

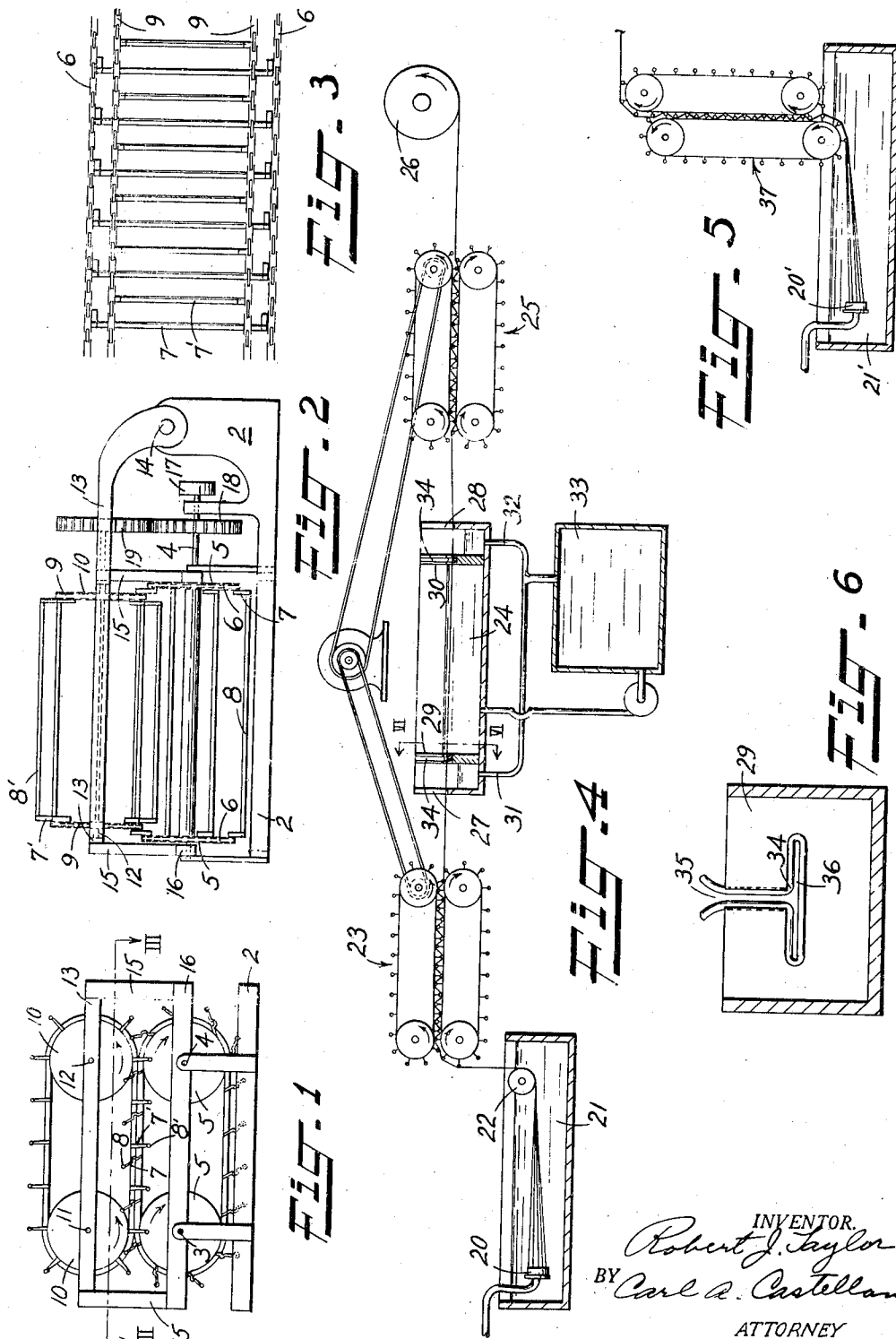
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HANDLING FILAMENTARY MATERIALS

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HANDLING FILAMENTARY MATERIALS

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This invention relates to apparatus for manipulating artificial material, especially when such filamentary material is in the form of a web-like band or sheet, and it is particularly adapted for the stretching of such filamentary material when in the form of a web-like band.

