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Fleissner

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[54] **APPARATUS FOR THE CONTINUOUS TREATMENT OF ESPECIALLY THICK, VOLUMINOUS TEXTILE MATERIALS WITH LARGE WIDTHS**

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[51] **Int. Cl.**.....**D06c 1/10**

[58] **Field of Search**.....34/242; 68/DIG. 5, 3 R, 5 D, 68/5 E, 9, 19.1, 22 R, 27

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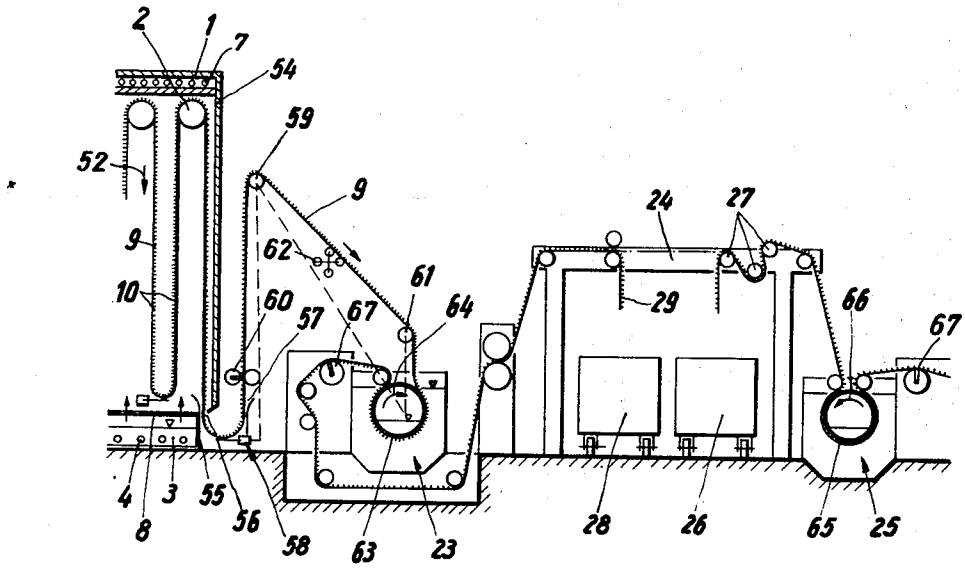
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[57] **ABSTRACT**

The present disclosure relates to a steamer apparatus for the dyestuff fixing of textile materials made of natural and synthetic fibers which comprises a heat-insulated treatment chamber containing a plurality of conveying rollers disposed in the upper portion thereof, and containing a drive means associated therewith, heating means disposed within said treatment chamber, inlet means for introducing the material to be treated to said treatment chamber and outlet roller means disposed at substantially the same level as said conveying roller but outside of the treatment chamber, said outlet roller means communicating with the drive means of the last conveying roller.

