Feb. 27, 1973 M. T. C. VINAS 3,718,012

DEVICE FOR THE WET TREATMENT OF TEXTILE MATERIALS

Filed Sept. 14, 1971

3 Sheets-Sheet 1

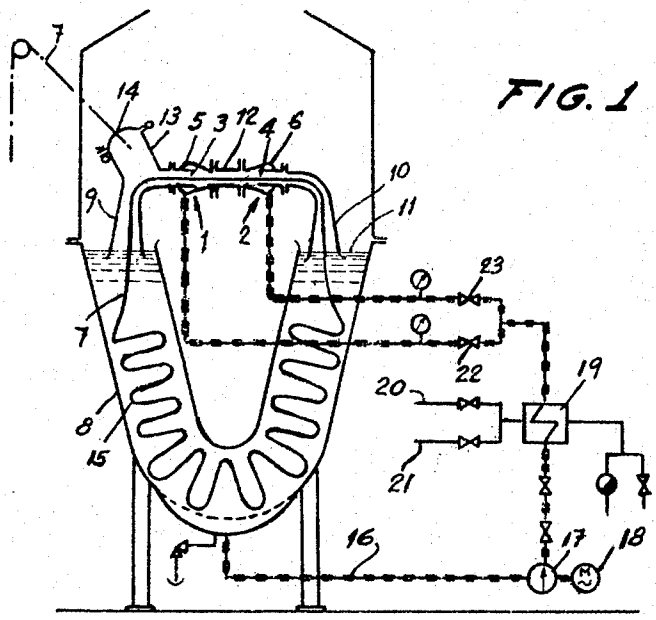

FIG. 1

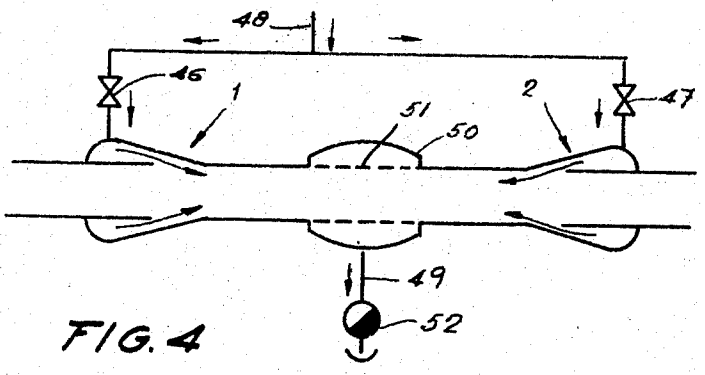

FIG. 4

DEVICE FOR THE WET TREATMENT OF TEXTILE MATERIALS

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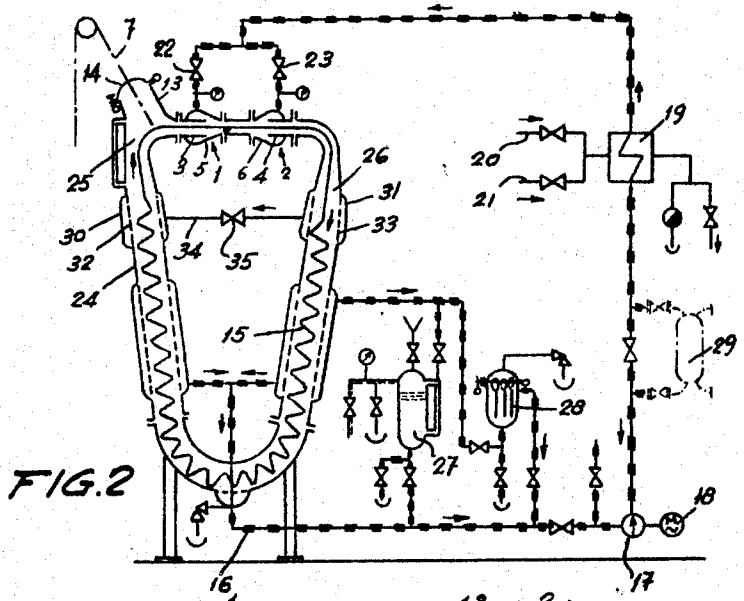

