

July 10, 1956

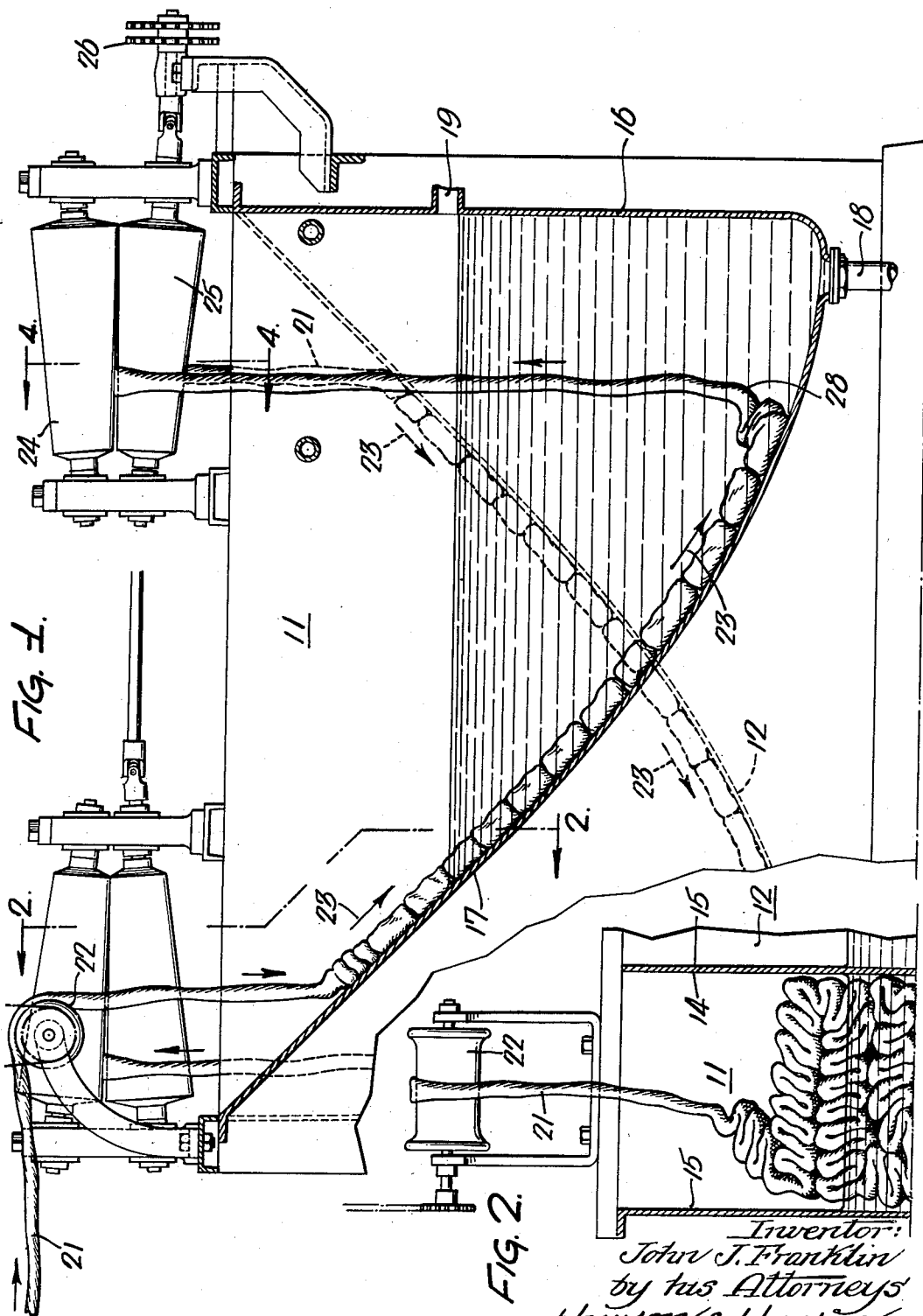
J. J. FRANKLIN

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COMPENSATING ROLLS FOR HANDLING CONTINUOUS LENGTHS OF
MATERIALS IN THE FORM OF STRAND, ROPES, AND THE LIKE

