PATENT SPECIFICATION

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COMPLETE SPECIFICATION

An Improved Method of Manufacturing Plastic Shuttlecocks

I, WILLIAM CHARLES CARLTON, of Parkstone Works, Wingletye Lane, Hornchurch, Essex, England, of British Nationality, do hereby declare the invention, for which I pray that patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to means of manufacturing plastic shuttlecocks.

It is known that an extremely light skirt is required for a good shuttlecock, and when a plastic shuttlecock is made by injection moulding it is extremely difficult to obtain the required lightness combined with strength because of the reluctance of the material to run in extremely confined spaces. When material running from the two ends of a groove in a tool meets in the middle of the groove, an additional problem is created because a very small amount of air is trapped too and this prevents a good joint or weld. This point can be used to advantage in some features of shuttlecock manufacture but it is a disadvantage in others.

I have found that the required lightness in the skirt of a shuttlecock can be obtained in the injection moulding process if the main stem-grooves bringing the material in fluid state are connected by a series of rib-grooves placed reasonably close together, and that the strength of the joint which must be made in the material setting in the centre of some of these rib-grooves is increased if subsidiary stem-grooves are provided between the main stem-grooves. In addition to acting as air escape lines, these subsidiary stem-grooves fill up with material and substantially increase the air resistence of the skirt without materially adding to the weight, and at the same time make it possible for the material to run along the rib-groves. If necessary, this system could be used to make a skirt in which there are no air passage holes when the skirt is removed from the tool, by permitting the material to overflow from the sides of the rib-grooves as distinct from overflowing from the sides of the stem-grooves.

The object of this invention is, in a tool for the injection moulding of plastic shuttlecocks, to provide means for moulding a light skirt for a shuttlecock, by cutting in the tool a number of rib-grooves from the stem-grooves, the tool being characterised in that the joints which will be made in at least some of these rib-grooves where it is desired to make them continuous from stem-groove to stem-groove, are strengthened by providing subsidiary stem-grooves between the main stem-grooves.

In this specification stem-grooves are feeding grooves in which material is carried from the cap towards the trailing edge and in which the stems of the shuttlecock set; subsidiary stem-grooves are escape grooves running from the rib-grooves towards the trailing edge and in which the subsidiary stems of the shuttlecock set; rib-grooves are grooves running from stem-groove to stem-groove and if desired, from stem-groove to subsidiary stem-groove and in which the ribs of the shuttlecock are formed; the cap is that part of the shuttlecock normally struck by the racket, and the skirt is the vane portion of the shuttlecock.

The grooves are passages cut in the male or female tool or both along which material or air or both may flow; after the flow of material has ceased, the material sets in the grooves in the shape of the skirt of a plastic shuttlecock, and provided that care is taken not to machine the rib-grooves at an angle which would lock the shuttlecock on the male or female tool after setting, the shuttlecock may be removed as a complete unit. For convenience in description, parts of the mould or tool are sometimes indicated by reference to parts of the object or shuttlecock to be formed on them.

It is a further object of this invention to provide rib-grooves of a shape which will not lock the shuttlecock on the tool. Some licence is permissible in this respect if the material being used is flexible when set, but in any case, a lead must be provided which will ease the shuttlecock from the rib-grooves when it is being removed. The object of this part of the invention is achieved if rib-grooves in the conical portion of the male tool are machined with one side of each groove substantially parallel to the principal axis of the conical portion of the tool, this

side being extended until it runs out of the tool towards the small end of the conical portion, and rib-grooves in the conical portion of the female tool are machined with one side of each groove substantially parallel to the principal axis of the conical portion of the tool, this side being extended until it runs out of the tool in the direction away from the small end of the conical portion. In practice, if the rib-grooves are machined on a lathe by moving the cutter into the male or female tool along the length of the lathe as distinct from across the bed of the lathe, the desired condition would be obtained.

In order that the invention may be clearly understood and carried into effect an embodiment of the invention will now be described with reference to the accompanying drawings in which:—

Figure 1 is a part sectional side elevation of a tool incorporating the required features.

Figure 2 is a section at XX in Figure 1, showing rib-grooves in the male tool.

Figure 3 would be the corresponding section to Figure 2 if rib-grooves were to be machined in the female tool.

Figure 4 is an enlarged view of section in circle in Figure 3.