11 Claims, 5 Drawing Figures



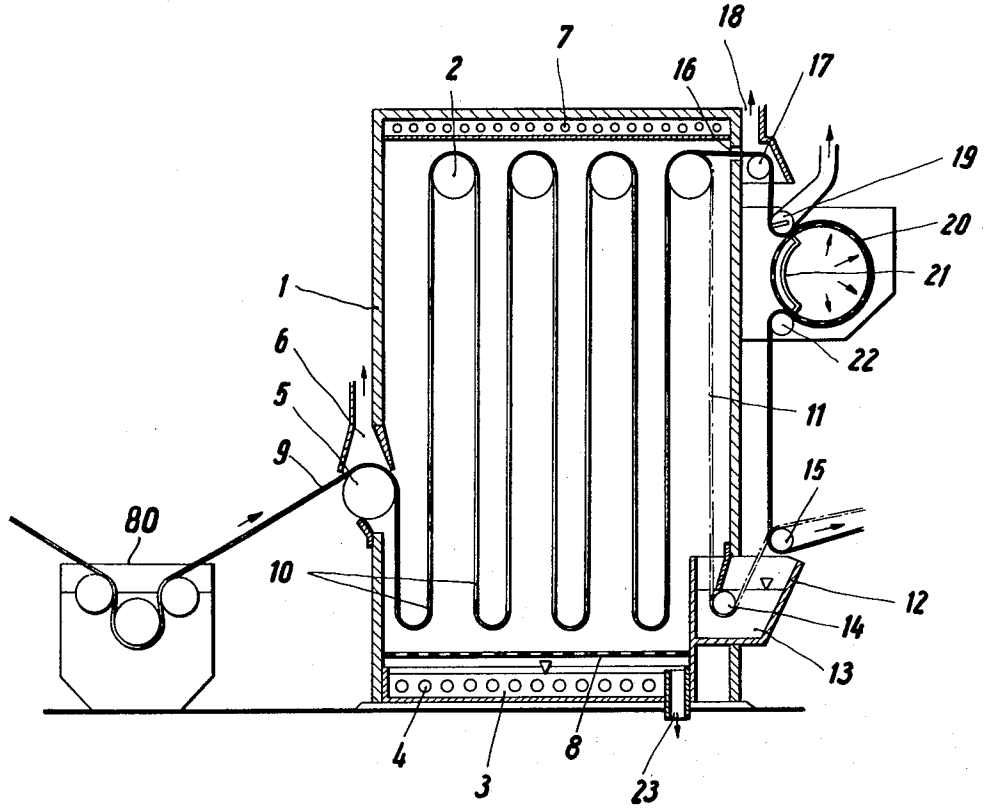


Fig. 1

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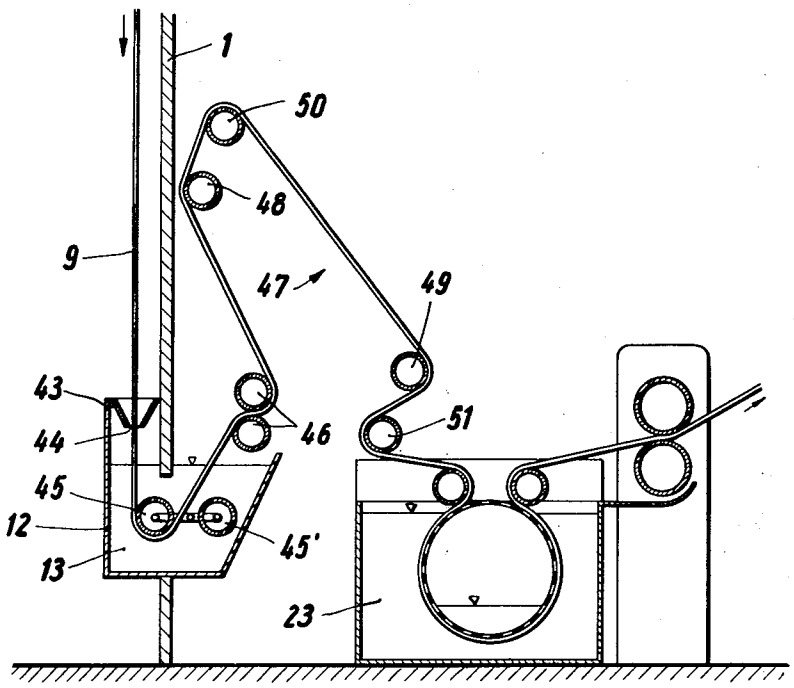


Fig. 2

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Fig. 3

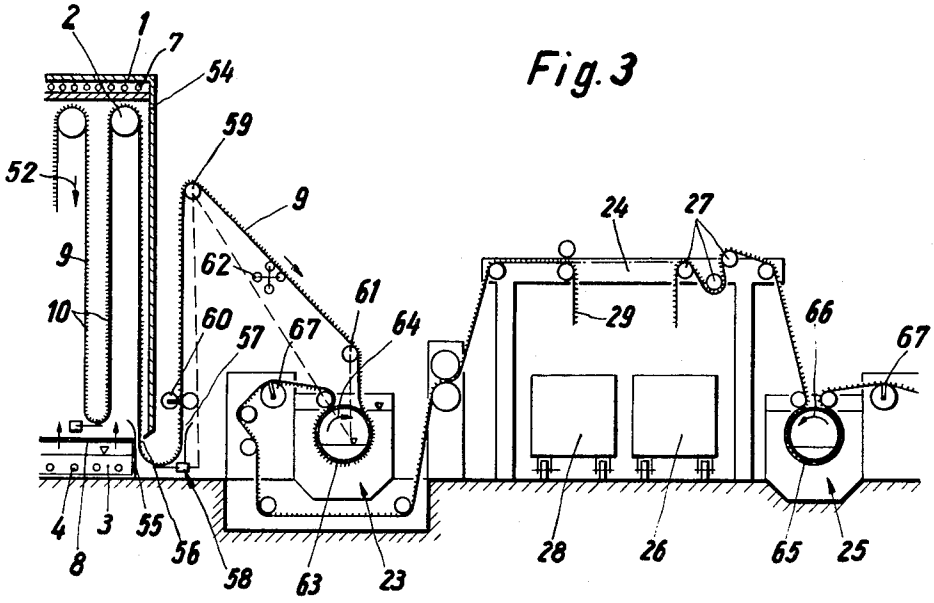


Fig. 5

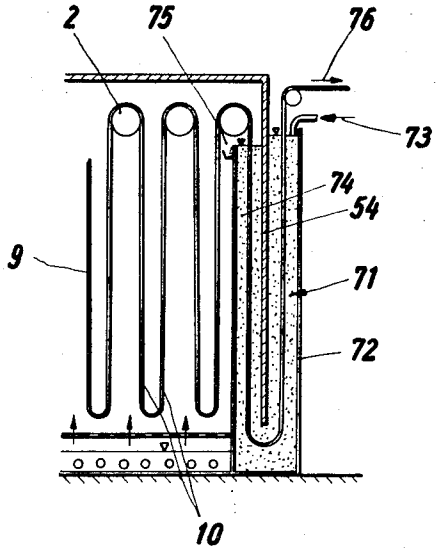
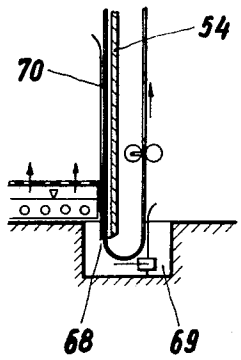


Fig. 4



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APPARATUS FOR THE CONTINUOUS TREATMENT OF ESPECIALLY THICK, VOLUMINOUS TEXTILE MATERIALS WITH LARGE WIDTHS

BACKGROUND OF THE INVENTION

The present invention relates to an apparatus for the continuous treatment of textile materials, particularly thick, voluminous textiles of large widths such as tufted carpets made of synthetic and/or natural fibers, especially polyacrylonitrile fibers. The apparatus comprises a dyestuff applicator and a steamer for dyestuff setting provided with guide rollers which are arranged near the steamer ceiling and ensure the formation of unilaterally guided material loops. A heated water sump for the production of saturated steam and a material discharge unit are also utilized. The apparatus further comprises a washing unit, a dryer and a common drive and control assembly for driving and adjusting the individual machines.