For positively delivering continuous filamentary material, one of the most common devices heretofore employed comprised a pair of rollers positively rotated in opposite directions and pressed toward one another to form a nip between their tangent peripheries and the filamentary material was introduced into the nip between the rolls. However, it is sometimes desirable to feed or deliver filamentary material when it is in such plastic condition that the application of pressure to directly opposite sides thereof would cause flattening and undesirable distortion of the filamentary material. Such is the case particularly when freshly spun solid or hollow filaments or even when completely set hollow filaments are being handled. For handling filaments when in such a plastic condition, other forms of feeding devices must be resorted to. One such device is illustrated in Griffin Patent No. 1,950,922 in which the filamentary material is wrapped a plurality of times about a driven roller and a guide associated therewith, the guide being arranged to cause lateral displacement of the wraps about the main driving roller. This latter device, however, as well as all others which involve the wrapping of a plurality of convolutions of the filamentary material about a driven roller is not applicable where it is desired to avoid condensation of the filamentary material into a yarn-like bundle. Thus, such devices cannot be used where it is desired to handle a web-like sheet or band of filaments and maintain the band in that form.

In accordance with the present invention, an arrangement is provided which is capable of feeding the filaments without the application of pressure simultaneously to directly opposite sides of the filamentary material and without the disadvantage of condensing the filamentary material to a yarn-like bundle when the filamentary material received by the device is in the form of a web-like sheet or band and it is desired to maintain it in that form. Other objects and advantages of the present invention will be apparent from the drawing and the description thereof hereinafter.

In the drawing, illustrative of the invention, Figure 1 is a side elevation of the feeding device of the invention,

Figure 2 is an end elevation thereof,

Figure 3 is a diagrammatic plan view showing the intermeshing of the cross-pieces or girts which exert traction upon the filamentary material,

Figure 4 illustrates the application of the feeding device of the invention to freshly spun filamentary material and particularly to the stretching thereof.

Figure 5 is an elevation showing a modification of the arrangement of Figure 4, and

Figure 6 is a detailed view in perspective taken on line VI—VI of Figure 4.

As shown in Figures 1 to 3, the feeding device of my invention comprises a suitable support 2 for bearings in which two shafts 3 and 4 each carrying two sprockets 5 are journaled. These sprockets cooperate with a pair of chains 6. The links of the chain are provided with upstanding brackets 7 which in turn are connected by cross-pieces or girts 8 extending between the chains in a plane outside that of the links of the chains 6.

A similar pair of chains 9 cooperating with two pairs of sprockets 10 on suitable shafts 11 and 12 and provided with brackets 7' and girts 8' are supported in a framework 13 which is pivotally mounted at 14 upon the support 2 for the first-mentioned chain and sprocket conveyor system or section. The framework 13 is provided with suitable positioning members 15 whose bases are adapted to rest upon a fixed member such as the beam 16 associated with the main base or support 2 of the device, thus positioning the upper chain and sprocket conveyor section with respect to the first-mentioned section with the girts of one section alternating with those of the other section and extending through the other section so that the girts in the interpositioned courses define a zigzag configuration. A motor (not shown) may be arranged to drive one of the shafts such as shaft 4 by means of gears or of a belt and pulleys (the driven gear or pulley being designated by 17) and the sprockets of the two conveyor sections may be connected by gears 18 and 19 for positively driving them in the proper relationship. The arms or brackets for supporting the cross-pieces or girts in either one or both sections may be either of rigid or resilient character. The pivotal relationship between the upper conveyor section with respect to the lower chain and sprocket section permits the opening of the device and the insertion of the leading end of the filamentary material which it is desired to feed therethrough.

In operation of the device, the filamentary ma-

terial is laid down progressively in the form of a zigzag configuration as viewed from the side of the device and it continuously travels through the device while held in this configuration. Substantially no sliding motion occurs between the filamentary material and the cross-members or girts which are in contact with the material and carry it directly except at the point of entrance and departure of the filamentary material into and out of the device respectively. Depending upon the frictional characteristics of the particular filamentary material being handled, more or less reverse bends of the filamentary material should be provided for during its passage through the device in order to assure adequate traction of the device upon the material to assure positive drawing and delivery thereof.

