

Oct. 20, 1942.

F. B. HILL ET AL

2,299,145

TREATMENT OF TEXTILE MATERIALS

Filed June 26, 1940

2 Sheets-Sheet 1

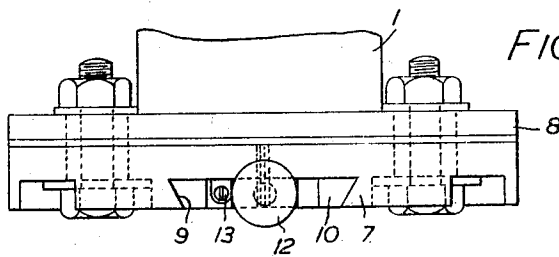
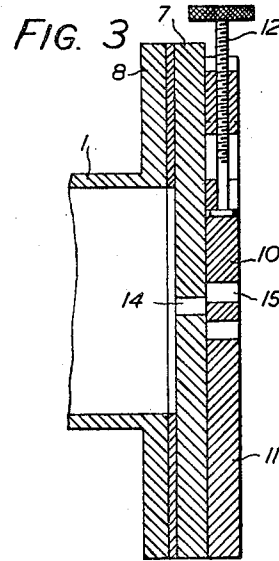
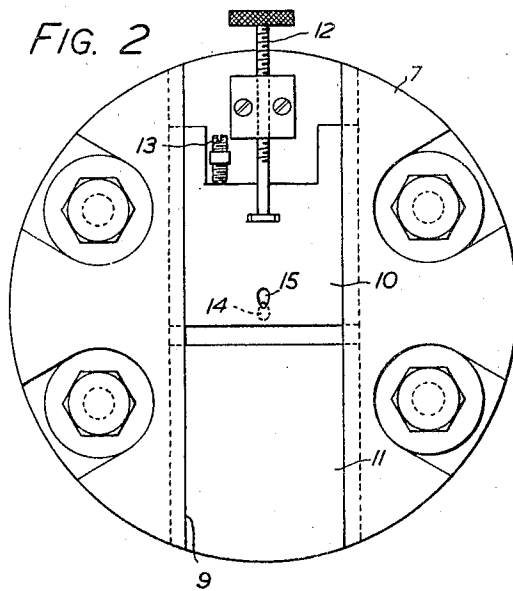
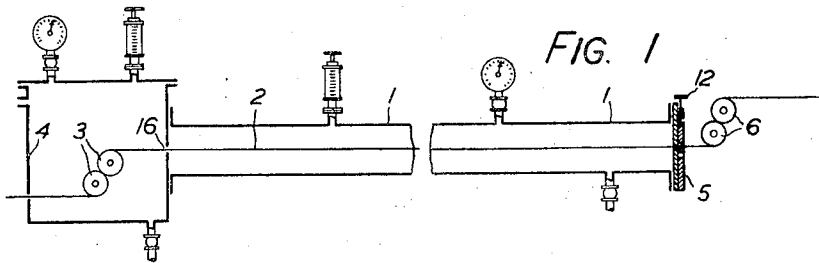
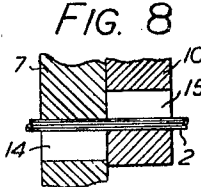
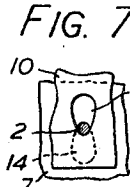
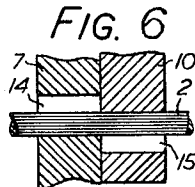
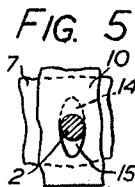


