PUBLISHED
APRIL 27, 1943.
BY A. P. C.

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SPINNING NOZZLE FOR THE PRODUCTION OF ARTIFICIAL HOLLOW THREADS

Filed Feb. 12, 1941

Serial No.
378,642

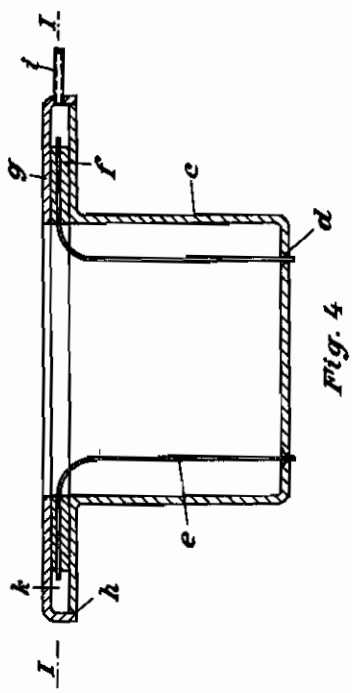

Fig. 4

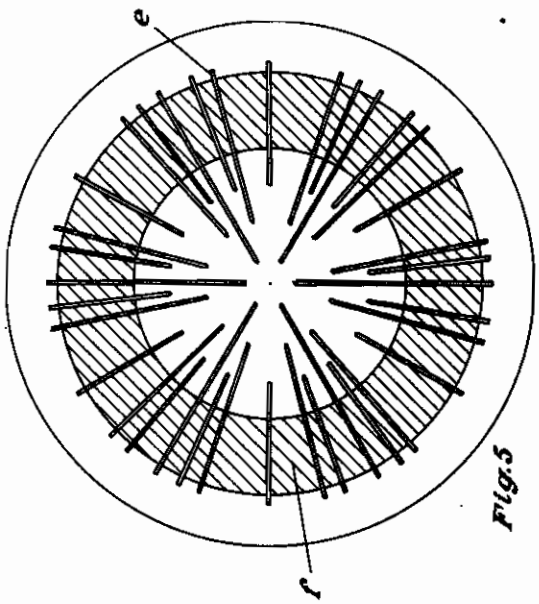

Fig. 5

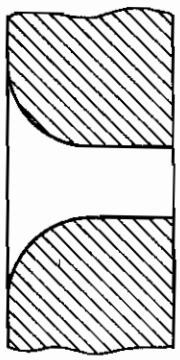

Fig. 1

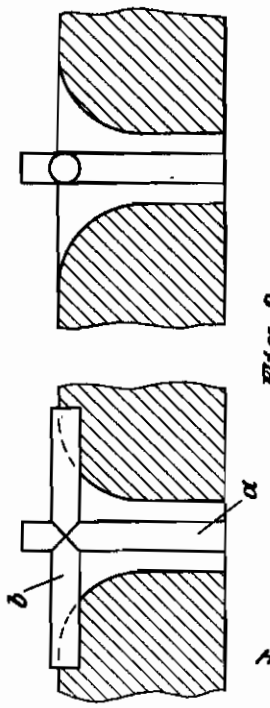

Fig. 2

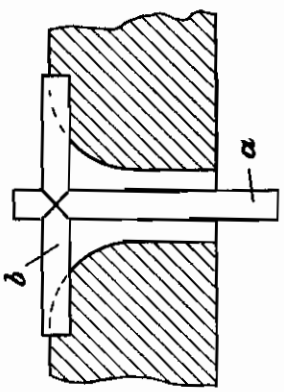

Fig. 3

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Published Apr. 27, 1943 Serial No. 378,642

ALIEN PROPERTY CUSTODIAN

SPINNING NOZZLE FOR THE PRODUCTION OF ARTIFICIAL HOLLOW THREADS

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Application filed February 12, 1941

The present invention relates to spinning nozzles for the production of artificial hollow threads used as substitutes of thin, natural threads, e. g., of cotton, animal wool, or silk, and having in general diameters approximating 30–100 my.

Sinee artificial threads because they have a solid cross section are known to possess disadvantages over natural threads, e. g., wool threads or silk threads, and have particularly less heat insulating properties, endeavors have been made ever so long to also produce hollow artificial threads.

Such efforts, however, have not yet succeeded in producing, in a technically satisfactory manner, threads having the dimensions of fine natural threads of the kind referred to and possessing hollow spaces extending over their whole length.

As fears have heretofore been entertained that the body forming the hollow space, the so-called core, would interfere with the not guided feed of the spinning material into the nozzle, experiments up till now essentially aimed at ensuring a uniform passage of the spinning material through the nozzle by a reciprocal movement between the core piece and nozzle. For example, it has been suggested to feed the spinning solution into the hollow spaces forming between two grooved rolls rotating in opposite directions and to insert needles in such hollow spaces with a view to obtain a hollow shape of the threads forming between the rolls.

Furthermore it has been suggested to reciprocate needles in spinning apertures.

Such methods are impracticable when spinning threads of the small dimensions referred to and, besides, are circumstantial, as they require, above all, a very complicated equipment, nor has one succeeded in producing thereby fine and even hollow threads in a satisfactory manner.

The essential feature of the spinning nozzle according to the present invention is that in the apertures of nozzle of otherwise conventional shape and size, having a plurality of bores for the fabrication of cellulose wool and rayon, hollow space forming cores, preferably in the form of an axially extending wire, or capillary tube, are provided, which are secured to the inlet of the nozzle aperture or proximity thereof. In using capillary tubes as hollow space formers which are used in special instances, e. g., when the compositions of the spinning solution or precipitant are varied, e. g., in the case of what is called "drawing spinning process," or are, in general, employed only for cross sections of holes from, say, 1 mm onward, the following dispositions prove useful:

The capillary tubes are either connected to a manifold, e. g., a hollow ring, or singly led out of the nozzle so as to permit air from the outside to be drawn into the nascent hollow thread or a medium to be blown in or pressed in.

