United States Patent [19]

Emus

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[54] **METHOD OF AND APPARATUS FOR PRODUCING HEMS ON CLOTH ARTICLES BY MEANS OF ADHESIVE**

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[52] **U.S. Cl.** **156/88**, 156/459

[51] **Int. Cl.** **D03d 47/50**

[58] **Field of Search** 156/459, 88

[56] **References Cited**

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Assistant Examiner—M. B. Wittenberg
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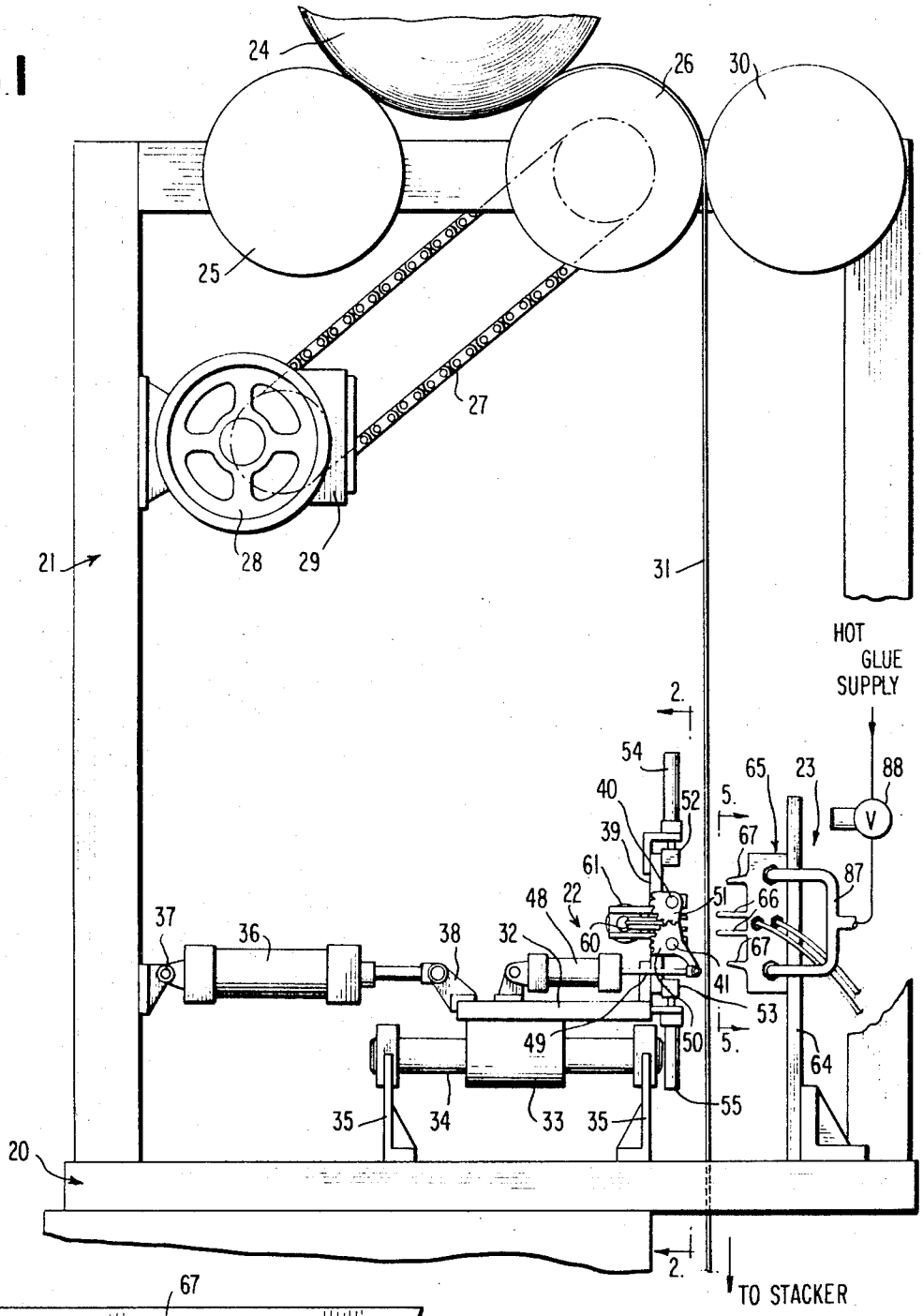
[57] **ABSTRACT**

A predetermined or sensed length of fabric, such as toweling, is delivered to a position between fixed and movable devices having parts which, upon engaging the fabric, have the capability of forming and folding it to produce industry standard hems. The fabric is severed between hem portions so that one hem is developed on the trailing end of one article while simultaneously a second hem is developed on the leading end of the next article. A part of the folding means also has the capability of depositing adhesive within the second fold of each hem to secure the hem without stitching after the application of pressure.

