Jan. 14, 1941. H. DREYFUS ET AL 2,228,260

TREATMENT OF TEXTILE MATERIALS, FOILS, AND THE LIKE

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FIG. 1.

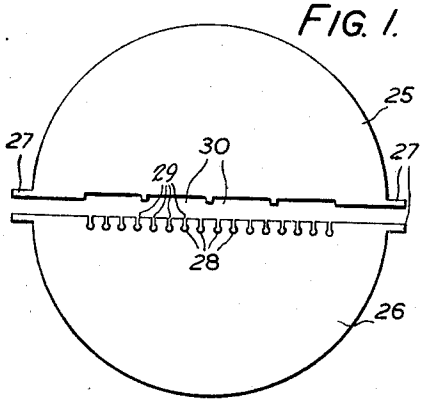


FIG. 2.

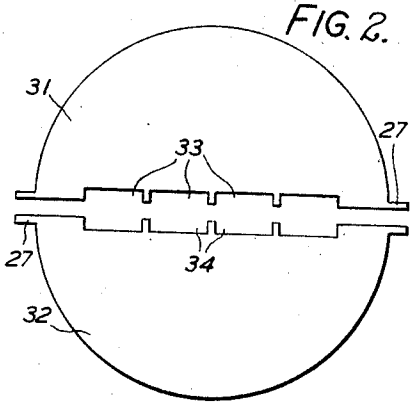


FIG. 3.

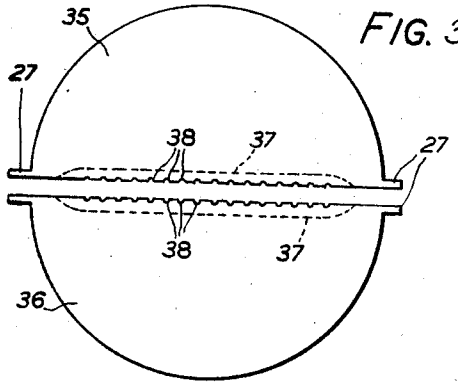
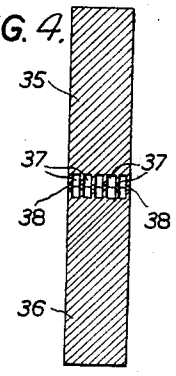


FIG. 4.



H. DREYFUS
R. W. MONCRIEFF
INVENTORS

Selfridge & Wilkinson

ATTORNEYS

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FIG. 8.

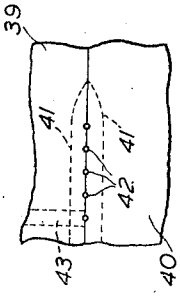


FIG. 7.

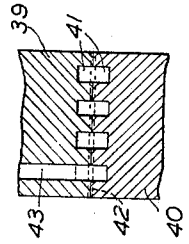


FIG. 6.

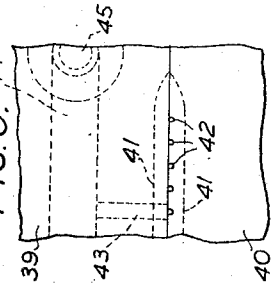


FIG. 5.

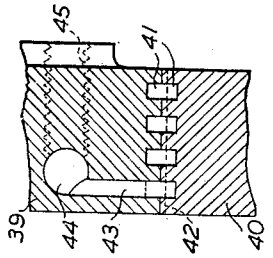
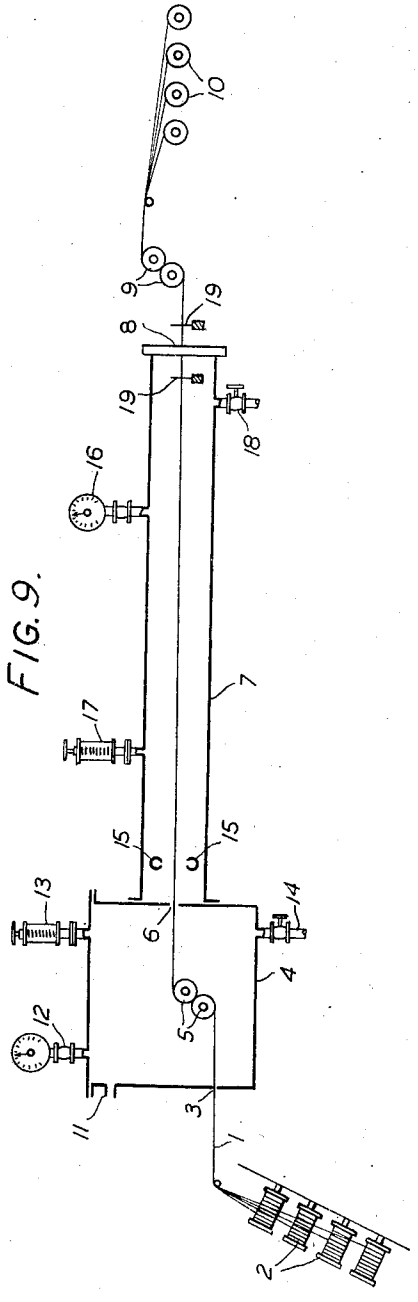