This kind of apparatus is especially advantageous because it permits the replacement of the discontinous dyeing process, applied up to now, with another process which is more economical and ensures a better final quality of the dyed material. By means of this apparatus it is now possible to continuously dye any textile material length, to set the dyestuffs, to wash out the residual dyes and finally to dry the dyed material.

Several problems must be taken into consideration when designing the discharge end of the steamer of this apparatus. Steam leakage must be kept to a minimum, the steam atmosphere within the steamer must be kept as clean as possible, i.e., there must not be any influx of fresh air to the steamer, and finally, the textiles which have been heated up to a temperature of about 100°C. must not be squeezed when leaving the machine, i.e., the upright pile fibers must not be pressed down. This last point is especially important with pile carpets which are made of polyacrylonitrile or similar type fibers, the softening point of which are less than about 100°C. As soon as a fiber with this physical characteristic has been heated up to the setting temperature, any kind of pressure marks the fiber, and the dislocation of the pile fibers which usually occurs in a surge tank, are permanently set.

SUMMARY OF THE INVENTION

An object of the present invention is to avoid the prior art disadvantages in the treatment of textile materials.

Another object of the present invention is to provide an improved steamer apparatus for the treatment of textile materials including those which are susceptible to high temperature, such as those containing polyacrylonitrile fibers.

Other objects and further scope of applicability of the present invention will become apparent from the detailed description given hereinafter; it should be understood, however, that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

For materials which feature a low softening point it is therefore suggested to replace or preferably to supplement the surge tank by an open material discharge unit, arranged at the same level as the driven conveying rollers. A guide roller is disposed outside the steamer, similar to those guide rollers utilized inside the steamer, said roller ensuring that only the reverse side of the material being treated comes into contact with machine parts. Thus, the pile side of the material is undisturbed and the fibers can harden in the required upright position in the subsequent cooling zone where the cooling air is applied preferably to the material underside. A most advantageous arrangement is obtained if at least one sieve drum is provided which is subject to an excess pressure. The pipe of the suction device which serves for raising the pile of the material can be used for reversing the material before feeding it onto the above sieve drum. The drum portion which is not covered by the material being treated is screened off from the suction draft by means of a segment-shaped baffle plate.

The material which is discharged from the sieve drum can be reversed by means of a roller or a drum which can be arranged at the pile side of the material because the fibers have already been sufficiently cooled down, thus eliminating possible pile deformations.

One or several nozzle assemblies can be utilized instead of a blower drum. These nozzle assemblies and the adjoining fans with drive units can be designed in the same way as those which are normally used with stenters.

Since solvent dyeing processes are gaining an ever increasing importance, it is suggested in accordance with the present invention to construct the device in such a way that it can also be used for solvents dyeing. According to the present invention it has been found that this can be easily obtained by providing the steamer with an exhaust opening on or near the floor. This exhaust opening can be connected with a solvent recovery unit which can be installed in a separate room. The other steam exhaust pipes at the inlet and discharge ends of the steamer can also be connected with this solvent recovery unit. The dyestuff applicator can be used for applying the solvent/dye liquor onto the material. Dye setting is effected in a solvent/steam atmosphere in the steamer. Solvent removal can be effected by means of nozzles which are arranged at the discharge end of the steamer and serve for blowing superheated steam onto the material. However, it is also possible to remove the solvents by guiding the material through a surge tank and by heating the liquor in this surge tank to near boiling temperature. With this process most of the applied solvent is evaporated; it collects on the steamer floor because its specific weight is higher than that of evaporated water and is then exhausted and guided to the solvent recovery unit. Part of the solvent remains in the water of the surge tank from where it can be removed directly by means of a water separator or a centrifuge. In order to avoid too strong a solvent concentration in the surge tank, part of the water is permanently circulated in the water separator or the centrifuge and thus constantly purified. Both the solvent and the water can be reused.

Despite all its other advantages, the suggested discharge opening on a level with the driven guide rollers near the ceiling of the steamer is still disadvantageous inasmuch as high volume of air is lost at such an open discharge end. Since steam is lighter than air it flows out preferably at the discharge end near the steamer ceiling. It can of course be exhausted so that it does not hinder the operators but steam consumption of a steamer with this kind of material discharge end is rather high. It is therefore one of the features of the present invention to provide a discharge end which permits the guidance of all kinds of textile materials, including those made of polyacrylonitrile fibers, through one and the same discharge opening into one subsequent washing machine, without the danger of any steam losses, without any pile fiber dislocation, which may be due to water flows and without any squeezing of the pile. The pile fibers must be raised upright before being cooled down below their softening point.

