

April 24, 1956

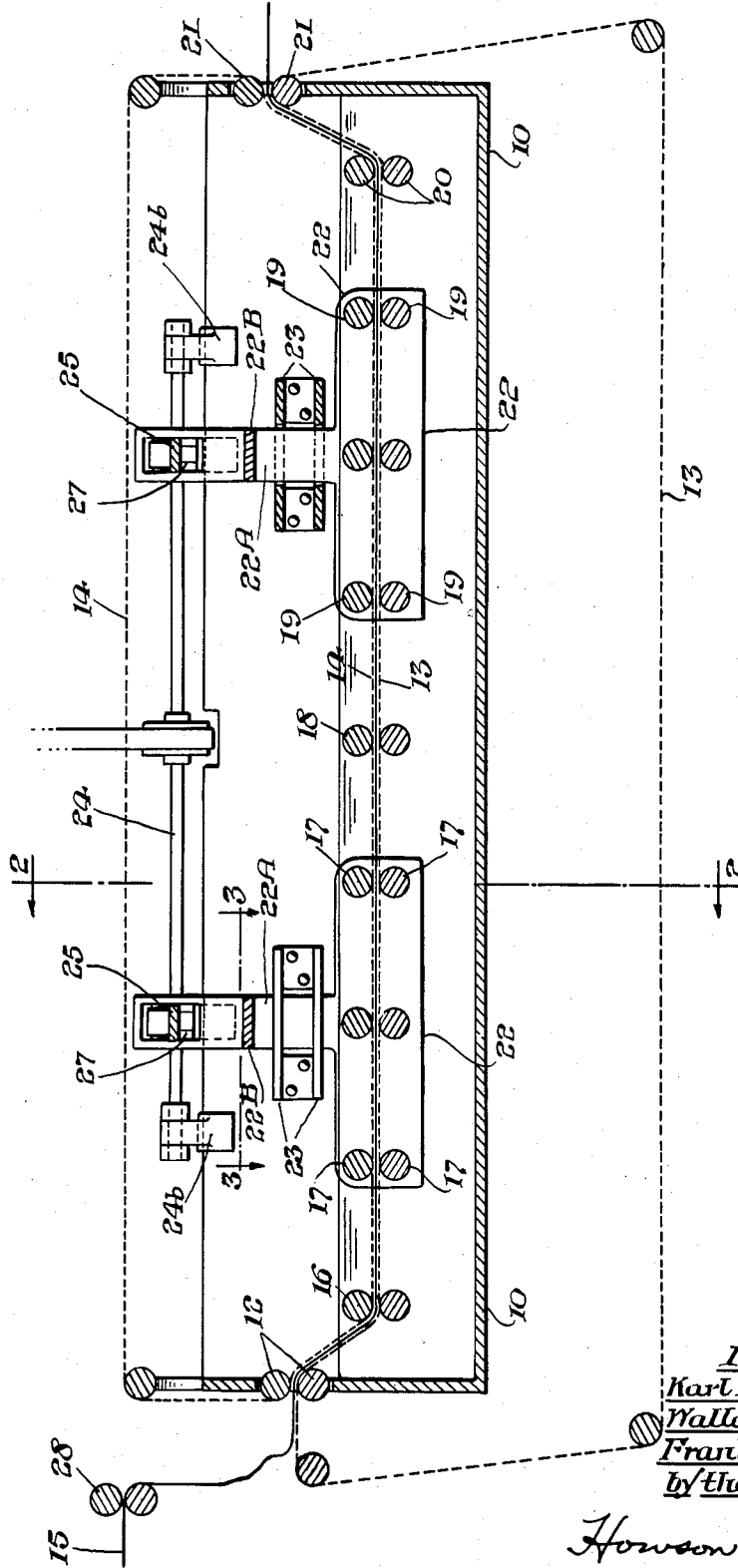
K. E. CHAMBERS ET AL
METHOD AND APPARATUS FOR TREATING TEXTILE
GOODS, LOOSE FIBERS AND LIKE MATERIALS

2,742,773

Filed March 21, 1952

3 Sheets-Sheet 1

Fig. 1.



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Fig. 2.

