April 30, 1963 H. FLEISSNER 3,087,320

APPARATUS FOR TREATING AND PROCESSING OF ELONGATED FLEXIBLE ELEMENTS

Original Filed June 3, 1959 3 Sheets-Sheet 1

FIG. 1

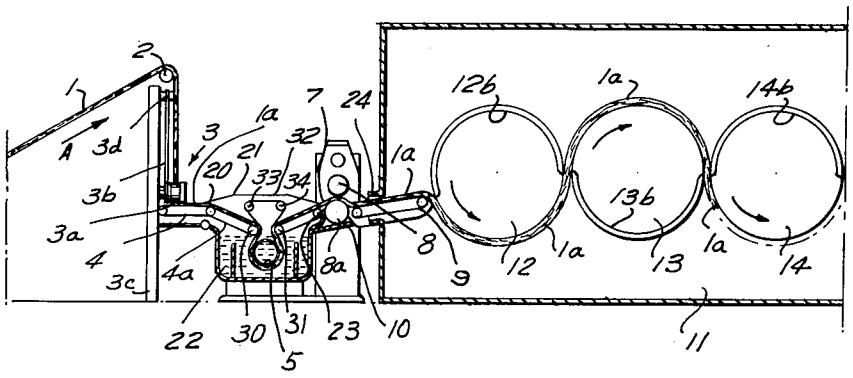

FIG. 2

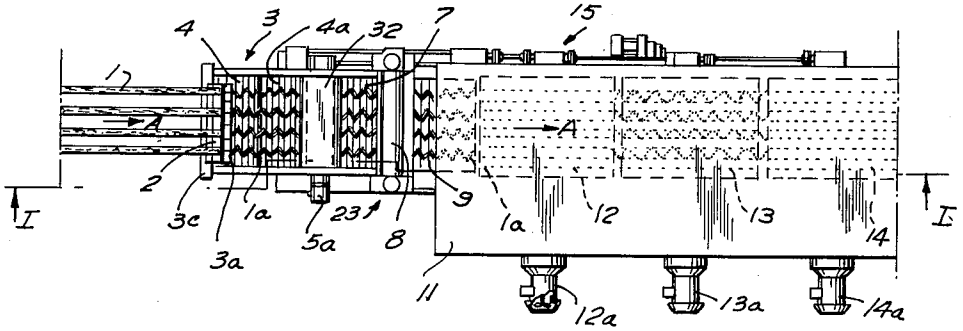

FIG. 3

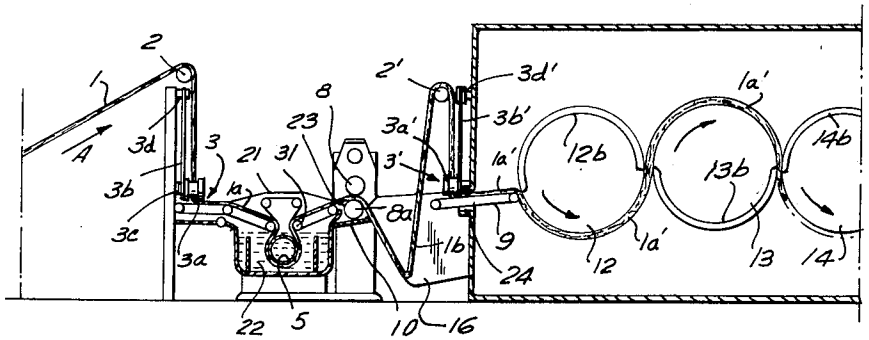

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FIG. 4a

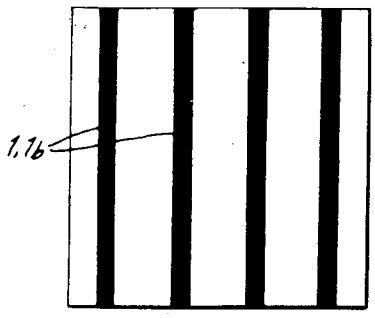


FIG. 4b

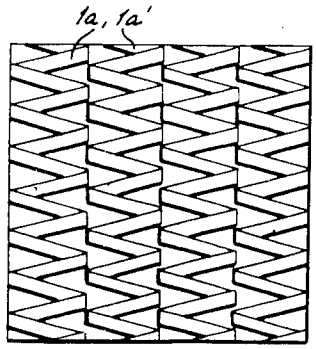