Filed Jan. 28, 1953

3 Sheets-Sheet 1



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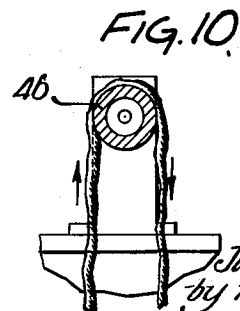
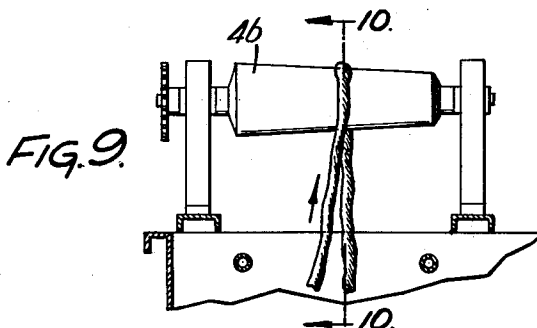
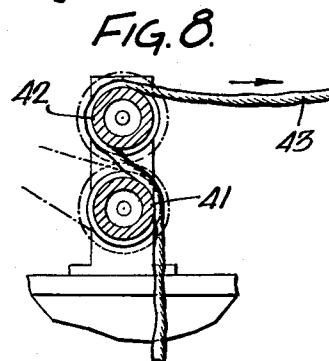
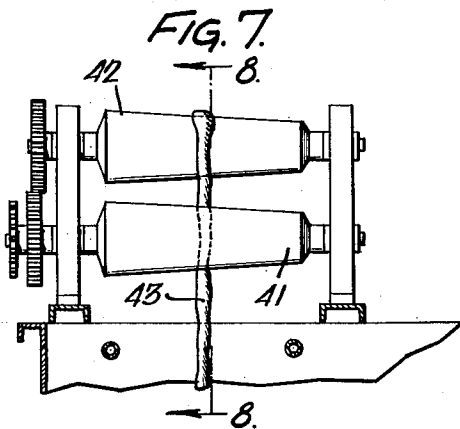
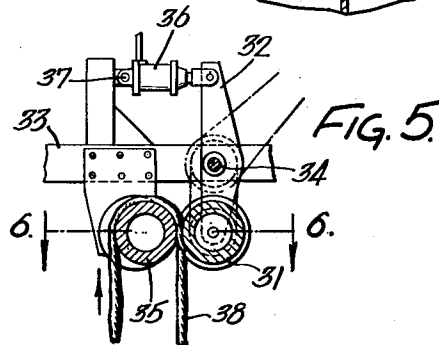
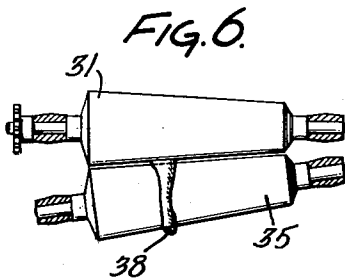
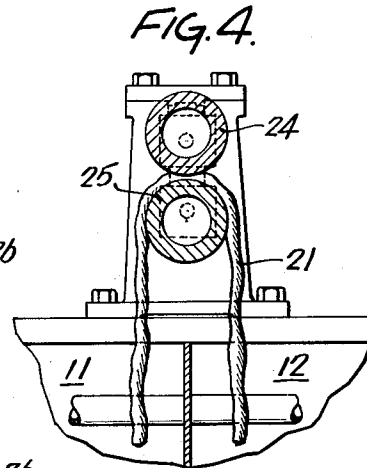
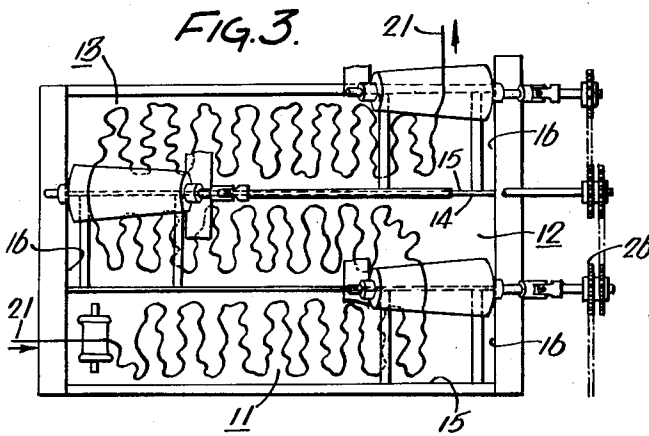
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3 Sheets-Sheet 2