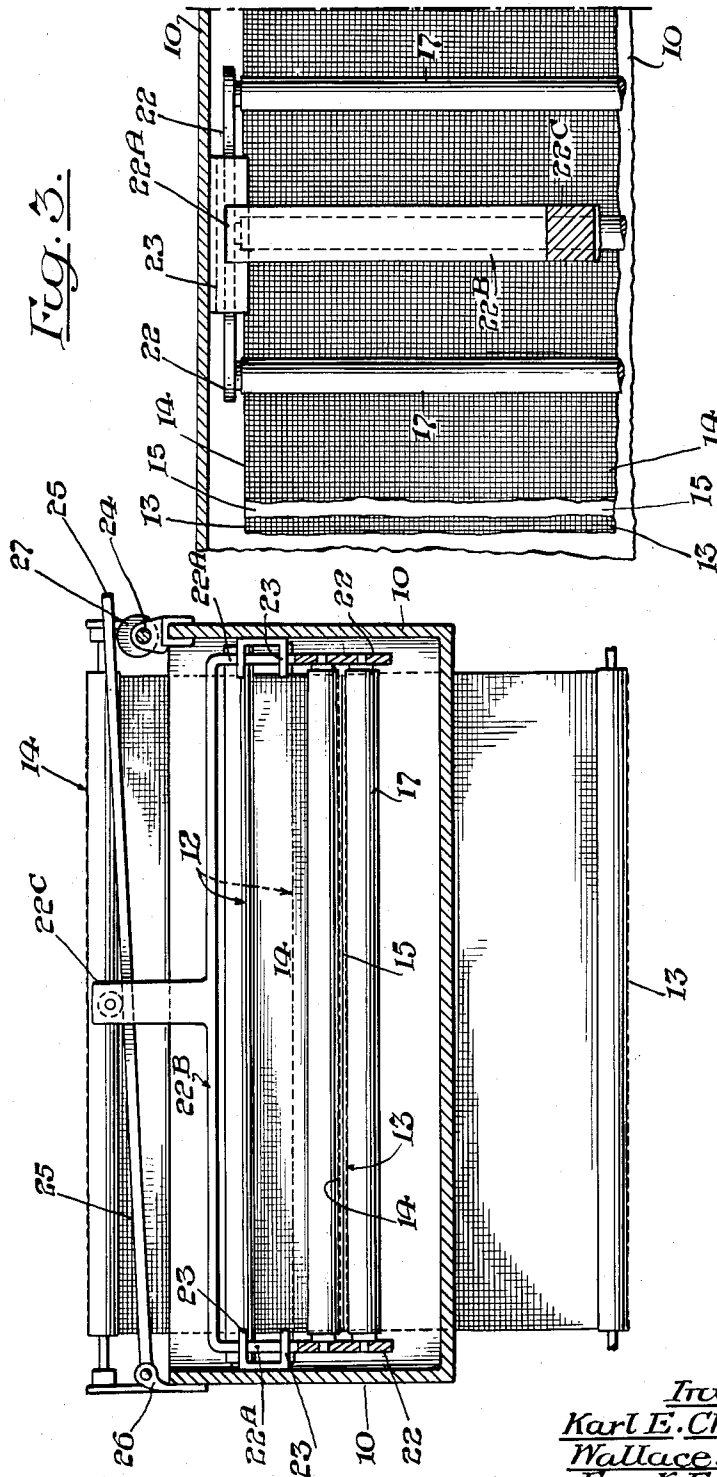
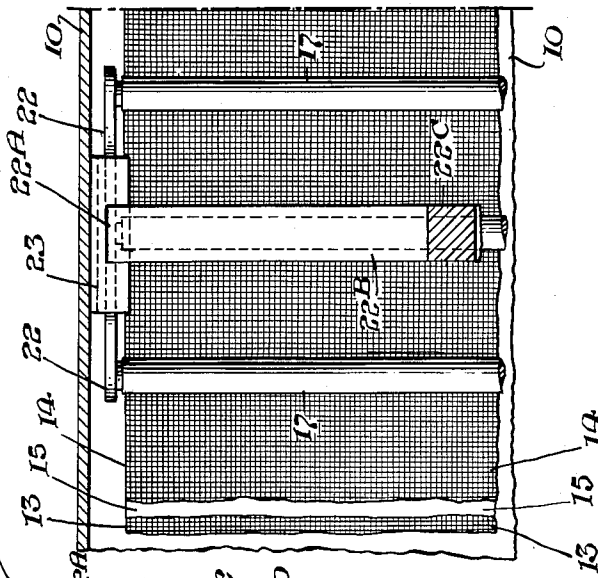


Fig. 3.