FIG. 4



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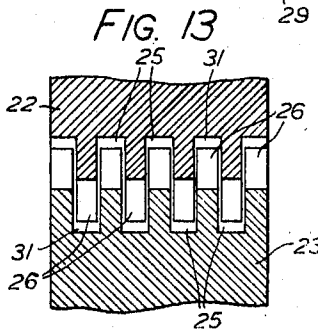
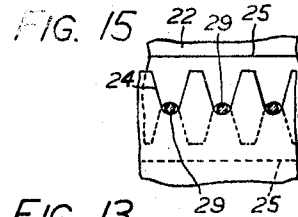
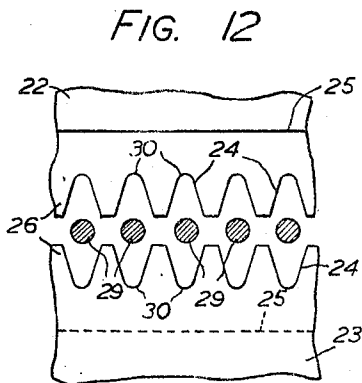
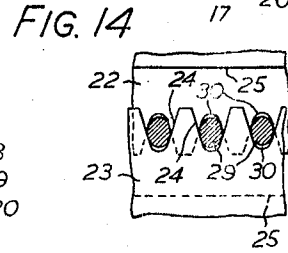
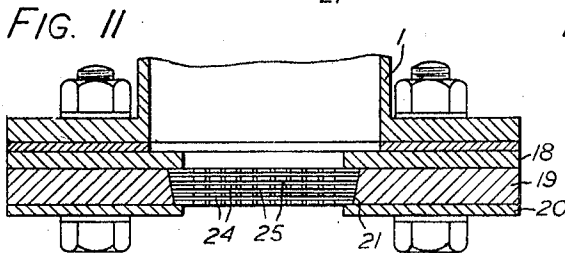
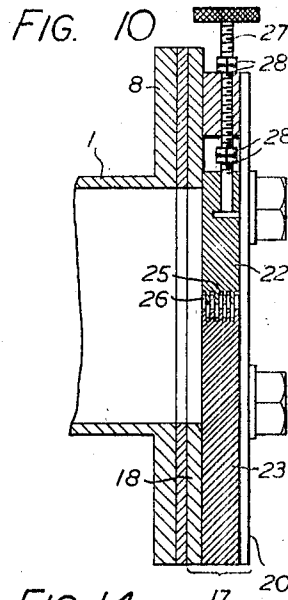
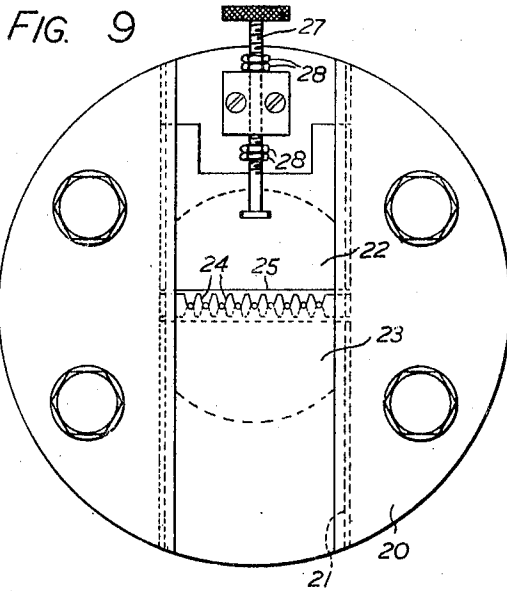
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,299,145

TREATMENT OF TEXTILE MATERIALS

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2 Claims. (Cl. 68—6)

This invention relates to improvements in the treatment of textile materials, particularly to treatments in which material passes through an orifice in a wall of a treatment vessel.

According to the present invention, an orifice device providing a passage of variable area is formed by mounting two members each formed with an aperture in such a manner that by relative sliding of the members the apertures may be caused to overlap each other to different amounts, means being provided to cause a relative movement between the two members to vary the area of the orifice formed by the overlapping apertures. For example, one member may be fixed and the other movable and the movement of the movable member controlled by a micrometer screw device so as to control accurately the size of the orifice formed at any given position of the two members.

The orifice of variable area enables textile materials of different cross-sectional area to be accommodated and at the same time cuts down the free area through which fluid might escape from a vessel in which the materials are treated. In general, textile threads are of substantially circular cross-section, and the shapes of the apertures in the two members is preferably such that the orifice has a near approximation to the circular in its several adjusted positions.

Thus the apertures in the two members may be in the form of elongated holes having substantially semi-circular ends of different radii (the aperture thus being approximately pear-shaped) so that when the two members are assembled with the smaller ends of the holes pointing in opposite directions an orifice of substantially circular cross-section can be formed at the junction of the two members, which orifice can be varied, by movement of one member relative to the other in the direction of the length of the holes, from a diameter substantially equal to twice the radius of the large end of the hole to a diameter substantially equal to twice the radius of the small end of the hole; or the apertures in the members may be notches, for example V-shaped notches with semi-circular apices, formed in the end of each member, in which case the two members are assembled with the apices of the notches pointing in opposite directions so that an orifice can be formed at the junction of the two members which orifice can be varied, by movement of one member relative to the other in the direction of the depth of the notch, from a substantially circular cross-section of a radius corresponding to the radius of the

apex of the notch to a larger orifice of approximately elliptical shape.

Instead of the two members being provided each with a hole or each with a notch, one member may be provided with a hole and other with a notch of the kind already described.