According to the present invention all this is obtained by arranging the end wall of the steamer in such a way that it is freely suspended and extends almost down to the water sump on the steamer floor, with which it forms a material discharge slit near the floor. Advantageously, a loop length adjusting unit is installed near the material loop which forms at the bottom edge of this discharge slit. By arranging the discharge opening hear the steamer floor, it is possible to prevent the material from coming into contact with anything, not even with water, when leaving the steamer. It is also possible, at the same time, to eliminate any excessive steam leakage. Advantageously, the end wall is suspended down beyond the steamer floor plate so that the discharge end proper is arranged beneath the steamer floor. This discharge end can also be followed by a suction device, disposed at the material pile side, outside the steamer, said suction device forcing the pile fibers into the required upright position. This suction device can be followed by a natural cooling zone which is obtained by arranging a guide roller outside the steamer, on a level with the steamer ceiling, onto which the underside of the material is conveyed so that any bending of the fibers which are not yet cooled down below their softening point is prevented. This guide roller can be advantageously designed as an expanding roller which removed plaits, which may have been produced, from the material.

In another embodiment, the apparatus of the present invention can be provided with a beating unit which is arranged behind the washing machine, near the reverse side of the downwardly running material stringer. This beating unit also effects a re-raising of the pile fibers. The air movement which is produced by the beating motion of this unit also provides a more rapid cooling of the material. With a material discharge end of the above described type, with subsequent cooling zone, the temperature of the material length is generally lower than the softening point of the respective fibers. In this case the material can be guided through the subsequent washing machine with its pile side contacting the drum surfaces, in tandem-connected wash bowls. If the material is cool enough, the pile cannot be adversely affected. However, if the cooling zone has been omitted, if the washing machine is directly connected with the steamer, if the cooling process has deliberately been prolonged or if a permanent displacement of the fibers is feared, the first wash bowl can be designed in such a way that instead of the pile side, the reverse side of the material is conveyed on the drum surface. This is possible because the drum of the first wash bowl behind the steamer can be rotated in the opposite direction to the subsequent drums. As a consequence, the material length is guided in the first wash bowl in the opposite direction to normal material passage. It is expedient to effect the take-over of the material from the first wash bowl from the bottom section of this bowl, e.g., by providing the foundation of the device with a cavity for the second wash bowl. This latter as well as the preceding provisions can also be made for solvent processing machines, the only special requirement being that the machines are sealed against the outside air.

However, in certain cases the discharge end of the steamer is preferably designed as a surge tank. The well-known advantages of a surge tank are that it ensures a 100 percent tightness of the steamer against outside air and also, the unset dyestuffs are substantially removed in the surge tank. However, depending on the physical characteristics of the textile fibers used for the material to be processed, it is disadvantageous to cool down the fibers rapidly from their setting temperature to the water temperature. The surge tank has always been objected to because the water of the surge tank inside the steamer has too low a temperature so that the steam condenses on the water surface. In order to improve the above described device, it would be desirable to develop a surge tank which would make it possible to cool the material, slowly, down from setting temperature to the outside air temperature and to eliminate the permanent fixation of pile fiber displacements which usually occur when the material enters the surge tank. According to the present invention these two requirements are met if both the inlet and discharge ducts of the surge tank have a considerably height and if the cold fresh water is introduced at the end of the discharge duct and is removed at the beginning of the inlet duct. If desired, the surge tank can be exactly as high as the steamer, which also ensures an excellent washing effect.

If the water is conveyed through the surge tank on the counterflow principle, i.e., if the water is added from the outside and flows off on the inside of the steamer, there is a uniform temperature drop in the discharge duct from the high inside temperature down to the fresh water temperature which prevails at the end of the discharge duct. This temperature drop is produced by the material heating the water as it is conveyed therethrough. Control of the fresh water supply from the outside can be effected by heating the water at the material inlet end up to 100°C. so that the material which itself has a temperature of 100°C. is introduced into water of the same temperature. Thus any permanent pile fiber displacement is effectively eliminated. The water flowing along the material length in the opposite direction of material passage ensures that pressed-down pile fibers are uniformly re-raised as soon as the material immerses into the liquor. The fibers are then set to the required upright position during the slow cooling process which the material is subjected to in the long discharge duct of the surge tank. Apart from this, a surge tank which is designed in ac-

cordance with the invention also prevents the steam from condensing on the hot water surface inside the steamer.

It is advantageous if the outer wall of the discharge duct is higher than the outer wall of the inlet duct so that the upper edge of the inlet discharge duct wall can serve as one overflow for the water which has to be removed from the surge tank. The water which flows off at the inside of the surge tank can be guided into the water sump of the steamer. This means that the filament energy which would be needed for heating the water from the outside temperature to the evaporating temperature, can be saved.

The above-described type of material discharge duct is necessary and advisable only for materials which are susceptible to pile fiber displacement. If other types of material are processed in the steamer the discharge end can be designed as a known surge tank which, despite its simple construction, guarantees perfect steam-tightness. In such a surge tank, the water surface itself serves for sealing, for instance, a vertical discharge duct which is completely surrounded by water. Here, however, it is disadvantageous that the cold watersurface comes into contact with the steam which is contained in the steamer. Therefore, it was suggested to seal the discharge duct above the water surface by means of a sheet metal plate with a longitudinal discharge slit, said plate being mounted to the inner wall of the discharge duct.

