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(54) Method and apparatus for continuous treatment of textiles.

(57) The method is performed within a single chamber in the inside of which the fabric is continuously moved. The application of the treatment agents is performed by making use of "polyfunctional fluids" or instantaneous transit, violent reaction ccompounds, and each said fluids includes a component for contributing the chemical energy agents and a component for contributing the kinetic and thermal energies to draw the previous components onto the fabric and make them to react. Both components are carried in suitable fluids, and the process conditions are elected such that the resulting liquid product amounts are just the amounts suitable to carry the reagents to the desired depth in the fabric, and the energy levels enough to perform the application and the reactions without harm to the fabric.

The apparatus comprises a single chamber having therein a series of return cylinders (7, 8) for conducting the fabric, and double action injectors (9) for the several fluids, arranged at the location of the said cylinders. The apparatus may comprise fabric input and output devices with seals to permit a superpressure to be created within the chamber; the output sealing device may be a hydraulic dam containing a bath that can be used for a final treatment of the fabric.

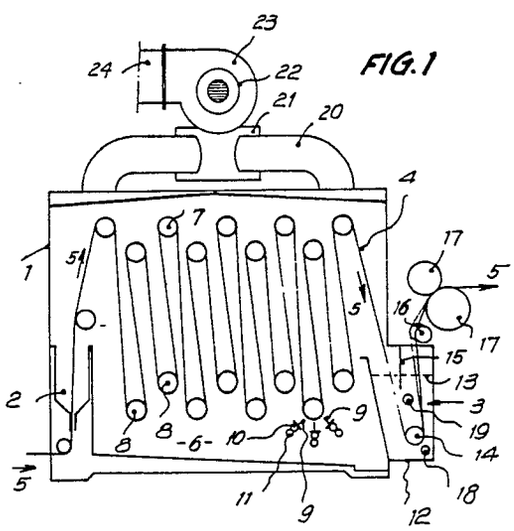

FIG.1

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METHOD AND APPARATUS FOR CONTINUOUS TREATMENT OF TEXTILES

The present invention relates to a method for continuously treating textile materials in general.

In the present specification, specific reference will be made to the treatment of roll or piece fabrics and clothes, though it is to be understood that the invention is likewise applicable to other textile materials which are not in this particular physical form, such as weaves, felts and the like, as well as to other non textile materials which are adapted to be under the form of continuous flat sheets, such as papers or plastics. In a similar manner, in the following description reference will be made, for the sake of an easy exposition, to fabric bleaching or decolorizing, though it is obvious, as it will appear from the following specification, that the principles of the present invention can be used, with the suitable variants in each case, also to other usual treatments of the said materials.

BACKGROUND OF THE INVENTION

The known bleaching and dyeing methods essentially comprise one or several successive immersions of the fabric with the treatment agents of each particular case, and a further reaction phase which may be as thermal energy contribution in the form of steam, or as a rest at ambient temperature during a rather extended time. At any rate, the time required for such treatments is rather lengthy, either in view of the long cold reaction period in the rest methods, or to the unavoidable waiting times between the immersions and the treatment phases. On the other hand, owing to the said waiting times, it is necessary to add stabilizing agents to the treatment baths to prevent decomposition of the treatment substances. These stabilizing agents in turn stop down the reagent activity and lead to a part of same being lost because of becoming unable to react.

DESCRIPTION OF THE INVENTION

The present invention removes the above drawbacks of the previous art procedures and provides a new method for the continuous treatment of textile materials as specified above, by moving the material through the inside of a treatment chamber along a path defined by return rollers, the material being subjected within the said chamber to the action of one or several treatment agents which are reactive with one another and/or with the material, and to one or several contributions of kinetic and thermal energies to give raise to the said reactions, the method being characterized in that:

- application of the treatment and thermal energy carrying agents is performed by pressure projecting or injecting polyfunctional fluids or instantaneous transit, violent reaction compounds against one or both material faces, each said fluids being constituted of a component carrying the kinetic and thermal energies, and a component carrying at least one treatment agent,
- the treatment and kinetic and thermal energy carrying components are contributed to the material in the proportions which are just necesary to complete the foreseen reactions,
- carrier components for the treatment and energy contribution components are applied to the material in proportions suitable for carrying the reactive components and the energies to the desired depth within the material thickens,

such that a reaction takes place in situ and instan taneously, of the reagents within the material to be treated, with the maximum performances of the said reagents and energies.