The invention is particularly applicable to the treatment of filaments, yarns and other materials with fluid media under pressure, as described for example, in U. S. Patents Nos. 2,142,717, 2,142,721, and 2,142,722. According to these specifications, filaments, yarns or other materials are subjected to stretching or other treatments in the presence of fluid media under pressure in an apparatus comprising a substantially closed chamber for the fluid media, the chamber being provided with orifices for the passage of the material through the apparatus. With such apparatus, if the fluid medium in the treating chamber is under a high pressure, there may be a considerable flow of fluid into the atmosphere through the orifices through which the material passes. U. S. Patents Nos. 2,142,909 and 2,142,910, describe apparatus for carrying out such treatments in which, in addition to the treatment chamber containing fluid medium under pressure, there is provided one or two end chambers for inert fluid under pressure communicating by means of orifices with the treatment chamber. The provision of an end chamber containing an inert fluid under pressure reduces or prevents the flow of fluid medium through the orifice between this chamber and the treatment chamber, but there still exists a body of inert fluid under pressure in the end chamber which communicates with the atmosphere through an orifice through which the material passes, and if the pressure is high there may be a considerable flow of fluid into the atmosphere through this orifice.

By applying the present invention to such processes and apparatus this undesirable flow of fluid from the apparatus may be considerably reduced with the result that a considerable quantity of fluid that would otherwise be wasted as saved. Furthermore the expression of a considerable quantity of fluid into an atmosphere in which operatives have to work may be detrimental to the convenience and health of the operatives. The present invention has the further advantage of reducing such effects.

A further important feature of the present invention is its particular applicability to processes of the type described in the above mentioned specifications in which the materials are

stretched during their passage through a substantially closed treating chamber containing a treating medium under pressure. When the material is threaded through the apparatus before the stretching treatment is commenced, the orifices must be large enough to allow free threading of the unstretched material. During stretching, the material undergoes a substantial reduction in cross-sectional area, so that the area of orifice necessary for threading is greater than that necessary for the passage of the stretched yarn by an amount depending on the degree of stretch, with the result that a considerable quantity of fluid may pass through the orifice with the yarn into the atmosphere.

On the other hand, in processes of stretching yarns or other materials employing the present invention, for example a process for stretching yarns consisting of cellulose acetate or other organic derivative of cellulose, the yarns are first threaded through orifices in the treating chamber, pressure is then applied to the treating medium in the chamber, the stretching treatment commenced and, as the cross-section of the yarns diminishes as a result of stretching the yarns, the area of the orifices through which the stretched yarns pass into the atmosphere is reduced. The present invention is particularly applicable to such treatments when a number of yarns consisting of continuous artificial filaments are combined to form a bundle of filaments of a total denier of the order of a sliver before passing through the orifice into the atmosphere. The ratio between the maximum and the minimum areas obtainable in any given orifice according to the invention for use in stretching depends on the degree of stretch required to be imparted to the material; for example, in stretching filaments of cellulose acetate to ten times their original length of ratio of about 3:1 can be used.

Whether or not the treatment in which the apparatus according to the invention is employed includes stretching the materials, the apparatus has the additional advantage of facilitating threading of the apparatus, particularly when dealing with materials of very small cross-section.

The invention will now be described in greater detail with reference to the accompanying drawings, in which

Fig. 1 is a diagrammatic sectional view of a stretching apparatus for textile threads or slivers;

Fig. 2 is an end elevation of a closure plate for the apparatus of Fig. 1 fitted with one form of adjustable orifice;

Fig. 3 is a sectional side elevation of Fig. 2;

Fig. 4 is a plan view of Fig. 2;

Figs. 5 and 6, 7 and 8 are enlarged detailed views corresponding to Figs. 2 and 3, showing the adjustment provided by the orifice;

Figs. 9, 10 and 11 are similar to Figs. 2, 3 and 4 showing a modified orifice construction; and

Figs. 12, 13, 14 and 15 are enlarged detailed views showing the operation and adjustment of the orifice construction shown in Figs. 9-11

Referring to Fig. 1, a pressure treating vessel 1 is fed with textile thread 2 by means of feed rollers 3 contained in an end-box 4 in which pressure-air is maintained at a pressure of 1 or 2 lbs. per square inch below the pressure in the vessel 1. The thread 2 leaves the vessel 1 by an orifice in the end-plate 5, stretching rollers 6 imparting the desired degree of stretch, e. g. 10 times.

The end-plate 5 is shown in detail in Figs. 75

2-4 as comprising a plate 7 bolted to the flange 8 of the vessel 1 and formed with a dovetailed slot 9 on its outer face to receive a sliding plate 10 and a fixed plate 11. A micrometer screw 12 enables the plate 10 to be slid in one direction until it contacts with the end of the plate 11 and in the other until it contacts with an adjustable stop 13.