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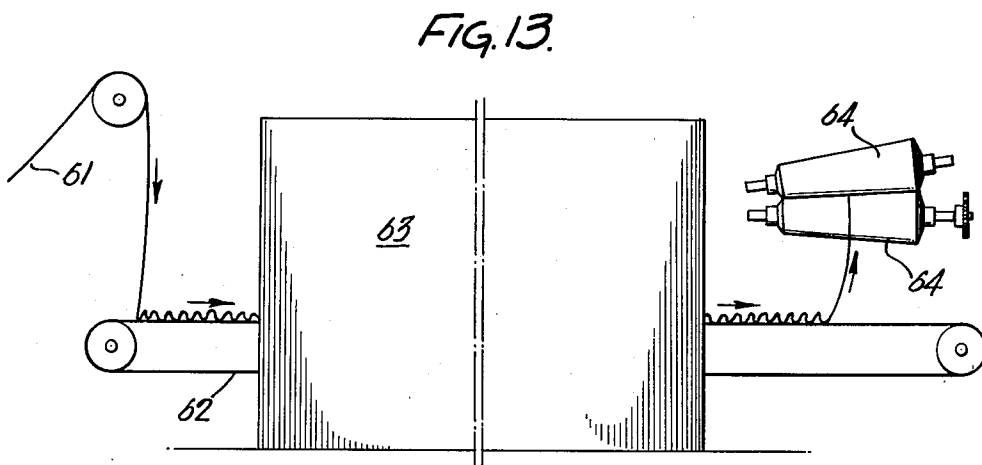
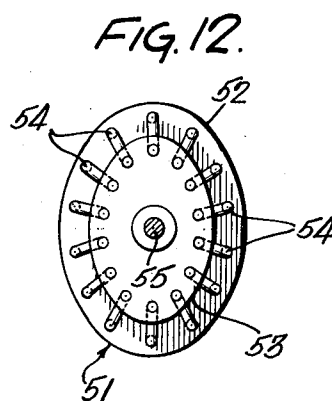
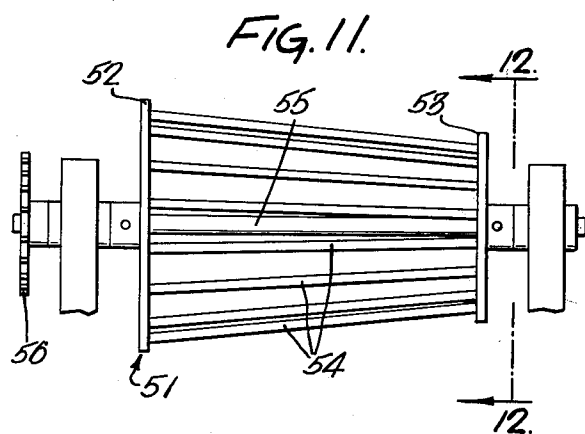
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3 Sheets-Sheet 3



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COMPENSATING ROLLS FOR HANDLING CONTINUOUS LENGTHS OF MATERIALS IN THE FORM OF STRAND, ROPES, AND THE LIKE

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Application January 28, 1953, Serial No. 333,702

7 Claims. (Cl. 68—9)

The present invention relates to apparatus comprising one or more handling rolls for continuous lengths of material in strand or rope form at a speed which is automatically compensated to the speed at which the material is advanced to the roll or rolls without changing the speed at which the roll or rolls are driven.

In the processing of continuous lengths of materials in strand or rope form, various factors such as, for example, shrinkage or stretch in the material, may cause fluctuations in the rate or speed at which the material progresses through the processing apparatus. In such event, the handling speed must be made slower or faster according to the fluctuations in the feed speed of the material. These fluctuations in the feed speed or progress of the material in the apparatus is not predeterminable and the compensation for any variation must be controlled by the condition of the material in the machine. If the material slows down, for example, due to shrinkage, and there is no compensating mechanism associated with the handling rolls, the material may become tensioned so as to cause binding of the material and set up stresses and strains in its body which impair its high quality. If the material speeds up, for example, due to stretching, and the apparatus lacks compensating means to speed up the handling rolls, the material will accumulate in the apparatus and will either jam it or spill out on the floor.