According to the main feature of the present invention, all of the contributions of treatment agents and thermal energy are performed directly against whichever faces of the material, to advantage over return rollers or cylinders, by means of projection devices placed very near to the said material face. It is thus attained that a series of different treatments can be performed within one and the same chamber in extremely short periods, and a considerable spare is performed as it is not necessary to perform treatments in separate chambers with the associated intermediate cooling and soaking operations.

The invention extends as well to an apparatus for carrying into practice the above defined method, comprising a treatment chamber with continuous material input and output means, and means for conducting the said material through the inside of the chamber across one or several treatment stations. The machine is characterized in that

- at least one treatment station comprises one or several projecting devices for the treatment agents and extending along the whole width of the material to be treated, arranged to project one or several polyfunctional compounds, as defined above, against at least one of the material faces,
- each polyfunctional compound comprises at least one kinetic and thermal energy contribution component, and
- the projecting devices are connected to impeller and dosing means for feeding the polyfunctional fluid components in the necessary relative proportions to carry the reactive agents to the desired depth within the material thickness,

such that a reaction takes place in situ and instantaneously of the reagents with one another and/or with the material, with the maximum performances of the chemical, kinetic and thermal energies.

Whatever gas or vapor heated to a temperature of from ambient temperature to some 300° C, preferably between 80 and 250° C, such as water or steam, can be used as the kinetic and thermal energies contributing fluid. Such fluids may show a vapour contents of the carrier liquid for the energy contributions, of up to a supersaturation of the contribution fluid, preferably between conditions of saturated vapor to superheated vapor. In this later instance, the moisture contents may be any under the 100 % saturation value, and at any rate small enough such as to permit eventual evaporation of a liquid constituting the chemical contribution agent carrier.

The liquids from which the thermal contribution fluid is formed and the liquid containing the chemical contribution fluid may be different, or preferably the same, water being used as the main support for these fluids. Thus, the chemical contribution fluid may be selected from gases, liquids, solids and the physical combinations of same, and in either case the fluid may be carried in a carrier liquid which, in turn, may be the thermal contribution support itself. To advantage, the chemical contribution fluid is a gas or a solution, dispersion or emulsion of the appropriate reagent in a liquid vehicle having a boiling temperature of between 60 and 250° C, preferably between 80 and 150° C.

According to a further feature of the invention it is possible to make for the kinetic and thermal energies contribution fluid to contain vapour of the same liquid used as a vehicle for the chemical treatment agents, and this in a proportion located under the saturation point, and at temperatures higher that the boiling point of the said liquid.

In this context, the temperature of the thermal energy contributing fluid is preferably selected such that it makes possible an spontaneous evaporation of the liquid used as a vehicle or carrier for the chemical contribution fluids, in order to attain a suitable concentration of the chemical energy contribution agents onto the material, and fast reactions, to advantage instantaneous, of the said agents with one another and/or with the material or substrate. Preferably, the moisture contents, the temperature and the kinetic energy are controlled such that they are enough to provide the evaporation of the chemical contribution carrier, and give to the ensemble a thermal energy level enough to give a fast chemical reaction of the chemical contribution agents with one another and/or with the textile material.

In some methods according to the invention, the textile material may be subjected to several successive applications of polyfunctional fluids during its travel through one single treatment chamber, so that the textile material is subjected to successive and different treatments.

In contrast with the known chamber performed treatment methods, wherein each treatment is to be performed within a chamber the volume of which is held full with a treatment fluid, generally steam, the method according to the invention can be conducted within a single chamber in the inside of which several different and successive treatments may be effected because the contributions of the several components intervening in the said treatments are performed directly in situ, onto or into the fabric material. Accordingly, the chamber can be merely designed as a housing to isolate the treatments as regards the outer atmosphere, there being no need to provide for a given energy consumption for holding the inside of the chamber to a given conditioning level, as is the case with the known practice.

BRIEF DESCRIPTION OF THE DRAWINGS

The enclosed drawings show an apparatus for carrying into practice and method according to the invention, only by way of a not restrictive example and wherein:

Figure 1 is a longitudinal elevation section of the apparatus, and

Figure 2 is an upper plan view of the apparatus, with a part thereof removed to expose the inside of the treatment chamber.

DESCRIPTION OF A PREFERRED EMBODIMENT

The method according to the invention will now be described with more detail having reference to the working mode of the apparatus.