The plate 7 is pierced by a pear-shaped aperture 14 having its enlarged end downwards, and a similar aperture 15 in the sliding plate 10 has its enlarged end upwards. The diameter of the enlarged ends corresponds to the diameter of the unstretched thread 2, and in the initial threading of the apparatus the plate 10 is moved towards the plate 11 so that the enlarged ends of the apertures 14, 15 overlap as shown in Figs. 5 and 6, thus making for easy threading and yet cutting down the escape of pressure fluid from the vessel 1.

When stretch is applied, the diameter of the thread is reduced, as shown in Fig. 7, and the sliding plate 10 is moved towards the stop 13 to make the small ends of the apertures 14, 15 overlap. In this way, the reduced thread again substantially fills the orifice, to cut down the escape of pressure fluid.

Since the thread 2 entering the vessel 1 from the end-box 4 is only stretched in its passage through the vessel, there is no change in relative areas at the inlet orifice 16 corresponding to that at the end-plate 5 and an adjustable orifice need not be provided there.

If necessary, other pairs of orifices 14, 15 may be provided in the plates 7, 10 to enable several threads to be simultaneously treated (as is the case in Figs. 9-15), but where comparatively large slivers of thread 2 are to be stretched (e. g. in the manufacture of stretched filaments intended to be cut into staple fibre) the whole capacity of the stretching apparatus may be needed to deal with a single sliver, in which case a single pair of orifices suffices, as shown in Fig. 2.

In Figs. 9-11, an end-plate 17 bolted to the flange 8 of the vessel 1 comprises three plates 18, 19, 20 forming a dovetailed slot 21 in which are a sliding plate 22 and a fixed plate 23. The approaching edges of these two plates are transversely notched as shown in Fig. 12, the notches 24 being V-shaped with rounded apices. The notches are in register and are enabled to overlap by the faces of the plates being grooved lengthwise as shown in Fig. 13, a groove 25 of one plate registering with a rib 26 lying between a pair of grooves 25 of the other plate. The ribs are slightly thinner than the width of the grooves.

A micrometer screw 27, fitted with pairs of adjustable stop nuts 28, enables the faces of the plates 22, 23 to be separated as shown in Fig. 12 for the easy positioning of a number of threads 29 in the initial threading of the apparatus. The edges may then be caused to approach until the grooves 25 and ribs 26 mesh with each other as shown in Fig. 14, the threads 29 then substantially filling the orifices formed by the overlapping apices 30 of the notches 24. When stretching has reduced the cross-section of the threads 29, the plates 22, 23 are moved to bring the grooves 25 and ribs 26 deeper into mesh, as shown in Fig. 15, until the threads again substantially fill the now smaller orifices.

With both the unstretched and the stretched threads, relatively little free space is left for the escape of pressure fluid, and this escape is further restricted by the labyrinth structure formed

by the intermeshing grooves and ribs. As will be seen from Fig. 13, any fluid escaping past the thread near the opposed faces of any pair of ribs 26 (i. e. a rib of the plate 22 and a rib of the plate 23) expands into a chamber 31, and escape 5 from any one chamber can only be by a similar expansion into the next chamber, and so on through the whole thickness of the plates 22, 23. As explained in U. S. Patent No. 2,228,272, dated 10 January 14, 1941, such an arrangement results in a much reduced flow of fluid from the vessel 1.

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

1. An orifice device for the passage of textile materials through a wall of a treatment vessel, 15 comprising two members having surfaces overlapping each other, said members being mounted in sliding relation one to the other, closed apertures in the overlapping parts of the members, an aperture in one member overlapping an aperture in the other member, and means for causing 20 relative sliding movement between the members to enable the apertures to overlap each other by varying amounts, the parts of the periphery of each aperture that intersects with the periphery 25 of the other aperture diverging from one end of

the aperture to the other, and the ends of each aperture joined by said parts being similar in shape but different in size, whereby said apertures in conjunction provide an opening for textile material that may be varied in size while remaining substantially constant in shape.

2. An orifice device for the passage of textile materials through a wall of a treatment vessel, comprising two members having surfaces overlapping each other, said members being mounted in sliding relation one to the other, pear-shaped apertures in the overlapping parts of the members, the smaller end of an aperture in one member pointing in the opposite direction to 15 that of an aperture in the other member and the apertures themselves overlapping each other, and means for causing relative sliding movement between the members to enable the apertures to overlap each other by varying amounts and 20 thereby to provide an opening for textile material that may be considerably varied in size while remaining substantially circular in shape.

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