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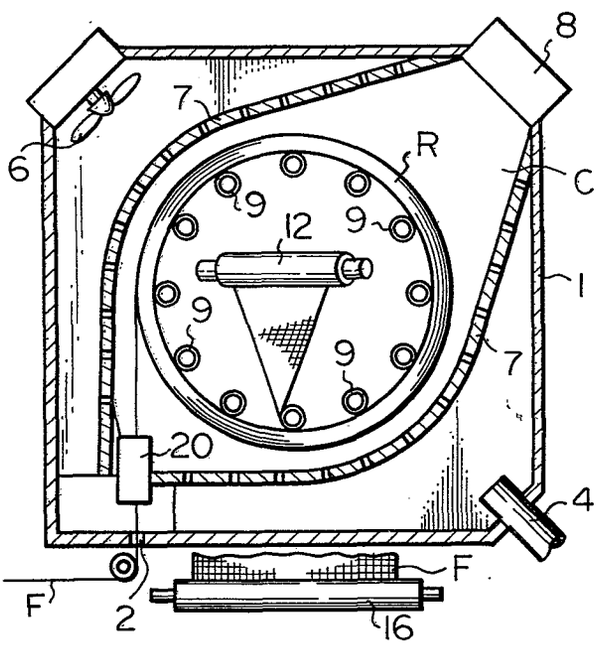
(54) Improved method and apparatus for continual treatment of textile sheet material by application of microwaves.

(57) Through a confined chamber (C) replete with saturated or overheated steam, a textile sheet material (F) such as a woven cloth is continually processed, under concurrent emanation of microwaves, along a continuous course made up of a plurality of substantially concentrically arranged, substantially circular sections of different diameters, for uniform treatment over entire length and thickness. The treatment can be used as a part of a continuous textile process.



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IMPROVED METHOD AND APPARATUS FOR CONTINUAL TREATMENT OF TEXTILE SHEET MATERIAL BY APPLICATION OF MICROWAVES

BACKGROUND OF THE INVENTION

The present invention relates to an improved method and apparatus for continual treatment of textile sheet material by application of microwaves, and more particularly to improvements in continual treatment of a textile sheet material such as a woven cloth within an atmosphere replete with saturated or overheated steam under emanation of microwaves for obtaining a uniform treatment effect over the entire length and thickness.

Fixation and development of dyes on a textile sheet material such as a woven cloth has since a long time been carried out by placing the textile sheet material in an atmosphere impregnated with steam.

As a substitute for such a steam process, it has already been proposed to subject a wet textile sheet material to emanation of microwaves. Here, the term "microwaves" refers to electro-magnetic waves having frequencies in a range from 300 to 30,000 MHz.

Use of microwaves has a wide variety of advantages in particular when they are used for treatment of a wet textile sheet material. Firstly, they permeate into and heat the textile sheet material very quickly. Secondly, since their heat generation is dependent upon dielectric loss, they can be selectively absorbed in and object with large dielectric loss and, thereby heating only necessary sections of the object. There will be no heating of unnecessary sections of the object, thereby well avoiding waste of thermal energy. Thirdly, the object exposed to microwaves generates heat by itself which naturally raises the temperature of the ambient atmosphere. As a consequence, the amount

of the thermal energy otherwise needed for heating the ambient atmosphere can be greatly reduced. Fourthly, since microwaves cause an almost simultaneous temperature rise at different sections of the object exposed thereto, regional variations in temperature within the object can be significantly minimized and this leads to ideal and uniform heating of the object. Finally, adjustment of the output voltage for microwave generation enables simple, easy and swift control of heating condition in accordance with demands in actual treatment of textile sheet materials.

Exposing a textile sheet to emanation of microwaves is said to cause ionic conduction and dipole rotation of the fibers composing the material and of the water and/or agents contained in the material. This is believed to result in the swift and uniform heating of the textile sheet material.

Based on recognition of these advantages, various systems have been proposed in the field in order to utilize microwaves in practical treatment of textile sheet material, but almost all of them are barely feasible in industrial scale.

One reason for such difficulty is the manner of microwave emanation. Various emanators are in general used to this end, and they are roughly classified into three major types, i.e. an emanator with a densely hairpin curved wave guide, and an open-type emanator.

In case the emanator is equipped with a wave guide, the wave length of the emanated microwave wields a great influence upon the heating effect and, consequently, the textile sheet material is liable to undergo uneven heating caused by possible variation in the wave length. Stable control of the wave length is highly difficult in practice. As a result, the emanators of this type are quite unsuited for treatment of wet

textile sheet materials which usually require high uniform heating effect and are susceptible to damage caused by fluctuating heating effect.

In the case of the open-type emanator having a metallic hexadral emanation chamber, it is strongly required to employ any special expedients to equalize the intensity of the magnetic field around the material placed in the emanation chamber. Otherwise, the emanators of this type do not operate satisfactorily in industrial scale although they may operate well in laboratory tests.