FIG. 4c

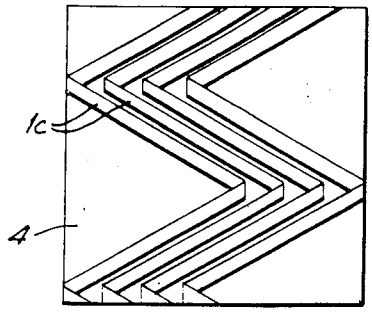


FIG. 4d

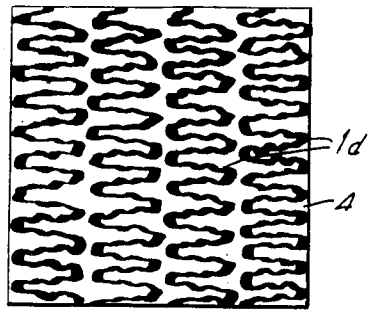


FIG. 4e

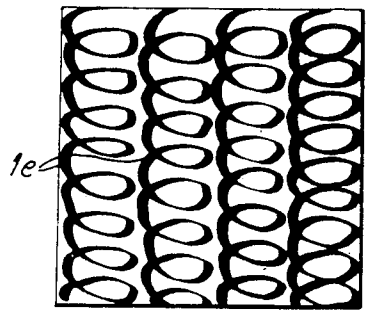
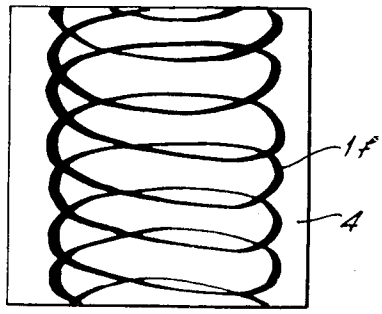


FIG. 4f



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APPARATUS FOR TREATING AND PROCESSING OF ELONGATED FLEXIBLE ELEMENTS

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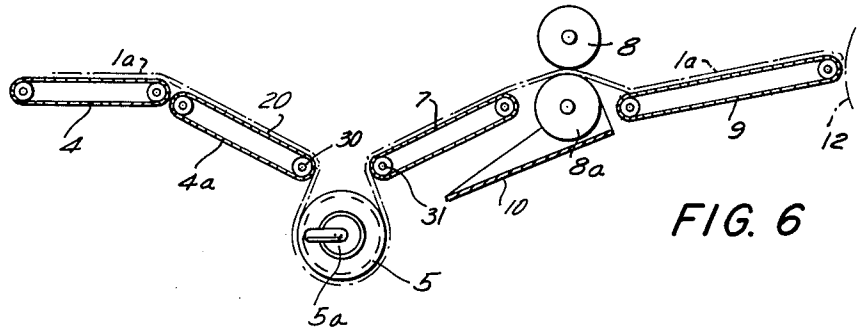
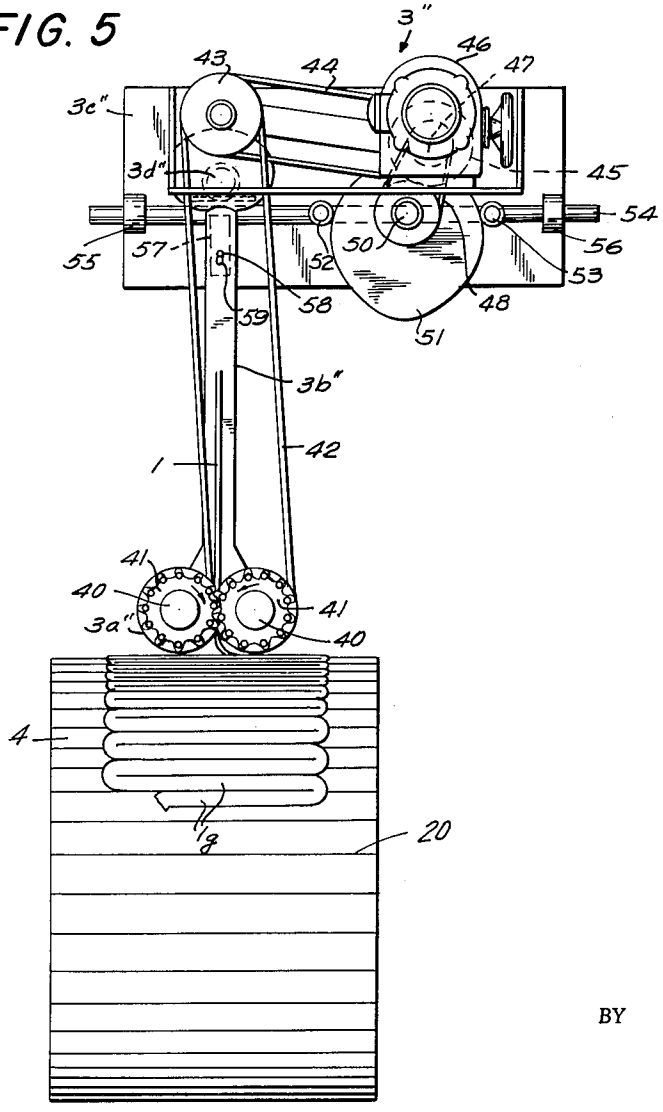