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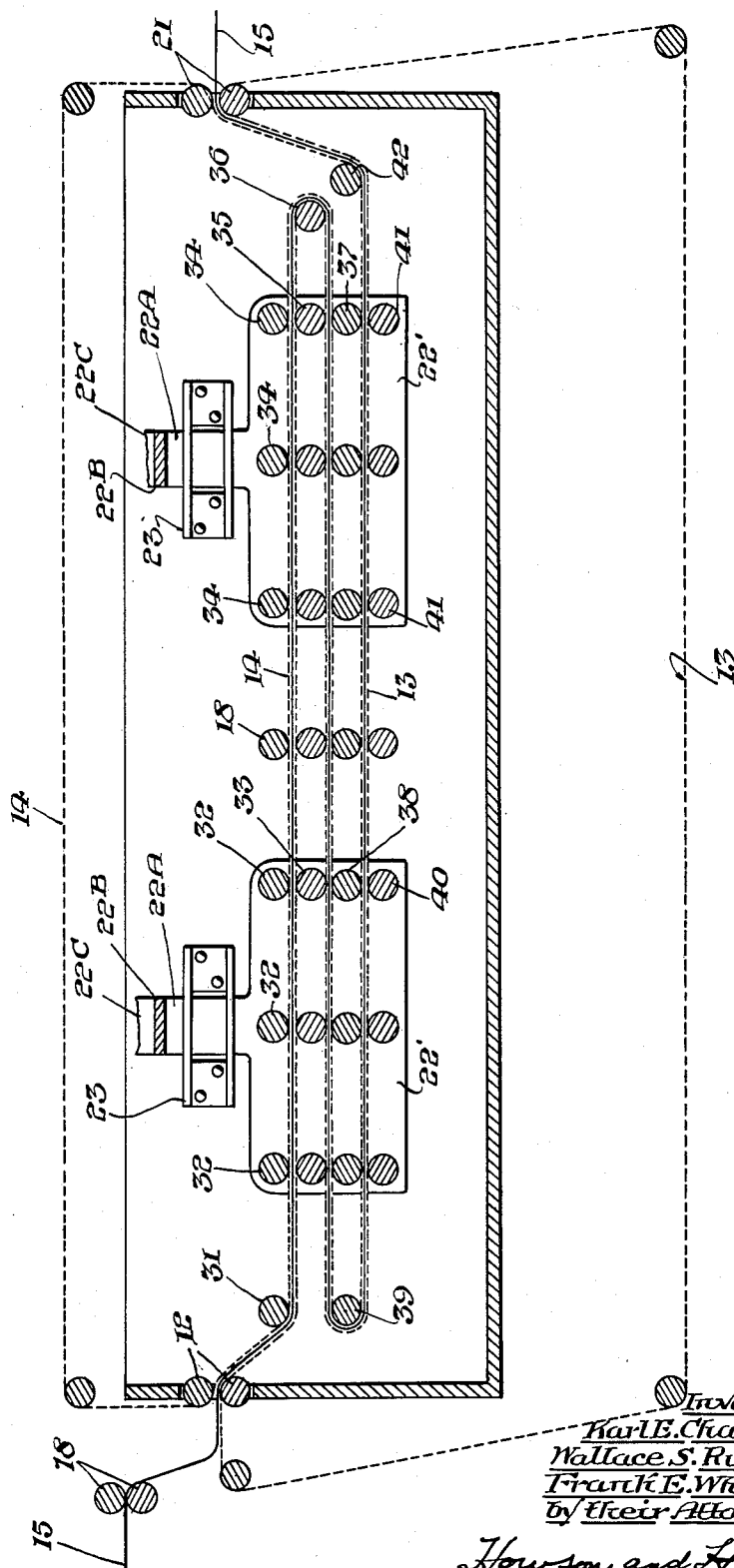
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Fig. 4.