Another fact causing the difficulty in practical use of microwaves is the risk of fusing the fibers composing a textile sheet material. Such fusion is caused by microwaves themselves. This causes serious problems in particular when the textile sheet material is composed of thermoplastic synthetic fibers such as acrylic fibers. Such fusion of fibers is caused by presence of water and high boiling point agents in the textile sheet material after finishing and souring. For example, when a textile sheet material is made of acrylic fibers, swelling of the fibers starts at a temperature very close to 100°C and, regardless of the dielectric constant, this swelling causes corresponding dipole rotation in the construction of the fibers. This dipole rotation results in abrupt evacuation of water and puts the fibers in arid state. Consequently, the temperature of the fibers rises quickly and such escalated temperature initiates fusion of the fibers composing the textile sheet material.

The other fact making practical use of microwaves difficult is the control of the above-described evacuation of water contained in the fibers. To this end, it has been proposed to clamp a textile sheet material between a pair of running conveyer belts or to place a

textile sheet material on a running wet sheet during transportation through the microwave emanation zone. In either cases, there is a considerable risk that any contamination on the belts or the sheets may be transferred to the textile sheet material during the treatment and this naturally causes serious degradation of the commercial value of the end product.

In order to remove such disadvantages inherent to the conventional textile treatment with microwaves, it has already been proposed in US Patent Application Ser. No. 107,790 and in EPC Patent Application No. 79850116.9 to place a textile sheet material in the form of a roll within a confined chamber replete with saturated or overheated steam and rotate the roll under concurrent emanation of microwaves.

This proposed system well removes most disadvantages of the conventional textile treatment with microwaves. However, since the textile sheet material in this system is exposed to steam and microwaves in a roll form, there is a significant difference in treatment effect between the section of the textile sheet material close to the core of the roll and the section close to the periphery of the roll. As a consequence, one cannot expect a uniform treatment effect over the entire length and textile sheet material.

In order to remove this disadvantage, a more dynamic system has also been proposed by the inventor of the present invention. In accordance with the dynamic system, a pair of rolls of a textile material are placed within a confined chamber replete with saturated or overheated steam, and the textile sheet material is continually transferred from one roll to another and vice versa under concurrent emanation of microwaves.

This improved system well solves the uniformity problem. However, since the textile sheet material has

to be kept, even provisionally, within the confined chamber during the treatment, this system is applicable to the so-called batch system process only. In other words, this system is quite unsuited to any continuous textile process in which a textile sheet material has to be continually transported from station to station.

SUMMARY OF THE INVENTION

It is the object of the present invention to apply a treatment by microwave emanation, as a part of a continuous textile process, to a textile sheet material with highly uniform treatment effect over the entire length and thickness of the material.

In accordance with the basic aspect of the present invention, a textile sheet material is continually advanced through a confined chamber replete with saturated or overheated steam and microwaves along a continuous course made up of a plurality of substantially concentrically arranged, substantially circular sections of different diameters.

In one preferred embodiment of the present invention, the above-described continuous course is defined by a plurality of substantially parallel guide rollers which are arranged, at given intervals, axially rotatably within the confined chamber along the periphery of an imaginary circle and adapted for winding thereabout the textile sheet material in the form of a cylindrical roll.

In another preferred embodiment of the present invention, the above-described continuous course is defined by a plurality of substantially parallel guide rollers which are arranged axially rotatably within the confined chamber along the peripheries of a plurality of substantially concentrically arranged imaginary circles, each circle containing a train of the guide

rollers at given intervals, so that the textile sheet material takes the form of a plurality of substantially concentrically arranged, substantially circular, mutually spaced layers during its travel along the continuous course.

In the other preferred embodiment of the present invention, the above-described continuous course is defined by a pair of helically constructed perforated air ducts defining the passage for the textile sheet material therebetween, so that the textile sheet material takes the form of helically arranged, mutually spaced layers during its travel along the continuous course.

BRIEF DESCRIPTION OF THE DRAWINGS

Of the drawings:

FIG. 1A, 1B and 1C are transverse, horizontal and vertical sectional views through a first embodiment of an apparatus according to the invention,

FIG. 2 is a transverse sectional view through a second embodiment of an apparatus according to the invention,

FIG. 3 is a transverse sectional view through a third embodiment of an apparatus according to the invention,

FIG. 4 is a partial horizontal sectional view through the perforated air ducts included in the embodiment according to FIG. 3, and

FIG. 5 is a sectional view through a shelter assembly used for blocking undesirable leakage of steam and microwaves.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the following description, elements substantially the same in construction and operation but used for dif-

ferent embodiments are designated with the same reference symbols.

The first embodiment of the apparatus in accordance with the present invention is shown in FIGS. 1A through 1C, in which a textile sheet material F to be treated is advanced along the above-described cintinuous course in the form of a cylindrical roll R and delivered outside the system from the innermost layer of the cylindrical roll R.