However, it has been found that the material may accumulate above this plate either because of an unevenness of the material, or because of faulty threading of the material length into the steamer, or the like. In order to improve the above sealing between the water surface and the steamer interior and to prevent the material from accumulating above the plate, it is suggested, according to the present invention, to install above the water surface of the surge tank, in the discharge duct of the steamer, a sealing means, e.g., a funnel-shaped plate with a longitudinal material discharge slit, the two sides of which run laterally to the material and are downwardly inclined.

The above device comprises a steamer through which the material is guided in the form of long loops. Especially for treating voluminous textile materials it is expedient to omit the guide rollers at the material backside so that the material length hangs only on the top guide rollers by means of which it is also transported. With such a steamer type there can be several reasons for a non-uniform material speed. However, any speed change at the material discharge end of the steamer makes itself felt on all subsequent machines, whether their speed out to be higher, or lower. For controlling the machines following the steamer it is suggested to design the guide roller within the surge tank as an oscillating roller. By means of such an oscillating roller it is possible to adjust the peripheral speeds of the machines which follow the steamer in dependence of the delivery speed of the material which is being discharged from the steamer.

The recommended device usually comprises two wash bowls after the steamer, which bowls are generally necessary for the effective removal of superfluous dyestuffs from the textile material. Another aspect of the present invention is to find a way of omitting one of these wash bowls and make the device shorter and less expensive. According to the present invention this is obtained by designing the surge tank at the discharge end of the steamer as a wash bowl, e.g., by installing a squeezing unit at the end of the surge tank for removing the liquor which has been taken up while the material was passed through the surge tank. Only by squeezing off the liquor and by pressing the material is a good washing effect obtained with a wash bowl which comprises only one single roller for guiding the material. Of course, it is also possible to use a sieve drum instead of a simple guide roller.

Another problem encountered is the maintenance of an exact material guidance of the material in each individual machine. The material should be conveyed through the machines without any folds and advantageously in the middle of the working widths. In order to obtain a crease-free guidance of the material, expander rollers can be used which are, for instance, provided with a special thread running from the center of the roller outward. By means of this thread, the material length is expanded in width. For the center guidance of the material there are several elements which can be utilized. Optical selvedge feelers with an automatic adjustment of the required material passage, crowned guide rollers or guide rollers which are vertically swivelable in the direction of material passage, can be utilized.

Practical experiences with the loop steamer have shown that the material cannot be prevented from running off the center of the guide rollers. In order to facilitate a faultless winding-up of the material at the end of the device, according to the present invention, it is necessary to provide a means for feeding the material exactly to the center of the working width of the subsequent washing machine. This means is preferably installed after the steamer. According to the present invention this can be obtained by arranging an expanding roller with a subsequent guide roller overhead the discharge end and between the discharge end and the following wash bowl, and by installing an adjusting unit in front of the wash bowl, which adjusting unit can be a roller which is swivelably tranversely to the direction of material passage. Possibly a subsequent guide roller which serves for feeding the material into this wash bowl can be additionally provided.

This type of unit is especially advantageous if the surge bowl of the steamer is designed as a wash bowl, i.e., if it is provided with a squeezing unit. In this case the material has a relatively low weight/sq.m. when it is transported from the squeezing unit to the expander roller which is arranged above the squeezing unit because the overall length of the device is required to be rather restricted. This kind of material discharge end would be detrimental for unsqueezed materials since in this case the heavy textile material length would be susceptible to lengthwise stretch. However, there must be a relatively wide distance between the expander roller and the adjusting unit in order to obtain a sufficiently long control distance.

The device for the continuous treatment, especially dyeing and/or printing of thick, voluminous textile materials of large widths comprises several machines which, as arranged in line in the direction of material passage include a dyestuff applicator, a steamer, a

washing machine and a dryer. Since this kind of production line is rather expensive to purchase it will only operate economically if it is permanently running. The washing machine and the dryer can easily stand a full 24-hour operation. The dyestuff applicator and the steamer, however, must be cleaned from time to time. Also the dryer and the washer machine must be stopped from time to time. Besides, the washing machine and the dryer are often used for materials which were previously dyed in a discontinuous process, e.g., by means of a winch beck instead of a dyestuff applicator with a subsequent steamer.

For the further treatment of these materials in the washing machine and the dryer, with the steamer being omitted, it is suggested in accordance with the present invention to arrange a cloth beam with rollers behind the washing machine, which ensures material conveyance between the individual machines. In this case the device is extended by about 3 – 5 m and it is thus possible to push one or several carriages underneath the cloth beam. The carriages can contain the material which comes from a winch beck. From these carriages the material is fed into the wash bowl and the dryer.