Prior compensating methods in processing equipment have proved unsatisfactory for one reason or another. For example, in the case of tubular knit fabric, the fabric is usually handled in rope form through a series of individual washers with squeeze rolls between. In many cases, these rolls are not controlled as to speed and in order to compensate for variations in the feed of the material, the operator must physically separate the rolls intermittently and hold the fabric back in order to retain the desired quantity of material in the preceding washer. If this method is employed, constant watchfulness is required on the part of the operator. In other methods, the handling rolls are driven through a variable speed transmission which must be adjusted manually by the operator, in accordance with the rate of feed of the material, or alternatively, the transmission must be provided with complex compensating mechanism involving feelers which are responsive to the feed of the material to vary the speed of the transmission. In the former case, the same watchfulness is required of the operator, and in the latter case, the equipment is very expensive.

With the foregoing in mind, the principal object of the invention is to provide novel handling equipment for continuous lengths of material in strand or rope form which automatically compensates for changes in the rate of progress of the material handled.

A further object of the invention is to provide novel handling equipment for continuous lengths of material wherein the rate of handling of the material is determined by the rate of progress of the material.

More specifically, the invention contemplates the provision of novel material handling equipment of the char-

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acter set forth having one or more handling rolls which are tapered to provide varying rates of handling of the material according to the point of engagement of the material with the roll along its longitudinal length.

A further object of the invention is to provide continuous-length material handling equipment as hereinafter set forth and described which is operable automatically to compensate for changes in the rate of progress of the material in an effective and efficient manner with inexpensive equipment, without reliance on the operator's watchfulness, and without building up tension or slack in the strand material.

These and other objects of the invention and the various features and details of the construction and operation thereof are more fully set forth hereinafter with reference to the accompanying drawings in which:

Fig. 1 is a longitudinal section of a scray washer embodying handling rolls made in accordance with the present invention;

Fig. 2 is a fragmentary sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a top plan view schematically illustrating the operation of the scray washer illustrated in Fig. 1;

Fig. 4 is a vertical sectional view taken on the line 4—4 of Fig. 1;

Fig. 5 is a transverse sectional view of a modified arrangement of handling rolls made in accordance with the invention;

Fig. 6 is a transverse section taken on the line 6—6 of Fig. 5;

Fig. 7 is a side elevational view of a further embodiment of the present invention;

Fig. 8 is a sectional view taken on the line 8—8 of Fig. 7;

Fig. 9 is a side elevational view of another embodiment of the present invention;

Fig. 10 is a sectional view taken on the line 10—10 of Fig. 9;

Fig. 11 is a side elevational view of yet another embodiment of the present invention;

Fig. 12 is a sectional view taken on the line 12—12 of Fig. 11; and,

Fig. 13 is a schematic representation of another mode of operation within the scope of the present invention.

The present invention is applicable to the handling of continuous lengths of almost any material in strand, rope, or like form in which it is desired to control the speed at which the material is handled in correspondence to the rate at which the material is supplied or advanced to the handling rolls. However, for the purposes of description, the present invention will be described in connection with apparatus for the handling of continuous lengths of textile materials in the form of strands, ropes, and the like.

In the embodiment illustrated in Figs. 1 to 4 of the drawings, the invention is applied to scray washers wherein a plurality of individual washer tanks are arranged side by side in series. In the present instance, three such washers are employed as indicated at 11, 12, and 13 in Fig. 3. Each washer consists of a generally rectangular tank having side walls 14 and 15 and an end wall 16. A concave scray element 17 comprises the bottom of the tank. The scray slopes downwardly from the top edge and terminates at the bottom of the end wall 16. The tank is fluid-tight and is provided with ports 18 and 19 for the admission and discharge of the bath liquid.

In the operation of the washer, the strand material is fed through the three tanks consecutively, as illustrated in Fig. 3. At the start of the process, the material, indicated by the reference numeral 21, is fed into the first tank 11, for example, by a positively driven roller 22. The roller deposits the material on the scray element 17,

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for example, lapping it back and forth as illustrated in Fig. 2. The weight of the material causes it to slide down the scray 17 as indicated by the arrows 23 and into the liquid bath to a handling zone at the bottom of the scray, where the material is withdrawn by a pair of handling rolls 24 and 25 respectively positioned above the delivery zone, as will be described more fully hereinafter. The handling rolls withdraw the material from the wash liquid and feed it into the second tank 12 as illustrated schematically in Fig. 3.