FIG. 2

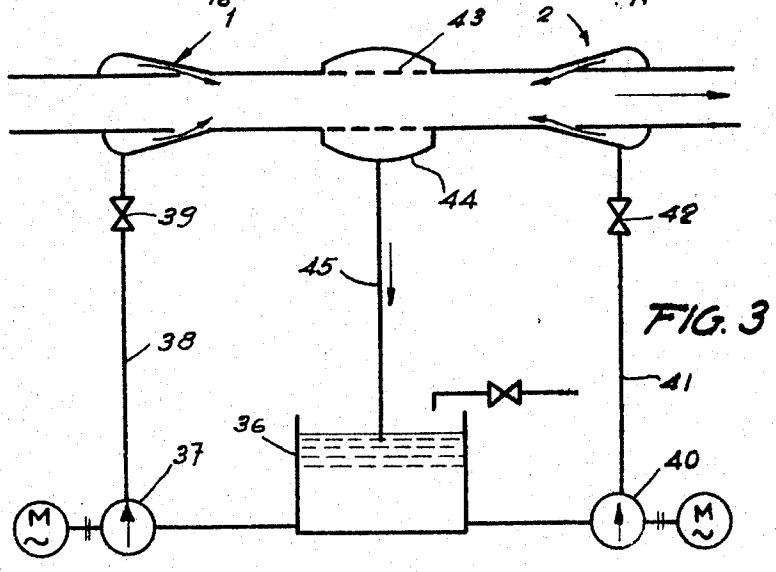

FIG. 3

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DEVICE FOR THE WET TREATMENT OF TEXTILE MATERIALS

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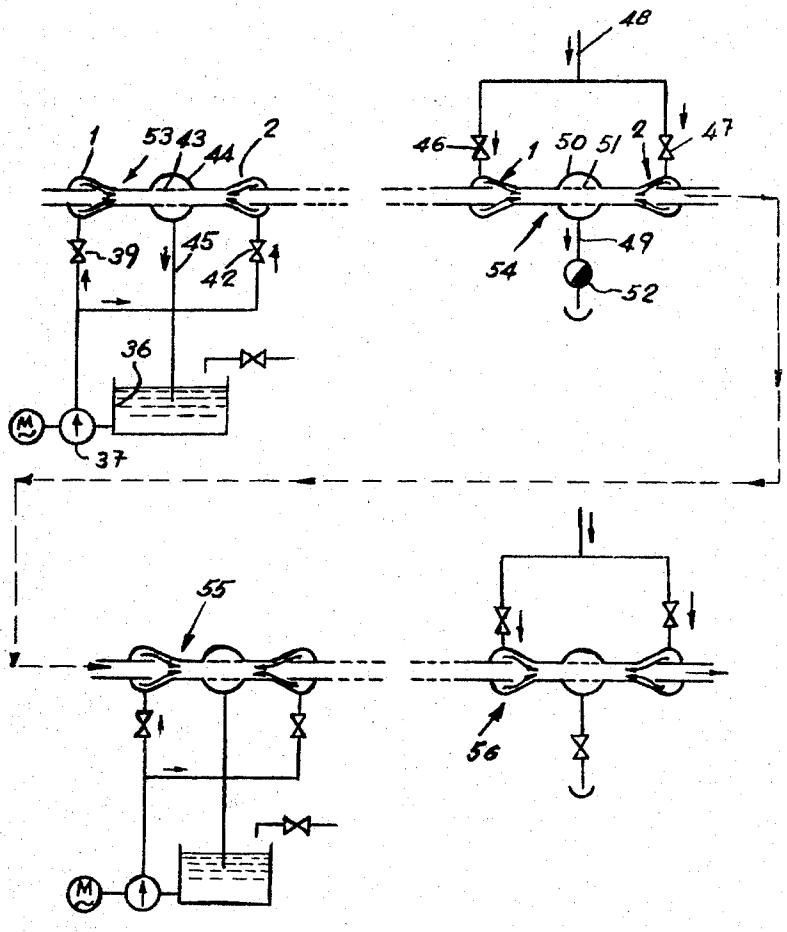

FIG. 5

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DEVICE FOR THE WET TREATMENT OF TEXTILE MATERIALS

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Int. Cl. B05c 3/12, 11/124
U.S. Cl. 68—9 8 Claims

ABSTRACT OF THE DISCLOSURE

Device for the wet treatment of textile materials, such as fabrics in rope form, comprising two Venturi injectors of the central suction type, their relative position being so that their outlets are positioned opposed to each other. The textile material travels in a continuous form through the central suction conduits of the two injectors into the outer conduits of the same where the treatment fluid is injected through regulating devices which permit variation of the fluid flow quantity supplied to each injector between 0% and 100% of the total fluid flow, and, in that way, the suctional power of each injector. This determines the forward feeding of the fabric in the direction which corresponds to the injector with the greater suctional power, and the opposite injector with the smaller drawing power produces a slowing down and compactation effect on the fabric.