FIG. 9.



H. DREYFUS
R. W. MONCRIEFF
INVENTORS

Stevens & Robinson
ATTORNEYS

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UNITED STATES PATENT OFFICE

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TREATMENT OF TEXTILE MATERIALS, FOILS, AND THE LIKE

Henry Dreyfus, London, and Robert Wighton Moncrieff, Spondon, near Derby, England, assignors to Celanese Corporation of America, a corporation of Delaware

Application February 2, 1939, Serial No. 254,224
In Great Britain February 23, 1938

5 Claims. (Cl. 28—59)

This invention relates to improvements in the treatment of textile and other materials, and particularly to improvements in the treatment of filaments, yarns, foils and similar materials with fluid treatment agents under pressure.

U. S. Patents Nos. 2,142,721 and 2,142,722 of January 3, 1939, describe processes and apparatus in which artificial filaments, foils and similar materials are stretched in hot water or steam. The apparatus specifically described and illustrated in these specifications consists of a substantially closed vessel or chamber for the steam or hot water into which the materials pass from the atmosphere and from which they emerge into the atmosphere, and if the steam or hot water is under a pressure considerably above atmospheric pressure there may be a considerable flow of stretching fluid through the inlet and outlet orifices for the materials. U. S. Patent No. 2,142,909 of January 3, 1939, describes processes and apparatus in which filaments, foils and similar materials are subjected to stretching or other treatments in the presence of fluid media under superatmospheric pressure, the apparatus employed according to this specification comprising in addition to a treatment vessel or chamber one or two end chambers for inert fluid under superatmospheric pressure which communicate therewith and which may contain forwarding devices for the materials. The presence of an inert fluid under superatmospheric pressure in an end chamber reduces or prevents flow of fluid treatment medium through the orifices between this chamber and the treatment vessel or chamber. Whichever form of apparatus is employed, however, there exists during the stretching or other operation a body of fluid, which may be under considerable superatmospheric pressure, in a substantially closed chamber which is in communication with the atmosphere through the inlet and outlet for the materials, and in these circumstances there may be a considerable flow of treatment or inert fluid through the passages into the atmosphere.

The present invention is concerned with improvements in apparatus comprising a substantially closed chamber for fluid under superatmospheric pressure by which this loss of treatment or inert fluid may be reduced or avoided and with processes in which such apparatus is employed. The apparatus according to the present invention comprises a series of substantially closed cavities, which may be 2, 3, 4 or more in number, which communicate with each other by means of orifices for the passage of yarns, foils or similar materials and are connected with the substantially closed chamber.

The series of cavities may be formed in various ways. Thus a series may be formed by plates of sheet metal each provided with a number of orifices for the passage of yarns or other materials and separated from each other by distance pieces which may, for example, be ½, 1 or 2 inches or more thick and which extend all round the edges of the plates so that between each pair of plates is a single cavity common to all the orifices in the two plates or to a set of such orifices.

Stretching and other operations carried out during the travel of yarns and other materials may be facilitated, particularly as regards the threading up of the apparatus, by so forming the orifices through which the materials pass that the materials can be introduced laterally into the orifices instead of being threaded through them. Thus a partition between two chambers may be made of an upper and a lower plate, circular orifices of e. g. 1.0 to 1.5 mm. diameter being drilled near that edge of the lower plate which meets the upper plate, e. g. at a distance of 1 or 2 mm. therefrom, and joined to the edge by slits of sufficient width, e. g. .1 or .2 mm., to allow yarns or similar materials to be introduced through them into the orifices. The slits may join the orifices at the portion of their periphery nearest the edge of the plate, in which case the slits may make an angle of 90° or less with the tangent to this portion, or they may join the orifices at some other point on their periphery. When the plates are in position the upper plate substantially closes the slits.

