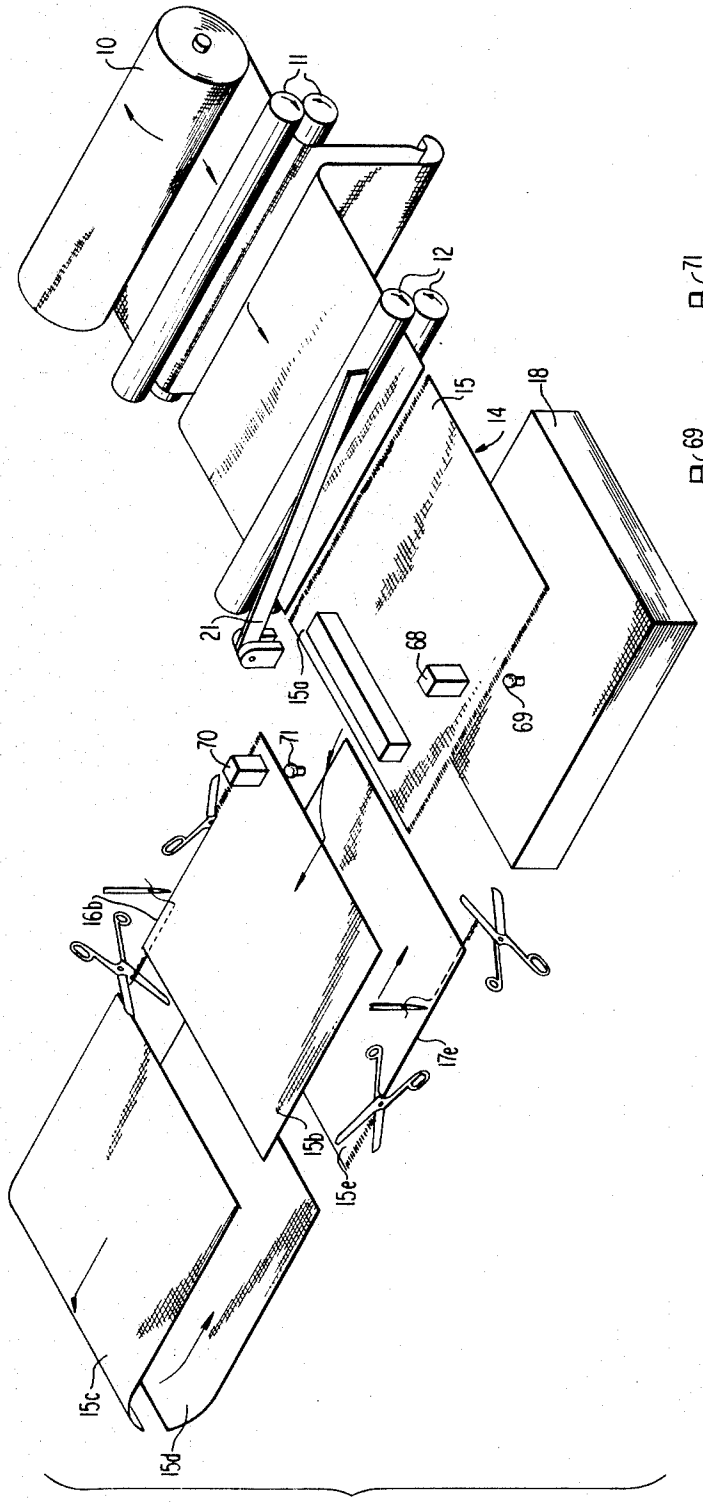


FIG.1