The present invention refers to a device for the wet treatment of textile matters, and more strictly speaking, for the treatment of the same in rope form. This permits the application of various wet treatments, such as bleaching, dyeing, etc., in a continuous way, be it at atmospheric pressure, be it at temperatures above 100° C. That way the formation of puckers, and extensions or the lengthening of the fabric which are being produced in the wet treatments, is eliminated, so that the present invention is specially suitable for the wet treatment of synthetic fibre fabrics.

In the art of dyeing fabrics in rope form, the use of one or several injectors injecting the dyeing liquor, and which are arranged in series, is known. These injectors produce the Venturi effect, and assist the forced impregnation of the fabrics in rope form with the dyeing liquor, and at the same time assist the forward stepping movement of the fabric in rope form by aiding the action of the mechanical devices in feeding the fabric, or otherwise, it is exclusively the very injector which causes the forward movement of the fabrics due to its suction effect on same and also due to the suction effect produced by the injected treatment fluid.

Generally speaking, the wet treatment of fabrics in rope form, mainly when carried out at high temperatures, assist in producing puckers and ripples in the fabric, and cause extensions and elongations in the same which originate variations in the fabric texture which the fabric should possess to achieve a perfect finish.

One of the purposes of the device of the present invention, is therefore, to avoid such drawbacks.

The device of the present invention comprises essentially two central suction injectors which inject the treatment bath, arranged opposite each other, i.e., with their outlet mouths disposed in front of each other, and which are provided with means to vary to each injection the fluid flow of

the bath which is injected, from 0% to 100%, independently the one from the other.

By means of this arrangement two effects may be achieved on the fabric in rope form, which effects are very important to succeed in eliminating above cited defects due to puckers and ripples and elongations. The first effect is achieved by having each injector act alone during a determined time period, for instance, of several minutes. This causes the fabric movement to be periodically reversed, thus avoiding the formation of puckers and ripples.

The other effect is achieved by having the two injectors act simultaneously, but by suitably regulating the liquor flow which passes through each of them, so that the fluid quantity from one of the injectors is notably greater than that from the other injector. Thus a relaxation effect of the tensions in the fabric in rope form is obtained, thus preventing the elongation of the fabric. At the same time the fabric in rope form is given a certain compactness, what is very important, especially when dealing with fabrics made of synthetic fibres or of mixtures thereof, to obtain, at suitable moisture and temperature conditions, a better quality of finished product.

At the present time, in order to solve these elongation problems or rather to produce determined effects as to the finish of the fabric due to compactation thereof, precautions must be taken before proceeding to the dyeing process. These precautions consist in performing a compactation which is greater than the required compactation, thus aiming at offsetting the elongations which are inevitably produced in the dyeing process. When using the device of the present invention, these precautions practically become unnecessary, since the above cited compactation occurs during the very dyeing operation as a consequence of the elimination of the tensions due to the elongation and of the turbulence created in the zone next to the fabric by the action of the two opposite injectors. Moreover, a suitable combination of the dynamic fluid pressures at the nozzle mouths of the injectors may cause an energetic compactation. Thus various finishing effects according to the type of the fibres used may be obtained.

The above arrangement of the two opposed counteracting injectors may be applied to the concrete case where endless fabrics in rope form are totally, or not totally, immersed in the dyeing bath, be it in containers which work at atmospheric pressure, or be it in closed containers which operate at temperatures higher than 100° C.

Furthermore, the above cited arrangement of the opposed counteracting injectors permits, on applying it industrially, the treatment of the fabric in rope form in a continuous way, be it a wetting treatment, fulling, degreasing, desizing, bleaching, dyeing, washing, anti-felting treatment, and chemical finishing. It is also feasible to carry out an impregnation with appropriate products in order to perform later a steaming treatment followed by wet chemical developing and washing treatments, including shrinking operations through steaming.

