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SPINNING METHOD
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Fig. 1

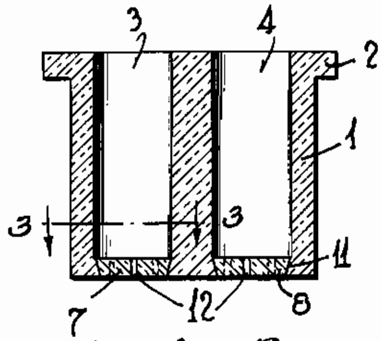


Fig. 2

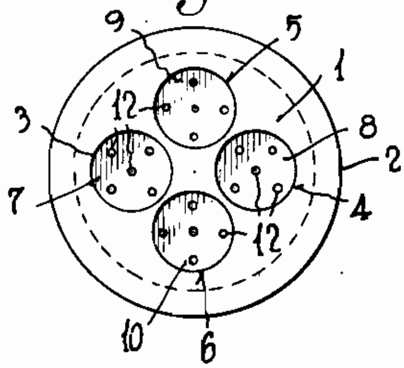
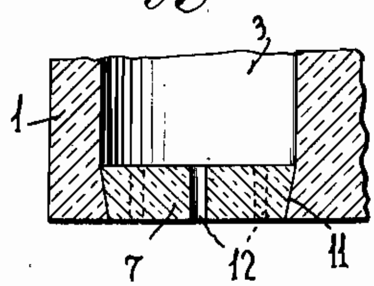


Fig. 3



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SPINNING METHOD

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The present invention relates to a spinning method for producing spinning fibres.

In the production of artificial spinning fibres by pressing liquids of any kind through nozzles, whereby substances either genuinely or colloidally solved in liquids or molten substances are formed to spinning fibres, the result of the finished product is amongst other factors essentially dependent on the properties of the spinning nozzles. The most various materials are used in practice to make such nozzles. Alloys of noble or precious metals, such as gold, platinum, rhodium, have been proposed for this purpose. Tantalum and other metallic substances have also been proposed for this purpose. The heat treatment of such alloys results in a high degree of hardness and therefore a long life of nozzles made of such alloys, a sufficient expansion or dilatation and elasticity respectively being ensured simultaneously.

Nozzles made of ceramic materials, particularly of glass, have originally been used in the production of fibres obtained from macromolecular solutions. Such nozzles practically are not used today if viscose is employed as spinning liquid, because nozzles of this kind proved to be too brittle. As nozzles of considerable hardness and capable of resisting acids and the like, the use of nozzles made of steatite has also been proposed which is drilled and subsequently hardened by annealing. It has not become known whether such nozzles have proved to be of value in practice. Anyhow nozzles of this kind are not used, because nearly exclusively nozzles made of noble or precious metal are employed to-day in practice in spite of the high costs of such nozzles.

Now, it has been found that nozzles made of metallic materials, primarily of so-called alloys of precious metal highly developed in the artificial silk industry, are not adapted to be used in connection with strongly glutinous spinning solutions, particularly such of macromolecular substances whether in solutions, hydrosols or organosols.

Generally all spinning nozzles built up on a metal basis fail, if melting of macromolecular substances obtained by polymerisation or polycondensation are to be spun. Since such spinning solutions, for instance spinning solutions obtained by dissolving casein and other protein substances in their solvents, spinning solutions obtained on the basis of hydrocarbons, polymerisates or condensates, phenol- or cresol-formaldehyde-rosins (phenoplastes) aniline rosins, phenol-furfural rosins, i. e. solutions or meltings of artificial substances on the basis of phenols and their derivatives, artificial substances on the basis of carbamides, artificial substances on the basis of carbocylic acid, such as are obtained by polymerisation thereof, as phthalic rosins, maleic acid esters, succinic acid esters, polymerisates of ethylene derivatives, as monomers and polymers of styrols, isobutylene, vinyl esters, vinyl ethers, vinyl methyl ketones, acrylic acid- and methacrylic acid-compounds, but also polymerisates and derivatives of butadiene, isoprene and other macromolecular substances, compounds of isoprene acid and other acids which at present are used in the artificial silk industry as basis of artificial substances, are employed in practice today to a large extent, it has proved that nozzles made of precious metal used in the artificial silk industry, particularly in connection with viscose or cupric oxide ammoniac cellulose, practically cannot be succesfully employed. Greatest difficulties arise particularly during spinning on. The perforations of the nozzles are closed by overgrowing and are covered. As a further result, the spun thread may only be drawn off with very low speed so that stretching practically is impossible. Moreover, substantial titre fluctuations occur when using metallic nozzles particularly when employing same for spinning meltings.