Figure 4 illustrates the application of the device of my invention for subjecting filamentary material to a stretching operation. The filamentary material proceeding from the spinneret 20 within a suitable coagulating bath 21 of a character depending upon the particular filamentary material being produced proceeds about a roller guide 22 and then into the feeding device 23 of the type shown in Figures 1 to 3. From this device, filamentary material proceeds through a chamber 24 in which it is adapted to be subjected to hot fluids, such as hot water or hot air or to solvent or swelling media, and then proceeds through another of such feeding devices 25. The latter device 25 is driven at a higher speed than the former 23 so that the filamentary material extending between the former to the latter is stretched. After leaving the latter feeding device 25, the filamentary material may be directly wound on a suitable take-up device 26 or it may be passed first through another feeding device of the type shown in Figures 1 to 3, driven at lower speed than the second such device in order to effect relaxation of the filamentary material immediately after it leaves the stage of stretching. Alternatively, the take-up mechanism may be driven so as to permit a certain amount of slack between the second feeding device and the point of take-up.

The arrangement for subjecting the filamentary material to hot fluids may comprise a longitudinal channel with openings 27 and 28 in its ends and provided with partitions 29 and 30 near its ends which are provided with openings for the passage of the filamentary material and are adapted to serve as weirs for the overflowing liquid. Discharge pipes 31 and 32 are connected to the small chambers or locks formed at each end of the main chamber between the weirs and outside end walls and are connected to a suitable reservoir 33 in which the fluid may be reheated prior to recirculation to the treating chamber 24. Suitable guides of glass, porcelain or other smooth and hard material may be provided in or adjacent the end walls and/or partitions within the treating chamber 24. Where the filamentary material is in the form of a horizontal band or web-like sheet, a guide 34 in the form shown in Figure 6 may be used, the upstanding prongs providing a slot 35 by which the filamentary material may be readily inserted into the horizontal slit-like passage 36 of the guide proper.

Figure 5 shows a modification of the arrangement of Figure 4 in which the roller guide 22 is omitted from the coagulating bath and a feeding device 37 of the type shown in Figures 1 to 3 is partially immersed in the coagulating bath 21' to receive the filamentary material directly from

the spinneret 20' and to pass it on to the next stage of treatment, such as to a suitable collecting device or through the stretching arrangement of Figure 4 preliminary to collecting.

The feeding device of my invention may be used for feeding, for stretching, for cold-drawing, or for stretching and subsequently relaxing filamentary material of any sort, such as regenerated cellulose from viscose or cuprammonium cellulose or coagulated viscose prior to regeneration, casein, soya bean protein, alginic acid and alginates, nylon, cellulose esters and ethers, such as cellulose acetate and ethyl cellulose, vinyl resins, such as polyvinyl chloride and copolymers of vinyl chloride and vinyl acetate, and other synthetic resins. The device may also be used for handling filaments of rubber and synthetic rubbers, such as plasticized vinyl resins, and artificial filamentary structures, such as yarns, of natural or artificial fibers which may or may not be in a plastic condition. The device may be used for handling continuous filaments individually or as twisted or untwisted bundles of yarn-like character or in the form of web-like sheets in which the filaments are parallel or may be inter-crossed in haphazard fashion. The device may be applied to the handling of filaments or filamentary structures thereof, such as yarn-like or web-like structures, which are completely set up or which are still in a plastic condition as a result of being freshly spun. It is particularly applicable to the handling of extremely fine diameter filaments, such as those of the order of 1 to 10 microns and of hollow filaments either in plastic or completely set condition regardless of size. With respect to hollow filaments, it is of especial advantage since the use of prior art devices would involve serious risk of loss of their bulbous character as a result of flattening under pressure. In the handling of band-like filamentary structures, the device is of particular advantage in that it feeds the material without substantially condensing or changing its filamentary form and for handling this particular type of filamentary structure, it is applicable whether the filaments are still plastic or are completely set up, whether the filaments are hollow or solid, natural or artificial.