As may be seen in the Figures, the apparatus comprises a generally cubic box 1 having input devices 2 and output devices 3, for a fabric 4 which is to be hand-led therein and, accordingly, is moved in the direction as indicated by arrows 5.

The inside 6 of box 1 constitutes the treatment chamber for the fabric or material 4, this latter being guided through a long path within the box, by means of successive rollers or cylinders 7,8 alternately arranged at two different, respectively upper and lower levels. These rollers, or some of them, are connected through suitable gearings with driving means provided with speed regulating means of a conventional type, not shown, to draw the fabric 4 with the speed required for the treatments to be performed. Means for applying the treatment agents for the fabric 4, are located by the cylinders 7,8 and indicated generally with 9; these means will be described further on.

In contrast with methods and apparatus of the previous art for the continuous treatment of fabrics, wherein the treatment agents, usually contained in the bottom of the chamber which is thus developed as a tub, are projected to the fabric at the chamber upper portion, approximately at the location of the upper rollers. and cascades along the fabric upright runs to be thereafter collected in the lower tub, the application of the treatment agents in the method and the apparatus according to the invention is performed in an essentially dry mode, with little or not at all flow of fluids towards the chamber bottom, by making use of the new concept of "polyfunctional fluids" simultaneously contributing the chemical, kinetic and thermal energies in the amounts which are just necessary to soak the material and perform therein the envisaged reactions.

The means 9 for applying the treatment agents are constituted by double action injectors adapted to provide jets or any suitable shape, between circular and flat shapes, and arranged to fall upon the whole width of the fabric 4. The polyfunctional fluids sprayed by the injectors 9 and their interactions with the fabric or material are in accordance with the features described in the introduction. The strength of the reagent or reagents in the chemical contribution fluid is calculated according to the product strength over the weight unit of fabric to be treated, which is a function of the fabric traveling speed through the treatment chamber, as well as a function of the amounts of fluid which are to be applied thereto in either case.

The polyfunctional fluid can as well be gen erated starting from a chemical contribution component which, on being heated, is adapted to generate a thermal contribution phase which, through physical means and mixed with the original chemical contribution fluid, builds up with this later the polyfunctional fluid according to the invention. Thus the double action injectors 9 are fed with the chemical contribution component through ducting 10 from tanks, not shown, wherein the previously prepared, chemical contribution component is stored; such tanks, as it is appreciated, do not require to have the great volumetric proportions which are common in the previous art procedures.

The kinetic and thermal energy contributing component, for example steam at a temperature selected in accordance with the previous specifications, is fed to the very double action injectors 9 or to adjacent injectors, not shown, by means of ducting 11 derived from a steam network generally present in the plants of the art to which the present invention appertains. The flow rates and pressures at which both components are fed to the injectors, are preferably regulated such as to adapt the mixture proportions to the features of the material being treated.

In a variation of the method, the admixture of both polyfunctional fluid components may be performed in prechambers with no pressure or with a light superpressure, the admixture being thereafter compressed such that the necessary pressure for obtaining a desired penetration, is attained at the instant of the application of the fluid onto the fabric.

As indicated in the preamble, the reactions take place, according to the invention, in an essentially instantaneous mode. Thus, whereas nothing prevents from using the double action injectors 9 of all of the cylinders to project one and the same polyfunctional fluid, the injectors of each cylinder may be used to project polyfunctional agents corresponding to different treatments. For example, the functional assemblies of the several cylinders could be fed with the chemical and energetic contributions necessary to perform all of the several operations of a treatment for bleaching and whitening fabrics which, in this way would become finished in a single pass through the apparatus shown.

For example, such a treatment may be performed by using a chemical contribution component having the composition:

Caustic soda, 48° Bè	240,0 cl
Moistener - detergent(1)	40,0 g
Stabilizer(2)	40,0 cl
Sodium silicate	8,0 cl
Potassium persulfate	20,0 g
Ca, Mg, Fe ion sequestrating agent	2,0 g
Hydrogen peroxide, 200 vol.	120,0 cl

wherein all of the values are referred to 1 liter of water.

The application is performed with a component ratio corresponding to 75 to 80 % dry weight of the dry fabric. The energy requirements are contributed as saturated steam at 3 Bar, such that the whole is applied under a pressure of 2 Bar.