More specifically, the apparatus includes a housing 1 defining a substantially rectangular space and having an inlet 2 (see FIG. 1A) and an outlet 3 (see FIG. 1C) for the textile sheet material F. A supply tube 4 of saturated or overheated steam is mounted to the housing 1 whilst opening in the above-described space. Preferably, a fan 6 is mounted to the housing 1 within the space in order to stir the atmosphere within the space.

A confined chamber C is formed within the above-described space by means of perforated shelter walls 7 secured to the housing 1. At least one microwave emanator 8 is mounted to the housing 1 whilst opening in the confined chamber C. In the case of the illustrated construction, the microwave emanator 8 is internally accompanied with a microwave generator (not shown). Alternatively, the microwave emanator 8 may be connected to a separate microwave generator by a suitable electric connection.

A plurality of substantially parallel guide rollers 9 are arranged within the confined chamber C for free axial rotation by means of bearing 11 mounted to the walls of the housing 1. The guide rollers 9 are allotted, preferably at equal intervals, to different positions on the periphery of an imaginary circle. Although only twelve sets of guide rollers 9 are shown in the drawings for clear illustration, a lot more guide rollers 9 may

be preferably arranged in practice.

Within the above-described imaginary circle, a delivery roller 12 is arranged for free axial rotation in bearings 13 secured to the walls of the housing 1. As best seen in FIG. 1B, the axial direction of this delivery roller 12 crosses the axial direction of the guide rollers 9 so that the textile sheet material F can be delivered in the axial direction of the above-described imaginary circle. Further guide rollers 14 and 16 are provided, one of them within the housing 1 and the other one outside the housing 1, in order to deliver the textile sheet material F outside the housing 1.

In order to block undesirable leakage of steam and microwaves, shelter assemblies 20 are arranged at or in the close proximity of the inlet 2 and the outlet 3.

One example of the shelter assembly 20 to be used for the inlet 2 is shown in detail in FIG. 5, in which the shelter assembly 20 includes a thick housing 201 secured to the walls of the housing 1, a steam ventilation duct 202 opening in the space defined by the housing 201, and a perforated cover 203 closing the open end of the duct 202 in order to block undesirable leakage of electric waves through the duct 202. The top of the space is covered by an adjustable slit plate 204 providing a necessary but minimal passage for the textile sheet material F to be treated. That is, by adjusting the slit plate 204, the size of the passage can be changed on case-by-case basis. A block filter 206 is arranged vertically within the space below the slit plate 204. This block filter 206 includes a number of electric wave damping elements 206a aligned in the vertical direction and facing the travelling path of the textile sheet material. The block filter 206 further includes an electric wave absorber 206b vertically ex-

tending on the opposite side of the above-described travelling path.

The significantly small size of the passage provided by the slit plate 204 well blocks leakage of the steam and the microwaves out of the space defined by the housing 1 whilst allowing free passing of the textile sheet material F. Even when any amount of the microwaves leak through the slit passage, they are almost fully enfeebled during their travel through the block filter 206 arranged below the slit passage. Preferably, a water reservoir 207 may be arranged in the space below the bottom of the block filter 206 in order to absorb microwaves which have survived even after the travel through the block filter 206.

In operation, saturated or overheated steam is first supplied into the space defined by the housing 1 via the supply tube 4 and flows into the confined chamber C through perforations of the shelter walls 7. Concurrently, the microwave emanator 8 is activated. Thus, the confined chamber C is rendered replete with saturated or overheated steam and microwaves.

Textile sheet material F is then introduced into the confined chamber C via the inlet 2 and the shelter assembly 20, and wound about the guide rollers 9 in order to form a cylindrical roll R. When a cylindrical roll R of a prescribed size has been formed on the guide rollers 9, the leading end of the textile sheet material F is taken out from the innermost layer of the cylindrical roll R, and delivered outside the confined chamber C and further the space defined by the housing 1 via the delivery roller 9, the guide roller 14, the shelter assembly 20, the outlet 3 and the guide roller 16. Thereafter, the textile sheet material F is continually introduced into the confined chamber C and continually delivered therefrom at a delivery speed

equal to the introducing speed in order to enable the continual processing of the textile sheet material F for treatment.

The second embodiment of the apparatus in accordance with the present invention is shown in FIG. 2, in which a textile sheet material F to be treated is advanced along the above-described continuous course in the form of a plurality of substantially concentrically arranged, substantially circular, mutually spaced layers and delivered from the outermost layer.

Like the first embodiment, the apparatus includes a housing 1, a supply tube 4 of steam, at least one microwave emanator 8, shelter assemblies 20 and preferably a fan 6. In this embodiment, however, the housing 1 directly defines a confined chamber C, and the shelter assemblies 20 form the inlet and the outlet of the chamber C.