These treatments, made in a continuous way, may include several of above cited operations which are carried out successively and in a continuous way. To this purpose you may arrange, successively and in the necessary numbers, several of those groups made up of two opposed counteracting injectors. Each one of those injector groups may be fed with a determined treatment fluid which may be liquid or in the form of steam or gas.

Finally, the suitable regulation of the fluid quantity injected by the opposite injectors, allows, in addition to making it possible to avoid elongations in the fabric, the varying of the fabric forward stepping speed so as to synchronize the fabric speeds within the totality of the in-

jector groups, i.e., within the injector groups which are arranged in series, as in above case of continuous treatments.

Although it has been indicated that the apparatus which covers the present invention is especially designed for the wet treatment of fabrics in rope form, it may also be successfully applied to the treatment of textile materials in other forms, such as synthetic fibre cables, threads, etc., with all types of gases or liquids.

The device of the present invention will now be described in more detail with reference to the enclosed drawings in which several embodiments are shown.

In these drawings:

FIG. 1 shows a schematical view of a device according to the present invention, for the wet treatment of fabrics in rope form, in an open container.

FIG. 2 shows a schematical view of another embodiment of the present invention, for the wet treatment of fabrics in rope form, in a closed container.

FIG. 3 shows, also schematically, an arrangement for the continuous treatment of a fabric by means of liquids.

FIG. 4, in turn, shows another diagram of a treatment arrangement, which is similar to the one shown in the foregoing figure, but it is designed to operate with fluids which are in the state of vapour, steam or gas phase.

FIG. 5 shows a general diagram of a treatment installation composed of several treatment modules such as those of the FIGS. 3 and 4, in order to carry out many successive and continuous treatment operations as above explained.

The essential feature of the device, which is the subject of the present invention, consists in the way of arranging two Venturi injectors **1** and **2**, where the suction effect takes place along their central tubing **3** and **4**, respectively. Such suction effect is caused by the injection of a fluid under pressure into their respective outer conduits **5** and **6**, where the injectors are positioned in opposite directions, i.e., with their mouths in front of each other, and are provided with means for individually adjusting the flow quantities of the treatment fluid which pass through each one of them, between 0% and 100% of the total fluid flow.

The textile material which has to undergo a continuous treatment, for instance a fabric **7** arranged in rope form, is caused to pass through the suction tubes **3** and **4** of the two injectors **1** and **2** which are placed in position opposite each other. The flow of the treatment fluids injected into each one of the injectors is suitably adjusted so that the difference between the dynamic pressures created by their opposing suctional effects caused in the one or other injector on the fabric **7** produces a movement of same in the direction in which the treatment liquor is injected with the higher pressure, while the action of the injector in front is to produce a relaxation effect on the tensions created in the fabric by the first injector.

In the instance of embodiment shown in FIG. **1**, the usage of above described contrivance is depicted for the treatment of fabrics in rope form, with endless arrangement, by means of a treatment bath disposed in an open container, i.e., working at atmospheric pressure and, therefor, not passing beyond the boiling temperature of the liquor at normal pressure.

From FIG. 1 it is to be seen that the treatment container or tank **8** is open and has the general shape of a U. At each of the ends of the two arms of the U there are bends **9** and **10**, which, extend from a point beneath the treatment liquor level **11** in the container **8** and terminate with their ends being positioned opposite each other at a certain distance, thus constituting the central suction tubes **3** and **4** of the two injectors **1** and **2**, each of the respective injection conduits of which is made up of outer casings which are joined with each other by an intermediate tubing segment **12**. Furthermore, bend **9** has an opening **13** at its top, provided with

a hermetic closing flange **14** which serves for the introduction and extraction of the rope-shaped fabric **7**, which after having been made to pass through the above cited suction conduits of the injectors is joined at its ends to form an endless fabric rope which settles down in the interior of container **8** forming folds **15**.

The treatment bath contained in the container **8** is made to flow within a closed circuit, and is extracted out of the container **8** by means of a pump **17** which is driven by an electric motor. The treatment bath is thus caused to flow through a heat exchanger **19** which is provided with inlet pipes for admitting in steam for heating, and cold water for cooling. Then the treatment liquor is injected into the two outer conduits **5** and **6** of both injectors, of course, having first passed through each controlling valve **22** and **23**.