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**METHOD AND APPARATUS FOR TREATING
TEXTILE GOODS, LOOSE FIBERS AND LIKE
MATERIALS**

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Application March 21, 1952, Serial No. 277,872

9 Claims. (Cl. 68—44)

The present invention relates to a method and means for repetitive impregnation of textile fabrics or fibers or goods whether woven, knitted or loose, with any desired solution. More particularly the invention relates to the treatment of wool fibers and fabrics containing wool to render them shrink-resistant. Although there are many methods for accomplishing the shrink-resistance of wool or wool-containing fabrics, they all appear to be subject to the difficulty that if carried too far the shrink-resisting process can become detrimental to the material being treated. On the one hand, if the treatment is carried out with solution concentrations which are such as to secure economically satisfactory speed of treatment, there is great danger that the outer fibers of the yarn or fabric may be treated to excess while the inner fibers are unaffected or insufficiently treated. On the other hand, if the solution concentrations are reduced sufficiently to obviate this difficulty the output of the equipment is greatly reduced.

This difficulty is enhanced by the fact that in any of the usual methods of continuous treatment of fabric for instance, the act of pulling the material through a tank containing the solution creates a tension in the fabric which has the effect of tightening up the yarn. This tightening up makes more difficult adequate contact of the inner fibers with the treating solution, firstly because of the reduced amount of solution which can reach the inner fibers, and secondly, because the solution which reaches the inner fibers tends to become exhausted and to inadequately treat the inner fibers.

Adequate treatment of the individual fibers requires that they all be brought into intimate contact with equal concentration of the treating solution for a sufficient time.

Many attempts have been made to achieve this condition by subjecting the material, while submerged in the solution, to alternate squeezing and relaxation, to insure the intimate contact of each fiber with a treating solution of sufficient concentration to insure the reaction being carried out with sufficient rapidity to be economical.

Such methods, however, have been inadequate. They require great pressure to substantially express the liquid from a bundle of wool fibers, thus necessitating the use of heavy rolls. Moreover, the number of transfers of the treating solution in and out of the goods needed to achieve adequate treatment required prohibitively bulky and expensive equipment. Furthermore, because of the physical size of the squeeze rolls, the outer fibers can readily become overtreated by too long contact with the solutions before a sufficient number of transfers can be effected to achieve adequate treatment of the inner fibers.

Attempts have been made in the past to achieve the required transfer of the treating solution in and out of the goods by swaying the material to and fro in the solution. While this procedure tends to enhance the trans-

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fer of liquid in and out of the interstices between the fibers, it simultaneously tends to close them because of the tension introduced in the goods in overcoming the resistance of the liquid. As a consequence ordinary swaying of the goods in the solution tends to become self-defeating.

Furthermore, we have found swaying of the goods does not per se accomplish the desired completeness of transfer of the treating liquid in and out of the fiber bundles. To be effective in achieving the desired completeness of transfer, it is necessary that certain conditions exist and be combined with other procedures as hereinafter more particularly described.

Thus, the ultimate objective objective is a simultaneous treatment of all of the fibers in the goods with the same concentration of solution and for the same length of time.

The various objects and advantages of the apparatus and method of this invention will become apparent as the description proceeds in connection with the accompanying drawing.

In the drawings:

Fig. 1 is a longitudinal elevational section view illustrating diagrammatically the arrangement of parts embodying the invention.

Fig. 2 is a transverse section view taken along line 2—2 of Fig. 1.

Fig. 3 is a fragmentary plan view, partly in section along line 3—3 of Fig. 1, of the vibrating rollers and the screen supported by them.

Fig. 4 is a view similar to Fig. 1 of another form of the invention.

Referring to Fig. 1, a treating tank 10, of any convenient shape and depth but conveniently usually of rectangular form, is made of any suitable material which will withstand the chemical action of the treating liquid it contains. A pair of entrance rolls 12, are fixedly mounted adjacent one end of the tank. A similar pair of output or exit rolls 21, are mounted adjacent the opposite end of the tank. Passing between the input and output rolls 12, and 21, are upper and lower screens 14 and 13, in the form of endless belts. The goods 15, to be treated, which may be fabric, wool tops, or any other material, is fed between a pair of preliminary input rolls 28, and then to the entrance rolls 12, between the screens 13 and 14. The preliminary rolls 28, preferably rotate at a slightly greater speed than the entrance and exit rolls 12 and 21. Obviously, the difference in speed of the rolls 28 and 12, should be very slight to avoid the piling up of the fabric between these pairs of rolls.