It is surprising that, merely by inserting, e. g., a solid wire into the conventional bore of generally extremely narrow cross section by this method of securing the hollow space forming wire to the inlet of the nozzle apertures, a spinning material, such as, e. g., asbestos material, does not stick together in view of such small dimensions of the nozzle area and as a result of the coupling pressures exerted after passing along the wires, nor that the requisite fastening of the hollow space formers either near the nozzle apertures or inside the latter does not result in irregular shapes of the hollow spaces, e. g., by the formation of eddies or deposits.

The fastening of the hollow space formers, i. e., the wires or capillary tubes, to the inlet of the nozzle apertures affords the advantage of great simplicity.

It must also be taken into consideration that the nozzle apertures with the materials here concerned are practically not discernible with the naked eye and the hollow space forming wires will only be diseovered by sufficient magnification, e. g., by means of a mieroscope.

Since difficulties have been encountered with the heretofore practised manufacture of hollow threads of larger dimensions in securing the hollow space forming needles to the nozzle duct, and makeshifts, such as a reciprocation of the hollow space forming needles have been adopted, this proves that it could so much the lesc be expected that in the case of nozzle apertures of, say, 50–100 my, hollow space forming elements could be fastened at all and become operative.

Experience has shown, however, that stationary needles and capillary tubes used as cores yield hollow threads that turn out particularly uniform and, above all, permit of a very economic production of hollow threads.

The accompanying drawing shows a spinning nozzle according to the present invention by a number of embodiments.

Fig. 1 shows a conventional nozzle bore with a tapering inlet, otherwise of cylindrical shape, such as in common use in spinning nozzles for spinning ordinary rayon.

Fig. 2 shows, in two views displaced by 90 deg., a nozzle bore of equal design with a wire axially

inserted from the inlet and held at the inlet of the nozzle aperture by means of a transverse wire; the wire forming the hollow space and also the transverse wire may be used in the form of a little cross consisting of one piece.

Fig. 3 shows another embodiment of the wire forming the hollow space in the thread.

Fig. 4 shows an embodiment with capillary tube as hollow space former in a longitudinal section through the nozzle.

Fig. 5 is the top view of a nozzle of this kind on the line T—T of Fig. 4.

In particular, (*a*) designates the wire forming the hollow space in the thread, (*b*) representing a transverse wire by which the wire (*a*) is held in centrical position. The transverse wire (*b*) may be fastened simply by pressing its free ends into the nozzle metal. The transverse wire may also be firmly connected, e. g., by being caulked into the nozzle.

When fastening the transverse wide (*b*) by pressing in, it is recommended to use heat-treatable alloys for the manufacture thereof. In this case the transverse wire is forced in tempered state into the aperture of the not tempered nozzle and the latter is then tempered also. The wires (*a*) and (*b*) are suitably made from the same metal too.

As shown in Figs. 4 and 5, (*c*) is the nozzle, (*d*) the nozzle bore showing a tapering inlet, (*e*) are the capillary tubes held in position by a holding ring (*f*) which, in turn, is held by the nozzle flange and an overlapping cap ring (*g*), the cap ring with the nozzle flange (*h*) forming a hollow space outside of the holding ring (*f*), in which hollow space the lead-in (*i*) is inserted for blowing in, or pressing in, a suitable medium forming a hollow space or supporting the formation of a hollow space, which medium diffuses in the annular hollow space and is fed from here to the individual capillary tubes.

It has been proved that so simple a fastening method as the one above referred to is absolutely sufficient to hold the wire extending axially in the bore of nozzle and to ensure faultless operation. Other fastening methods may, of course, also be adopted, e. g., by means of two transverse wires.

Another particularly useful fastening method consists in the clamping of both sides of the wire, or capillary tube, forming the hollow space in the thread by means of the material of the nozzle itself; in this case the wire itself is clamped in axial position in the bore of corresponding shape, e. g., by a pressure exerted with a suitable tool upon the inner nozzle bottom on two opposite sides. Hereby, narrow transverse straps are formed from the material of the nozzle bottom, which straps hold the wire in a similar manner as the transverse carrier shown in the drawing.

In certain instances, especially with spinning nozzles having a very small bore, it is possible to cause the wire forming the hollow space in the thread to protrude beyond the exterior edge of hole, as is shown in Fig. 3 by way of example.

When operating the spinning nozzle according to the invention, the spinning solution on entering the bore of nozzle surrounds in a similar manner the wire forming the hollow space in the thread from all sides and evenly. The wire is held in the center of the bore by the streaming viscose and is possibly also forced into axial position when assuming a slightly inclined position.

In this way it is possible to produce artificial hollow threads in the simplest and cheapest manner by conventional spinning nozzles which, by inserting more or less thin wires, or capillary tubes, into the bores, produce hollow spaces of a particularly desired shape in the thread or permit artificial threads of different shell thickness to be manufactured. The members forming the hollow space in the thread, e. g., wires of suitable shapes, such as cylindrical, conical shape, or of suitable cross sections, may in the simplest manner be inserted into the bores specially prepared, if desired, and may, if necessary, be interchanged with comparative ease.

The produced threads possess the advantage that in the case of thinnest threads they have equal outer diameters, but a much lighter weight than solid threads and thus may be made with an appreciably smaller expenditure of material. Besides, they possess the known advantages of hollow threads, in particular the merit of excellent heat insulation.

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