4 Claims, 13 Drawing Figures

FIG. 1



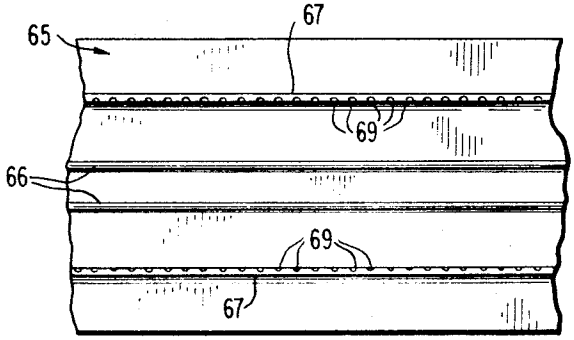


FIG. 5

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ATTORNEY

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FIG 4

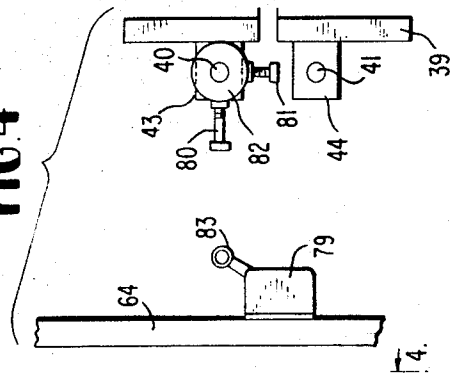


FIG 3

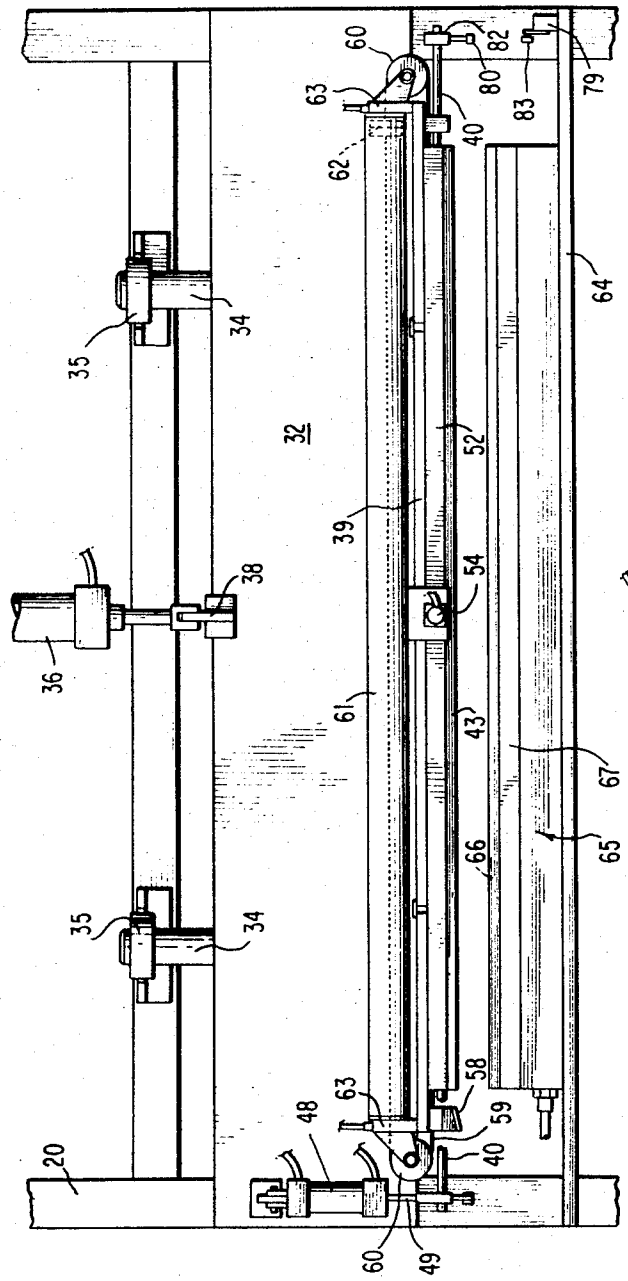