This method of construction is illustrated diagrammatically in Figs. 1 and 2 of the accompanying drawings, wherein Fig. 1 shows the front elevation of the upper and lower segments of a plate containing orifices for the materials and Fig. 2 the front elevation of the upper and lower segments of a plate which when interposed between two of the plates illustrated in Fig. 1 forms a number of cavities.

Fig. 3 shows a front elevation of two semicircular plates.

Fig. 4 shows a vertical cross-section of a series of cavities and orifices formed from the two plates shown in Fig. 3.

Fig. 5 shows a vertical cross-section of a portion of a plate containing a series of end chambers and connecting orifices.

Fig. 6 shows an end view of the construction shown in Fig. 5.

Fig. 7 is a view showing a vertical cross-section of a portion of another form of plate containing a series of cavities and connecting orifices.

Fig. 8 is an end view of the construction shown in Fig. 7, and

Fig. 9 is a view showing an apparatus for stretching in steam provided at the outlet end of the stretching vessel with a series of cavities.

Like reference numerals indicate like parts throughout the several views of the drawings.

Referring to Fig. 1 the lower segment **26** contains a number of small orifices **28** connected with the diametral surface of the segment by transverse slits **29** while the upper segment **25** contains shallow longitudinal slots **30**. Each slot **30** extends over a set of 4 orifices and slits **28**, **29** of the segment **26**, the face of the upper segment **25** containing the slots **30** fitting closely against the face of the lower segment **26** between each set of orifices and slits, so that each slot **30** forms a gap of, for example, 0.1 or 0.2 mm. in width along the top of each set. The provision of such slots **30** renders it possible, if an end breaks, to tie it to an adjacent end of the same set before it enters the apparatus and separate it again from this end after it issues from the apparatus. In order to reduce any tendency for the filaments to stray from one orifice to another there may be provided a bar or other device which contacts with the materials just before and just after their passage through the apparatus and presses them lightly into the orifices.

In Fig. 2 the upper and lower segments **31** and **32** are slotted longitudinally as shown at **33** and **34** respectively. When a plate formed from these segments is assembled between two plates formed from the segments illustrated in Fig. 1 the slots **33** and **34** form cavities between the orifices in the two plates. Preferably the plates illustrated in Fig. 2 are thicker than those illustrated in Fig. 1.

In order to form a series of cavities with connecting orifices from the plates illustrated in Figs. 1 and 2, segments **31** are fixed between pairs of segments **25**, e. g. by bolting them or brazing them together, thus forming a hemi-cylindrical assembly containing n segments **31** and $n+1$ segments **25**. A similar assembly is formed from the segments **32** and **26**. After insertion of the yarns or other materials in the orifices **28** the two assemblies are brought together to form a series of cavities and orifices and held together by a suitable means. For example, bars may be positioned above and below the projecting portions formed by the lugs **27** and bolted together by bolts passing through holes drilled through the projecting portions in suitable positions.

A series of cavities connected by orifices into which yarns can be introduced laterally may also be formed by taking two semi-circular plates having the same diameter and a thickness of 21 mm., cutting three slots longitudinally along their diameters of a width of 5 mm. and about the same depth, the slots being separated from each other and from the edges of the plate by a distance of 1.5 mm., clamping the plates together side by side so that the edges of the adjacent faces coincide and milling transverse semi-circular notches of 1 to 1.2 mm. diameter in the divisions between the slots in a direction transverse to the slots. In general it is desirable that the only communication between the cavities and the atmosphere should be through the orifices for the materials, and therefore the slots should not extend as far as the periphery of the plates. When the plates are in position they thus form a circular plate containing a series of cavities connected by orifices for the threads. Each yarn passage in this plate comprises four holes of 1 to 1.2 mm. diameter and 1.5 mm. length separated by three cavities of 5 mm. diameter, each of these cavities being common to all the yarns passing through the plate.

The above method of construction is illustrated in Figs. 3 and 4 of the accompanying drawings wherein Fig. 3 shows a front elevation of two semi-circular plates and Fig. 4 shows a vertical cross-section of a series of cavities and orifices formed from the two plates in the above manner. The plates **35** and **36** have longitudinal slots **37** and transverse notches **38** and are provided with lugs **27** for the purpose described above.

Instead of cutting slots in each plate the slots may be cut in only one plate.

