

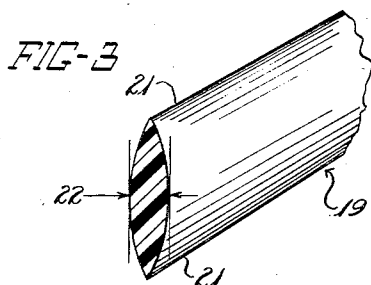
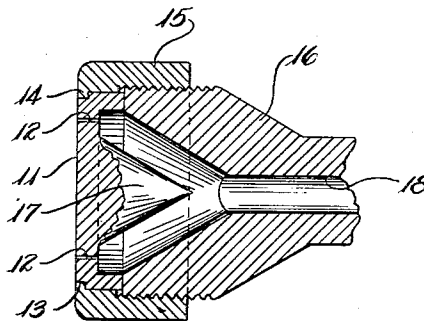
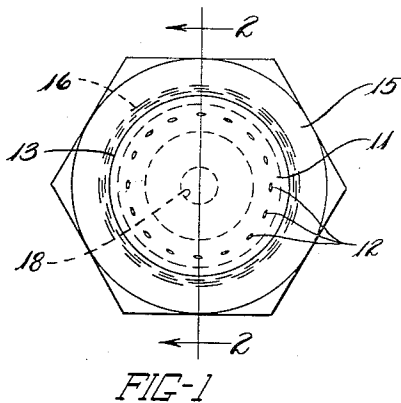
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C. F. POETTER ET AL

2,848,737

EXTRUSION DIE

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1

2,848,737

EXTRUSION DIE

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1 Claim. (Cl. 18—8)

This invention relates to a unique plastic monofilament and method and equipment for producing same.

Plastic monofilament strands or strips of extruded, oriented plasticized vinylidene chloride copolymer are described in Stedman U. S. Patent 2,354,435. The cross section suggested by this patent for such filaments is circular, flat with rounded edges, semi-elliptical or concavo-convex. In certain applications, as in kitchen cleaning aids such as scouring pads, these plastic filaments were unsatisfactory for effective cleansing action of pads embodying them, because of the smooth, rounded edges of the filaments.

Various metallic strands or filaments have been incorporated into cleaning rods. Such metallic strands have usually been flat or rounded in cross section, and have depended for abrasive action on the inherent harshness or rigidity of the metal making up such strands. Metallic wire for various uses has been disclosed in a number of cross sections in numerous U. S. patents, examples being Taylor 414,090, Howell 723,873 and Blount 2,146,788. However, pads made of metallic strands have always possessed certain disadvantages inherent in the metal strands themselves. Pads made of iron or steel wire rust rapidly and scratch silverware, china and cooking vessels of aluminum or copper. Pads made of copper or brass strands tend to discolor aluminum cooking vessels, and also to scratch silverware and china. Metal cleaning pads quickly become soggy and difficult to keep clean.

It is an object of the present invention to provide an improved filamentary material designed to overcome the deficiencies of the prior art discussed above. It is also an object to provide suitable equipment and method for producing such improved filamentary material. The above and other objects will become apparent in the following description of the invention and in the accompanying drawing, in which:

Fig. 1 is a front elevation of an extruding head suitable for production of filamentary material of the invention;

Fig. 2 is a fragmentary sectional view taken along line 2, 2 of Fig. 1; and

Fig. 3 is a fragmentary perspective view of the improved filamentary material of the invention, shown partially in section.

Referring to the drawing, a die 11 is provided with a multiplicity of orifices 12, 12, arranged in a circular configuration about the axis of the die. The die with 16 orifices shown in Fig. 1 is merely typical of a die suitable for small production of the filament of the invention, and dies having more or less orifices may also be utilized. Although a simple die having a single orifice may be employed, especially for experimental work, a die having even more than 16 orifices presents the advantage of providing greater production from a given extruder. For example, a die having 32, 64, or even more than 100 orifices may be employed, and the orifices are preferably arranged in one or more concentric circles,

2

or otherwise arranged, substantially uniformly about the axis of the die.

The outer face of die 11 is provided with a recess 13 around the periphery thereof. The recess is adapted to mate with a flange 14 of a cap 15. The cap is interiorly threaded to secure the die in proper position against an exteriorly threaded extruder head 16 of an otherwise conventional extruder (the remainder of which is not shown). Th side of die 11 opposite to the outer face thereof is provided with an integral conical portion 17 to insure uniform delivery of plastic material from extrusion chamber 18 of head 16 to the orifices 12, 12 of the die, and to avoid creation of a pocket or region of relatively stagnant plastic material, which may be subject to decomposition when maintained at a high temperature for any substantial length of time.