FIG 2

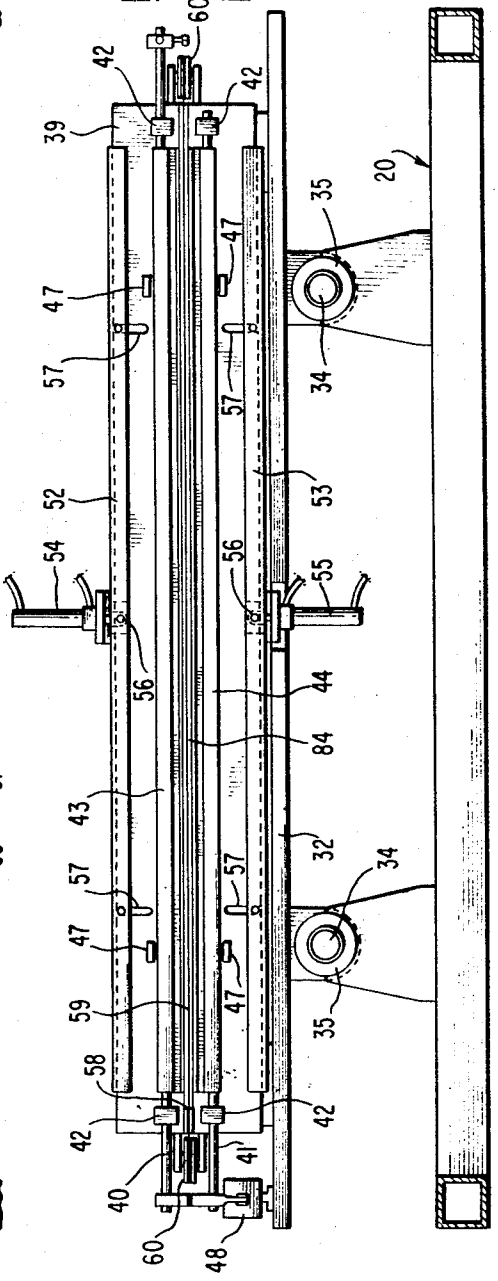


FIG. 6A

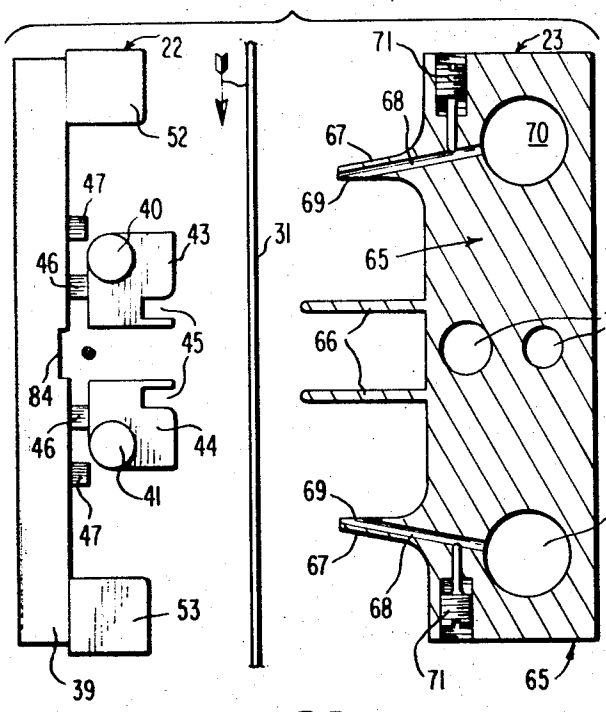


FIG. 6B

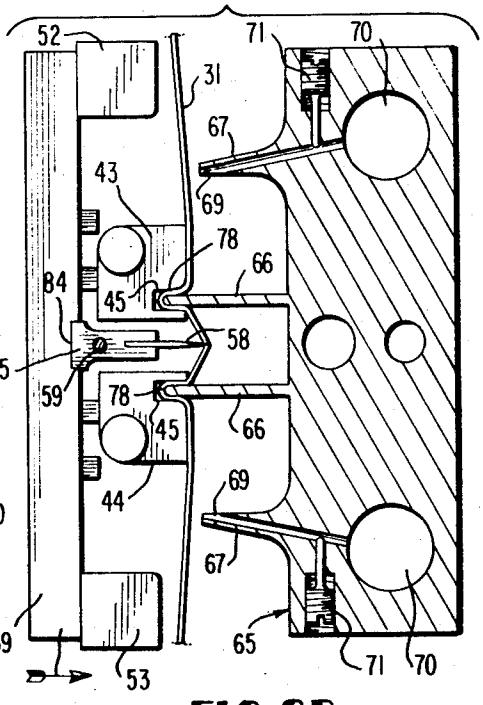


FIG. 6C

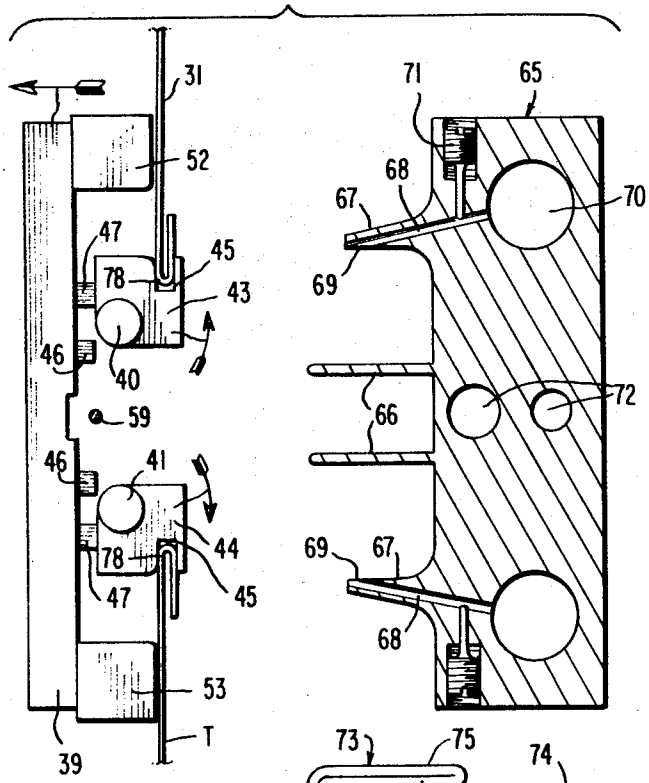


FIG. 6D

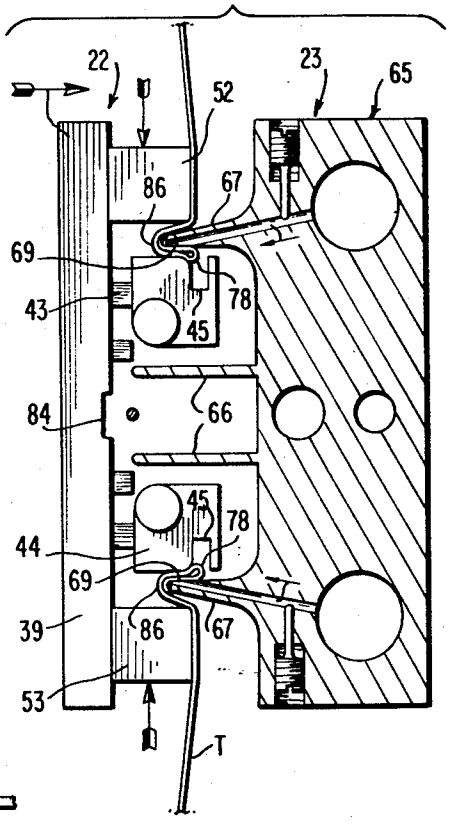
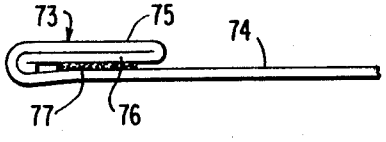