The handling rolls 24 and 25 are generally frusto-conical in shape and overlie the path of travel of the strand material 21 on the scray 17 approximately parallel thereto. With reference to Fig. 1, it is seen that the roll surfaces are tapered in a direction opposite to the direction of travel of the material on the scray 17 indicated by the arrows 23. The roll 25 is positively driven at a predetermined rate of speed as indicated at 26, and the roll 24 is mounted for free rotation in pressure contact with the roll 25. The pressure contact between the rolls 24 and 25 will squeeze out the liquid trapped in the body of the strand material as the latter is withdrawn from the tank.

Scray washers of this character are conventionally employed for washing and rinsing tubular knit goods which are passed through the apparatus in rope form such, for example, as the strand 21. Tubular knit fabric is especially susceptible to shrinkage and stretching during processing so that the progress of the material through the apparatus will vary accordingly, and, consequently, it is desirable to provide means for varying the rate of handling of the material in accordance with the rate or speed at which the material feeds or progresses through the apparatus.

In accordance with the present invention, the rolls 24 and 25 compensate changes in the rate of progress of the strand material through the scray washer. The decreasing radius of tapered rolls provides means for varying the rate of handling, since the latter rate is dependent directly upon the radius of the handling roll at the point where the strand material engages the roll. For example, a difference of one inch in radius will effect a difference of over six inches of feed for each revolution of the handling roll.

In the operation of the device, therefore, the position of the leading lap 28 of the material in the handling zone at the bottom of the scray element 17 will determine the rate of handling effected by the rolls 24 and 25. The position of the leading lap 28 in the handling zone is determined by the amount of material on the scray element. If, for example, due to the stretching of the strand, an excess of material is retained in the tank, the material will force the leading lap 28 to the right as seen in Fig. 1. If, on the other hand, the strand material shrinks, the extent of progress of the material in the tank will be less, so that the leading lap 28 will travel to the left. The position of the leading lap 28 determines the point along the line of contact of the rolls at which the strand is nipped.

Because of the taper in the rolls, as the nip is urged to the right, the handling speed will be increased, and as the nip is urged to the left, the handling speed will be decreased. Since the handling speed is dependent upon the radius of the handling rolls at the point of nip, and since the point of nip is determined by the position of the leading lap 28 on the scray element, the handling rolls 24 and 25 automatically compensate for variations in the progress of the material through the apparatus. It should be noted further that the material, as it travels down the scray element 17 and into the handling zone, is not subjected to any internal stresses or strains but travels unconstrained under its own weight and is entirely free during its travel until it is lifted bodily out of the bath by the rolls 24 and 25. In the present instance the rolls are positioned so that the line of contact between them which produces the nip on the material is

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horizontal but it has been found that this line may assume any angle without affecting the efficiency of the machine, as long as the roll is tapered in a direction opposite to the direction of travel of the material on the scray.

In the modified form of the invention illustrated in Figs. 5 and 6, pressure is applied between two generally frusto-conical handling rolls to more effectively squeeze the bath fluid from the strand material. In this embodiment the rolls are disposed in horizontal, side by side relation. The driven roll 31 is mounted on an arm 32 which is pivoted on the frame 33 as indicated at 34. An idler roll 35 is rotatably mounted in a relatively fixed position on the frame 33 adjacent the driven roll 31. The arm 32 which mounts the roll 31 extends beyond the pivot 34 and is connected at its opposite end to a pressure cylinder 36 which is pivotally mounted at its other end on the frame 33 as indicated at 37. By this arrangement, the pressure cylinder will exert a predetermined constant pressure on the arm 32 so as to cause the driven roll 31 to bear against the idler roll 35 with a constant predetermined force. In this instance, the strand material 38 may be looped over the idler roll 35 since the roll 31 will be under sufficient pressure to frictionally drive the idler roll and thereby handle the strand material 38 without slippage. As in the previous embodiment the rolls 31 and 35 are tapered in a direction opposite to the direction of travel of the strand material on the scray, and operate automatically to compensate for changes in the rate of progress in the manner described above.