This treatment may be performed at only one of the apparatus upper cylinders and, if desired, may be followed by a similar treatment, performed in the same conditions as above at the second cylinder, making use of the composition:

Caustic soda, 48° Bè	120,0 cl
Moistener - detergent(1)	20,0 g
Stabilizing agent(2)	20,0 cl
Sodium silicate	4,0 cl
Potassium persulfate	8,0 g
Ca, Mg, Fe ions sequestering agent	1,0 g
Oxygen peroxide, 200 vol.	60,0 cl
Optic brightener	2,0 g,

wherein all of the values are referred to 1 liter of water.

In both formulations, the moistener (1) may be anysuitable product available in the market and complying with the required features for a suitable formulation. Making use of the two above formulations, in the described manner, particularly good results have been obtained with a residence time of about 20 seconds in the ensemble of the two operations.

Whereas the composition of the second bath has a minimal difference as to the persulfate contents, this must not be understood such that the successive treatments in steps of the procedure following to one another must be more or less similar. In fact, in accordance with the above specifications, and this constitutes one of the important advantages of the present invention, thoroughly different treatments can be developed at successive stages or cylinders and which, while they are thoroughly compatible in accordance with the invention, they would be unimaginable at all in the field of the known treatment techniques. It is also to note that, except for the small difference as quoted above, the second composition has a strength of about one half that of the first one. When it is necessary, in the known art plants, to perform successive treatments in which only the reagent strength does change, it is necessary for the two baths to be separately prepared with the respective strengths, and to use each bath at its pertinent instant or phase. According to the invention, on the contrary, it is possible to start from a single original bath having the higher necessary strength, or even a further higher strength, thus forming sort of a replenishing bath from which it is possible to arrive to any lower strength, on its application to the fabric, by merely varying the pressure and flow rate parameters intervening in the feeds for the double action injectors 9, indeed instantaneously and in situ. On the other hand, such a regulation is particularly adapted to be mastered by microprocessor.

The temperature at the inside of the chamber 6 my be different to that under which the polyfunctional fluids are applied. In the case of endothermic reactions it may be of advantage to keep the chamber temperature under the reaction temperature with the aim of exactly controlling the desired reaction times. When it is necessary to perform a heating of the chamber, this may be performed by taking the more from the proper heat of the thermal energy component, suitably overdimensionated the case arising, or by means of additional heat contributions by conventional means.

The admixture proportions of the polyfunctional fluids may be regulated on the basis of a detection of physical parameters on the fabric, either before, during or after either treatment. Specially suitable parameters for such regulations are temperatures and temperature gradients at several locations of the fabric, moisture contents and moisture content gradients at several places of same, as an indicator of the

presence of reagents or of an excess development of reagents, such as O_2. The data obtained by means of such detections can be dealt with by microprocessors to convert them in commands for regulating the fabric traveling speed, the polyfunctional fluids flow rates, the proportions of the components in these latter, etc.

In the embodiment shown, the input to the chamber 6 is closed by merely a conventional thermal dam 2. At the output end there is provided the hydraulic dam device 3, constituted by a tank 12 containing a liquid 13, a plunger inverter roller 14 for the fabric, and a bridge screen 15 the lower edge of which plunges into the liquid, thus separating the inside of chamber 6 from the outer atmosphere. The fabric is passed through the device as shown and is guided outside by a guide roller 16 and a pair of squeezing rollers 17, and thereafter passed to the following fabric handling stage.

The bath formed by the liquid 13 may be used to effect a washing of the fabric, for example to remove cotton sizing waxes, provided it is heated to a suitable temperature by means of a live steam input 18, and renewed by means of a fresh water input 19.

The ventilating ducts 20 having their openings distributed through the chamber 6 ceiling, converge into a collector 21 joined by a duct 22 to the drawing side of a radial impeller 23 allowing the gases and vapours generated during the treatment reactions to be discharged through ducting 24 to a dispensing off or recovering plant.

It appears from the above that the invention attains the above objects and advantages. Further, it can be said that owing to the absence of high squeezing ratio foulard units, the fabric is not crushed, which is of particular advantage in most cases. Also, in the case of cotton fabrics, the invention thoroughly eliminates the impurities called "tobacco" and permits to reach white levels equivalent to those resulting from the lengthy in dustrial processes of the known art.