FIG. 6

FIG. 5



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United States Patent Office 3,087,320 Patented Apr. 30, 1963

3,087,320

APPARATUS FOR TREATING AND PROCESSING OF ELONGATED FLEXIBLE ELEMENTS

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Original application June 3, 1959, Ser. No. 817,949. Divided and this application July 12, 1960, Ser. No. 42,380

Claims priority, application Germany June 4, 1958

6 Claims. (Cl. 68—19)

The present invention relates to an apparatus for treating and processing elongated flexible elements, and more particularly for washing, rinsing, bleaching, dyeing, impregnating or sizing of cables, textile bands, belts, threads or the like regardless of whether the materials are made of natural or synthetic substances.

This application is a division of my copending application Serial No. 817,949, filed June 3, 1959, intitled "Process and Apparatus for Treating and Processing of Elongated Flexible Elements."

It is already known to wash or otherwise treat cables or bands made of flexible material by leading the material in parallel strands over a series of guide rollers immersed in a liquid treating substance. The disadvantage of such systems is in that the apparatus occupies too much space, and especially in that it is very difficult to allow for shrinkage of and to subsequently outshrink the treated material.

An important object of the invention is to provide an improved process of treating and processing flexible material which may be practiced in a compact apparatus occupying comparatively little space, and which takes into full consideration the shrinkage of processed material due to the latter's contact with a liquid treating agent.

A further object of the invention is to provide an improved apparatus which is capable of folding the treated material at least once without interruptions in the continuous or stepwise advance of the material toward and beyond the liquid treating station.

A still further object of the instant invention is to provide an apparatus of the above outlined characteristics which is so constructed that it may continuously process a single or simultaneously a large number of elongated flexible elements.

A concomitant object of the invention is to provide an apparatus of the type above set forth which is comparatively short, compact and cheap in manufacture, which is capable of folding the conveyed material into layers of many different configurations, and which is constructed with a view to maintain the material in folded condition during certain stages of or during the entire treating and processing cycle.