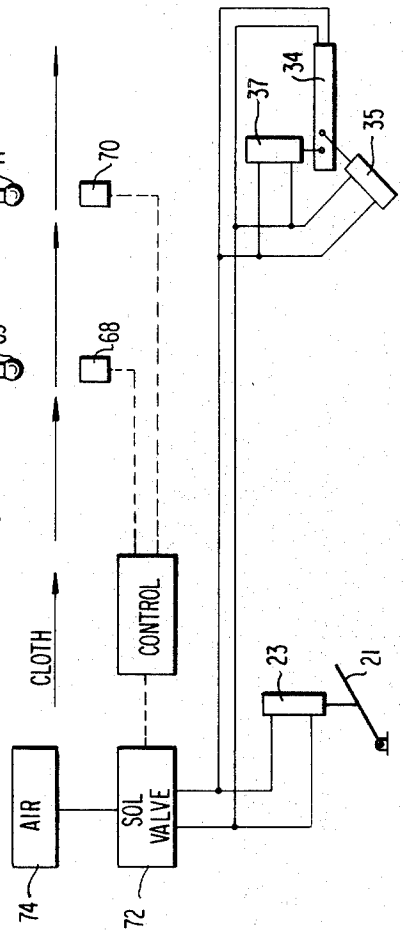
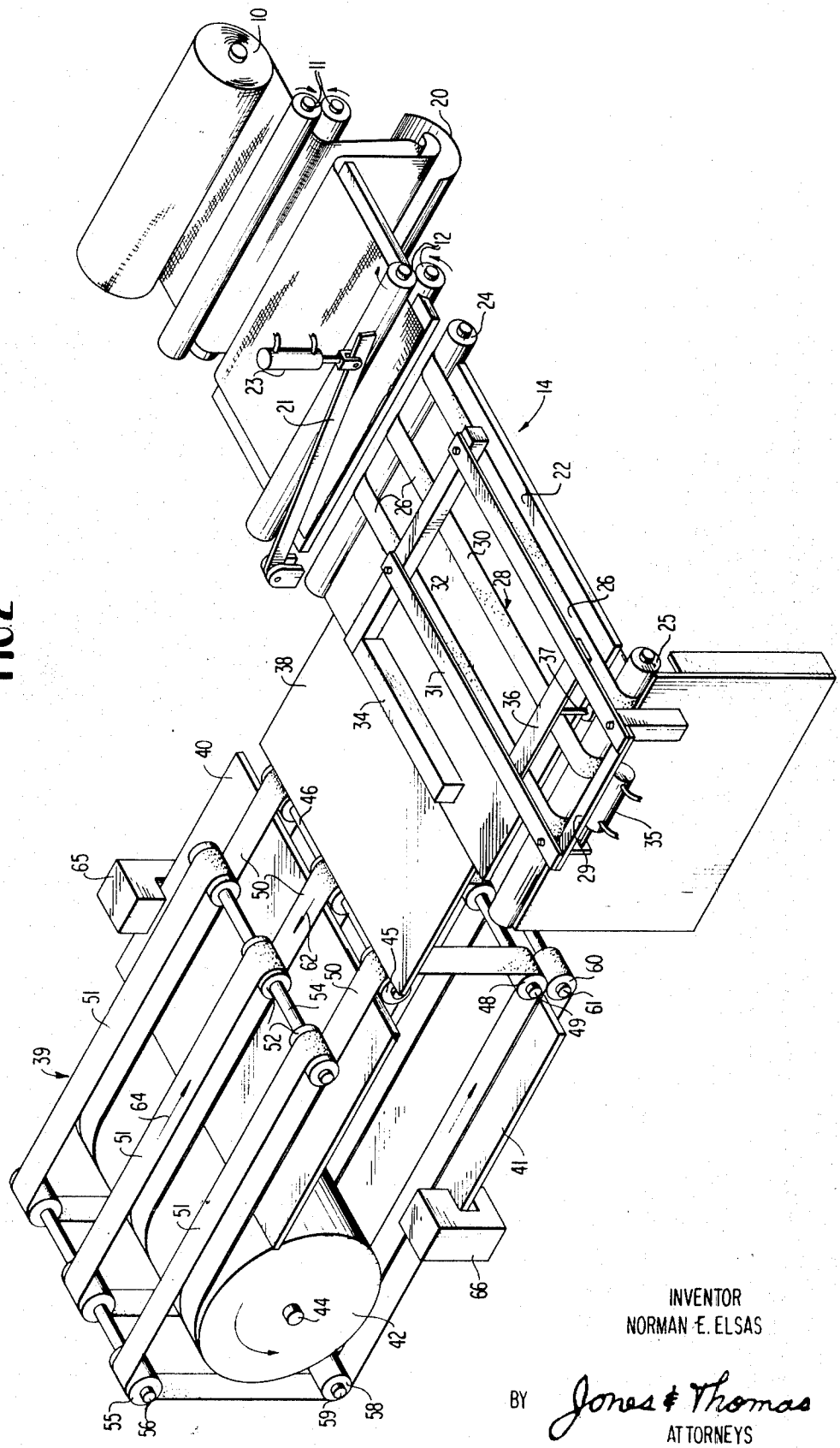