In order to ensure an effective treatment of the material, a washing machine usually comprises more than two wash bowls. According to the present invention it is advantageous to arrange the cloth beam between the two bowls or, if several wash bowls are provided, preferably in front of the last bowl. This arrangement offers the great advantage that the material which is possible drawn out of the carriages, is again thoroughly soaked before entering the dryer. The upper layers of the material which has been stored in a carriage inevitably dry out while the bottom layers stay wet or are even immersed in liquor which may have gathered on the carriage bottom. According to the present invention this disadvantage can be easily compensated by installing the cloth beam in front of the last wash bowl and by ensuring that the material length is uniformly re-wetted before the drying process. It is of course possible to replace this wash bowl by another wetting unit, e.g., a simple dipping unit.

In a further embodiment of the present invention, the free space in front of the cloth beam can have a length of at least two carriage widths. This permits plaiting of the material which leaves the steamer into one carriage and feeding the subsequent dryer with material from the second carriage. This cloth beam can also be used in the material to be process is plaited in several carriages. If two carriages are disposed beside one another, the end of one material length can be sewn to the beginning of the other material length. This permits the continuous treatment of the textile material in the subsequent machines.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawings which are given by way of illustration only and thus are not limitative of the present invention and wherein,

FIG. 1 is a section through a steamer;

FIG. 2 is an enlargement of the discharge end of the steamer according to FIG. 1 with a subsequent wash bowl;

FIG. 3 shows the discharge end of a steamer with the subsequent washing unit consisting of two wash bowls and a cloth beam;

FIG. 4 is another embodiment of the discharge end of the steamer according to FIG. 3; and

FIG. 5 shows the material discharge section of a steamer with a surge tank which tank has almost the same height as the steamer proper.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The steamer of the present invention comprises a heat-insulated housing 1, provided with conveying rollers 2 for unilateral material guidance, a heated or heatable sump 3 containing heating elements 4 for the production of saturated steam, a heatable feed roller 5 and an exhaust hood 6 which is installed at the inlet end of the apparatus. Additional heating elements 7 serve for maintaining the required temperature constant and a perforated plate 8 serves for holding back water drops which might otherwise be carried along by the rising steam and produce spots on the material.

The material 9 is fed to the steamer via the heatable feed roller 5 and forms loops 10 because of the particular arrangement of the conveying rollers 2. After having passed the steamer, the material which can be made, for example, of wool or polyamide fibers, travels the distance 11 (dash-and-dot line) and reaches the surge tank 12 where it is guided around a roller 14 which is immersed in the liquor 13. Through the use of roller 15 the material is then carried along to the subsequent treatment units.

Goods of polyacrylonitrile fibers, which are very susceptible to pressure as long as they are heated to near the setting temperature, are guided through the discharge opening (which can be closed if necessary) to the guide roller 17, above which an exhaust hood 18 is arranged. The suction pipe 19 re-raises the pile fibers and leads the material onto the sieve drum 20 which is subject to a positive draft. The positive draft of that portion of the sieve drum which is not covered with the material being treated is screened off by means of a baffle plate 21. The material is transported to the following machines by means of guide rollers 22 and 15. For a solvent dyeing process, the exhausts 6 and 18 as well as the water outlet 23 can be connected with a solvent recovery unit.

FIG. 2 is an enlargement of certain sections of the device which represent further objects of the invention. This figure shows only the surge tank which serves as the material discharge outlet. The water surface of the surge tank is sealed against the steamer interior by means of a plate 43. This plate 43 which is provided with a material slit 44 serves for separating the hot steam atmosphere from the water surface so that any excessive steam condensation on the water surface is eliminated. In order to ensure a better material passage and to prevent the material from accumulating, the plate 43 is funnel-shaped and inclined in the direction of material passage. It is also fitted to the walls of the discharge duct.

In this embodiment of the apparatus according to the present invention, the guide roller 45 which is immersed in the liquor of the surge tank is designed as an oscillating roller which controls the conveying speeds

of the machines which follow the steamer in accordance with the inclination of its counter-roller 45'. This arrangement has been utilized because it has been found that especially at the beginning of the treatment process, the material speeds at the inlet and discharge ends of the apparatus do not always correspond. Such a speed difference can be due, for example, to a material loop 10 having wound up because its own weight is too great.

After having passed the surge tank 12, the material is guided into a squeezing unit 46, which means that the surge tank 12 can be advantageously used as a wash bowl and thus the otherwise necessary additional wash bowl can be omitted. Squeezing off the superfluous liquor which is mixed with unset dyestuffs, permits the obtaining of a good cleaning effect. The cleaning effect can be improved by the use of a sieve drum instead of a simple guide roller 45.

The squeezed material which is now substantially dehydrated is then guided over the expanding and controlling unit 47, to the middle of the wash bowl 23. This controlling unit is needed since it has been found that, due to the great number of material loops 10, the material cannot be prevented from running off the middle of the steamer working width. The unit 47 comprises an expander roller 48 with a thread running from the center outward and a roller 49 which is swivelable, vertically, to the direction of material passage and onto which the material is fed by the guide roller 50. It is advantageous to arrange the controlling unit 47 after the squeezing unit 46, above the surge tank 12, and between the surge tank and the subsequent wash bowl 23, so that the overall length of the apparatus is not extended and the material is already shifted to the middle when being fed into the wash bowl 23. The installation of the squeezing unit 46 is especially advantageous because most of the liquor is thus removed from the material. Accordingly, the material is lighter and any sagging or lengthwise stretching of the material length is thereby effectively eliminated.