With the above objects in view, the invention consists essentially in the provision of an apparatus for treating and processing at least one flexible element which comprises various structural features in combination. Means are provided in the apparatus for bending the element at spaced intervals in substantially opposite directions so as to form a to and fro bent structure located in a predetermined plane as well as means for advancing each bent flexible element. Also provided are means containing a supply of liquid treating medium in the path of each bent flexible element and at least one hollow drum having a perforated mantle and rotatably installed in the treating medium having its axis of curvature extending substantially parallel to the plane of the bent structure and transversal to the longitudinal extension thereof along the periphery of the mantle. Means for rotating each drum and means for withdrawing the treating medium from the interior of each drum so that the treating medium causes each bent flexible element to adhere to at least a portion of the mantle of each drum by penetrating through each mantle into the interior of the respective drum are also provided in the apparatus. Other features of the combination are means for advancing each bent flexible element from the treating medium and pressing means comprising rotatable roller means for at least partially expelling the treating medium from each flexible element. Finally, there are provided in combination with the foregoing, means comprising a drying compartment, at least one drying drum in the compartment, the drying drum having a perforated mantle, means for rotating the drying drum, and means for withdrawing air from the drying drum so that the flexible element is caused to adhere to at least a portion of the mantle of the drying drum while advancing through the drying compartment.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of certain specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is schematic side elevational view of an apparatus for the treatment of elongated flexible elements which embodies the invention, certain parts being shown in vertical section taken substantially along the line I—I of FIG. 2, as seen in the direction of arrows;

FIG. 2 is top plan view of the apparatus partly broken away;

FIG. 3 is schematic side elevational view of a modified apparatus with certain parts shown in vertical section;

FIGS. 4*a*–4*f* are schematic diagrams showing different manners of laying one or more flexible elements onto various conveying components of the apparatus;

FIG. 5 is schematic view of one form of a cable or band laying or folding device; and

FIG. 6 is a diagrammatic enlarged view of part of the apparatus shown in FIG. 1.

Referring now in greater detail to the illustrated embodiments, and first to that shown in FIGS. 1 and 2, the apparatus for the treatment of flexible elements comprises essentially a receptacle **21** for a liquid treating medium **22**, a drum **5** in the receptacle **21** about which the flexible element or elements **1** may be led during one stage of the treatment, a drying compartment **11**, means **3**, for folding the flexible element or elements **1** into a plurality of folds, layers or coils **1***a* at a point in advance of the treating medium **22**, and conveying means **4**, **4***a* and **7**, **9** for advancing the layers **1***a* of flexible element or elements **1** into the treating bath **22**, and from the latter through a pressing or squeezing station **23** into the drying compartment **11**, respectively.

The flexible element or elements **1**, four of which are shown in FIG. 2, advance in the direction of arrow A over a deflecting roll **2** to be thereupon engaged by the folding, pleating or bending elements **3***a* of the folding device **3** whose swingable levers **3***b* are pivotally connected at **3***d* to an upright frame member or support **3***c*. Elements **3***a*, mounted in pairs on their respective levers **3***b*, fold the flexible elements **1** which pass therebetween, for example, in the form of zig-zag layers **1***a* onto the upper run of the first band of apron conveyor **4** which delivers the folded, coiled or pleated material onto the slightly inclined second conveyor **4***a*. The bands or aprons of conveyors **4**, **4***a* preferably consist of a series of parallel strips or slats schematically indicated in FIG. 1 by the reference numeral **20**. The flexible elements in the form of zig-zag layers **1***a* are thereupon led over a deflect-

ing roll **30** and are urged by the liquid treating medium **22** toward the perforated or apertured mantle of the drum **5** which is hollow and houses a portion of a vacuum pump **5***a*, the latter's function being to draw liquid **22** through the perforations or apertures formed in the mantle of e.g. washing drum **5** whereby the liquid treating medium **22** causes the layers **1***a* of flexible elements **1** to firmly adhere to the drum while the elements **1** are led thereabout. Upon leaving the mantle of drum **5**, the layers **1***a* pass about a second deflecting roller **31** and onto the upper run of the aforementioned band or apron conveyor **7** to thereupon pass between the pressing or squeezing rollers **8**, **8***a* of the pressing apparatus **23** before being led onto the upper run of the conveyor **9** whose righthand portion extends through an opening **24** into the interior of drying compartment **11** and into close proximity of the mantle of a first drying drum **12**.

The transfer of layers **1***a* from conveyor **4***a* into the path about the mantle of drum **5** and from the latter onto the conveyor **7** is assisted by a sieve-like belt **32** which travels in an endless path about the mantle of drum **5**, between deflecting rollers **30**, **31**, and about a second pair of deflecting rollers **33**, **34**. Thus, the layers **1***a* do not come into actual contact with the mantle of drum **5** but rather with the outer side of endless band **32**. The liquid treating medium which is squeezed or pressed from the material **1***a* by rollers **8**, **8***a* is collected in an inclined chute or tray **10** to be returned into the receptacle **21**. It will be readily understood that each flexible element may be caused to travel about more than one drum **5** while subjected to the action of liquid treating medium **22**.