FIG.3

INVENTOR
NORMAN E. ELSAS

BY Jones & Thomas
ATTORNEYS

FIG 2



INVENTOR
NORMAN E. ELSAS

BY Jones & Thomas
ATTORNEYS

CLOTH CUTTING AND HEMMING METHOD AND APPARATUS

BACKGROUND OF THE INVENTION

In the manufacture of lengths of material or cloth, such as towels, diapers, wiping rags, etc., the cloth lengths usually are manufactured by cutting lengths of cloth from a generally continuous supply of cloth, and hemming or otherwise treating the cut ends of the cloth lengths to prevent the ends from raveling. Cloth lengths usually were processed through sewing machines by hand with the sewing machine operator guiding the cut ends of the cloth lengths through the machine to perform the hemming process. While some automated machinery has been developed to relieve the machine operators from continuous and close observation and control of the machines used for hemming the cloth lengths, it is still necessary for the cut lengths of cloth to be cut, accumulated in stacks, and then fed into sewing machines in separate steps. This requires the manual handling of the cloth lengths between and during the separate steps and the services of various sewing machine operators and attendants.

SUMMARY OF THE INVENTION

Briefly described, the present invention comprises a method and apparatus for cutting lengths of cloth or other material from a generally continuous supply, and then automatically trimming and hemming the ends of the cloth lengths in a continuous mechanical process which does not require the manual handling of the cloth lengths between the steps of feeding the continuous supply to the apparatus and receiving the stacks of hemmed cloth lengths. The continuous supply of cloth is continuously fed to a cutting station where it is cut, and the cut lengths are then moved in a U-shaped path generally normal to the direction from which the continuous supply was fed to orient the cut ends in an attitude parallel to the direction of movement of the cut lengths. As the cut lengths of cloth are conveyed through a U-shaped path the hemming function for one cut end is performed in one leg of the U-shaped path and the hemming function of the other cut end is performed in the other leg of the U-shaped path, which enables both hemming functions to be performed with right handed sewing machines.

Thus, it is an object of this invention to provide a method and apparatus for forming hemmed lengths of material from a generally continuous source of material in a continuous, automatic, mechanical process.

Another object of this invention is to provide an inexpensive, durable and versatile apparatus for rapidly and accurately cutting and hemming or otherwise treating the cut ends of lengths of material.

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

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic illustration of the cutting and hemming process of the present invention.

FIG. 2 is a schematic illustration of the apparatus utilized to perform the cutting and hemming process.

FIG. 3 is a schematic illustration of a control system suitable for operating the apparatus of FIG. 2.

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 shows a generally continuous supply **10** of cloth, material or similar flat goods. Supply **10** is shown in the form of a reel of cloth supported in a rotatable manner so that the free end of the cloth can be pulled from the reel by a first pair of feed rollers **11**. A second pair of feed rollers **12** feeds the free end of the cloth supply to a cutting station **14** where it is cut into cut lengths of cloth **15**. The cut length **15***a* is then transferred away from the first path toward a second U-shaped path. As cut length **15***b* moves through the first leg of the U-shaped path, its cut edge **16***b* is treated as desired, as by trimming and hemming with a chain link stitch. The chain stitch is continuous and is trimmed as cut length **15***c* begins to pass around the curved portion of the U-shaped path. The cut length **15***e* has its cut edge **17**e trimmed and hemmed in the same manner as cut length **15***b* and the chain link stitch is cut between the cut lengths of cloth. The cut lengths are then automatically stacked in a pile **18** by any conventional stacking equipment.

As is illustrated in FIG. **2**, the first pair of feed rollers **11** function to feed the continuous length of material to a weighing pan **20**, and the second pair of feed rolls **12** function to withdraw the material from the weighing pan and move the material to the cutting station and feed determined lengths of material onto conveying tapes **26** supported on table **22**. Weighing pan **20** is arranged to terminate the rotation of feed rollers **11** after a prescribed amount of the material is present in the weighing pan. The second set of feed rollers **12** operate intermittently, and cutting blade **21** is positioned adjacent feed rollers **12** and is actuated by pneumatic cutting ram **23** to cut the continuous lengths of cloth.

Cutting station **14** comprises a cutting table or transfer platform **22**, conveyor rollers **24** and **25** at the opposite ends of the cutting table, and spaced conveyor belts or tapes **26** which include upper flights that extend across the surface of cutting table **22** and lower or return flights which extend beneath the table. Parallel linkage or pantograph **28** is secured to one end of cutting table **22** and extends over the cutting table. Parallel linkage **28** includes "stationary" or power arm **29**, swinging arms **30** and **31**, and support or movable arm **32**. Gripping member **34** is rigidly connected to support arm **32**. Pneumatic ram **35** is positioned at the end of cutting table **22** and functions to operate power arm **29**, to impart movement to the parallel linkage **28**. The swinging arms **30** and **31** are pivotally supported at their ends adjacent power arm **29**,**30** that a small movement of the power arm **29** under the influence of pneumatic ram **35** causes a large arcuate movement of support arm **32** and gripping member **34**.