From the rolls 12, the screens and goods next pass between a pair of submerged rolls 16, which also exert only light pressure and serve primarily to guide the combination to a group of three pairs of rolls 17. These rolls 17, are in linear alignment and are supported at their opposite ends in bearing plates 22, which in turn are each supported by a vertical column or bar 22A. These vertical members 22A are, or may be, connected at their upper ends to a transverse bar 22B, forming a yoke. At the center of the bar 22B, an arm, 22C extends vertically upward by means of which the yoke (22A-C), is suspended from a transverse lever, 25. One end of the lever is pivotally supported from brackets 26, attached to one side of the tank 10. The other end of lever 25 rests upon, and is moved by, a cam 27, rotated by a motor-driven shaft 24, supported in bearing brackets 24B, mounted on the other side of tank 10.

From the rolls 17, the screens and goods supported thereby continue in a substantially straight line path to,

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and are supported by a pair of rolls 18, located approximately in the middle of the tank. From the rolls 18, the screen and goods still continuing in straight line path, pass between three pairs of linearly aligned rolls 19, similar to the rolls 17 and supported in the same manner. From the pairs of rolls 19, the screens then pass to a pair of guide rolls 20, adjacent the exit end of the tank and from these guide rolls 20, these screens pass to the exit rolls 21. All of the rolls heretofore mentioned, except the exit rolls 21, purposely exert but light pressure upon the screens in order that the goods shall be conducted through the solution in a substantially tensionless manner and with a minimum amount of power. Thus the goods are merely supported by and between the screens. However, the exit rolls 21 press upon the screens and goods with sufficient pressure to squeeze out excess solution from the goods. The rolls need be made of materials which resist the action of the solutions in which they are immersed. Excepting the exit rolls 21, we have found Pliofilm in sponge form wrapped around Bakelite rods advantageous. Rolls of that form can be set close together so as to keep the conveyer screens together and still the sponge material will give if clumps of wool pass through between the screens, as when processing wool tops or loose fibers.

The pressure exerted by the exit rolls 21, which are power driven, provides traction sufficient to pull the combination of screens and fabric supported thereby through the tank without imposing tension upon the fabric and with minimum power requirements.

Since the mere passage of the fabric or goods through the tank supported by the screens is not sufficient to accomplish impregnation and adequate treatment, and since swaying or oscillation of the goods in the treating solution does not per se accomplish adequate treatment without over-treatment, we achieve the desired transfer of solution and treatment by rapidly vibrating the goods, thus accelerating it first in one direction and then in the other. By such rapid repetitive to and fro movement of the goods through a small distance, we achieve acceleration of the goods in a substantially tensionless condition through the solution against the inertia of the liquid. Rapid acceleration, in contrast to slow movement at low velocity or low frequency swaying, enables thorough penetration and transfer of the solution relative to the goods.

To provide the necessary acceleration, the cam 27 is rotated rapidly causing the lever 25, to move vertically carrying the yoke 22, 22A, 22B with it. The vertical movement of the side plates 22 may be guided by a pair of vertically spaced stationary guide members 23, which may be mounted on the side walls of the tank or on the frame of the machine or in any conventional fashion. Although the vibrating motion thus imparted to the screens is an important feature of the invention, such motion may be imparted by various means and in various ways within the scope of the invention, the invention not being limited to any particular vibratory means.

We prefer to carry the vibrational interchange of the shrink-proofing solution in and out of the material by vibrating it at a relatively low amplitude and relatively high frequency for a period long enough to ensure the reaction being satisfactorily completed.

In this connection it should be noted that the maximum acceleration imparted to a sinusoidally vibrating member equals the amplitude of oscillation in feet, times the square of 2π , times the frequency in cycles per second. In other words, for a given frequency of oscillation, the acceleration is directly proportional to the amplitude. In the present invention, the oscillation is applied at substantially the same amplitude over the entire area of the material between the rolls of the groups of rolls 17; and the same applies to the group of rolls 19.