After passing about the lower half of drying drum **12**, the layers **1***a* advance onto the mantle of a median drying drum **13**, and finally about the mantle of a third drying drum **14** to be thereupon led by non-represented conveyor means to one or more additional treating stations, not shown. While advancing through the compartment **11**, the layers **1***a* of material **1** are subjected to the action of a suitable drying medium, e.g., hot air. The mantles of drums **12–14** are perforated or apertured (see FIG. 2), and vacuum is generated in the interior of drying drums **12–14** by ventilators or fans **12***a*, **13***a*, **14***a*, respectively; therefore, the layers **1***a* are caused to adhere to the mantles of respective drums while passing through the drying compartment **11**. The inner sides of the upper halves of drums **12** and **14** are covered by substantially semicylindrical covers **12***b*, **14***b*, respectively, of sheet metal or any other suitable material, and a similar cover **13***b* is provided adjacent to the inner side of the lower half of median drum **13**. Covers **12***b*, **13***b* and **14***b* are stationary and thus prevent the layers **1***a* from passing about the upper half of drum **12**, about the lower half of drum **13**, and about the upper half of drum **14**, respectively. Due to the provision of members **12***b*–**14***b*, the radially oriented suctional force generated by ventilators **12***a*–**14***a* is prevented from attracting the layers **1***a* except in the lower halves of drums **12**, **14** and in the upper half of median drum **13**. Thus, as soon as the layers **1***a*, while traveling about the first drum **12**, reach the closest point between drums **12**, **13**, the suctional force generated by ventilator **12***a* is prevented by cover **12***b* from causing further adherence of layers **1***a* to the mantle of drum **12** while the force generated by fan **13***a* becomes effective at a point just beyond the adjacent axially parallel edge of cover **13***b* to cause transfer of the layers **1***a* onto the upper half of median drum **13**. The transfer of layers **1***a* from the drum **13** onto the lower half of drum **14** is analogous.

Drums **12–14**, conveyors **4**, **4***a* **7**, **9**, the drum **5** in bath **22**, and the pressing rollers **8**, **8***a* may all be rotated at predetermined angular speeds, either intermittently or continuously, by a schematically represented adjustable drive **15** whose details of construction form no part of this invention.

Flexible elements **1** may consist of cables, bands, threads, belts or the like and may be made of a synthetic or natural textile material, e.g., cotton, wool, rayon or the like. It is assumed merely by way of example that the flexible elements **1** advancing toward the deflecting roll **2** at the left-hand end of FIG. 1, are woolen or synthetic bands or threads coming from a suitable spinning apparatus, not shown. The liquid **22** in receptacle **21** may constitute a dyeing, sizing or simply a washing medium, depending upon the treatment which the flexible elements **1** should be subjected in the receptacle **21** while passing about the apertured mantle of drum **5**.

The construction of the apparatus shown in FIG. 3 is slightly different from that of the assembly just described in connection with FIGS. 1 and 2. It is assumed in FIG. 3 that the pressing or squeezing rollers **8**, **8***a* are driven at speeds sufficiently high to draw the flexible element or elements **1** from deflecting roller **31** under such tension that the layers or folds **1***a* formed by device **3** are destroyed and the treated material advances beyond the rollers **8**, **8***a* in the form of straight bands **1***b*. This is desirable in certain instances, for example, when the treating liquid should be nearly completely removed from the bands **1***b* before the latter reach the drying compartment **11**. Moreover, the rapidly rotating rollers **8**, **8***a*, by generating tension in conveyed material, may also stretch and thus restore the original length of flexible elements **1** which might have shrunk while passing through the liquid bath **22**.

