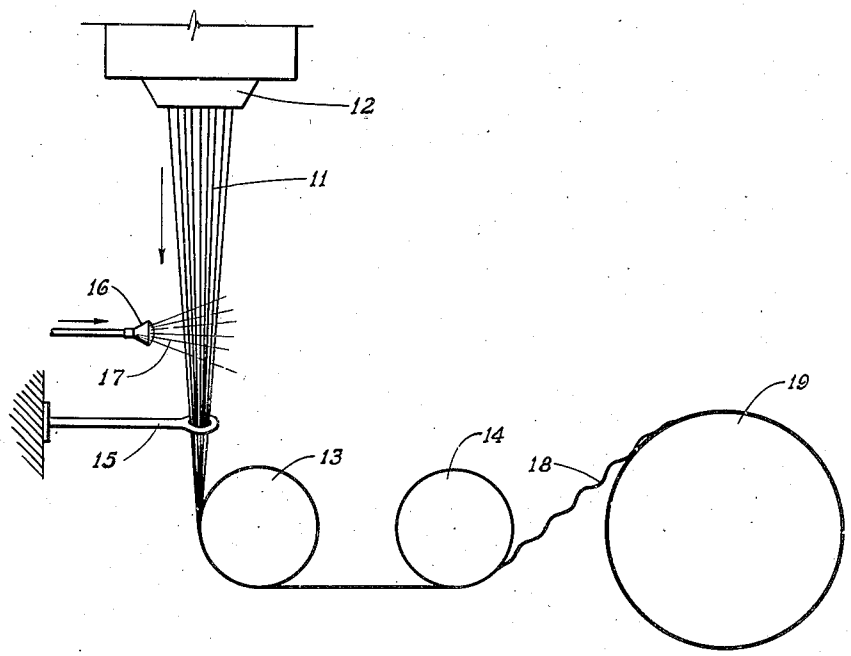
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CRINKLED POLYMERIC VINYLIDENE CHLORIDE FIBERS

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CRINKLED POLYMERIC VINYLIDENE CHLORIDE FIBERS

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4 Claims. (Cl. 18—54)

The invention relates to synthetic fibers, filaments, or threads and more particularly to the manufacture of crinkled fibers or filaments from polymeric vinylidene chloride.

The term "polymeric vinylidene chloride" as used herein and in the appended claims is intended to mean polymers, copolymers, and interpolymers of vinylidene chloride wherein the polymerized vinylidene chloride is present in predominant amount. Such polymeric vinylidene chloride may be obtained by polymerizing together monomeric vinylidene chloride with one or more other polymerizable materials such as vinyl chloride, vinyl acetate, styrene, acrylonitrile, the esters of acrylic or methacrylic acid, allyl and related esters of carboxylic or inorganic acids, unsaturated ethers, etc.

In producing fine fibers or filaments from the polymeric vinylidene chloride, it is the practice to extrude one or a number of filaments having a comparatively large diameter relative to the diameter desired in the finished filament. It is desirable to extrude the filaments or fibers of relatively large diameter and thereafter stretch them to reduce the diameter because less trouble is encountered due to clogging of the die orifices than when extremely fine filaments are directly extruded from small orifices. The extruded filaments are then subjected to a stretching operation while still in a hot state to bring about a substantial reduction in the diameter of the filament. Thereafter the filament is subjected to a cold-drawing or stretching operation which further reduces its diameter and produces orientation along the fiber axes, resulting in a product having greatly enhanced strength properties. The latter operation causes long chain molecules to line up along the fiber axis giving a fiber or filament having greatly enhanced strength properties. The degree of permanent elongation produced during the cold-drawing operation generally amounts to from 300 to 400 per cent.

While the fibers prepared as described above can be made into attractive and durable fabrics having somewhat the general appearance and feel of silk, it is also desirable to be able to produce a fiber that will serve as a substitute for wool. Among the wool-like properties desired in the fibers or filaments are tightly curled or crinkled filament structure, good heat-insulating properties, springy feel, and a fluffy appearance.

It is, therefore, the principal object of this invention to prepare artificial filaments, fibers, yarns and fabrics resembling wool from vinylidene chloride. A further object is to prepare fibers of a wool-like nature having good heat-insulating properties, retentivity of curl or crinkle in both the wet and dry state, and excellent strength.

Other objects and advantages of the invention will appear during the course of the following description.

I have now found that a wool-like substitute can be prepared from polymeric vinylidene chloride by causing a fine spray of liquid to impinge against the surface of the filament during the stage in its production when the filament is in a hot condition, e. g. at, or near, its softening point. Preferably, the liquid is caused to strike the filament from one side only as by directing a very fine spray, mist, or fog of liquid against one side of the filament while it is still hot, and prior to the cold-drawing operation. Thereafter, the material may be cooled, if desired, as by passing it through a cold water bath, although contact with air may produce sufficient cooling. The filament is then subjected to a cold-stretching operation as by leading it around a pair of rolls operated at differential rotational speeds wherein it is given an additional elongation of from about 200 to 400 per cent. The cold-stretching operation may be carried out at a temperature of from 5° to 50° C., although preferably at from about 20° to 30° C. The resulting cold-stretched product is then unexpectedly found to possess a tightly curled or crinkled filament structure, which somewhat resembles wool. The filaments retain these wool-like characteristics when made into yarns and impart wool-like properties to the fabrics into which they are made.