FIG. 7



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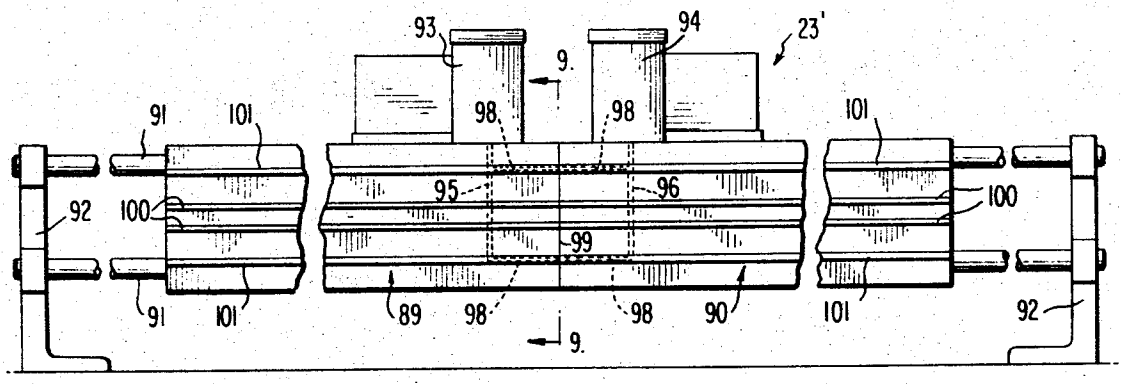


FIG.8

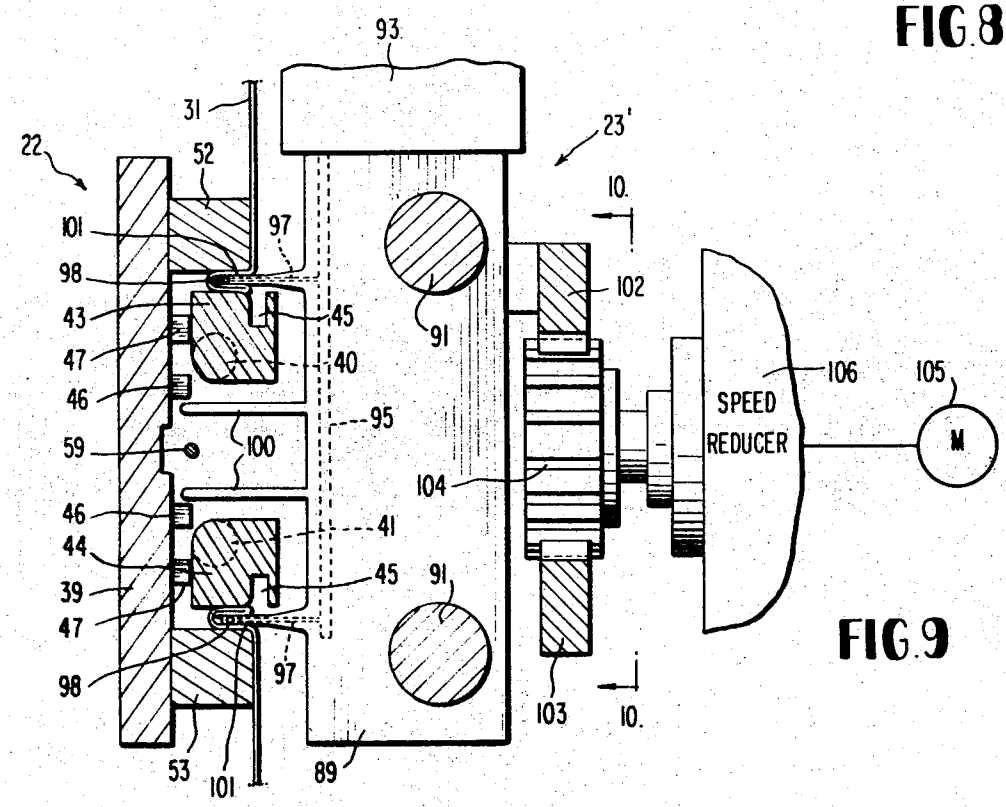
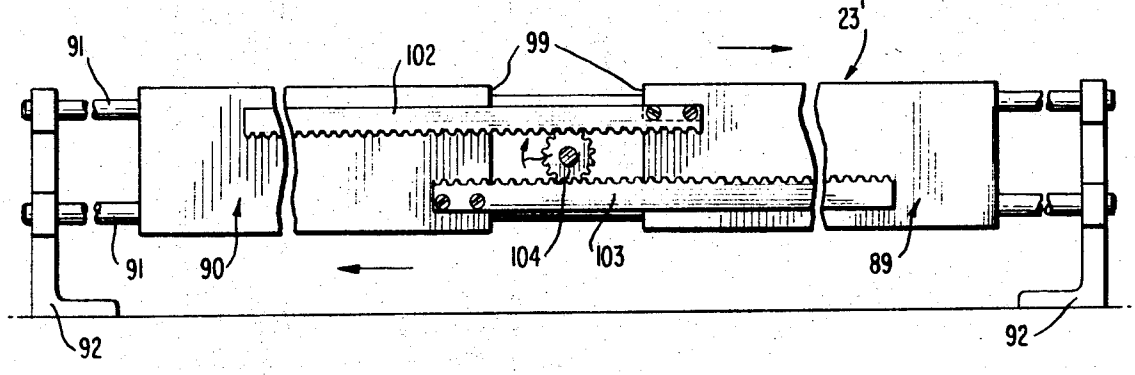


FIG.9

FIG.10



METHOD OF AND APPARATUS FOR PRODUCING HEMS ON CLOTH ARTICLES BY MEANS OF ADHESIVE

The towel and garment industry for many years has sought to develop a method or machine for producing industry standard hems on towels or on parts of certain garments without the necessity for sewing or stitching. Any sewing operation is essentially time-consuming and costly and involves a sewing machine operator and considerable manual manipulating of the cloth or article.

Ideally, the formation of a hem on a towel or the like by the use of adhesive has been sought by the industry for some time but without success to the extent of achieving a commercially accpetable method or machine. A number of problems have resisted solution. Until recently, completely satisfactory adhesives which resist repeated laundering and which do not discolor the articles and which produce a strong and durable hem have not been available. Such adhesives are now becoming available. Additionally, no completely satisfactory mechanism for producing the type of hem accepted by the industry and for depositing the adhesive has been developed. The standard hem recognized by the sewing industry for towels, sheets and the like embodies a double fold on all finished exposed edges to prevent a rough cut edge from being exposed to the consumer's view.