Now, it has been found that all these disadvantages are obviated by the use of nozzles of vitreous materials, such as glass and quartz glass, and that with such nozzles the spinning speed may very considerably be increased. It has been shown that glass is very slightly moistened only by such strongly glutinous substances, so that the spun thread may quickly be withdrawn and simultaneously easily be spun on. The force required for drawing off may be so chosen that practically the limit of the strength of the spun thread is reached.

Particularly when using meltings, nozzles of low heat conductivity must be used, because the artificial substances to be spun as meltings very often have a very low range of temperature in which they may be spun, i. e. in which they pass from the solid state by way of the viscous state to the diluted state capable of being spun. If the temperature is not high enough such spinning solutions are too viscous to be spun at all, and if the temperature is raised a little higher only the danger exists that hereby disintegrations are caused.

This is very peculiar and cannot easily be explained. It may be imagined that the surface tension of the strongly glutinous substances in consideration, i. e. of the protein solutions, the solutions or meltings of the above mentioned preferably thermoplastic condensates and polymerisates, due to their low viscosity relatively to other spinning solutions, just with regard to vitreous substances is so favorable that the otherwise rather injurious brittleness of the glass is not harmful and just owing to the favorable proportion of the surface tension of the spinning liquids in consideration to glass or quartz allows a smooth separation without cloggings occurring.

The invention, therefore, relates to a method of spinning strongly glutinous spinning liquids, as solutions or meltings of thermoplastic and meltable macromolecular condensates or polymerisates, spinning solutions on the basis of protein substances, as preferably casein or protein of fish. For carrying out the new method it is further of importance that the drawing off speed may be greater than corresponds to the amount fed by the spinning pump, whereby the force used for drawing off may nearly reach the limit of the strength of the thread, and that the spinning is effected by means of nozzles of vitreous material, as glass or quartz glass. It is of no importance, whether solutions or meltings are spun and whether the spinning is effected in a liquid or in a gas.

By using nozzles made of the above mentioned materials in connection with the spinning solutions in question, spinning nozzles may be employed in which the individual spinning holes are spaced apart for a distance of 3 to 5 times as large as the diameter of the holes. In contradistinction thereto considerably larger spacings of the holes must be provided if a trial is made to spin glutinous liquids by the use of metal nozzles.

The heat and electric-conductivity of the material used according to the present invention probably is the reason for the fact, that electric tensions do not occur which are encountered, when the liquids in consideration are spun by means of metal nozzles. It was not to be foreseen that a strongly glutinous liquid, as for instance a spinning solution on the basis of alkaline protein substances or solutions of vinyl derivatives and the meltings thereof respectively could be spun by means of the rather brittle glass nozzles. It was to be assumed that clogging and bursting respectively of the nozzles would occur at once, owing to the large sticking capacity which for instance in the case of vinyl derivatives is used for the manufacture of compound bodies of glass. It is, however, rather strange, that this clogging or bursting does not occur. It is, however, true that metal nozzles are clogged, whereas nozzles of glass remain clear and even allow operation with increased spinning speed.

In the accompanying drawing a nozzle adapted for carrying out the spinning method according to the invention is shown by way of example.

In this drawing:

Fig. 1 is a vertical section through a nozzle according to the invention,

Fig. 2 shows a plan view of the nozzle illustrated in Fig. 1 and

Fig. 3 is a section on line III—III of Fig. 1 on a larger scale.

The body 1 of the spinning nozzle consisting of a vitreous substance, for instance glass, quartz glass or the like, has a flange 2 and four cylindrical openings 3, 4, 5 and 6 the lower ends of the boundary walls of which are inclined towards the centre of the corresponding hole. In these holes the perforated plates 7, 8, 9 and 10 respectively are inserted. In Fig. 3 showing this construction on a larger scale the conical wall 11 obtained by the peculiar formation of the holes 3, 4, 5, 6 is clearly illustrated which serves the purpose of holding the perforated plates 7, 8, 9 and 10 in the body 1 of the spinning nozzle.

As may be seen from the drawing the individual perforations or holes 12 in the plates 7, 8, 9 and 10 are separated from each other for a distance about three to five times as large as the diameter of the holes 12.

Of course, the nozzle may be constructed in another manner without departing from the scope of the invention, as long as the nozzle is made of a vitreous material and the holes in the perforated plates are spaced apart a distance of three to five times the diameter of said holes.

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