The apparatus further includes a plurality of axially rotatable guide rollers 21 which are arranged, at given intervals, along the peripheries of a plurality of substantially concentrically arranged imaginary circles. Each circle includes a train of guide rollers 21. At positions near the ends of the trains of guide rollers of the adjacent circles, transfer rollers 22 are arranged in order to transfer the textile sheet material F from the guide rollers 21 of one circle to the guide rollers 21 of the adjacent circle. A delivery roller 23 is arranged at a position outside the outermost imaginary circle. Depending on the situation, however, the delivery roller 23 may be located on the outermost imaginary circle next to the last guide roller 21 of the train belonging to that particular circle. Including these two possibilities, it is stated here that the delivery roller 23 is arranged in the vicinity of the outermost circle.

In operation, prior to full running, the textile sheet material F is introduced into the confined chamber C via the shelter assembly 20 and brought into engagement with the guide rollers 21 of the innermost train (first train). In the illustrated example, the textile sheet material F is advanced, forming the first layer, in the clockwise direction in the drawing during its engagement with the guide roller 21 of the first train. After engagement with the last guide roller 21 of the first train, the textile sheet material F is passed over to the guide rollers 21 of the adjacent outer train (second train) via the transfer roller 22. The textile sheet material F is now advanced, forming the second layer, in the counter-clockwise direction during its engagement with the guide rollers 21 of the second train. Thus, the advancing direction of the textile sheet material F in the second layer is opposite to that in the first layer.

After engagement with the last guide roller 21 of the second train, the textile sheet material F is passed over the guide rollers 21 of the adjacent outer train (third train) via the transfer roller 22. The textile sheet material F is then advanced, forming the third layer, in the clockwise direction during its engagement with the guide rollers 21 of the third train. Apparently, this advancing direction of the textile sheet material F in the third layer is opposite to that in the second layer, but equal to that in the first layer. In this way, the textile sheet material F is advanced in one direction in one layer and in the opposite direction in the next outer layer.

Finally, after engagement with the last guide roller 21 of the fifth train, the textile sheet material F is delivered outside the confined chamber C via the delivery roller 23 and the shelter assembly 20. When

the above-described preparation is over, the full running of the textile sheet material F is initiated.

The third embodiment of the apparatus in accordance with the present invention is shown in FIG. 3, in which a textile sheet material F takes the form of helically arranged, mutually spaced layers during its travel along the continuous course.

Like the foregoing embodiments, the apparatus includes a housing defining a confined chamber C, supply ports 4a and 4b of steam opening in the confined chamber C, at least one microwave emanator 8 and shelter assemblies 20 arranged at the inlet and outlet of the confined chamber C.

In this embodiment, the above-described course for the textile sheet material F is defined by a passage 31 formed between a pair of perforated air ducts 32a and 32b. The air ducts 32a and 32b are constructed so that the passage 31 first converges towards the centre of the confined chamber C and then diverges towards wall of the housing 1. Although not shown in the drawing, the air ducts 32a and 32b are coupled to a proper supply source of pressurized air so that blowing of air through their perforations keeps the advancing textile sheet material F floating in the passage 31. A delivery roller 33 is arranged at the outlet terminal of the passage 31.

As shown in FIG. 4, the perforations formed in the mating walls of a pair of air ducts 32a and 32b should preferably be directed sideways in the same direction with an appropriate inclination with respect to the surface of the textile sheet material F to be processed so that the textile sheet material F can be stretched in the width direction during the treatment due to the pneumatic force. Preferably, the textile sheet material F should be stretched in opposite width directions in

the adjacent layers.

CLAIMS

1. Improved method for continual treatment of a textile sheet material by application of microwaves comprising continually introducing said textile sheet material (F) into a confined chamber (C) replete with saturated or overheated steam, guiding said textile sheet material (F) within said confined chamber (C) along a continuous course made up of a plurality of substantially concentrically arranged, substantially circular sections of different diameters, delivering said textile sheet material from either one of the innermost and outermost sections of said continuous course towards the outside of said confined chamber, and emanating microwaves into said confined chamber (C) at least during travel of said textile sheet material (F) therethrough.

2. Improved method as claimed in claim 1 in which said textile sheet material (F) is wound up into the form of a cylindrical roll (R) during its travel along said continuous course, and delivered from the innermost layer of said cylindrical roll.

3. Improved method as claimed in claim 1 in which said textile sheet material (F) takes the form of a plurality of substantially concentrically arranged, substantially circular and mutually spaced layers during its travel along said continuous course, said textile sheet material (F) being advanced in one substantially circular direction in one layer and in the opposite substantially circular direction in the next outer layer, and said textile sheet material being delivered from the outermost layer.

4. Improved method as claimed in claim 1 in which said textile sheet material (F) takes the form of substantially helically arranged and mutually spaced layers during its travel along said continuous course, said

textile sheet material being delivered outwardly from the innermost layer along a helical course.