Reference is made to the accompanying drawing showing one manner in which the invention may be carried out. In the drawing a number of filaments 11 of fused polymeric vinylidene chloride are extruded from an extrusion head 12 and, after being cooled by contact with the air, are conducted around a first roll 13 and a second roll 14. The second roll 14 is run at a peripheral speed greater than that of the first roll 13 so that the filament is cold-stretched between the two rolls. A guide 15, such as a suitably supported stationary ring, may be provided ahead of the first roll 13 to collect and guide the filaments onto the surface of the roll. A nozzle 16 is provided and so positioned that a fine mist or spray of water or other suitable liquid ejected under pressure therefrom strikes the moving filaments 11 after they leave the extrusion head 12 and before they have cooled sufficiently to be cold-stretched. The crinkled fiber or filament 18 leav-

ing the cold-stretching rolls may be wound on a take-up drum 19 and stored for further use.

Illustrative of a temperature at which the filament should be maintained at the time the freely dispersed liquid is directed thereat, might be mentioned from about 90° C. up to the softening point of the polymeric vinylidene chloride, although it will be understood that the temperature range will vary somewhat depending on the particular composition of the material being treated. The spray or other device directing liquid against the filament may be satisfactorily placed at any convenient distance from the extrusion head providing the material is treated while at the indicated temperature.

Fibers or filaments of widely varying diameter may be treated. For example, individual filaments or fibers having a denier of from about 0.5–20 may be treated in the foregoing manner to produce a wool-like filament structure, although filaments having a denier of 0.5 to 10 are of most utility and value.

In general, the type of liquid to be sprayed against the hot filament may be of a varied nature, it being desirable however to direct it against the filament in finely dispersed form. For example, water has proved to be highly satisfactory for use in this operation, although organic liquids are also satisfactory, it being preferable however to choose one which does not possess too marked a solvent power for the polymeric material being treated. The temperature of the liquid being employed is preferably kept near room temperature or below since the best result as regards wool-like appearance is then obtained. In general, a finely dispersed liquid is preferred since forcing a gas against the hot filament does not appear to give as marked a wool-like filament structure.

It will be appreciated that the method is readily adapted to continuous operation wherein one, or a number of filaments are continuously extruded, hot-stretched, sprayed with a finely dispersed liquid, and cold-stretched to give a wool-like product which may then be wound up on a suitable take-up reel for forming into yarn and fabric, or directly formed into yarn. Thus, in the foregoing manner, crinkled filaments or fibers resembling wool may be simply and economically prepared from polymeric vinylidene chloride without any substantial alteration of the conventional process now employed for the production of the straight filaments or fibers. The wool-like fibers resulting from the foregoing treatment possess all the excellent elastic and strength properties of the normal filaments and fibers together with their chemical resistance and insensitivity to moisture. It will be generally desirable in forming wool-like yarns to produce the crinkled filaments in relatively long lengths and thereafter cut them up into staple fibers in lengths of from an inch or less up to eight inches or more, since yarn made from the short crinkled fibers is of a more wool-like nature.

I claim:

1. In a method of producing a crinkled filament from polymeric vinylidene chloride the steps which comprise directing an unheated liquid, characterized by having substantially no solvent action on the filament, in finely dispersed form against the filament of polymeric vinylidene chloride while said filament is at a temperature above about 90° C., and thereafter subjecting said filament to a cold-stretching operation.

2. In a method of producing a crinkled filament from polymeric vinylidene chloride the steps which comprise extruding a filament of fused polymeric vinylidene chloride, directing a finely dispersed unheated liquid against the filament while the filament is at a temperature above about 90° C., said liquid being characterized by having substantially no solvent action on the filament, and thereafter subjecting said filament to a cold-stretching operation at a temperature of between about 5°–50° C.

3. In a method of treating a filament of polymeric vinylidene chloride produced by forming a filament of polymeric vinylidene chloride and thereafter cold-stretching the filament, the step which comprises directing an unheated liquid, characterized by having substantially no solvent action on the filament, in finely divided form against the filament while the latter is at a temperature above about 90° C.

4. In a method of treating a filament of polymeric vinylidene chloride produced by extruding a filament of polymeric vinylidene chloride, stretching the filament while at a temperature above about 90° C., and thereafter cold-stretching the filament, the step which comprises directing an unheated liquid, characterized by having substantially no solvent action on the filament, in finely divided form against the filament during the first of said stretching operations.

WILLIAM B. ROBBINS.