Referring to Figure 1; A is the main piece of the male tool, including the cone portion and the rear portion fixed by means of bolts secured in the threaded holes L to the tailstock mould plate of an injection moulding machine. The ejector C is connected to the ram E and runs right through the male tool to the cap of the shuttlecock. The ejector is maintained in the closed portion against the nose W of the male tool by the spring F acting against the retaining plate G, and the ejector guide D which is secured to the male tool by the screws K. The retaining plate G is secured to the ram E by the bolt J and washer H.

B is the main piece of the female tool and this is threaded on to the plate M which in turn is secured to the headstock mould plate of the moulding machine. Water flows through the pipe N and into recesses between M and B to cool the cap of the shuttlecock. A nozzle plate P is secured to the plate M by the screws Q, and a watertight packing is forced into joint O to prevent leakage of water into the cap of the shuttlecock. A heating element U is secured around the outside of the female tool to warm the skirt portion of the shuttlecock to reduce the chilling of the material as it flows into the grooves.

The stem-grooves S are in this instance cut in the male tool, the rib-grooves T are cut around the male tool and shown in more detail in Figure 2. The subsidiary stem-grooves V run between the main stem-grooves and in this example start at the rib-groove nearest to the cap and finish at the rib-groove furthest from the cap. The material is forced under pressure in a fluid state through the inlet R, and runs round a space left for the cap of the shuttlecock into the stem-grooves S, it then runs into the rib-grooves T and thence into the subsidiary stem-grooves.

The rib-grooves T are machined to the shape shown in the section in Figure 2, the depth of the groove from the surface of the male tool being about .010" if polythene is the material being used. One side of each of these rib-grooves is substantially parallel to the principal axis of the conical portion of the tool, this side being extended until it runs out of the tool towards the small end of the conical portion. If nylon is the material it will not stretch as readily as materials like polythene and particular attention should be paid to avoid locking on the tools.

It will be understood that stem-grooves, rib-grooves and subsidiary stem-grooves could also be machined in the female tool or both in the male and female tool. See Figure 3 which shows rib-grooves as correctly machined in female tool. Note now that one surface in each of these rib-grooves is again machined substantially parallel to the main axis of the shuttlecock and that these surfaces run out of the cone at their edge furthest from the cap.

Figure 4 shows an enlarged view of a rib-groove machined in a female tool, Z being the surface machined substantially parallel to the main axis of the shuttlecock.

It will be understood that suitable materials other than polythene and nylon may be used, in this method of manufacture.

More than one subsidiary stem-groove may be made between each pair of stem-grooves, and in practice this is desirable because of the filling up effect thus given to the skirt.

The stem-grooves S should be .070" deep and about the same width at the cap end and taper to about .010" at the trailing edge. The subsidiary stem-grooves should be about .008" deep and wide but these dimensions are given as an indication and not as a limitation.

The temperature of the skirt portion of the mould is satisfactory at 40 degrees C.

In the method of shuttlecock manufacture described herewith the indications are that pressures higher than normal are required, particularly when the tools are new.

What I claim is:—

1. A tool for the injection moulding of plastic shuttlecocks comprising male and female parts partly conical and embodying grooves in the conical portions in which the stems and the ribs of the skirt of the shuttlecock will set, the tool being characterised in that subsidiary stem grooves are provided in the tool between the main stem grooves.

side being extended until it runs out of the tool towards the small end of the conical portion, and rib-grooves in the conical portion of the female tool are machined with one side of each groove substantially parallel to the principal axis of the conical portion of the tool, this side being extended until it runs out of the tool in the direction away from the small end of the conical portion. In practice, if the rib-grooves are machined on a lathe by moving the cutter into the male or female tool along the length of the lathe as distinct from across the bed of the lathe, the desired condition would be obtained.

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2. A tool for the injection moulding of plastic shuttle cocks as in Claim 1 and characterised in that rib grooves in the conical portion of the female tool are machined with one side of each groove substantially parallel to the principal axis of the conical portion of the tool, this side being extended until it runs out of the tool away from the small end of the conical portion.

3. A tool for the injection moulding of plastic shuttlecocks as in Claim 1 and characterised in that rib grooves in the conical portion of the male tool are machined with one side of each groove substantially parallel to the principal axis of the conical portion of the tool, this side being extended until it runs out of the tool towards the small end of the conical portion.

4. A tool for the injection moulding of plastic shuttlecocks substantially as described in the specification and illustrated in the drawings herewith.

W. C. CARLTON.

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