The dyeing bath or any other treatment liquor which, as it has been said, is impelled by the pump **17** reaches the injectors **1** and **2**, and the ratio of their flow quantities is controlled at will by means of the respective controlling valves **22** and **23**. Thus, suction strengths proportional to those flow quantities are created in the corresponding central injector conduits **3** and **4**. Assuming that the controlling valve **22** is opened and the controlling valve **23** is closed, then only in injector **1** will be produced a suction effect while injector **2** will remain inactive, so the fabric rope **7** will be impelled forward in a clockwise direction, while it will move in a counterclockwise direction if the controlling valve **22** is closed and the controlling valve **23** opened. But if both controlling valves **22** and **23** are opened at the same time so that the treatment bath flow quantity which reaches injector **1** is several times larger than that reaching injector **2**, then the fabric rope **7** will be moved forward in a clockwise direction, but will undergo a slowing down action on passing through the second injector **2**, whereby elongation of the fabric will be avoided and a compactation effect will be produced.

The device shown in FIG. 2 is similar to the one which has been just described, the difference being that the treatment container **24** is closed, so that pressures higher than atmospheric pressure may be reached, and, therefore, it is possible to work at high temperatures. In this device, the ends of the two arms of the U-shaped container are joined, thus a sole tightly closed enclosure is formed with the bends **25** and **26**. Besides the pump **17** and the heat exchanger **19**, the closed treatment bath circulation circuit comprises an expansion vessel and, preferably, a device **28** for extracting samples so as to enable one to carry out exact treatment control, and, finally, a mixing vessel **29** to allow two similar devices to work simultaneously together and to reach a perfect equalization in the treatment effects in both devices.

Since the remaining elements pertaining to this treatment device are equivalent to those of the treatment device shown in FIG. 1, the same reference numbers as used in this figure, are being used.

When the container **24** of this embodiment of the wet treatment device is closed, the treatment bath may cover the inlet opening of the injectors, so that the action thereof may produce a compound suction effect, i.e., not only on the fabric but also on part of a flow quantity which is a function of the injector nozzle diameter.

So it would result that the flow quantity of the treatment liquor at the injector outlets would be the sum made up of the flow quantity supplied to same by the injection pump **17** plus the liquor quantity sucked in with the fabric **7**. The total fluid flow might thus reach such an excessive magnitude that proper operation of the device might be harmed.

At first, if the fluid flow resulting out of the sum made up of the injected fluid and the fluid sucked in were of high magnitude, an excessive movement of the fabric accumulated in the fabric folds **15** and inside the container **24** of the device would be produced, since only part

of this fluid flow, i.e. that of the injected liquor, is sucked in by the pump **17** which is inserted in the circulation circuit of the liquor, and therefore the impelling action produced the sucked liquor persists.

On the other hand, the suction effect produced at the inlet of injector **1** would strengthen the above cited effect, thus a disorder in the folds **15** of the textile material might take place with the resultant formation of knots, which might cause the stoppage of the fabric and the subsequent production of puckers and ripples, and the treatment would lack uniformity.

Furthermore, in order to avoid the effects of such compound suction the wet treatment device shown in FIG. 2 carries a shunt pipe **34** in which an adjustable by-pass valve **35** is inserted between two points of that device which are near to the outlet of injector **2** and to the inlet of injector **1**, across the jackets **30** and **31** of the one and other arm of the wet treatment device.

With this shunt pipe **34** a direct passage for that portion of the treatment bath which is sucked in by the injector **1** is established, and this passage may be adjusted according to the treatment liquid quantity sucked in by suitably adjusting the by-pass valve **35**. In this way, the portion of the treatment bath sucked in by the injector **1** circulates directly between the injector **2** and injector **1**. Thus the influence of that portion of the treatment bath on the movement of the folds **15** of the fabric accumulated within the wet treatment device is avoided, and the folds are solely subjected to the action of the treatment fluid which flows through the treatment bath circuit **16**.

In order to apply the wet treatment device, which is the subject of this invention, to the continuous treatment of a textile material requiring several successive operations with liquids or gases, various treatment modules such as shown in FIG. 3 when the treatment fluid is a liquid, or such as shown in FIG. 4 when the treatment fluid is a gas, or a vapour or steam, are used.

The treatment module shown in FIG. 3 comprises two injectors **1** and **2**, which are positioned in opposite directions in the way above described. The tank **36** is filled with the treatment bath. The treatment bath is impelled by the pump **37** towards the injector **1** passing through the pipe **38** and the valve **39**, and by the pump **40** towards the opposite injector **2** passing, in turn, through the pipe **41** and the valve **42**. Between the injectors which are positioned in front of each other, there is a perforated zone **43** which is surrounded by a collecting chamber **44** from which the treatment bath flows back through the return pipe **45** into the tank **36**.