The present invention has for its objective the provision of a fully practical and economical method and apparatus having the capability of forming hems or cloth articles by means of adhesive with uniformity and efficiency. The hems produced are strong, acceptable in appearance, and will withstand laundering. The hems are produced in a simple sequence of method steps and by an apparatus which is relatively uncomplicated and substantially completely automatic so that manual labor is completely eliminated. The method and apparatus produce hems on towels or the like in a rapid manner and with the uniformity, appearance and economy demanded by the industry.

Other features and advantages of the invention will appear during the course of the following detailed description.

BRIEF DESCRIPTION OF DRAWING FIGURES

FIG. 1 is a general side elevation of apparatus for producing hems in accordance with the invention, certain elements being shown schematically.

FIG. 2 is a side elevational view of a movable cloth folding, severing and clamping assembly forming a major part of the apparatus taken on line 2—2 of FIG. 1.

FIG. 3 is a fragmentary plan view of the apparatus.

FIG. 4 is an enlarged end elevational view taken on line 4—4 of FIG. 2.

FIG. 5 is a fragmentary view similar to FIG. 2 showing the relatively stationary coacting folding and adhesive depositing means.

FIGS. 6A through 6D are enlarged transverse cross sectional views through the movable and stationary folding and adhesive depositing units or assemblies and showing their relative positions during the major method steps for producing the hems.

FIG. 7 is an enlarged end elevational view of a hem on one end of a towel or the like produced in accordance with the invention.

FIG. 8 is an elevational view similar to FIG. 5 showing a modification of the apparatus.

FIG. 9 is a cross sectional view similar to FIGS. 6A through 6D and taken on line 9—9 of FIG. 8.

FIG. 10 is a vertical section taken on line 10—10 of FIG. 9.

With respect to the drawings in general, it should be understood that they illustrate the complete apparatus for performing the complete method, but many minor details of construction present in the commercial machine are omitted for simplicity and because such details are not required for a full understanding of the invention.

DETAILED DESCRIPTION

Referring to the drawings in detail wherein like numerals designate like parts and making reference first to FIGS. 1 through 6D and FIG. 7, the numeral 20 designates an apparatus supporting table or frame having a frame superstructure 21 mounted thereon to support certain overhead components. The details of the supporting means are unimportant. The apparatus embodies two major units or assemblies, namely, a horizontally reciprocable folding, severing and gripping assembly designated in its entirety by the numeral 22. A coacting stationary assembly or unit 23 opposes the assembly 22 and both are based on the table support 20. The stationary assembly 23 coacts in the folding of the cloth to produce hems and also contains the means to introduce adhesive into the second fold of the hem, as will be fully described.

In addition to the two main assemblies 22 and 23, the apparatus includes an overhead roller bed for supporting a cloth roll 24, the cloth being suitable for toweling or the like. The roller bed comprises parallel horizontal rolls 25 and 26 suitably journaled on the superstructure 21 and the roll 26 is power driven through suitable gearing 27 from a motor unit 28 also on the superstructure 21. This motor unit embodies a speed reducer 29 and may also employ conventional controls for dispensing or feeding intermittently precalculated regular lengths of cloth from the roll 24 downwardly into the apparatus. In this connection, an additional overhead roll 30 on the superstructure 21 is opposed to the feed roll 26 and the vertical cloth web 31 passes between the nips of these two rolls, as shown. The hanging web 31 extends into the space between the assemblies 22 and 23 and dwells when the web is to be acted upon by the opposed folding, gripping and adhesive-applying means. When each preset length of cloth is acted upon by the invention to produce identical hems on the trailing end of one article and the leading end of the next article, one completed article will be severed from the web and the next identical length of cloth will be fed downwardly automatically into position for severing and hemming. Alternatively, the cloth web 31 may possess certain markings at regular intervals of a nature detectable by photocell means or electronic control means, to assure that regular lengths of cloth will be fed intermittently. Such control means are conventional and need not be described herein. If desired, simple mechanical cloth measuring devices may be engaged by the cloth or one of the rolls 26 and 30.

The reciprocating assembly 22 comprises a main carriage plate 32 supported on sturdy bearings 33, slidable on horizontal guide bars 34, in turn supported on table-mounted bearings 35. The carriage plate 32 and all

parts mounted thereon are reciprocated at predetermined times longitudinally of the bars **34** by a main pneumatically operated cylinder-piston unit **36** connected to the superstructure **21** and **37** and connected to the plate **32** at **38.**

Mounted on the leading edge of the horizontal carriage plate **32** and forming a part of the carriage is an upstanding vertical mounting plate **39.** At the forward side of this mounting plate are disposed a pair of vertically spaced parallel horizontal rocker shafts **40** and **41** journaled in bearings **42** on the plate **49.** Rigid with these rocker shafts **40** and **41** and turnable therewith are hem folding or turning bars **43** and **44** of generally rectangular cross section. As shown in FIG. **2,** these hem forming bars extend substantially for the full width of the apparatus and are sufficiently long to accommodate a cloth web wide enough to produce the largest bath towels.

The cross sectional configurations of the bars **43** and **44** are detailed in FIGS. **6A–6D** and each of these bars is formed to provide a longitudinal cloth forming slot **45** in its normal leading face and extending for the full length of each bar. A first pair of stops **46** on the front face of mounting plate **39** limits the turning of the bars **43** and **44** at positions where the slots **45** are facing forwardly and horizontally with respect to the vertical cloth web **31,** see FIGS. **6A** and **6B.** A second and like pair of stops **47** on the plate **39** above and below the stops **46** arrest turning of the hem forming bars **43** and **44** when the slots **45** are vertically disposed upwardly and downwardly as in FIG. **6C.**

Means to turn the bars **43** and **44** with the rocker shafts **40** and **41** include a horizontal pneumatic cylinder-piston unit **48** on the carriage plate **32** having its piston rod **49** connected to the lower one of a pair of gear sectors **50** and **51,** fast on the shafts **41** and **40,** respectively, and in mesh. Other suitable linkage means may be employed to turn the rocker shafts **40** and **41** in lieu of the arrangement shown.