The bands **1***b* advancing beyond the liquid-expressing or squeezing rollers **8**, **8***a* are led along the inclined surface of a frame member **16** to pass over a deflecting roll **2'** similar to member **2** and fixed to the drying compartment **11**, to be thereupon deformed into zig-zag or otherwise shaped layers **1***a'* by a second folding device **3'** comprising parts **3***a'*, **3***b'* and **3***d'* analogous to similarly numbered components of the first cable or band folding device **3**. It will be noted that the pivot means **3***d'* about which the lever or levers **3***b'* may be swung with elements **3***a'* are mounted directly on the outer side of drying compartment **11**.

FIG. 4*a* illustrates portions of four straight cables or bands **1** or **1***b* as they are led toward the deflecting roll **2** (FIGS. 1 to 3) or toward the deflecting roll **2'** (FIG. 3), respectively.

FIG. 4*b* illustrates layers **1***a* or **1***a'* of flexible elements **1** substantially as folded by the devices **3** and **3'**. It will be noted that the layers **1***a* or **1***a'* in FIG. 4*b* are closely adjacent to each other while the layers formed by device **3**, as best shown in FIG. 2, are formed with intervals therebetween. The closeness of layers **1***a* or **1***a'* and the length of their folds or plies depends upon the length of oscillatory movements performed by levers **3***b* or **3***b'*, as will be described in connection with FIG. 5.

FIG. 4*c* shows a modified arrangement of layers **1***c* whose portions are parallel and closely adjacent to each other. In addition, each layer **1***c* extends over more than one-half of the width of conveyor **4**. It will be readily understood that such an arrangement requires slight modifications in the mounting of elements **3***a*, **3***a'* in folding devices **3**, **3'**, respectively.

FIG. 4*d* shows four layers **1***d* of flexible elements whose individual portions are corrugated or puckered to fully utilize the surface of conveyor **4**.

FIG. 4*e* shows four closely or densely coiled helical layers **1***e*.

FIG. 4*f* illustrates a single coiled layer **1***f* of very large diameter extending substantially over the entire width of conveyor **4**; thus, it will be seen that the novel method and apparatus may be utilized for treating only one or simultaneously a large number of elongated flexible elements. As will be described in connection with FIG. 5, a single flexible element may be laid in parallel folds which extend over the entire width of a conveyor or other carrier, if desired.

The selection of the manner in which the flexible ele-

ment or elements 1 may be laid by devices 3, 3' often depends upon space considerations, it being desirable to process great quantities of material per unit of time. Moreover, such selection further depends upon the manner in which the material is removed from the last drying drum 14, and also upon the desired degree of crimping, coiling or curling of the processed material. For example, regenerated cellulose fibers should often be treated to assume the desirable elastic characteristics of wool. To that end, the synthetic material is formed by the device 3 or 3' into a number of curls or layers and led into the bath 22 which may then consist of an impregnating agent. The thoroughly wetted material is thereupon squeezed or pressed by passing between rollers 8, 8*a* to be dried in the compartment 11 and to be thereupon fixed in any known manner. It has been found that, upon storing for a period of, say 14 days, a synthetic material processed in the just described way assumes desirable elastic characteristics and a curly or coiled shape to be ready for use as a substitute for wool in pillows or the like.

FIG. 5 shows merely by way of example a suitable folding device 3'' which, for the sake of simplicity, has been illustrated with a single pendulum or lever 3*b*''. Lever 3*b*'' is rockable about a pivot axle 3*d*'' which is mounted on the frame member or support 3*c*''. The lower end of lever 3*b*'' carries a pair of shafts 40 each rotatably mounting a folding element or roller 3*a*''. Each roller 3*a*'' is connected for rotation with a gear 41; these gears are in mesh and are rotated in the directions indicated by arrows over a pulley mounted at the rear end of the right-hand roller 3*a*''. The pulley is driven by a belt 42 which also passes over a second pulley 43 rotatably mounted on support 3*c*''. Member 43, in turn, is driven by a belt 44 which travels over a further pulley 45 operatively connected to the output shaft 47 of a motor 46. Output shaft 47 also drives a third belt 48 passing over a pulley 49 which is rotatably mounted on a shaft 50 fixed to the frame member or support 3*c*''. Pulley 49 is connected for rotation with a cam 51 whose peripheral cam surface is in contact with two followers 52, 53 both fixed to a rod 54 which is reciprocably mounted in two aligned bearings 55, 56 carried by the support 3*c*''. Rod 54 is formed with a downwardly extending bracket 57 which carries a pin 58 received in an elongtaed closed cam 59 formed in the lever 3*b*''.