In general it is desirable that the length as well as the cross-sectional area of the orifices through which the materials pass should be small. If the difference of pressure on the two sides of a partition in which orifices are formed is considerable, it may be necessary to make the partition of fairly thick sheet material and in such a case orifices may be made in the partition which are somewhat larger than is desirable, and these orifices may be covered with thin sheeting which is drilled with the small orifices required. Alternatively, orifices in a thick partition may be drilled in a conical form, the direction of the taper being either such that the materials approaching the partition pass first through the narrowest portion of the orifice or such that they pass first through the broadest portion thereof.

It will be understood that in apparatus according to the present invention there will be between a substantially closed chamber and the atmosphere a number of orifices in line separated by the cavities. These orifices are referred to below as a "series" of orifices. Further when, as is usual, an apparatus for the treatment of yarns is designed to treat a number of yarns simultaneously it is in general desirable to provide a series of orifices for each yarn, so that an apparatus for treating a number of yarns may have a number of series of orifices arranged e. g. side by side. Between the corresponding pairs of orifices in the different series there may be either a single cavity common to all these orifices or a number of cavities, e. g. one for each pair of orifices.

By employing orifices formed as described above in combination with an apparatus comprising a liquid seal, as described in U. S. Patent No. 2,142,913 of January 3, 1939, threading up and the recovery of broken ends may be still further facilitated.

In order to reduce still further any loss of steam or other fluid, the series of cavities may be provided with an inlet through which cold water, air or other fluid under superatmospheric pressure may be introduced. By this means any flow of fluid from the substantially closed chamber may be eliminated. Examples of a series of cavities provided with such an inlet are illustrated in Figs. 5, 6, 7 and 8 of the accompanying drawings wherein

Figs. 5 and 6 show respectively a vertical cross-section and an end view of a portion of a plate containing a series of cavities and connecting orifices and

Figs. 7 and 8 show, respectively, a vertical cross-section and an end view of a portion of an-

other form of plate containing a series of cavities and connecting orifices.

Referring to Figs. 5 and 6, the plate comprises an upper segment 39 and a lower segment 40, each of which contains longitudinal slots 41 milled in their contacting faces and transverse orifices 42 connecting the slots. The slot in the upper segment nearest that face of the segment which is intended to be in contact with the fluid at the higher pressure communicates by means of one or more passages 43 with a channel 44. This channel communicates with the other face of the plate through a threaded passage 45 into which a pipe for feeding cold water or other suitable fluid can be screwed.

Figs. 7 and 8 show portions of a similar plate except that the orifices 42 are of circular shape and are formed from semi-circular channels milled in the contacting edges of the two segments. The passage 43 communicates with a channel and a threaded passage as shown in Figs. 5 and 6.

The most important form of the apparatus according to the present invention comprises an end chamber containing a positively driven feed device for the yarns or other materials and communicating with a substantially closed vessel or chamber for steam or hot water as described in U. S. Patent No. 2,142,909 of January 3, 1939, the substantially closed vessel or chamber being provided at the outlet for the materials with a series of cavities as described above. Such an apparatus is illustrated in Fig. 9 of the accompanying drawings which shows an apparatus for stretching in steam provided at the outlet end of the stretching vessel with a series of cavities in accordance with the present invention.

In this apparatus, the threads 1 from a creel of bobbins 2 pass through small orifices 3 into a compressed air chamber 4 in non-slipping contact with nip rollers 5 in the compressed air chamber, through small orifices 6 into a steam chamber 7, and out of the steam chamber through an end plate 8 having a series of cavities formed according to the present invention. Combs 19 are provided before and after the plate 8 to assist in guiding the threads. From the second comb the threads pass in non-slipping contact with nip rollers 9 for stretching and are finally wound on a creel of bobbins 10. Compressed air is introduced through the inlet 11 into the chamber 4 which is provided with a pressure gauge 12, a pressure relief valve 13, and a steam trap 14. Steam enters through perforated pipes 15 so positioned that wet or saturated steam is directed on to the threads immediately on their entry into the steam chamber 7. The chamber 7 is also provided with a pressure gauge 16, a pressure relief valve 17, and a drain 18 for condensate.

A series of end chambers and a pair of combs may also be provided at the inlet 3.

Pressure treatment apparatus which comprises only a chamber for the treatment fluid and no end chamber, such as is described in U. S. Patent No. 2,142,722 of January 3, 1939, may likewise be provided with such a series of cavities. Moreover, such a series of cavities may be provided between two substantially closed chambers designed to contain fluids under different pressures.

The general conditions for the treatment of yarns and other materials with fluid media under superatmospheric pressure are similar to those described in the prior specifications referred to in the opening passages of this specification, to which reference is made in this connection.