5. Improved method as claimed in any of the preceding claims in which said textile sheet material (F) is delivered at a speed substantially equal to its introducing speed into said confined chamber (C).

6. Improved apparatus for continual treatment of a textile sheet material by application of microwaves comprising a housing (1) including a confined chamber (C) which has an inlet (2) and outlet (3) for said textile sheet material (F), means (9, 21, 31) for guiding said textile sheet material, within said confined chamber, along a continuous course made up of a plurality of substantially concentrically arranged, substantially circular sections of different diameters, means (12, 23, 33) for delivering said textile sheet material from either one of the innermost and outermost sections of said continuous course towards the outside of said confined chamber (C), at least one microwave emanator (8) mounted to said housing (1) whilst opening into said confined chamber (C), means (4, 4a, 4b) for supplying saturated or overheated steam into said confined chamber, and means for advancing said textile sheet material through said confined chamber.

7. Improved apparatus as claimed in claim 6 in which said guiding means include a plurality of substantially parallel guide rollers (9) which are arranged, at given intervals, within said confined chamber along the periphery of an imaginary circle and adapted for winding thereabout said textile sheet material in the form of a cylindrical roll (R), and said delivering means include at least one rotary delivery roller (12) arranged within said imaginary circle.

8. Improved apparatus as claimed in claim 7 in which said confined chamber is defined by perforated

shelter walls (32a, 32b) arranged within said housing.

9. Improved apparatus as claimed in claim 7 or 8 in which the axial direction of said delivery roller (12) crosses that of said guide rollers so that said textile sheet material can be delivered in the axial direction of said imaginary circle.

10. Improved apparatus as claimed in claim 6 in which said guiding means include a plurality of substantially parallel, axially rotatable guide rollers (21) which are arranged within said confined chamber (C) along the peripheries of a plurality of substantially concentrically arranged imaginary circles, each said imaginary circle includes a train of said guide rollers arranged at given intervals, and said delivering means include at least one guide roller arranged near the last guide roller (23) of the train in the outermost imaginary circle.

11. Improved apparatus as claimed in claim 6 in which said guiding means include a pair of helically constructed, mutually spaced, perforated air ducts (32a, 32b) defining a passage (31) for said textile sheet material therebetween, and means for supplying pressurized air into said air ducts, said delivering means including a pair of helically constructed, mutually spaced, perforated air ducts formed in communication with said first named air ducts, respectively, and defining a passage for said textile sheet material, and said first named passage extending from the periphery to the core of said confined chamber whilst said second named passage extends, in communication with the innermost terminal of said first named passage, from said core to said periphery of said confined chamber.

12. Improved apparatus as claimed in claim 11 in which perforations of each said air duct run in a direction normal to the travelling directions of said textile

sheet material (F) through said associated passage with inclination to the wall of said duct facing said textile sheet material.

13. Improved apparatus as claimed in claim 6, 7, 10 or 11 further comprising shelter assemblies (20) attached to said inlet and outlet of said confined chamber in order to block leakage of said microwaves whilst allowing free passage of said textile sheet material therethrough.

CLAIMS

1. Method for continuous treatment of a textile sheet in which a textile sheet (F) is subjected to microwave emanation within a confined chamber (C) replete with saturated or overheated steam, c h a r a c t e r i z e d in that the textile sheet (F) advances in the confined chamber (C) along a continuous course having a center space and made up of a plurality of substantially concentrically arranged, substantially circular sections of different diameters, that the textile sheet is continuously fed from outside the confined chamber to the outermost or innermost section of the continuous course, and that the textile sheet is concurrently delivered outside the confined chamber from the innermost or outermost section of the continuous course.

2. Method as claimed in claim 1 in which said textile sheet material (F) is wound up into the form of a cylindrical roll (R) during its travel along said continuous course, and delivered from the innermost layer of said cylindrical roll.

3. Method as claimed in claim 1 in which said textile sheet material (F) takes the form of a plurality of substantially concentrically arranged, substantially circular and mutually spaced layers during its travel along said continuous course, said textile sheet material (F) being advanced in one substantially circular direction in one layer and in the opposite substantially circular direction in the next outer layer, and said textile sheet material being delivered from the outermost layer.

4. Method as claimed in claim 1 in which said textile sheet material (F) takes the form of substantially helically arranged and mutually spaced layers during its travel along said continuous course, said textile sheet material being delivered outwardly from the innermost layer along a helical course.

5. Method as claimed in any of the preceding claims in which said textile sheet material (F) is delivered at a speed substantially equal to its introducing speed into said confined chamber (C).