The relatively large distance between the squeezing unit 46 and the respective expander roller 48 and guide roller 50 is necessary in order to obtain a sufficiently long control distance for the swivelable roller 49. After the material has been re-shifted to the middle, it is fed into the wash bowl 23, if necessary, via guide roller 51. If need be, the cloth beam 24, described with reference to FIG. 3, can be adjoined directly thereto.

FIG. 3 shows the discharge end of the steamer and the subsequent washing machine which are part of the device according to the present invention comprising a dyestuff applicator 80, a steamer (both according to FIG. 1) for heat-setting the dyestuffs, a wash bowl 23, a cloth beam 24, another wash bowl 25 and a dryer (not shown). The material (which here is supposed to be pile material) passes the steamer in the direction of the arrow 52 in the form of several loops 10 which are, as has been described, guided through the machine only by means of guide rollers 2 which are arranged near the steamer ceiling.

The discharge end wall 54 of the steamer extends down to the perforated plate 8 of the water sump on the steamer floor. Together with the steamer housing wall 55, the discharge end wall 54 form the material discharge slit 56 which is situated near the bottom of the steamer. The material discharge slit 56 should preferably be only as wide as the material is thick so that steam leakages from the steamer interior are eliminated. However, the slit must not be too narrow since in this case the pile of the carpet is pressed down and the voluminosity of the material is permanently impaired.

A material loop 57 forms around the bottom edge of the steamer end wall 54, the length of said loop being controlled by the control unit 58. This control unit 58 regulates the rotational speed of the guide roller 59 which in its turn controls the speeds of the subsequent machines. Between the guide roller 59 which can be designed as an expander roller and the lower loop end 57 there are disposed an exhaust device 60 at the material pile side and a counter roller at the reverse side of the material. Device 60 is a conventional sieve roller having internal baffle means (as shown) which define a narrow slit through which a vacuum is applied to the textile material. These two rollers ensure that the pile is re-raised and can be fixed in an upright position when passing the subsequent cooling distance.

The steamer is followed by a washing machine. Between the expander roller 59 and the roller 61 which feeds the material onto the drum of the first wash bowl, a beating unit 62 is installed on the reverse side of the material, said unit causes a fluttering of the material length. This fluttering of the material ensures a rapid cooling of the fibers beneath their softening point. However, if the material is not yet cooled down beneath the fiber softening point and there is still the danger of fiber displacement when the pile side of the material comes into contact with the surface of the sieve drum 63, the underside of the material is put onto the wash bowl drum 63 which rotates in the opposite direction to the subsequent wash bowl drum 65 (see arrows 64 and 66). The material which adheres with its underside on the drum 63 is penetrated by the washing liquor because of the existing liquor level difference. The fibers are efficiently cooled down beneath their softening point and the pile is raised, due to the direction of the liquor flow. After the material 9 has been guided around the drum of the first wash bowl 63, most of the absorbed liquor is removed by means of the suction unit 67. Thereafter, the material is guided through a cavity in the foundation, via the cloth beam 24, to the following wash bowl 25, where it can safely adhere with its pile side on the drum surface.

Between the two wash bowls a cloth beam 24 is arranged which serves for transporting the material which comes from the wash bowl 23 to the second was bowl 25 by means of transporting rollers.

In a continuous process the cloth beam 24 has no special function. However, if the dyestuff applicator (not shown), or possibly a printing unit or the steamer are cleaned, if one of these machines must be stopped for some reason, or if shorter material lengths which have, for instance, been dyed previously in a winch beck are to be dried in a subsequent dryer, the material is transported in a carriage 26 underneath the cloth beam 24 and drawn off from this carriage by means of the rollers 27. The second carriage 28 can serve either for taking up the material which is discharged from the steamer or for supplying further material lengths from a winch beck, for instance. This offers the advantage that

the ends of two material lengths can be sewn together so that a continuous treatment of the textile material is possible. In the embodiment shown, the cloth beam **24** is installed between the first and the second wash bowls (**23/25**). This arrangement has been chosen because the upper layers of the material which lies plaited in the carriages **26** and **28** tend to dry out in the course of time. However, in order to obtain a uniform drying effect, the moisture content must be uniform over the entire material length. Therefore, the material is preferably guided through the second wash bowl **25** before being fed into the subsequent dryer.

FIG. **4** shows a steamer discharge end which corresponds essentially to the discharge end shown in FIG. **3**, with the difference, however, being that the material discharge slit **68** is arranged in a cavity **69** underneath the steamer floor. This ensures the elimination of any undesired steam leakages. Furthermore, FIG. **4** shows a somewhat prolonged material discharge duct **70**. This duct is formed by a wall which is at the same time the front wall of the water sump. This kind of extended duct also prevents the steam from leaking out at the material discharge slit **68**.

FIG. **5** shows another type of material discharge end. In this case the discharge end comprises a surge tank **71** which is almost as high as the steamer itself. Here, too, the material is guided around the lower edge of the front wall **54** of the steamer, but this front wall is almost entirely surrounded by the water container **72** of the surge tank which forms a material discharge duct at both sides of the front wall **54**.