While preferred embodiments of the invention have been disclosed, it is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. A method of stretching filamentary material of continuous character comprising continuously introducing the material at one portion of its path longitudinally in zigzag conformation between two sets of spaced parallel tactile members transverse of the material, the members of one set alternating with and being spaced from those of the other set in such an arrangement that the tactile surfaces thereof are on the side thereof away from the tactile surfaces of the other set, discharging the material at another portion of its path from engagement by said members, and during at least part of the time of engagement of the material between the members imparting motion to the members as a unit to effect translation of the material without substantial sliding thereof with respect to at least some of the members, concurrently introducing the material at another portion of its path in advance of the point of discharge by the first two sets of members between another two sets of similarly related mem-

bers, and imparting motion to these members as a unit at a higher rate of speed than that of the motion of the first two sets of members.

2. In apparatus for handling filamentary material, two superposed horizontal substantially parallel concurrently movable conveyor sections each including a pair of laterally spaced side chains disposed in a common plane and a series of transverse laterally spaced girts disposed in a common plane substantially parallel to but spaced from the common plane of said side chains, means supporting said girts in said spaced plane with the girts of each section projecting through the other of said sections and disposed in a plane beyond the plane of the side chains of said other section with the girts of each section interposed between and alternating with the girts of the other of said sections in staggered relation thereto, means for driving the sections so that their interpositioned courses move at the same speed, the upper section being pivotally mounted to facilitate lacing of the device.

3. In apparatus for handling filamentary material, two superposed horizontal substantially parallel concurrently movable conveyor sections each including a pair of laterally spaced side chains disposed in a common plane and a series of transverse laterally spaced girts disposed in a common plane substantially parallel to but spaced from the common plane of said side chains, means supporting said girts in said spaced plane with the girts of each section projecting through the other of said sections and disposed in a plane beyond the plane of the side chains of said other section with the girts of the other of said sections in staggered relation thereto, means for driving the sections so that their interpositioned courses move at the same speed, the upper section being pivotally mounted on an axis parallel to the direction of motion of the interpositioned courses to facilitate lacing of the device.

4. In apparatus for stretching filamentary material, a plurality of devices through which the material is passed in sequence, each device comprising two superposed horizontal substantially parallel concurrently movable conveyor sections each including a pair of laterally spaced side chains disposed in a common plane and a series of transverse laterally spaced girts disposed in a common plane substantially parallel to but spaced from the common plane of said side chains, means supporting said girts in said spaced plane with the girts of each section projecting through the other of said sections and disposed in a plane beyond the plane of the side chains of said other section with the girts of each section interposed

between and alternating with the girts of the other of said sections in staggered relation thereto, means for driving the sections of one of the devices so that their interpositioned courses move at a higher rate of speed than that of the interpositioned courses of the sections of a preceding device.

5. In apparatus for handling filamentary material, two adjacent substantially parallel concurrently movable conveyor sections each including a pair of laterally spaced endless side chains arranged to run in a closed path in substantially parallel relationship and a series of spaced substantially parallel transverse girts carried by the chains and arranged so as to follow a path spaced outwardly from and surrounding that followed by the chains, said conveyor sections being so disposed relative to each other that the girts of the adjacent courses of each section project through the other of said sections and follow a path therethrough beyond the path of the chains of said other section with the girts of each section interposed between and alternating with the girts of the other of said sections in staggered relation thereto, means for driving the sections so that their interpositioned courses move at the same speed, one of said sections being pivotally mounted laterally thereof to facilitate lacing of the device.

6. In apparatus for stretching filamentary material, a plurality of devices through which the material is passed in sequence; each device comprising two adjacent substantially parallel concurrently movable conveyor sections each including a pair of laterally spaced endless side chains arranged to run in a closed path in substantially parallel relationship and a series of spaced substantially parallel transverse girts carried by the chains and arranged so as to follow a path spaced outwardly from and surrounding that followed by the chains, said conveyor sections being so disposed relative to each other that the girts of the adjacent courses of each section project through the other of said sections and follow a path therethrough beyond the path of the chains of said other section with the girts of each section interposed between and alternating with the girts of the other of said sections in staggered relation thereto, means for driving the sections so that their interpositioned courses move at the same speed; means for driving the sections of one of the devices so that their interpositioned courses move at a higher rate of speed than that of the interpositioned courses of the sections of a preceding device.

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