Above and below the hem forming and folding bars **43** and **44** are upper and lower vertically shiftable preferably plastic clamping or pressing bars **52** and **53.** As shown, these pressing bars are rectangular in cross section and they are moved upwardly and downwardly at proper times over the vertical plate **39** by means of a pair of centrally located vertical pneumatic cylinder-piston units **54** and **55** suitably secured to the vertical plate **39** by bracket means. The bars **52** and **53** are secured directly as at **56** to the piston rods of units **54** and **55** and, if desired, the end portions of the bars on opposite sides of the units **54** and **55** may float freely or may be guided by slot means **57.** As indicated by the vertical arrows in FIG. **6D,** the bars **52** and **53** at prescribed times may move toward pressing or gripping relationship with the top and bottom faces of the folding rotary bars **43** and **44.** This operation will be further described in full detail in connection with the steps depicted in FIGS. **6A–6D.**

Also on the movable assembly **22** at an elevation between the folding bars **43** and **44,** FIG. **6B** and FIG. **2,** is a cloth severing knife **58** carried and driven by a cable **59,** said cable engaging pulleys **60** bracketed to the ends of a long horizontal cylinder **61** having a piston **62** therein, FIG. **3,** said piston secured to the cable **59** within the cylinder. This form of drive for the knife **58** is conventional and achieves a quick stroke of the knife across the cloth web **31** and the longest possible stroke in the shortest space. The knife drive shown is of the type shown in catalog No. 1066 of Tol-O-Matic, Inc., 246 Tenth Ave. South, Minneapolis, Minn. 55145. The knife drive assembly is suitably secured to the rear of the vertical plate **39,** FIG. **3,** by arms or brackets **63.** Other forms of cloth severing means may be employed in some instances but the present severing means is preferred. The knife **58** is of low inertia and traverses the cloth web quickly and cleanly at prescribed times and has a quick return stroke.

The coacting relatively stationary assembly **23,** previously mentioned, rests on the frame **20** and embodies a vertical mounting plate **64** which may span the entire apparatus, FIG. **3.** Upon this vertical plate **64** is fixedly mounted a combined adhesive dispensing manifold and cloth folder **65** having the form of an elongated block-like body which also extends substantially across the apparatus. The surfaces of the body **65** which directly contact the cloth web are preferably coated with teflon and this is also true of the rotating folding bars **43** and **44.**

In direct opposition to the slots **45,** FIG. **6A,** a pair of thin folding blades **66** are formed on the body **65** integral therewith and in parallel spaced relation and extending for the entire length of the member **65.** These folding blades are adapted to enter the slots or grooves **45** at prescribed times in the manner shown in FIG. **6B** to effect a first folding or offsetting of the cloth web **31.** Above and below the blades **66** are additional somewhat tapered and somewhat shorter folding blade projections **67** which also constitute adhesive distributors or nozzles. The elements **67** have a multitude of ports **68** formed therein opening through the sides thereof immediately above and below the blades **66** as at **69.** The ports **68** do not open through the opposite or outer sides of the elements **67** as viewed in FIGS. **6A–6D** and this is important in applying the adhesive to precisely the right location in each hem. The ports **68** all communicate with a common adhesive manifold passage **70,** FIG. **6A,** two such passages being provided, one for each element or projection **67.** Each port **68** has its own individual adjustable valve **71** to assure a most uniform and accurate application of adhesive along the hem and at closely spaced intervals. In the method, it is possible to use solvent cements or adhesives and also hot melt adhesives in some cases. Additional passages **72** may be provided in the body **65** for the reception of heating elements. The body **65** may conveniently be formed of aluminum or some like material. It will further be noted that the interior sides of the nozzle projections **67** are parallel to the blades **66** while the exterior sides are inclined and convergent.

Referring now to FIG. **7,** a conventional hem **73** as used in the towel industry and produced with adhesive by this invention is shown. A fragment of the towel body is shown at **74** folded back upon itself at **75** in a first fold and folded forwardly again at **76** in a second fold which lies between the towel body and the outside fold or layer **75.** The adhesive mass is indicated at **77** in FIG.. **7** where the adhesive lies between the interior wall of the hem and the towel body **74** in a fully concealed but effective manner. The invention method and apparatus herein will produce this desired hem uniformly as will now be described in connection with the method steps shown particularly in FIGS. **6A–6D.**

In these figures, the cloth web **31** is fed downwardly a prescribed amount and hangs stationary between the

two opposing assemblies 22 and 23 which are now separated, FIGS. 1 and 6A. The bars 43 and 44 are turned against the positive stops 46 and the slots or grooves 45 are facing the folding blades 66. The projections 67 are above and below the bars 43 and 44 and are not active at this time.