Claims

1. A method for the continuous treatment of textile materials as specified above, by moving the material through the inside of a chamber along a path defined by return rollers, the material being subjected within the said chamber to the action of one or several treatment agents which are reactive with one another and/or with the material, and to one or several contributions of kinetic and thermal energies to give raise to the said reactions, the method being characterized in that:
- application of the treatment and thermal energy carrying agents is performed by pressure projecting or injecting against one or both material faces, polyfunctional fluids or instantaneous transit, violent reaction ccompounds constituted, each, of a component carrying the kinetic and thermal energies, and a component carrying at least one treatment agent,
- the treatment and kinetic and thermal energy carrying components are contributed to the material in the proportions which are just necessary to complete the foreseen reactions, and
- carrier components for the treatment and energy contributing components are contributed to the material in proportions suitable for carrying the reactive components and the energies to the desired depth within the material thicKness,
such that a reaction takes place in situ and instantaneously, of the reagents within the material to be treated, with the maximum performances of the said reagents and energies.

2. A method according to claim 1, charac terized in that the kinetic and thermal energies contributing fluid is selected from gases and vapours heated to temperatures of between the ambient temperature and about 300 ° C.

3. A method according to claim 2, characterized in that the kinetic and thermal energies contributing fluid is selected from gases and vapours heated to temperatures of between about 80 and 250 ° C.

4. A method according to claims 1 and 2, characterized in that the kinetic and/or thermal energies contribution fluid is water or steam.

5. A method according to any of the preceding claims, characterized in that the kinetic and/or thermal energies contribution fluid includes some contents of the vapour of the liquid forming it, comprised between 0 % and up to supersaturation of the thermal contributing fluid.

6. A method according to claims 1 and 5, characterized in that the kinetic and/or thermal energies contribution fluid includes a contents of the vapour of the liquid forming it, ranging from saturated vapour and overheated vapour conditions.

7. A method according to any of the preceding claims, characterized in that the moisture contents of the kinetic and/or thermal energies contribution fluid is lower than 100 % saturation.

8. A method according to claims 1 and 7, characterized in that the moisture contents of the kinetic and/or thermal energies contribution fluid is small enough such as to allow evaporation of a liquid carrier for the chemical contributing fluid.

9. A method according to any of the preceding claims, characterized in that the chemical contribution fluid is elected from between gases, liquids, solids and physical combinations of liquids and solids.

10. A method according to claims 1 and 9, characterized in that the chemical contribution fluid is drawn in a carrier liquid.

11. A method according to claims 1, 9 and 10, characterized in that the chemical contribution fluid is a gas or a solution, dispersion or emulsion of the pertinent reagent in a liquid carrier having a boiling point of between 60 and 250 ° C.

12. A method according to claims 1, 9, 10 and 11, characterized in that the chemical contribution fluid is a gas or a solution, dispersion or emulsion of the pertinent reagent in a liquid carrier having a boiling point of between 80 and 150 ° C.

13. A method according to any of the preceding claims, characterized in that the chemical and thermal energies contribution field includes vapour of the same liquid carrier of the chemical contribution, in amount corresponding to a proportion placed under the boiling point of the said liquid carrier.

14. A method according to claims 1 and 13, characterized in that the temperature of the thermal energy contribution fluid is selected such that it permits an spontaneous evaporation of the liquid vehicle for the chemical contribution fluid or fluids, to reach a suitable strength of chemical contribution agent on the fabric and the rapid or instantaneous reactions with one another and/or with the fabric.

15. A method according to any of the preceding claims, characterized in that the moisture contents, the temperature and the kinetic energy are controlled so as to be high enough to provide for evaporation of the chemical contribution carrier fluid, and to impart the ensemble thermal energy level high enough to perform an accelerated chemical reaction between the product and/or the contributed chemicals and/or the fabric.

16. A method according to any of the preceding claims, characterized in that the fabric is subjected to several polyfunctional fluid applications during its traveling through the single treatment chamber, so that successive and different fabric treatments are performed thereon.

17. A method according to one of claims 1 and 16, characterized in that at least one reagent of the chemical contribution fluids reacts with at least one reagent contributed by the polyfunctional fluids which are applied to the fabric in preceding stations or stages within the single treatment chamber.

18. Apparatus for the continuous treatment of fabrics, for performing the method according to the preceding claims, comprising a treatment chamber with continuous material input and output means, and means for conducting the said material through the inside of the chamber across one or several treatment stations, characterized in that:

- at least one treatment station comprises one or several projecting devices for the treatment agents and extending along the whole width of the material to be treated, arranged to project one or several polyfunctional compounds, as defined above, against at least one of the material faces,
- each of the polyfunctional compound comprises at least one chemical energy contribution compound and at least one kinetic and thermal energy contributing component, and
- the projecting devices are connected to impeller and dosing means for feeding the polyfunctional fluid components in the necessary relative proportions to carry the reactive agents to the desired depth within the material thickness,

such that a reaction takes place in situ and instantaneously of the reagents with one another and/or with the material, with the maximum performances of the chemical, kinetic and thermal energies.