Lifting arm **36** is located below swinging arms **30** and **31** of parallel linkage **28**. Lifting arm **36** is disposed in a horizontal attitude, and its pneumatic ram **37** functions to raise and lower the lifting arm into and out of engagement with swinging arms **30** and **31**. This functions to lift and lower gripping member **34** with respect to cutting table **22** beyond the last conveying tape, so that the gripping member is lowered into contact with each cut length of cloth **15** at its edge adjacent transfer table **38**, grasps the length of cloth, and then the gripping

member is lifted away from the cutting table while the parallel linkage **28** pivots, Ram **35** functions to swing the parallel linkage rapidly toward transfer table **38** so that the cut length of material is cleared from cutting table **22** and the cutting table is ready for another cycle of operation. The arc of movement of parallel linkage **28** is adjusted so that the cut edges of the length of material are properly positioned for subsequent steps in the process. Gripping member **34** can be formed of any conventional design, and can comprise a suction device, a clamp device, movable needle device, or virtually any device compatible with the material being cut and hemmed. The actuation of the gripping member **34** is through an air conduit, described more fully hereinafter.

Gripping member **34** functions to transfer the cut lengths of cloth from cutting table **22** across transfer table **38** toward U-shaped conveyor **39**. U-shaped conveyor **39** is arranged so that it moves the cut lengths of cloth through a U-shaped path which is generally normal to the direction of movement of the continuous length of material from supply **10**. Work table **40** is positioned at the upper leg of the U-shaped path, while work table **41** is positioned at the lower leg of the U-shaped path. The cylindrical drum **42** forms the curved portion of the U-shaped path and is rotatably mounted on axle **44**. A plurality of pulley sheaves **45** are mounted on axle **46** between transfer table **38** and work table **40**, while a plurality of pulley sheaves **48** are mounted on axle **49** adjacent work table **41**. A plurality of conveyor belts or tapes **50** are guided by pulley sheaves **45** and **48** and cylindrical drum **42** along the upper surfaces of work table **40** and **41**. A second plurality of conveyor belts or tapes **51** are guided into abutting relationship with the first plurality of conveyor tapes **50** by means of pulley sheaves **52** on axle **54**, pulley sheaves **55** on axle **56**, pulley sheaves **58** on axle **59**, and pulley sheaves **60** on axle **61**. The arrangement is such that continuous conveyor tapes **50** move in the direction as indicated by arrow **62** from transfer table **38** toward tangential engagement with drum **42**. As the conveyor tapes **50** move in this direction, the abutting conveyor tapes **51** move in the direction as indicated by arrow **64** until they pass around pulley sheaves **52**, whereupon they are guided into abutting relationship with conveyor tapes **50** and move in unison therewith about cylindrical drum **42**. After both pluralities of conveyor tapes move about cylindrical drum **42**, they move in unison over work table **41** until they emerge between the plurality of pulley sheaves **48** and **60**, whereupon tapes **50** move back toward pulley sheaves **45** and tapes **51** return below work table **41** beyond cylindrical drum **42**, and then above work table **40**.

Sewing machine **65** is of conventional construction and is positioned at the edge of work table **40** and is the type that functions to trim the edge of the material being fed thereto and to form a chain link stitch about the edge of the material. In addition to the sewing machine, there is included an attachment (not shown) which functions to trim any loose thread, including the loose chain link stitch formed by the sewing machine extending between the cut lengths of cloth. Thus, sewing machine **65** and its attachment functions to trim or edge the cut lengths of cloth, hem the edges of the lengths of cloth, and trim the chain link stitch extending between the lengths of cloth. These functions are represented in a schematic fashion in FIG. **1**.

Sewing machine **66** is positioned at the edge of lower work table **41** on the opposite side of the U-shaped path from sewing machine **65**. Sewing machine **66** is substantially identical to sewing machine **65**, and both of the sewing machines are "right handed" machines.

Sewing machine **65** and **66** normally will operate continuously, as will U-shaped conveyor **39**. The conveyor and sewing machines operate in unison, that is, the sewing machines operate at a speed compatible with the speed of U-shaped conveyor **39**.