In general, we have found that the acceleration needed to give an adequate interchange of treating solution into

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and from the fiber bundles is dependent upon the character of the bundles, i. e. a worsted yarn requires a higher acceleration rate than a softer twisted yarn. Also, the acceleration value must at least equal the minimum required for the type being treated. In the present invention, the amplitude necessary for this acceleration is attained as soon as the goods reach the group of oscillating rolls 17. This full scale amplitude and concomitant acceleration continues effective upon the goods until they leave the rolls 17. The same applies to the rolls 19. This is a distinct advantage over other methods of moving the goods relative to the liquid, such as by use of a single oscillating pair of rolls at say a mid-point. In that method, in order to obtain at least the minimum acceleration over the same distance as is done in the present invention, the amplitude of motion at the mid-point would clearly need to be twice as great as in the present invention for the same frequency. Furthermore, such increased amplitudes mean that the screens and consequently the goods carried between them are subjected to a greater and undesirable tension. Moreover, the use of high amplitudes to attain the desired acceleration rates are detrimental because they tend to set up wave motion in the tank which is difficult to control and is almost entirely avoided by the present invention.

As an example of the present invention, the rolls 16-20 inclusive immersed in the tank may all be about two (2) feet apart or sufficiently close to prevent appreciable sag of the screens in a tank about eighteen (18) feet long through which the goods travels at about twelve (12) yards per minute. The roll groups 17 and 19 may be vibrated at about 350 vibrations per minute through an amplitude of 0.3 inch.

The screens are constructed to afford minimum interference to free interchange of treating solution, by not having their interstices so small as to impede flow. Nor should the screens stretch, since stretching exerts an adverse effect on the goods.

From the foregoing, it will be readily understood that the arrangement just described has many advantages. Firstly, the fabric, yarns, or loose fibers, such as wool tops or scoured wool, are in a relaxed condition when fed through the tank because the tension required to lead them through the tank is applied to the screens, not to the goods. Secondly, the force required to conduct the goods and screens through the tank, is a minimum because they are in substantially the same plane from entrance to exit. This also enables the use of a weaker screen than would otherwise be necessary since the weaker screen will not stretch with the lower force applied. Thirdly, the reversing of the direction of acceleration repeatedly and rapidly causes thorough and even impregnation of all of the fibers rapidly, without creating undesirable wave motion in the solution.

In Fig. 4 another embodiment of the invention is illustrated. This embodiment is advantageous when space limitation require a tank of limited length and when the material must pass through additional sets of vibrating rolls to receive full treatment.

In Fig. 4 like reference numerals refer to like parts in Figs. 1-3. On entrance into the solution in the tank, the goods and screens 13, 14, 15, pass around an entrance guide roll 31; and thence in a single plane to three aligned, spaced, vibrating rolls 32, which cooperate with rolls 33 beneath them. Beneath rolls 33, and cooperating with them, is a similar set of three rolls 38; and beneath rolls 38 and cooperating therewith, is a fourth similar set 40. All of rolls 32, 33, 38, and 40, are mounted on, and carried by, movable supporting frame plates 22' like plates 22 and vibrated in the same manner as plates 22, so as to cause all the rolls 32, 33, 38, and 40 to vibrate vertically. From the last pair of rolls 32, 33, the screens continuing in the same plane pass between a similar set of three pairs of rolls 34, 35.

The rolls 34 have three sets of three rolls each 35,

37, and 41, respectively, mounted beneath them on a plate 22' in the same manner as rolls 32, 33, 38, and 40; and they are vibrated in the same manner as rolls 17 of Fig. 1.

From the last pair of rolls 34, 35, the screens pass around a fixed guide roll 36, and run in a reverse straight path between the sets of rolls 35, 37, and then between the sets of rolls 33, 38. From rolls 33, 38, the screens pass to a fixed guide roll 39 at the entrance end of the tank and have their path again reversed by it. The screens then pass in a straight path between the sets of rolls 38, 40, and then, between the sets of rolls 37 and 41. From rolls 37, 41, the screens pass around an exit guide roll 42, and out of the tank to squeezing rolls 21, as in the previous form.

Thus, in Fig. 4, three passes through two tiers of vibrating rolls are made in a short tank. In each pass the screens are only lightly pressed upon by the vibrating rolls, and are conducted in a single plane on each pass from one end of the tank to the other. The advantages of tensionless support and full amplitude of vibration are also achieved here as well as in Fig. 1.

Clearly, the set of rolls 34, 35, 37, and 41 may be omitted if less treatment is needed over what is provided for in the arrangement of Fig. 4. In that case, the rolls 36, and 42, preferably will be located the same distance from rolls 32, 33, 38, and 40, as they are from rolls 34, 35, 37, and 41, and the tank can be correspondingly shortened. Even so additional treatment is provided over that illustrated in Fig. 1.