19. An apparatus according to claim 18, characterized in that the projection devices comprise one or several transversal conduits formed with double action injectors which are directed towards the fabric and have discharge openings arranged to give laminar, conical or fan-like jets which are mutually overlapped.

20. An apparatus according to claim 18 and 19, characterized in that the transversal conduits are connected to a source of a fluid constituting the energy contribution component, through a pressure regulating device.

21. An apparatus according to claim 18 and 20, characterized in that the fluid constituting the energy contribution component is overheated steam.

22. An apparatus according to any of claims 18 to 21, characterized in that the projecting devices of several treatment stations are arranged satellite wise about a portion of the lateral surface of corresponding cylinders and over the whole length of these latter, about which the fabric passes in succession, so that different fabric treatments can be performed in successive stations.

23. An apparatus according to any of claims 18 to 22, characterized in that the treatment chamber has external heating means to avoid moisture condensations on its inner walls.

24. An apparatus according to any of claims 18 to 23, characterized in that it comprises means for restricting the O_2 contents within the chamber.

25. An apparatus according to any of claims 18 to 24, characterized in that the fabric input and output means to the chamber include sealing devices to permit a superpressure to be created within the chamber.

26. An apparatus according to claims 18 and 25, characterized in that the sealing devices are of the Foulard type.

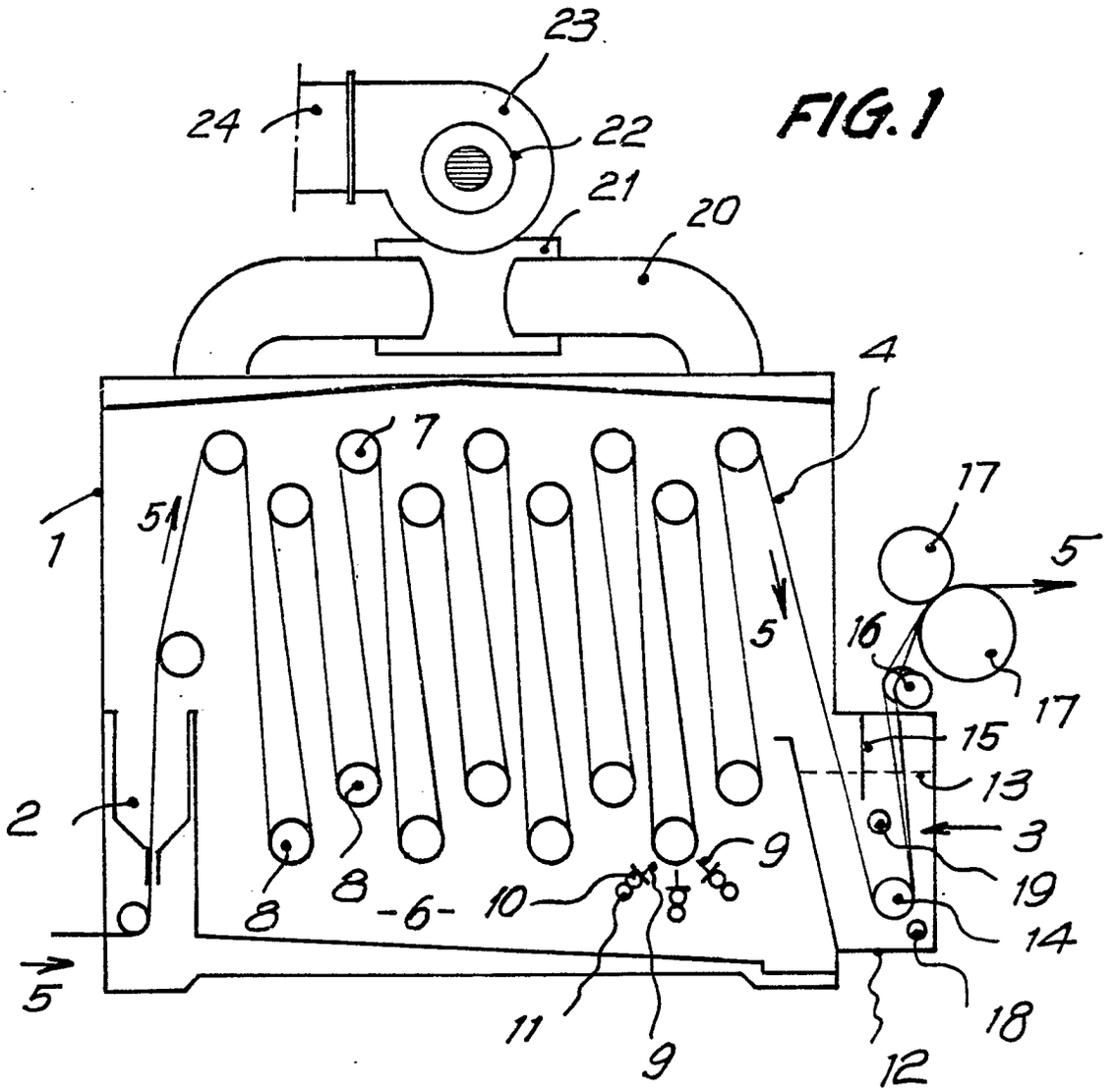
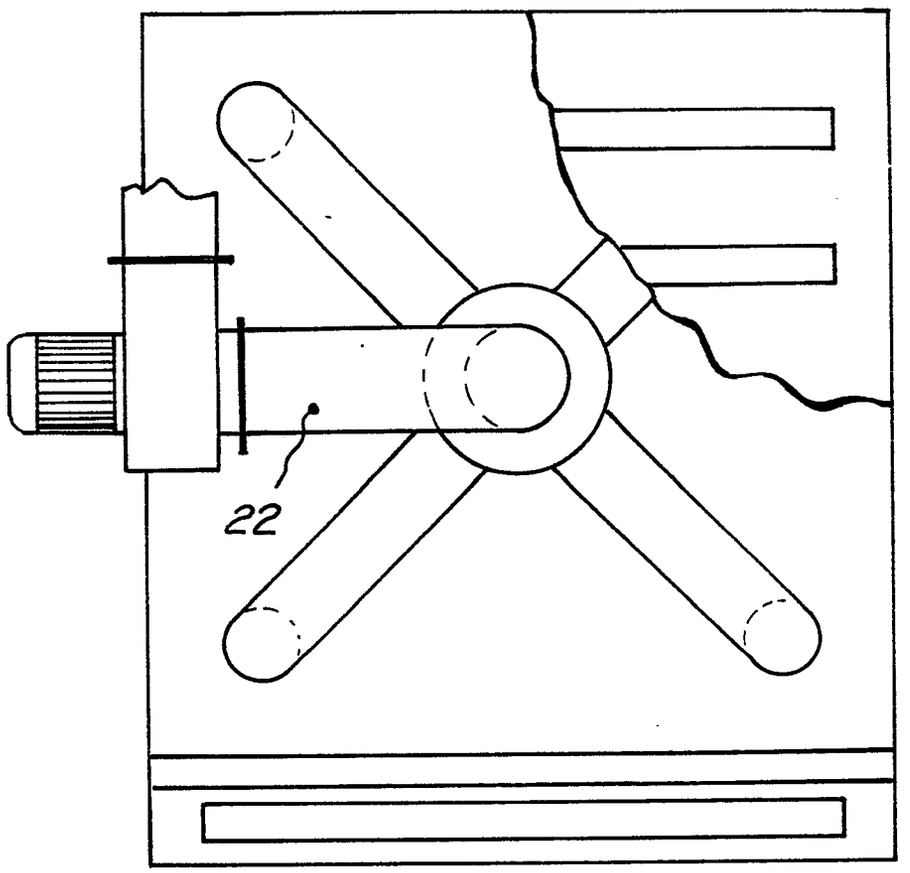


FIG. 1

FIG. 2



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EUROPEAN SEARCH REPORT

Application Number

EP 88 50 0030

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	EP-A-139617 (CIBA-GEIGY) * the whole document *	1-15	D06B1/02 D06B23/16
X	GB-A-2137670 (SANDO IRON WORKS COMPANY Ltd) * the whole document *	1, 18	
A	FR-A-2060773 (ARTOS)		
A	DE-A-1460347 (VALLS FORNE)		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

D06B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	11 MAY 89	PETIT J.P.

CATEGORY OF CITED DOCUMENTS

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