When apparatus according to the present invention is employed, for example, in the stretching of cellulose acetate filaments or foils using wet steam under superatmospheric pressure, the series of cavities may at the start of the operation contain air under normal atmospheric pressure. When the stretching chamber is filled with steam under superatmospheric pressure steam passes out of the chamber into the series of cavities, and the pressure in the cavities decreases successively from the cavity adjacent to the stretching chamber to the one communicating with the atmosphere. For example, if a series of four cavities is employed and the steam in the stretching chamber is at a pressure of 35 pounds per square inch the pressures in the four cavities may be 22, 12, 5 and 2 pounds per square inch. Since the pressure in the cavity communicating with the atmosphere is only slightly in excess of atmospheric pressure, the flow of steam into the atmosphere will be comparatively small and very much less than would be the case in the absence of the cavities.

The apparatus according to the present invention may be employed for stretching, saponification and other treatments in which fluid treatment media under superatmospheric pressure are employed as described in the prior specifications referred to above.

Having described our invention what we desire to secure by Letters Patent is:

1. Apparatus for the treatment of travelling yarns and other filamentary materials with fluid media under superatmospheric pressure, comprising a substantially closed chamber for the fluid medium and an orificed member for the passage of the materials through a wall of the chamber, said member being formed of two components having contacting faces adapted to be juxtaposed and providing a number of sets of transverse orifices, at least some of which are connected by a longitudinal slot, in alternation with a number of cavities so that by the separation of the faces the materials can be introduced laterally into the orifices and so that the materials can be transferred by way of the longitudinal slot from one orifice of a set to another when the components have been assembled.

2. Apparatus for the stretching of travelling yarns and other filamentary materials in fluid media under superatmospheric pressure, comprising a substantially closed end chamber for inert fluid containing a positively driven feed device for the materials, a substantially closed chamber for stretching fluid communicating with the end chamber, and an orificed member for the passage of the materials through a wall of the stretching chamber, said member being formed of two components having contacting faces adapted to be juxtaposed and providing a number of sets of transverse orifices, at least some of which are connected by a longitudinal slot, in alternation with a number of cavities so that by the separaton of the faces the materials can be introduced laterally into the orifices and so that the materials can be transferred by way of the longitudinal slot from one orifice of a set to another when the components have been assembled.

3. Apparatus for the stretching of travelling yarns and other filamentary materials in fluid media under superatmospheric pressure, which comprises a substantially closed end chamber for

inert fluid containing a positively driven feed device for the materials, a substantially closed chamber for stretching fluid communicating with the end chamber, and an orificed member for the passage of the materials through a wall of the stretching chamber, said member being formed of two components having contacting faces adapted to be juxtaposed and providing respectively a number of sets of transverse orifices in alternation with a corresponding number of longitudinal cavities, and a corresponding number of longitudinal slots in alternation with longitudinal cavities, so that by the separation of the faces the materials can be introduced laterally into the orifices and so that the materials can be transferred by way of a longitudinal slot from one orifice of a series to another when the compopents have been assembled.

4. Apparatus for the treatment of travelling yarns and other filamentary materials with fluid media under superatmospheric pressure, which comprises a substantially closed chamber for the fluid medium communicating with a series of substantially closed cavities connected by orifices for the passage of the materials through a wall of the chamber, at least one of said cavities being provided with an inlet for inert fluid, and an orificed member for the passage of the materials through a wall of the chamber, said member being formed of two components having contacting faces adapted to be juxtaposed and providing a number of transverse orifices in alternation with a number of cavities, so that by the separation of the faces the materials can be introduced laterally into the orifices.

5. Apparatus for the stretching of travelling yarns and other filamentary materials in fluid media under superatmospheric pressure, which comprises a substantially closed end chamber for inert fluid containing a positively driven feed device for the materials, a substantially closed chamber for stretching fluid communicating with the end chamber and a series of substantially closed cavities connected by orifices for the passage through a wall of the stretching chamber of the materials communicating at one end with the chamber and at the other end with the atmosphere, at least one of the cavities of the series being provided with an inlet for inert fluid, and an orificed member for the passage of the materials through a wall of the chamber, said member being formed of two components having contacting faces adapted to be juxtaposed and providing a number of transverse orifices in alternation with a number of cavities, so that by the separation of the faces the materials can be introduced laterally into the orifices.

HENRY DREYFUS.
ROBERT WIGHTON MONCRIEFF.