The flexible element 1 passing from the non-represented deflecting roll, e.g., the member 2 shown in FIGS. 1 and 2, is entrained by the mantles of rollers 3*a*'' which rotate in opposing directions to be fed in parallel layers 1*g* onto the upper run of conveyor 4 which is assumed to be advanced in stepwise fashion by the non-represented drive e.g., by the assembly 15 shown in FIG. 2. The movements of lever 3*b*'' transversely of the conveyor 4 are brought about by cam 51 which reciprocates the rod 54 by means of followers 52, 53, and by the pin 58 which engages with the walls of member 3*b*'' surrounding the latter's cam slot 59.

It will be readily understood that the layers 1*g* may be arranged in zig-zag fashion, as shown in FIGS. 4*b* and 4*c*, if the intermittent movement of conveyor 4 is changed to a continuous movement at a predetermined speed. The types of layers shown in FIGS. 4*d*, 4*e* and 4*f* may be arrived at by imparting to the lever 3*b*'' a second movement over a non-represented system of cams or the like. As before stated, the type of folding device 3'' shown in FIG. 5 is but one of many known assemblies which may be utilized in the apparatus of FIGS. 1 to 3, and no claim is made to the specific construction of this folding device.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic and specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

The embodiments of the invention in which an exclusive property or privilege is claimed, are defined as follows:

1. An apparatus for treating and processing at least one flexible element which comprises, in combination, means for bending said element at spaced intervals in substantially opposite directions so as to form a to and fro bent structure located in a predetermined plane; means for advancing each bent flexible element; means containing a supply of liquid treating medium in the path of each bent flexible element; at least one hollow drum having a perforated mantle and rotatably installed in the treating medium so as to advance the bent flexible element in a curved path having its axis of curvature extending substantially parallel to the plane of said bent structure and transversal to the longitudinal extension thereof along the periphery of said mantle; means for rotating each drum; means for withdrawing the treating medium from the interior of each drum whereby the treating medium causes each bent flexible element to adhere to at least a portion of the mantle of each drum by penetrating through each mantle into the interior of the respective drum; means for advancing each bent flexible element from the treating medium; pressing means comprising rotatable roller means for at least partially expelling the treating medium from each flexible element; and means for drying each flexible element.

2. An apparatus for treating and processing at least one flexible element which comprises, in combination; means for bending said element at spaced intervals in substantially opposite directions so as to form a to and fro bent structure located in a predetermined plane; means for advancing each bent flexible element; means containing a supply of liquid treating medium in the path of each flexible element; at least one hollow drum having a perforated mantle and rotatably installed in the treating medium so as to advance the bent flexible element in a curved path having its axis of curvature extending substantially parallel to the plane of said bent structure and transversal to the longitudinal extension thereof along the periphery of said mantle; means for rotating each drum; means for withdrawing the treating medium from the interior of each drum whereby the treating medium causes each bent flexible element to adhere to at least a portion of the mantle of each drum by penetrating through each mantle into the interior of the respective drum; means for advancing each bent flexible element from the treating medium; pressing means comprising rotatable roller means for at least partially expelling the treating medium from each flexible element; means for rotating said roller means at such speeds that the roller means produce tension in each bent flexible element whereby to destory the layers; second bending means for again forming a to and fro bent structure of each flexible element; and means for drying each bent flexible element.

3. An apparatus for treating and processing at least one flexible element which comprises, in combination; means for bending said element at spaced intervals in substantially opposite directions so as to form a to and fro bent structure located in a predetermined plane; at least one conveyor means for advancing each bent flexible element; means containing a supply of liquid treating medium in the path of each bent flexible element; at least one hollow drum having a perforated mantle and rotatably installed in the treating medium so as to advance the bent flexible element in a curved path having its axis of curvature extending substantially parallel to the plane of said bent structure and transversal to the longitudinal extension thereof along the periphery of said mantle; means for rotating each drum; means for withdrawing the treating medium from the interior of each drum whereby the treating medium causes each bent flexible element to ad-

here to at least a portion of the mantle of each drum by penetrating through each mantle into the interior of the respective drum; means for advancing each bent flexible element from the treating medium; pressing means comprising rotatable roller means for at least partially expelling the treating medium from each flexible element; and means for drying each flexible element.