6. Apparatus for continuous treatment of a textile sheet comprising a housing (1) defining a confined chamber (C) replete with saturated or overheated steam and at least one microwave emanator (8) arranged in the confined chamber, c h a r a c t e r i z e d by means arranged in the confined chamber (C) and for advancing the textile sheet (F) along a continuous course having a center space and made up of a plurality of substantially concentrically arranged, substantially circular sections of different diameters, means for continuously feeding the textile sheet from outside the confined chamber to the outermost or innermost section of the continuous course, and means for concurrently delivering the textile sheet outside the confined chamber from the innermost or outermost section of the continuous course.

7. Apparatus as claimed in claim 6 in which said guiding means include a plurality of substantially parallel guide rollers (9) which are arranged, at given intervals, within said confined chamber along the periphery of an imaginary circle and adapted for winding thereabout said textile sheet material in the form of a cylindrical roll (R), and said delivering means include at least one rotary delivery roller (12) arranged within said imaginary circle.

8. Apparatus as claimed in claim 7 in which said confined chamber is defined by perforated shelter walls (32a, 32b) arranged within said housing.

9. Apparatus as claimed in claim 7 or 8 in which the axial direction of said delivery roller (12) crosses that of said guide rollers so that said textile sheet material can be delivered in the axial direction of said

imaginary circle.

10. Apparatus as claimed in claim 6 in which said guiding means include a plurality of substantially parallel, axially rotatable guide rollers (21) which are arranged within said confined chamber (C) along the peripheries of a plurality of substantially concentrically arranged imaginary circles, each said imaginary circle includes a train of said guide rollers arranged at given intervals, and said delivering means include at least one guide roller arranged near the last guide roller (23) of the train in the outermost imaginary circle.

11. Apparatus as claimed in claim 6 in which said guiding means include a pair of helically constructed, mutually spaced, perforated air ducts (32a, 32b) defining a passage (31) for said textile sheet material therebetween, and means for supplying pressurized air into said air ducts, said delivering means including a pair of helically constructed, mutually spaced, perforated air ducts formed in communication with said first named air ducts, respectively, and defining a passage for said textile sheet material, and said first named passage extending from the periphery to the core of said confined chamber whilst said second named passage extends, in communication with the innermost terminal of said first named passage, from said core to said periphery of said confined chamber.

12. Apparatus as claimed in claim 11 in which perforations of each said air duct run in a direction normal to the travelling directions of said textile sheet material (F) through said associated passage with inclination to the wall of said duct facing said textile sheet material.

13. Apparatus as claimed in claim 6, 7, 10 or 11 further comprising shelter assemblies (20) attached to said inlet and outlet of said confined chamber in order

to block leakage of said microwaves whilst allowing free passage of said textile sheet material therethrough.