As is illustrated in FIGS. **1** and **3**, a control means is provided for operating cutting blade **21** and gripping member **34**. A photo-electric cell **68** is positioned above cutting table **22** at cutting station **14**, and a light source **69** is positioned below the cutting station. A second photo-cell **70** is positioned above U-shaped conveyor **39** at its infeed end and a light source **71** is positioned below work table **40**. The movement of the leading or free end of the continuous length of cloth across the cutting table **22** eventually causes the light from source **69** to be blocked from photo-electric cell **68**, causing a change in condition, causing solenoid valve **72** to shift and feed rolls **12** to stop. Solenoid valve **72** is connected between a source of air under pressure **74** and cutting ram **23**, parallel linkage ram **35** and lifting arm ram **37**. When solenoid valve **72** is shifted in this manner, the feed rolls have stopped and cutting blade **21** is lowered and functions to sever the continuous length of material and form a cut length of material on cutting table **22**. In the meantime, lifting arm ram **37** functions to lower its lifting arm **36** and parallel linkage **28**, causing gripping member **34** to move down into contact with the length of material on cutting table **22**. The air from solenoid valve **72** also communicates with gripping member **34**, causing its gripping elements to function to grasp the cut length of cloth. Parallel linkage ram **35** causes gripping member **34** to move from cutting table **22** across transfer table **38** toward U-shaped conveyor **39**.

As gripping member **34** moves in this manner, it eventually breaks the light source to photo-electric cell **70**. This causes solenoid valve **72** to shift back to its original position and cause the high pressure air from air source **74** to communicate with the opposite ends of pneumatic rams **23**, **35** and **37**, which causes gripping member **35** to release the cloth length and be raised and moved back to its original position above cutting table **22**. The retraction of cutting blade **21** can also be controlled by the shifting of solenoid valve **72**, or in order to more quickly retract the cutting blade a separated pneumatic circuit can be utilized (not shown).

The movement of gripping member **34** toward U-shaped conveyor **39** is of a distance suitable to cause the cut length of cloth to be released on conveyor tapes **50** at a position where the cut length of cloth will ride through the U-shaped conveyor **39**. The arc of movement of gripping member **34** can be lengthened or shortened by moving photo-electric cell **70** toward U-shaped conveyor **39** or toward cutting table **22**. This allows the position at which the cut lengths of cloth are released on U-shaped conveyor **39** to be adjusted so that the trailing cut edge can be moved into proper

alignment with sewing machine **65**. In a similar manner, photo-electric cell **68** at cutting table **22** can be repositioned to cause a longer or shorter length of the continuous length of material to be cut, thereby lengthening or shortening the cut length of material.

The control circuitry of FIG. **3** can be modified to include a control for the driving element of the second pair of feed rollers **12**, so that these rollers will cease their feeding function as the cut lengths of cloth are being transferred from cutting table **22** to U-shaped conveyor **39**. Of course, the speed of operation of parallel linkage **28** can be so rapid that the second pair of feed rollers **12** can operate as soon as the cut length of cloth is clear of line of material being fed. Moreover, conveyor tapes **26** of cutting table **22** normally will be driven at a surface speed higher than the feed rate of the second pair of feed rollers **12**. With this arrangement, when the material is fed onto cutting table **22**, the conveyor tapes will tend to draw the material out and any wrinkles, folds, creases, etc. will tend to be stretched out as the material passes onto cutting table **22**. The conveyor tapes **26** of cutting table **22** normally will be driven continuously.

As the cut lengths of material are dropped onto conveyor tapes **50** of U-shaped conveyor **39**, they tend to ride in between the abutting tapes **51**, so that a positive grip is applied to the cut lengths of cloth as the cut edge reaches sewing machine **65**. Any vibration or other disrupting influence encountered by the cut lengths of cloth will not function to dislodge the cut lengths of cloth from the positive grip of the U-shaped conveyor **39** and this positive grip is maintained on the cut lengths of cloth as they travel about cylindrical drum **42** and over lower work table **41** into sewing machine **66**.

Sewing machine **66** is supported in an adjustable mounting (not shown) so that the sewing machine can be moved toward or away from U-shaped conveyor **39**. This enables sewing machine **66** to function properly in trimming and hemming shorter or longer lengths of cloth. For instance, when photo-electric cell **68** is moved closer to cutting blade **21** to cause the cutting blade to cycle early and cut short lengths of cloth, it will be necessary to reposition sewing machine **66** closer to U-shaped conveyor **39** so that the cut edge of the cut length of cloth will be properly trimmed and hemmed. If necessary, the conveyor tapes shown adjacent sewing machine **66** can be removed and sewing machine **66** can be moved far over toward the center of U-shaped conveyor **39** to accommodate extremely short lengths of cloth.