4. An apparatus for treating and processing at least one flexible element which comprises, in combination; means for bending said element at spaced intervals in substantially opposite directions so as to form a to and fro bent structure located in a predetermined plane; means for advancing each bent flexible element; means containing a supply of liquid treating medium in the path of each bent flexible element; at least one hollow drum having a perforated mantle and rotatably installed in the treating medium so as to advance the bent flexible element in a curved path having its axis of curvature extending substantially parallel to the plane of said bent structure and transversal to the longitudinal extension thereof along the periphery of said mantle; means for rotating each drum; means for withdrawing the treating medium for the interior of each drum whereby the treating medium causes each bent flexible element to adhere to at least a portion of the mantle of each drum by penetrating through each mantle into the interior of the respective drum; conveyor means for advancing each bent flexible element from the treating medium; pressing means comprising rotatable roller means for at least partially expelling the treating medium from each flexible element; and means for drying each flexible element.

5. An apparatus for treating and processing at least one flexible element which comprises, in combination; separate means for bending said element at spaced intervals in substantially opposite directions so as to form a to and fro bent structure located in a predetermined plane; means for advancing each bent flexible element; means containing a supply of liquid treating medium in the path of each bent flexible element; at least one hollow drum having a perforated mantle and rotatably installed in the treating medium so as to advance the bent flexible element in a curved path having its axis of curvature extending substantially parallel to the plane of said bent structure and transversal to the longitudinal extension thereof along the periphery of said mantle; means for rotating each drum; means for withdrawing the treating medium from the interior of each drum whereby the treating medium causes each bent flexible element to adhere to at least a portion of the mantle of each drum by penetrating through each mantle into the interior of the respective drum; means for advancing each bent flexible element from the treating medium; pressing means comprising rotatable roller means for at least partially expelling the treating medium from each flexible element; and means for drying each flexible element.

6. An apparatus for treating and processing at least one flexible element which comprises, in combination; means for bending said element at spaced intervals in substantially opposite directions so as to form a to and fro bent structure located in a predetermined plane; means for advancing each bent flexible element; means containing a supply of liquid treating medium in the path of each bent flexible element; at least one hollow drum having a perforated mantle and rotatably installed in the treating medium so as to advance the bent flexible element in a curved path having its axis of curvature extending substantially parallel to the plane of said bent structure and transversal to the longitudinal extension thereof along the periphery of said mantle; means for rotating each drum; means for withdrawing the treating medium from the interior of each drum whereby the treating medium causes each bent flexible element to adhere to at least a portion of the mantle of each drum by penetrating through each mantle into the interior of the respective drum; means for advancing each bent flexible element from the treating medium; pressing means comprising rotatable roller means for at least partially expelling the treating medium from each flexible element; and means for drying each flexible element, said means comprising a drying compartment, at least one drying drum in said compartment, each drying drum having a perforated mantle, means for rotating each drying drum, and means for withdrawing air from each drying drum whereby each flexible element is caused to adhere to at least a portion of the mantle of each drying drum while advancing through the drying compartment.

References Cited in the file of this patent

UNITED STATES PATENTS

313,306	Farmer	Mar. 3, 1885
1,220,268	Payet	Mar. 27, 1917
1,432,319	Brandwood	Oct. 17, 1922
1,794,403	Hanhart	Mar. 3, 1931
2,293,154	Lovett	Aug. 18, 1942
2,520,594	Costa	Aug. 29, 1950
2,552,078	Williams	May 8, 1951
2,637,659	Miller	May 5, 1953
2,817,227	Eriksson	Dec. 24, 1957
2,835,047	Fleissner	May 20, 1958
2,922,229	Kiefer	Jan. 26, 1960

FOREIGN PATENTS

213,709	Australia	Mar. 6, 1958