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Fig. 1A

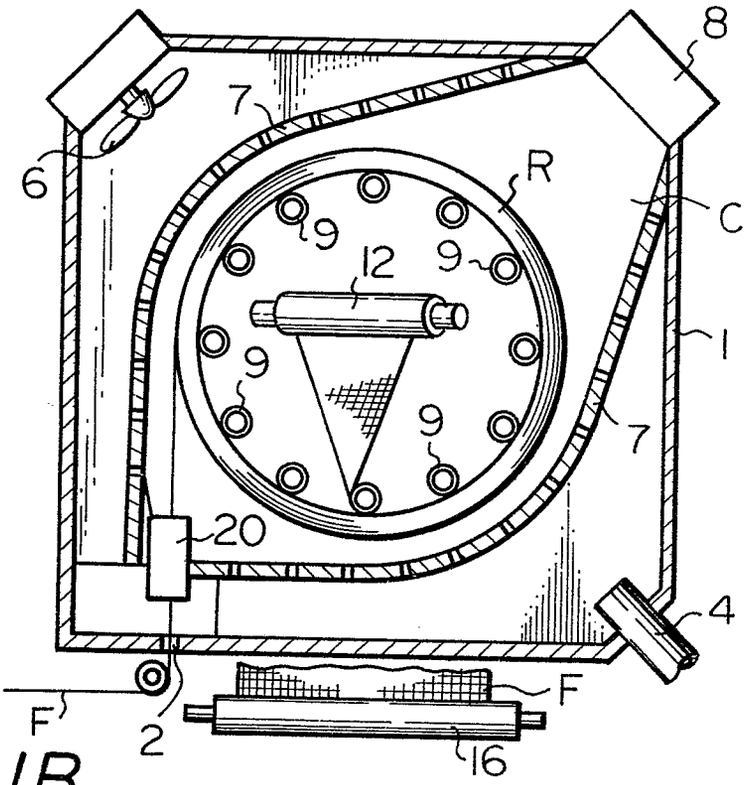

Fig. 1B

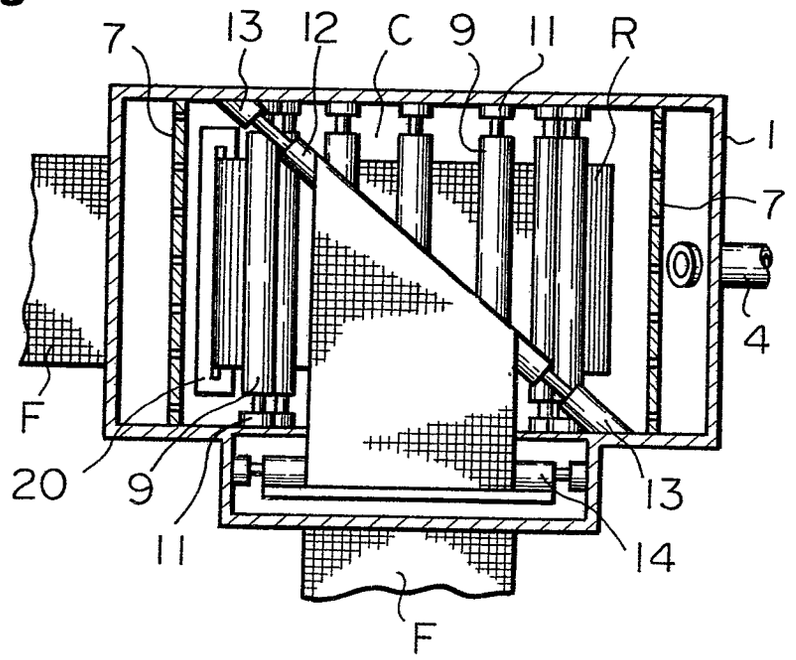

Fig. IC

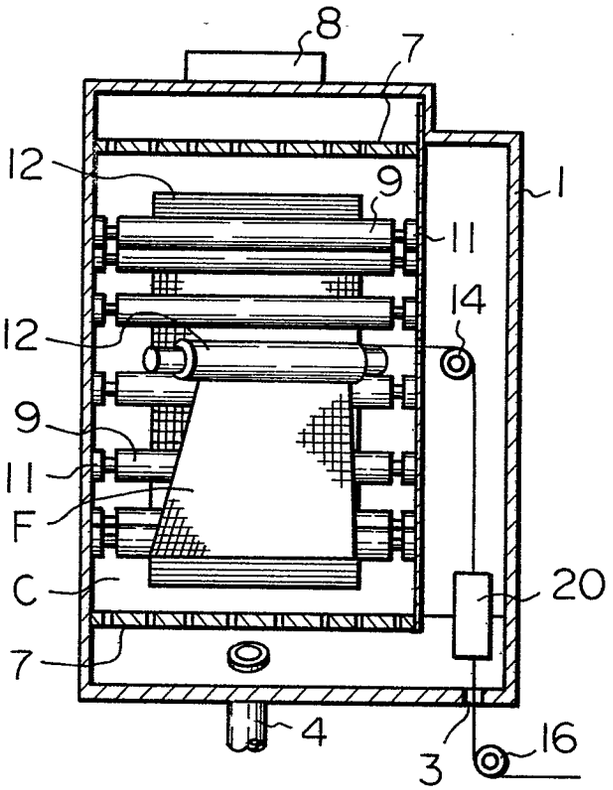
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Fig. 2

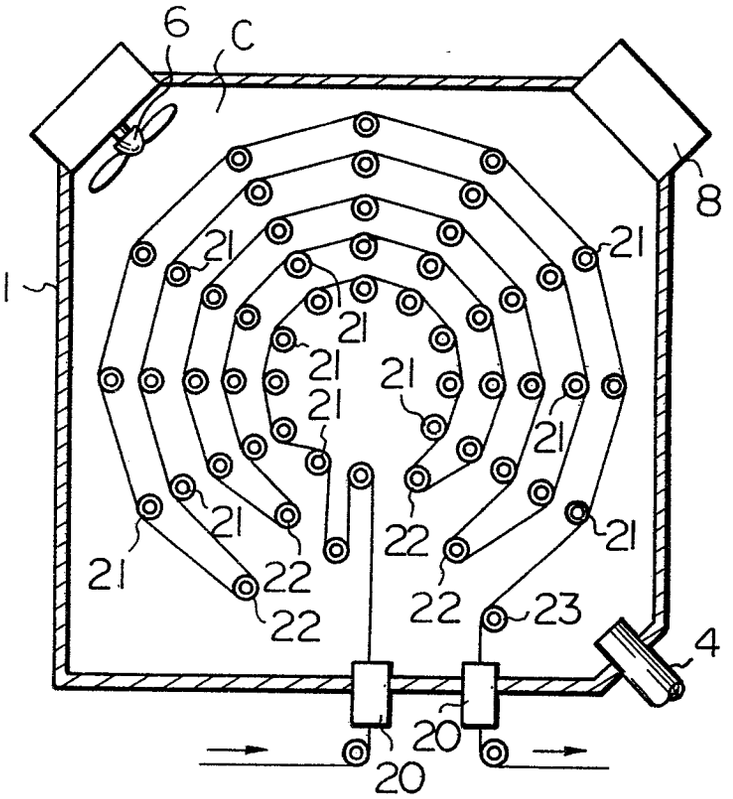
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Fig. 3