In the production of plastic filament of the invention, a crystalline thermoplastic resin, which may contain plasticizer, heat and/or light stabilizers, coloring pigment and any other conventional compounding ingredient, is introduced into the extruder in the form of a powder, finely granulated solid or blended compounded resin, and is then heated in the extruder and delivered to the head 16 as a substantially liquid, plastic, homogeneous material. The head 16 is maintained at a suitably controlled high temperature by means of a hot fluid jacket (not shown), or by means of electrical resistance heating means (not shown), as will be understood by those skilled in the art. An example of a preferred crystalline resin is a vinylidene chloride polymer, including copolymers or terpolymers consisting of 70% or more of vinylidene chloride polymerized therein. The best-known commercial example of resins of this type is known as Saran, which is understood to include copolymers of 85 to 95% of vinylidene chloride, with correspondingly, 15 to 5% of vinyl chloride. The plasticized and otherwise compounded Saran resin is suitably extruded at a temperature well above 100° C. and usually in the range of 160 to 175° C. From the orifices 12, 12 of die 11, the issuing filamentary material is carried through a water bath (not shown) to quench the hot, plastic filaments. From the water bath the quenched filaments pass to suitable stretching means (not shown); a variety of such means are well known to those skilled in the art, and usually comprise a series of rolls driven at successively greater speeds of rotation. The band of the 16 parallel strands of the extruded plastic filaments is passed around successive rotating rolls and thereby gradually stretched to reduce the cross section of each filament to the desired extent and also to orient the crystalline resinous portions of the plastic substance of the filaments. The drawn, oriented filaments are wound upon suitable spools, bobbins or rolls and shipped to the user, such as the manufacturer of knitted plastic tubing, subsequently converted by a simple fabricating operation into a scouring pad.

The filament produced as described above is shown in perspective and partially in cross section in Fig. 3, and is identified by numeral 19. This preferred filament is substantially elliptical in cross section, except that opposite edges 21, 21 are relatively sharp. The ratio of thickness 22 of the filament to the width thereof (the distance normally measured between opposite edges 21, 21) is in the range of 1/5 to 1/2, and is preferably substantially 1/3.

Suitable filaments of plasticized and stabilized Saran resin have been produced in cross sections of 13 x 30 mils (thousandths of one inch), 8 x 20 mils, 7 x 18 mils and 6.5 x 20 mils. The orifice in the die is suitably made substantially 3 to 4 times larger than the cross section of the final filament. For example a commercial filament measuring 13 mils in thickness and 30 mils in

width was produced from a die in which the orifice measured 40 x 115 mils. Both the die orifice and the cross section of the filament produced therefrom were elliptical in cross section, in the manner illustrated in the drawing.

The unique plastic filaments of the invention, produced as described above, display tensile strengths in the order of 25,000 to 60,000 pounds per square inch. The oriented filaments are tough, lustrous and very resistant to the action of ordinary organic solvents, such as dry cleaning solvents, and also to other cleansing liquids, including ordinary soap and water. The filaments are very flexible and tough, and they possess long flex lives. The filaments are also substantially non-splintering and non-porous. The filaments will not imbibe water, and are actually hydrophobic. The filaments are suitably produced in a great latitude of colors, ranging from a straw color or other light color, through many bright and deep colors now well known in the plastics arts, to dark colors, and even to black.

As indicated above, a variety of different compounding materials and/or pigments may be incorporated into the resin mixture prior to extrusion of the filaments. As a further example, one or more fluorescent pigments or materials are suitably incorporated into the plastic mixture, and the resulting elliptical filament displays a fluorescent color. Depending upon the particular fluorescent pigment incorporated into the mixture, the resulting filament is luminous in the dark, and/or visibly glows in daylight or in the presence of ultra-violet light, to make the article containing the filament stand out and attract the attention of casual observers. Filaments containing an inorganic fluorescent pigment, such as the activated metal sulfides, are luminous in the dark immediately after exposure to ordinary light or invisible ultra-violet radiation, and are suitably compounded to project more than 50% of the incident visible light of daylight in the dominant wave band. Filaments containing certain organic fluorescent pigments, for example as disclosed in U. S. Patent 2,498,592, project substantially more of the daylight of a corresponding color in the

incident visible light, often in the range of 100 to 150% of such visible light.

The die 11 is made of a suitable tough, corrosion-resistant metal, such as a number of the stainless steel alloys and other alloys high in nickel and/or chromium. Nickel and alloys high in nickel are especially suitable for the material of die 11, since nickel dies have been found to be especially resistant to corrosion or wearing away when employed for extrusion of crystalline vinylidene chloride polymers of the type contemplated herein. Die 11 may also be formed of any suitably hard metal and plated with nickel and/or chromium to protect the operative surfaces thereof.

We claim:

A die for production of a plastic filament substantially elliptical in cross section and having sharp opposite edges, the die comprising a multiplicity of substantially elliptically shaped orifices of uniform size, the orifices being symmetrically arranged in respect to the center axis of the die, and the dimensions of said orifices being substantially 3 to 4 times larger than the corresponding dimensions of said filament, the die being provided with an integral conical structure on the inner face thereof, said structure having a complete conical surface, the axis of which is coaxial with the center axis of the die and the vertex of which is directed away from the outer face of the die, said structure being adapted to distribute plastic material uniformly to each of the orifices of the die.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,848,737

August 26, 1958

Clarence F. Poetter et al.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 28, for "rods" read -- pads --; column 2, line 9, for "Th" read -- The --.

Signed and sealed this 21st day of July 1959.

(SEAL)

Attest:

KARL H. AXLINE

Attesting Officer

ROBERT C. WATSON
Commissioner of Patents