A further embodiment of the invention is illustrated in Figs. 7 and 8. In this instance, the frusto-conical handling rolls 41 and 42 are both positively driven and are in spaced-apart relation so that there is no squeezing of the strand material. The material 43 is looped around both the rolls as clearly illustrated in Fig. 8 and the tortuous path thereof will cause sufficient frictional engagement between the material and the rolls that the feed of the material will be positive and will be controlled by rotation of the rolls. As in the previous embodiment the handling rolls compensate automatically for changes in the rate of progress of the material because of their tapered configuration which, as described above in connection with Figs. 1 to 4, determines the rate of handling of the strand material in accordance with the amount of material within the washer.

The application of the invention to handling continuous lengths of material does not require the use of two handling rolls, but a single frusto-conical driven roll may be used as illustrated at 46 in Figs. 9 and 10 without departure from the invention. This embodiment of the invention is especially suitable for materials which have frictional characteristics and which will frictionally engage the roll without the necessity of pressure from a second idler roll. Here again the roll is tapered and the rate of handling will be determined by the quantity of material within the washer.

Another embodiment of the invention is illustrated in Fig. 11 wherein a generally frusto-conical roll 51 takes the form of opposed elliptical end plates 52 and 53 having mounted between them, a plurality of axial slats 54. The plates are connected together by a common shaft 55 and are positively driven, such, for example, as indicated at 56 in Fig. 11. In this embodiment of the invention, the contact between the roll and the material being processed is minimized. As the roll rotates about its axis, because of the elliptical configuration, the material will be thrown out regularly so as to afford wider distribution of the material within the tank. It should be noted that the end plate 52 is greater in diameter than the end plate 53 so that the slats 54 define a tapered roll surface. The taper will provide for compensating handling of the material from the processing apparatus as described hereinbefore. This embodiment of the invention is especially applicable to dyeing process where it is desired to minimize the contact between the material and the ap-

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paratus so as to afford more even permeation of the dye-stuff into the body of the strand material.

The invention is not limited to scray washers nor to any specific type of conveyor. For example, the invention has utility in other systems wherein the strand material passes through a chamber on an endless apron conveyor. This is illustrated schematically in Fig. 13 wherein the strand material 61 is looped onto a conveyor 62 at the feed end of the machine. It then passes through a chamber 63 and out the other side towards a handling zone underlying a pair of frusto-conical handling rolls 64. The rolls 64 may be constructed similarly to the rolls of any of the embodiments set forth above so as to similarly compensate for variations in the rate of progress of the strand material during its passage through the chamber. For the purposes of illustration, the rolls 64 are shown in the arrangement set forth at 24 and 25 in Figs. 1 to 4. For example, if the material shrinks as it travels through the chamber and the conveyor 62 delivers less material than the handling roll is lifting off the conveyor, the point in the handling zone at which the material will be lifted off the conveyor 62 approaches the chamber 63, so as to cause the nip on the strand 61 to be urged to the left. The smaller diameter of the rolls at this point will cause a reduction in the handling speed so as to correspond to the rate of progress of the material on the conveyor. If the material stretches and accumulates on the conveyor, the material will be lifted off the conveyor at a point in the handling zone more remote from the chamber which will cause the nip on the strand to be urged to the right as viewed in Fig. 13. Thus, the nip will be at a point of greater diameter and the handling speed will be increased so as to compensate for the increased rate of progress due to the greater length of material being delivered by the conveyor. As in the previously described embodiments, the material travels unconstrained on the conveyor. Therefore, it will not be subjected to any internal stresses or strains and it may be of a uniform, standard high quality.

The various modifications of the invention herein illustrated and described are not exhaustive. For example, both handling rolls need not be frusto-conical but it is within the scope of the invention to have only one roll tapered in a direction opposite to the direction of travel of the material in the apparatus, the other roll, which provides the nip, being straight. Similarly, the axes of the roll need not be exactly parallel to the direction of travel but may be tilted or positioned angularly just so long as the roll is tapered in a general direction opposite to the direction of travel.

As previously pointed out, the present invention is applicable to the handling of almost any material in continuous strand, rope, and like form, and while the invention has been described with particular relation to the processing of textile materials in such forms, it is not intended to limit the invention to such materials. Furthermore, it is intended that changes and modifications may be made in and to the apparatus and method within the scope of the following claims.