In FIG. 6B, the cylinder-piston unit 36 is activated to move the carriage plate 32 and all parts thereon toward the fixed assembly 23 which includes the body 65. As this happens, the folding blades 66, FIG. 6B, will enter the slots 45 and produce a pair of U-shaped loops 78 in the cloth. Immediately following this, the knife blade 58 will engage and sweep across the web 31 and sever the same cleanly midway between the blades 66 and the knife will quickly return. At this time, the carriage plate 32 is not advanced to the fullest possible extent by the cylinder 36 but only sufficiently to engage the blades 66 in the slots 45 as in FIG. 6B to form the loops 78. To limit and arrest the forward movement of the carriage by the cylinder 36, a limit switch 79 or like control device, FIGS. 3 and 4, may be mounted on one end of the vertical plate 64 to be engaged by the longer of two actuator pins 80 and 81 carried by a collar 82 secured to the adjacent end portion of rocker shaft 40. The longer in 80 is spaced 90° from the shorter pin 81, FIG. 4, and will be positioned to trip the limit switch actuator arm 82 when the folding bar 43 with the groove 45 is positioned as in FIG. 6A, that is, the groove 45 is positioned horizontally to receive the blade 66 as in FIG. 6B. The limit switch 79 will stop the movement of the carriage plate 32 and associated parts as soon as the blades 66 enter the grooves 45 sufficiently to produce the desired loops 78. The switch actuating pins 80 and 81 are adjustable. It might also be mentioned here in connection with the severing knife 58 that the vertical plate 39 contains a horizontal guide groove 84 for the base member 85 or holder of this knife. This will stabilize the knife 58 during its sweep across the cloth web.

Following the severing of the web, FIG. 6B, the carriage plate 32 retracts as in FIG. 6C and the folding bars 43 and 44 are rotated upwardly and downwardly 90°, respectively, until the bars engage the second set of stops 47. This will position the previously formed loops or folds 78 vertically in back-to-back relation and the two loops are now physically separated, one loop being on the trailing end of a towel T, FIG. 6C, and the other loop 78 being on the leading end of the next oncoming towel still integral with the web 31.

Following this, FIG. 6D, the cylinder 36 again advances the carriage plate 32 and all parts thereon toward the fixed body 65. The bars 43 and 44 are still positioned against the stops 47 or turned 90° from their starting positions in FIG. 6A. Under these conditions, the shorter pin 81, FIG. 4, is turned into position previously occupied by the pin 80 and aligned with limit switch actuator arm 83. The coaction of the elements 81 and 83 will stop the carriage only after it has moved sufficiently far toward the body 65 to allow the folding and nozzle projections 67 to engage the cloth and produce a second loop or fold 86 therein. In so doing, the original loop or fold 78 will be withdrawn from the groove 45, FIG. 6D. Substantially simultaneously, the vertical cylinders 54 and 55 are activated to move the two clamping bars 52 and 53 vertically downwardly and upwardly, FIG. 6D, to engage the second folds 86 and pinch or clamp the same against the projecting elements 67 or nozzles. At this time, the openings 69 are directly facing the interior walls of the loops or folds 78 corresponding to the wall 76 in FIG. 7.

Referring to FIG. 1, a manifold 87 is connected to deliver adhesive to the two passages 70 and a suitable solenoid-operated valve 88 is employed to release to the manifold 87 pressurized cement from a source not shown while the nozzles 67 are positioned as in FIG. 6D. This causes a multitude of small streams of cement to be delivered to the interior faces only of the loops 78, FIG. 6D. Immediately following this operation, the cylinder 36 will retract the carriage plate 32 and the teflon coated nozzles 67 will slip out of the hem and the clamping bars 52 will press the hem into its final configuration as shown in FIG. 7. The final movement of the clamping bars 52 and 53 against the hem to press it and the withdrawal of the nozzles from the hem is a quick and practically simultaneous operation. The completed hem is carried away from the nozzles 67 by the clamping action of the bars 52 and 43 and 53 and 44. In the retraction of the nozzles from the hem, any excess glue from the openings 69 will, in effect, be wiped off cleanly on the interior faces of the loops 78 or the portion 76, as shown in FIG. 7. This arrangement assures that no streaks of cement are ever deposited or wiped off on the body of the towel or article which is the portion 74 in FIG. 7. The wiping off of cement takes place only on the portion 76 in FIG. 7 as the nozzles are withdrawn. When the carriage is retracted, the clamping bars 52 and 53 return to their release positions of FIG. 6A and the folding bars 43 and 44 return to their original positions and the apparatus is conditioned for another complete cycle of operation. It should be mentioned that the required turning of the folding bars 43 and 44 is accomplished by the cylinder-piston unit 48, previously mentioned.

Conventional controls, either fully automatic or semi-automatic, may be employed in the apparatus for the pneumatic cylinders 36, 48, 54 and 55, and for the valve 88 which releases the adhesive and also for the feeding of the cloth web 31. Since these controls may be conventional, they are not illustrated herein and such illustration is not believed to be necessary to a full understanding of the method and apparatus. For example, a push button control panel may be mounted at a convenient point on the machine frame with push button switches to start the feeding cycle of the motor 28 which feeds the cloth intermittently. A second push button can initiate the operation of the cylinder 36 whose forward travel will then be automatically controlled by the limit switch 79 and pins 80 and 81 to attain the two carriage positions shown in FIGS. 6B and 6D. Other push buttons may be provided to retract the carriage, to operate the clamping bars 52 and 53 and to release the cement. A completely automatic cycle timer and controller is entirely feasible and well within the reach of the art under conventional practice.

To briefly summarize the operation and the method embodied in FIGS. 1 through 7, the following sequence takes place. The cloth web 31 is fed downwardly a measured amount and stopped between the two assemblies 22 and 23 while they are separated. This is the condition shown in FIG. 6A. The carriage for the assembly 22 is advanced to the position shown in FIG. 6B and the elements 45 and 66 coact to produce the first hem folds or loops while substantially simultaneously the cloth web is severed by the knife 58.