While photo-electric cells **68** and **70** have been illustrated as the adjustable control elements in the system, it should be apparent to those skilled in the art that various other detecting and control devices can be utilized. For instance, the system can be controlled with the use of micro-switches, or a measuring device can be applied to the second pair of feed rollers **12** to detect the exact length of material extending from the rollers. Also, various pressure sensitive devices, wands or other detective devices can be utilized. Moreover, the simplified control system of FIG. **3** is presented by way of example only, and it will be understood that various other integral control systems or separate control systems can be utilized to cause the various elements of the system to properly function. While the treating of cut edges has been disclosed as trimming and hemming with a chain stitch, the cut edges can be treated in various other ways, as by turning and hemming, turning and applying an adhesive, the application of a sealing plastic, etc.

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 fabricating lengths of cloth or the like from a continuous supply of cloth comprising a transfer platform, feed means for feeding the end of a generally continuous supply of cloth in a first path onto said transfer platform, sensing means for determining when a predetermined length of cloth has been fed onto said transfer platform, cutting means responsive to said sensing means for cutting a length of cloth on said transfer platform from the supply of cloth, conveyor means for moving the cut length of cloth in a U-shaped path generally normal to the first path, transfer means responsive to said sensing means for urging the cut length of cloth from said transfer platform toward said conveyor means, first edge treating means positioned at one side of said conveyor means in one leg of the U-shaped path for treating one cut edge of the cut length of cloth as the cut length of cloth moves along the U-shaped path, and second edge treating means positioned at the other side of said conveyor means in the other leg of the U-shaped path for treating the other cut edge of the cut length of cloth as the cut length of cloth moves along the U-shaped path.

2. The apparatus of claim **1** and wherein said conveyor means comprises a cylindrical drum rotatable about its longitudinal axis, a first plurality of conveyor belts extending about and engaging said cylindrical drum in an arc of approximately 180° about its curved surface, and a second plurality of conveyor belts urged into engagement with and movable with the first plurality of conveyor belts.

3. The apparatus of claim **1** and wherein said first and second edge treating means each comprise hemming means constructed and arranged to form a thread chain between the edges of adjacent ones of the cut lengths of cloth, and further comprising cutting means at the sides of the U-shaped path for cutting the thread chains.

4. A method of continuously fabricating cloth lengths or the like comprising moving a continuous length of cloth along its length, cutting lengths of cloth away from the continuous length of cloth at a cutting station, moving at least two conveyor belts into abutment with each other then along a U-shaped path through a first horizontal leg in a direction normal to the length of the continuous length of cloth at the cutting station, around the annular surface of a rotating drum, then through a second horizontal leg, and parting the conveyor belts, moving each cloth length cut from the continuous length of cloth in series into the conveyor belts as the conveyor belts come into abutment with each other and along the U-shaped path with the conveyor belts with the cut ends of the cloth lengths

extending along the direction of the path, sequentially treating one end of each cloth length as it moves along the first horizontal leg of the U-shaped path, and sequentially treating the other cut end of each cloth length as it moves along the second horizontal leg of the U-shaped path.

5. The method of claim 4 and wherein the steps of treating the cut ends of the cloth lengths comprises trimming and sewing the cloth lengths at their ends.

6. A method of continuously fabricating lengths of cloth or the like from a continuous supply of cloth comprising feeding a continuous length of cloth from a supply along a first path, continually cutting predetermined lengths of the cloth away from the continuous length of cloth as the continuous length of cloth moves along the first path, moving the cut lengths of cloth along a second path approximately normal to the first path without changing the attitude of the cut lengths of cloth, treating one of the cut ends of each length of cloth as the lengths of cloth move along the second path, inverting the lengths of cloth, moving the lengths of cloth along a third path in a direction opposite the second path, and treating the other cut ends of the lengths of cloth as the lengths of cloth move along the third path.

7. The method of claim 6 and wherein the step of feeding the continuous length of cloth from a supply of cloth along a first path comprises feeding the leading end of the continuous length of cloth past a cutting device until a predetermined length of the cloth has moved past the cutting device, and terminating the feeding of the continuous length of cloth until the step of cutting the cloth has occurred and the step of moving the cut length of cloth along the second path has begun.

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