I claim:

1. In apparatus for handling continuous lengths of material in strand, rope and like form, a plurality of elongated tanks arranged in contiguous laterally adjacent alignment, feeding means mounted adjacent one end of the first tank and operable to introduce the textile material into said tank in overlapping runs disposed transversely of the tank, handling means to remove the material from said first tank comprising tapered roll means mounted adjacent the opposite end of the tank for rotation about a generally horizontal axis overlying the side of said tank adjacent the second tank, a surface in said first tank declining longitudinally downward from a point adjacent said feeding means and terminating in a terminal portion disposed below and substantially coextensive with the length of said tapered roll means, said surface and

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said feeding means cooperating to advance the overlapping runs of material unconstrained in a direction generally opposite to the direction of taper of said tapered roll means and into said terminal portion, a surface in said second tank declining longitudinally downward from a point adjacent said tapered roll means and terminating in a terminal portion adjacent the other end of said second tank, a second tapered roll means coextensive with and lying above said last-mentioned terminal portion and mounted for rotation about a generally horizontal axis overlying the side of said second tank remote from the first tank, said first and second tapered roll means being substantially parallel and tapered in opposite directions, said first roll means operable to feed the material into the second tank in overlapping runs disposed transversely of said second surface, said roll and surface cooperating to advance the overlapping runs of material unconstrained into said last-mentioned terminal portion in a direction opposite to the direction of taper of said second roll means, and drive means for said tapered roll means operable to rotate the same at predetermined speeds to effect handling of the material from said terminal portions at rates determined by the radius of the tapered roll means at the points of engagement of said tapered roll means by the material being determined automatically by the extent of advancement of the material into said terminal portions.

2. Apparatus according to claim 1 wherein each said tapered roll means comprises a pair of tapered rolls mounted for rotation about substantially horizontal axes and tapered in the same direction.

3. Apparatus according to claim 2 wherein said rolls are in contact along the length thereof.

4. Apparatus according to claim 3 including pressure-bias means biasing said rolls into contact.

5. In apparatus for handling continuous lengths of material in strand, rope and like form, a tank having oppositely spaced inlet and outlet ends and provided with a sloping bottom surface declining in one direction substantially from the inlet end to the outlet end of said tank, material feeding means adjacent the inlet end at the upper end of said declining bottom surface operable to feed the continuous length of material into said tank and onto said declining bottom surface in the direction of decline thereof in successive overlapping runs extending transversely of the direction of decline of said tank bottom surface, handling means to withdraw the material from the outlet end of said tank comprising a tapered roll overlying the lower terminal portion of said tank bottom surface at the outlet end of the tank and spaced from the material feeding means in the direction of decline of the tank bottom surface to afford an accumulation of said overlapping runs of material on the declining surface between said feeding means and said tapered roll, said tapered roll having its axis lying longitudinally of the direction of decline of the tank bottom surface with the taper of the roll extending oppositely to the direction of feed of the material and toward said feeding means, and drive means to rotate said tapered roll at a selected constant speed to effect unrestrained withdrawal of the material from said terminal portion of the tank bottom surface at a rate determined by the radius of the tapered roll at the point of engagement thereof by said material, the point at which the material engages said tapered roll longitudinally thereof varying automatically in response to changes in the extent of advancement of the material upon said terminal portion of the tank bottom surface in the direction of decline thereof to thereby vary the rate of withdrawal of the material from the tank according to changes in the length of the material in the tank.

6. Apparatus according to claim 5 wherein said handling means includes a second tapered roll revolving about a substantially horizontal axis adjacent said first horizontal axis and tapered in the same direction as said first tapered roll.

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7. Apparatus according to claim 6 wherein said first and second tapered rolls are disposed in pressure contact along their length.

2,149,708
2,333,278
2,504,554

References Cited in the file of this patent

5

UNITED STATES PATENTS

858,068 Hartley ----- June 25, 1907

47,400
968,761

8

Von Recklinghausen ---- Mar. 7, 1939
Truesdail ----- Nov. 2, 1943
Lindsay ----- Apr. 18, 1950

FOREIGN PATENTS

France ----- Dec. 29, 1936
France ----- May 3, 1950