Although the use of screens is the recommended mode of operation, under special conditions, certain fabrics may support themselves sufficiently to make the use of screens not essential. In such instances the spacing of the rolls will be such as to prevent any substantial sag of the cloth, the maximum spacing being dependent on the nature of the material. When the cloth constitutes its own support the vibratory motion imparted by the apparatus described will, by the rapid acceleration first in one direction and then in the other, cause the desired penetration.

For some materials which need to be supported, other means than screens may be employed, such as continuous belt-like tapes or cords running around the rolls in the same path as indicated for the screens. The cords or tapes may, if need be, be connected and spaced transversely by cross tapes or ties. Thus, the invention is not limited to a particular form of support for the material so long as it permits passage readily and freely of the solution through it into the material, and so long as the material is supported in substantially non-sagging and tensionless condition.

Many modifications within the scope of the invention will occur to those skilled in the art. Therefore we do not limit the invention to the exact form and detail as illustrated and described.

What we claim is:

1. Apparatus for treating textile goods, loose fibers and like materials, comprising a tank containing a solution, upper and lower endless reticulated conveying means, means to continuously move said conveying means through the solution, means to introduce the material between said conveying means, means supporting said conveying means at spaced points along its path through the solution including pairs of stationary rolls at the inlet and exit ends of the tank and at least two pairs of laterally movable rolls between said stationary rolls, said pairs of rolls being substantially equally spaced at such distance from one another as to prevent sagging of the conveying means and conveyed material, and means to vibrate said movable rolls rapidly through a small amplitude to accelerate the whole of that area of the material transiently between said vibrating rolls through the same amplitude to and fro and to cause penetration of the so-

lution into the material, said conveying means holding the goods between them with light pressure and conveying the goods through the solution in tensionless condition.

2. Apparatus for treating textile goods, loose fibers and like materials, comprising a tank containing a solution, a pair of endless-belt-type screens, means to convey said screens through the solution, means to introduce the material between said screens, means supporting said screens at spaced points along their path through the solution, and means to vibrate both said supporting means in unison transversely of the direction of conveyance, thereby moving the whole area of the screens and material transiently bounded by said spaced points to and fro with a rapid vibratory motion of small amplitude and high frequency to cause rapid repeated penetration of the solution into the material.

3. Apparatus as claimed in claim 2 wherein the screens run back and forth through the solution and wherein the screen supporting means includes pairs of cooperating rolls, one of each pair being above the upper screen while the other is below the lower screen, and roll supporting means at each end of said pairs of rolls, said roll supporting means carrying a plurality of said pairs of rolls which support the screen in its movement both back and forth through the tank.

4. Apparatus as claimed in claim 3 wherein certain of said screen supporting rolls act as top rolls for portions of the screens moving in one direction and bottom rolls for portions of the screen moving in the opposite direction.

5. Apparatus as claimed in claim 2 wherein the screens run back and forth in the solution and wherein the screen supporting means includes pairs of rolls one roll of each pair being on one side of the screens while the other is on the other side of the screens, and roll supporting means at each end of said pairs of rolls, said roll supporting means carrying a plurality of said pairs of said screen supporting rolls, some rolls supporting a portion of the screens moving in one direction and some supporting a portion of the screens moving in the other direction.

6. Apparatus for treating textile goods, loose fibers and like materials, comprising a tank containing a solution, juxtaposed endless reticulated conveying means to support said material on both sides, means to continuously move said conveying means through the solution in juxtaposition, means to sandwich the material between said conveying means, means supporting said conveying means at spaced points along its path through the solution, and means to rapidly accelerate in a direction transverse to the direction of conveyance the whole of that portion of the material which is transiently situated between said supporting means and also to reversely accelerate said portion, said acceleration of the whole of said portion being through the same amplitude and being caused by vibration of low amplitude and high frequency.

7. Apparatus as claimed in claim 6 wherein the supporting means are positioned to exert only light pressure on said conveying means and material whereby the conveying means conveys the material through the solution in tensionless and relaxed condition.

8. Apparatus as claimed in claim 7, having a plurality of said spaced vibrated supporting means, said supporting means being substantially in alignment for conveying the material through the solution substantially in a single plane.

9. Apparatus as claimed in claim 6, having a plurality of said spaced vibrated supporting means, said supporting means being substantially in alignment for conveying the material through the solution substantially in a single plane.

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