The surge tank is supplied with fresh water from the outside (see arrow **73**) and a corresponding amount of water flows off within the steamer, i.e., over the upper edge of the duct **74**, into an overflow channel **75**. Depending on the amount of fresh water being supplied, the water which is drained off can have a temperature which corresponds to the setting temperature of the material. The water in the surge tank is heated up by the hot material which is guided therethrough. The fresh water flows through the surge tank in the opposite direction to the discharged material **9** (see arrow **76**) and is subsequent removed from the surge tank so that the material is cooled down rapidly and any fixation of displaced fibers is effectively prevented. The water which leaves the surge tank via the overflow channel **75** inside the steamer and which has here a temperature which almost corresponds to the material setting temperature can preferably be guided into the water sump of the steamer.

The materials which can be treated by the apparatus of the present invention include any of the natural or synthetic fibers. The natural fibers can include cotton, wool, silk, cellulose, etc., and the synthetic fibers may comprise synthetic polymers such as polyolefins, e.g., polyethylene, polypropylene, etc., polyamides, e.g., Nylon 6 obtained by the condensation of caprolactam, Nylon **66** obtained by the condensation of hexamethylenediamine with adipic acid, etc., polyester, e.g., polyethylene terephthalate, etc., phenolic resins, e.g., phenol formaldehyde resins, urea formaldehyde resins, etc., polyvinyl materials, e.g., polyvinyl chloride, polyvinyl acetate, etc., and acrylate resins such as e.g., polymethylmethacrylate. Copolymers of these materials with one another or with ethylenically unsaturated monomers, and similar type polymers are also encompassed by the present invention. The present invention is also applicable to blends of the above-mentioned textile materials.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not be to regarded as a departure from the spirit and scope of the invention, and all such modifications as would be apparent to one skilled in the art are intended to be included.

What is claimed is:

1. A steamer apparatus for the dyestuff fixing of textile materials made of natural and synthetic fibers which comprises a heat-insulated treatment chamber containing a plurality of conveying rollers disposed in the upper portion thereof for forming loops of textile material within said steamer, drive means operatively associated with said conveying rollers, heating means disposed within said treatment chamber, water sump means located along the bottom of said steamer for generating steam therein, inlet means for introducing the textile material to be treated to said treatment chamber onto the first of said conveying rollers and outlet means for removing the textile material from the last of said conveying rollers and from the steamer in the form of a loop, said outlet means comprising a narrow aperture defined between a wall forming the discharge end wall of the steamer and a wall forming the end wall of the water sump at the bottom of the steamer, said discharge end wall of the steamer extending downward to at last the height of the end wall of the water sump whereby leakage of steam from said steamer is substantially eliminated during discharge of said textile material through said aperture near the bottom of said steamer and the last conveying roller being arranged directly above said aperture so that the textile material only contacts said last conveying roller before removal from said steamer.

2. The apparatus of claim **1**, wherein the material being treated forms in the loop around the bottom edge of the steamer discharge end wall, and is guided on a guide roller disposed a distance above the outlet means, the length of the loop being controlled by a control unit which regulates the rotational speed of the guide roller.

3. The apparatus of claim **2**, wherein said control unit is located adjacent to the loop of said material.

4. The apparatus of claim **2**, wherein a wash bowl containing a sieve drum means subjected to a suction draft is disposed behind the guide roller.

5. The apparatus of claim **4**, wherein a beating unit is disposed between the guide roller and the wash bowl and associated with one side of the material to cause a fluttering of the material length.

6. The apparatus of claim **5**, wherein a further guide roller is disposed above the above wash bowl to deposit the material on the wash bowl drum so that its backside contacts the surface of the drum.

7. The apparatus of claim **6**, wherein a suction unit is disposed after the wash bowl.

8. The apparatus of claim **7**, wherein an additional wash bowl is provided after the suction unit, and a cloth beam containing conveying rollers provides communication between said wash bowls.

9. The apparatus of claim 8, wherein the cloth beam is installed above and between the wash bowls and at least one carriage means is disposed below the cloth beam between said wash bowls.

10. The apparatus of claim 8, which further comprises a dyestuff applicator means disposed in front of the steamer and a dryer disposed behind the wash bowls.

11. A steamer apparatus for dyestuff fixing of textile materials made of natural and synthetic fibers which comprises a heat-insulated treatment chamber containing a plurality of conveying rollers disposed in the upper portion thereof, drive means operatively associated with said conveying rollers, heating means disposed within said treatment chamber, water sump means located along the bottom of said steamer for generating steam therein, inlet means for introducing the textile material to be treated to said treatment chamber, said textile material having a pile side and a back side, and outlet means for removing the textile material from the steamer, said outlet means comprising a narrow aperture defined between a wall forming the discharge end wall of the steamer, and a wall forming the end wall of the water sump at the bottom of the steamer, said discharge end of the steamer extending downward to at least the height of the end wall of the water sump whereby leakage of steam from said steam is substantially eliminated during discharge of said textile material through said aperture near the bottom of said steamer, the material being treated forming a loop around the bottom edge of the steamer discharge end wall and being guided on a guide roller disposed a distance above the outlet means, the length of the loop being controlled by a control unit which regulates the rotational speed of the guide roller, and an exhaust device provided between a curved portion of the loop of the material being treated and said guide roller, said exhaust device comprising an exhaust roller associated with the pile side of the material and a counter-roller associated with the back side of the material.

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