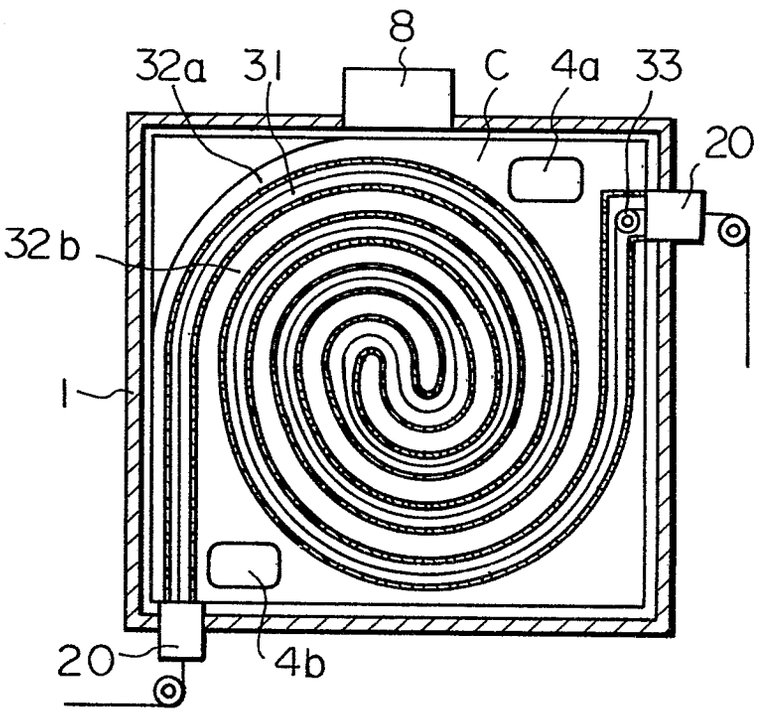


Fig. 4

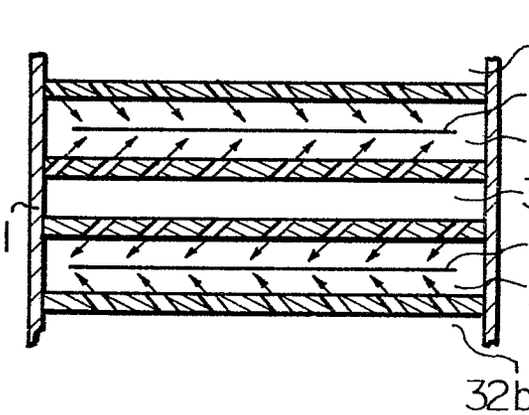
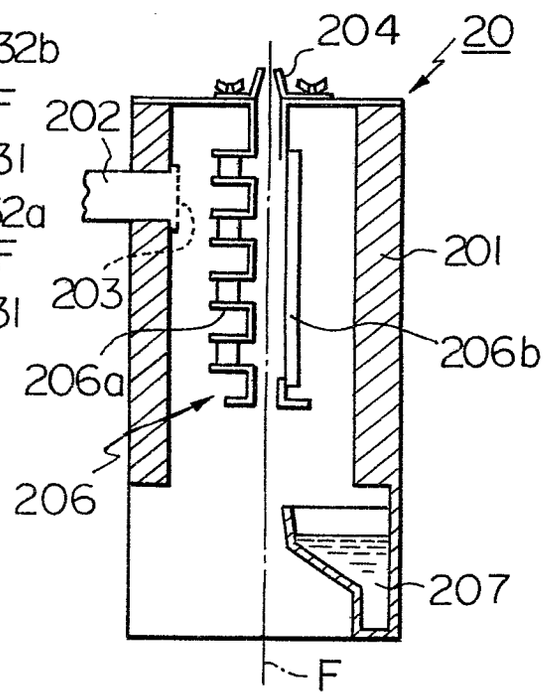


Fig. 5



European Patent Office

EUROPEAN SEARCH REPORT

0065057

Application number

EP 81 85 0085

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
DE	EP - A - 0 031 862 (THE ICHIKIN) * Abstract *	1
A	GB - A - 1 124 787 (WOLSEY)	
A	FR - A - 1 456 122 (I.C.I.)	
A	FR - A - 2 375 384 (HOECHST)	

CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)

D 06 B 19/00

TECHNICAL FIELDS SEARCHED (Int.Cl. 3)

D 06 B
D 06 P

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
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A: technological background
O: non-written disclosure
P: intermediate document
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E: earlier patent document, but published on, or after the filing date
D: document cited in the application
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	18-01-1982	PETIT

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