cl. 18

Published Apr. 27, 1943

Serial No. 301,162

ALIEN PROPERTY CUSTODIAN

PRODUCING INJECTION-MOULDED ARTICLES

Heinrich Hopff and Hanns Ufer, Ludwigshafen-on-Rhine, Germany; vested in the Alien Property Custodian

No Drawing. Application filed October 25, 1939

The present invention relates to improvements in producing injection-moulded articles.

It is well known that for the manufacture of threads, ribbons and films there are excellently suitable "superpolyamides", i. e. highly condensed polyamides of practically linear molecular structure similar to polypeptides. These superpolyamides are obtained, for example, by heating aminocarboxylic acids by themselves or by heating dicarboxylic acids with diamines at higher temperatures until condensation products are formed which in the fused state can be drawn out to threads. Since the superpolyamides usually have a sharply defined melting point, they may also be used for the preparation of mouldings by the casting method. They may further be worked by the injection moulding method but the mouldings so obtained are unsatisfactory as regards their mechanical properties both when moulded or cast.

We have now found that mouldings having good mechanical properties can be prepared from superpolyamides according to the injection-moulding process by using the superpolyamides in a pre-orientated condition and injection-moulding them at temperatures below their melting point.

The orientation of the molecules of the superpolyamides may be effected in known manner, for example by extruding the molten superpolyamides through narrow orifices, slits or nozzles. Ribbons, foils, threads or tubes are thereby obtained. They are preferably stretched, if desired, at decreasing temperature. A sufficient orientation may also be obtained by rolling the superpolyamides on friction rollers.

The superpolyamides pre-orientated may then be comminuted in suitable apparatus, as beating mills, crushers or similar means and then be filled into the injection-moulding machine.

Care must be taken that the mass does not completely fuse in the injection cylinder; i. e. the operation must be performed below the melting point of the superpolyamides. Temperatures up to 40° C, preferably of between 10° and 35°, below the melting point of the superpolyamides have proved of particular advantage. The lower limit in the said range of temperatures is defined by the temperature at which the particles of the material to be injection-moulded only just coalesce thus forming homogeneous articles. This lower limit of temperature generally lies about 60° C below the melting point of the superpolyamides. Mouldings having particularly good mechanical properties are obtained within a relatively narrow range of temperature.

Preferably the orientated mass, while being injected into the moulds, is further kept strongly orientated for example by passing the mass, prior to entering the mould, through especially long narrow channels which may be heated to avoid excessive cooling of the mass, or through especially narrow nozzles, i. e. nozzles having less than 2 mm in diameter.

The mechanical properties of the superpolyamides are not only a function of the nature of the initial materials used, but also to some extent of the manufacture of the superpolyamides. Those superpolyamides have the best mechanical properties which have been prepared for example by condensing diamines with dicarboxylic acids or aminocarboxylic acids in a first stage in a closed vessel or in an open vessel under reflux of the water formed during the first stages of the condensation. The injection-moulded articles obtained from superpolyamides prepared in this manner are practically non-brittle and distinguished by a particularly high elasticity.

The masses to be injection-moulded may contain softeners and/or fillers, for example talcum, glimmer, graphite, asbestos, metal powder and the like. There may also be used superpolyamides of differing colors or mixtures of colored and uncolored superpolyamides, in order to produce mouldings of marbled appearance.

The mouldings obtained are distinguished by a high tensile strength and elasticity as well as by very smooth surfaces. They resist water and heat well and possess a good shape stability and a good electrical insulating power.

The following Example serves to illustrate how the present invention may be carried out in practice, but the invention is not restricted to this Example. The parts are by weight.

Example

A superpolyamide obtained by heating 100 parts of hexamethylenediamine adipic acid salt in a pressure-tight vessel at 280° C for 90 minutes in the presence of nitrogen, gradually releasing the pressure and again heating for about 4 hours at the same temperature under atmospheric pressure is pressed out from the reaction vessel through a rectangular slit of 5 mm in height and 50 mm in length (mounted on the bottom of the vessel) by pressing nitrogen into the vessel. The material when leaving the slit is stretched to twice its length and cooled with water. A long, thin, colorless, very tough, elastic band is thus obtained. The mass melts at about 250° C. It is reduced in a beating mill to about pea-size and worked in a usual injection-moulding machine having nozzles of from 1 to 2 mm in diameter at from 210 to 230° C. The mouldings thus obtained have a high tensile strength and elasticity and a beautiful smooth surface.

HEINRICH HOPFF.
HANNS UFER.