The main carriage is retracted, FIG. 6C, and the folding bars 43 and 44 are turned 90° with the first folds of the two hems being simultaneously formed. The carriage is again advanced by the cylinder 36 to the position of FIG. 6D and the folders or nozzles 67 engage the two sections of cloth which are positioned as in FIG. 6C and form the second hem fold in each cloth piece and this action will withdraw the original loop 78 from the vertical groove 45 of the bar 43 or 44, these two bars remaining in the same positions which existed in FIG. 6C. The clamping bars 52 and 53 now move inwardly to grip or press the hems against the upper and lower faces of bars 43 and 44 as the main carriage retracts and the nozzles 67 slip out of the hems after having deposited the adhesive therein all along the hems in an even manner through the multitude of ports 69. When the apparatus returns to the position of FIG. 6A, the two hems are released and the lower article or towel T is simply dropped to a suitable collection point or onto some sort of stacker bar. The method simultaneously produces a hem on the trailing end of a towel and on the leading end of the next oncoming towel not yet severed from the cloth web 31.

FIGS. 8 to 10 show a slight modification of the invention wherein the general method of producing the hems is virtually the same but the apparatus is somewhat different mainly as regards the elements which produce the second hem folds and deliver the adhesive into the hems.

FIG. 8, for example, is a view similar to FIG. 5 depicting the modification. The previously-described carriage mounted horizontally shiftable assembly 22 remains unchanged in the modification and its construction and operation need not be re-described. It is the relatively stationary coacting assembly 23 which is modified and this is indicated at 23' in the drawings.

In the modified form, the body portion of the adhesive dispensing body or manifold is formed in two equal length sections 89 and 90 and both of these sections and independently slidably supported on a pair of horizontal guide bars 91 whose ends are supported on bearing brackets 92 suitably secured to the main frame 20. Separate reservoir means 93 and 94 for adhesive is provided on top of each manifold section 89 and 90 so as to be capable of delivering either a hot melt adhesive or a solvent type adhesive through vertical passages 95 and 96 into branch passages 97, FIG. 9, which in turn lead into longitudinal passages 98 which open through the opposing end faces 99, see FIG. 8. The two sections 89 and 90, just as in the prior embodiment, are equipped with the blade elements 100 which produce the first hem folds and, as previously, the blade-like glue dispensing nozzles 101 are formed on the separate sections 89 and 90 to produce the second hem folds in the same manner previously-described and depicted in FIG. 6D. As will become apparent, the chief difference in the modification is that the adhesive is not delivered laterally into the folded hem as by the ports 69 in the nozzles 67 but rather the adhesive is delivered endwise into the folded hems through the ports 98 as the two manifold sections 89 and 90 carrying the nozzle and folding elements 101 are separated gradually from their starting positions in FIG. 8.

The means to cause this separation of the two separate units comprises a pair of rack bars 102 and 103 attached, respectively, to the sections 89 and 90 as depicted in FIG. 10. A spur gear 104 meshes with the two rack bars and is driven by a suitable motor 105 and speed reducer unit 106 to cause slow separation of the sections 89 and 90 after the nozzles 101 are positioned as in FIG. 9 so as to have completed the second folding of the two hems. At this time, the motor 105 is activated and the gradual separation of the two sections 89 and 90 causes streams of adhesive to be delivered endwise and trailingly from the ports 98 into the two hems rather than laterally into the two hems, as in the prior embodiment. The guide bars 91 are sufficiently long to allow the folders and nozzles 101 to pass completely out of and free of the opposite ends of the hems being formed so that the same are adhesively secured throughout their full lengths. The initial folds in the hems are produced in exactly the same manner previously described in the prior embodiment through the coaction of the blades 100 and slots 45 in the folding bars 43 and 44 and this operation need not be redescribed. Also, the clamping bars 52 and 53 function in the same manner previously described and serve to press or grip the hems as the nozzles slide endwise through them and finally pass clear of the hems. One advantage of the adhesive application in the modified form is that the adhesive is deposited deeply within the second fold of the hem and there is no tendency whatsoever for the nozzles to smear adhesive outside of the hem fold because the nozzles move lengthwise of the fold. The advantage of the prior and preferred embodiment is a more rapid application of adhesive laterally through the ports 69 and simultaneously all along the length of the hem. The drive means for the two sections 89 and 90 in the modified form may have a quick return feature so that the two sections of the apparatus will return quickly to their positions in FIG. 8 and thus speed up the overall method. Again, the sequence or cycle controls may be conventional.

It is to be understood that the forms of the invention herewith shown and described are to be taken as preferred examples of the same, and that various changes in the shape, size and arrangement of parts may be resorted to, without departing from the spirit of the invention or scope of the subjoined claims.

I claim:

1. A method of producing hems on cloth articles comprising feeding a cloth web to a hemming station and arresting movement of the web at such station, engaging the cloth web at the hemming station on opposite sides by coacting folding means and producing in the cloth web substantially simultaneously first folds for a pair of hems and substantially simultaneously severing the web substantially midway between the first folds by a means other than said folding means, turning the first folds substantially 90° oppositely with respect to the plane of the web, engaging the web on opposite sides in the regions of the first folds to produce second folds therein substantially simultaneously and depositing adhesive material into the second folds of the hems being produced, and pressing the double folded hems with the adhesive therein as the adhesive depositing means is withdrawn from the second folds of the hems to thereby complete the two hems.

2. A method as defined by claim 1, and wherein the adhesive is deposited laterally in the second folds of the hems by the means producing the second folds.

3. A method as defined by claim 1, and wherein the adhesive is deposited longitudinally along the second folds of the hems by the means producing the second

folds as such means is withdrawn longitudinally from the second folds.

4. A method of producing industry standard hems on cloth articles comprising the steps of feeding a cloth web intermittently vertically between two opposing co-acting hemming means, engaging the cloth web with said means on opposite sides of the web while the web is at a dwell in its movement and forming a pair of first folds in the web which are vertically spaced, severing the web between said first folds while said engagement of the web is maintained, turning the first folds upwardly and downwardly substantially 90° after said severing and disengaging the opposite sides of the web, again engaging the opposite sides of the web with said means to form second folds therein adjacent the first folds, injecting adhesive into the second folds and pressing the first and second folds together firmly in a vertical direction while said folds are held generally at right angles to the plane of the web.

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