The module shown in FIG. 4 is of a similar construction, but is meant to perform the treatment by means of fluids in vapour or steam or gas form. In this module, each injector **1** and **2** receives the gaseous fluid at a preset ratio, through the respective adjusting valves **46** and **47** of the pipe **48**. The pipe **48** comes from a tank which is filled with gaseous fluid under pressure, and the pipe **49** which comes out of the chamber **50** which surrounds the perforated zone **51** which is located between both injectors is provided with a scavenger **52** which eliminates the condensate.

At last, FIG. 5 shows an instance of an embodiment of a continuous thread bleaching plant where the cited thread, after having been fed into the system, is passed through a first impregnation module **53** similar to that in FIG. 3, comprising the two injectors **1** and **2**, a return pipe for the return of the residual bath to the tank **36** containing the impregnation liquid, an adjusting system for the regulation of the liquid flow into the opposite injectors and means of dosification to ensure the quantity and concentration of the impregnation bath, and a bath temperature adjusting system, not shown in the drawing, as well.

Subsequently, the continuous thread is passed through a vapourization module **54** similar to that one in FIG. 4, likewise provided with a set of opposed injectors **1** and **2** the purpose of which is to detach the oxidizing product and to release the suitable reaction to have the thread bleached.

Several washing modules or sets **55** are subsequently inserted, the purpose of which are to eliminate and neutralize in a contraflow the bleaching products. Finally, the thread is passed through a drying modulus **56** where the moisture in the thread is eliminated by using compressed air. Then comes a finishing drying operation by means of a number of hot air drying units and of a final winding operation.

It is obvious that above described operational system can be adapted to multiple threads or twines as well. They would be treated in multiple injector group lines where all the lines would be fed by the same pump groups, the same tanks and automatic devices, they would undergo the same steaming and washing operations. They would be dried in hot air drying units which receive the hot air from the same hot air supply source, and there would be the final winding process.

The performance of continuous operations on fabrics may also be done, in accordance with the present invention, on synthetic fibre cables, threads, twines and fabrics, using any sort of gases or liquids.

I claim:

1. A treatment device for the treatment of textile materials with a treatment fluid, said device comprising first and second Venturi injectors of the central suction type, each of said injectors having an inner conduit and an outer conduit surrounding said inner conduit, said injectors being mounted with the outlets thereof opposed and the outer conduits thereof joined to form a connecting section; first means to supply said treatment fluid through said outer conduit of said first injector into said connecting section to create suction in said inner conduit of said first injector; second means to supply said treatment fluid through said outer conduit of said second injector into said connecting section in opposition to said treatment fluid through said first injector to create suction in said inner conduit of said second injector; means to pass said textile material through said inner conduits of said first and second injectors and said connecting section; and means to individually regulate said first and second supply means to selectively control the total amount of said treatment fluid supplied to each of said injectors from 0 to 100%.

2. A device as claimed in claim **1**, further comprising a U-shaped tank open to the atmosphere, said treatment fluid being a liquid and being stored in said tank, the inner conduits of each of said injectors being bent and positioned such that the open ends thereof are below the upper level of said treatment fluid in said tank.

3. A device as claimed in claim **2**, wherein said first and second supply means are part of a fluid circulation circuit leading from said tank to said outer conduits, and said circuit further includes means for controlling the temperature of said fluid.

4. A device as claimed in claim **1**, further comprising a U-shaped tank closed to the atmosphere, the free ends of said inner conduits of each of said injectors being sealingly attached to communicate with said tank.

5. A device as claimed in claim **4**, further comprising a shunt line connecting the two legs of said U-shaped tank to provide passage therebetween of said treatment fluid.

6. A device as claimed in claim **5**, further comprising a control valve positioned in said shunt line.

7. A device as claimed in claim **4**, wherein said first and second supply means are part of a fluid circulation circuit leading from said tank to said outer conduits and said circuit further includes means for controlling the temperature of said fluid.

8. A device as claimed in claim **1**, employed in a continuous system for performing a plurality of fluid treatments on said textile materials, said system including a

plurality of said devices, and means for continuously conveying said textile materials successively through said plurality of devices.

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68—5 D, 177, 184, DIG 1