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(54) **SHUTTLECOCK**

(54) **VOLANT DE JEU**

(57) **Abstract:**

This specification relates to methods of manufacturing shuttlecocks having skirts made in one piece of plastic material by an injection moulding process. The invention and claims do not relate to shuttlecocks having skirts made of textile fabrics made up of fibres, threads or yarns or strands, in which a genuine stretching process (as distinct from a straightening process) reduces the strength of the material. This invention is useful only when the material used can be stretched without loss of strength. Such a material would be nylon in solid form.

In this specification, the cap of the shuttlecock is that part normally struck by the racket and including any covering such as kid or sponge rubber, the upper or inner skirt is that part of the shuttlecock adjacent the cap and the lower or outer skirt is that part of the skirt remote from the cap, which includes the tops of the stems and the

vane area and is joined to the cap by the stems of the upper or inner skirt. The stems are used to stiffen the skirt and preferably are thicker where they leave the cap than material between the stems in the lower skirt. By the term "stretching" is meant a substantial extending of the length of the material without breaking down the attraction within the material of the molecules for each other.

An important quality in a shuttlecock is to possess as light a lower skirt as possible, and since a certain vane area is essential it follows that the thickness of the vane area should be as small as possible.

In moulded shuttlecocks the limiting factor can be the size of the gap between the male and female tools through which the material may be made to flow and still retain its strength characteristics. The object of this invention is to make a skirt of a shuttlecock lighter than it could be made by the use of the known art and at the same time to increase the strength of part of the vane area.

A secondary object which may be achieved if desired is to flute the skirt without increasing the weight by means of the process; these flutes may be used as directional air passages which could be made to cause the shuttlecock to spin, or to decrease the speed of spinning.

It is further believed that the stretching process may rearrange the molecules of the material so that the shuttlecock becomes more difficult to break; by the stretching process the tensile strength of the stretched material is increased by at least 50%.

This invention resides in a shuttlecock of the type that consists of a cap and a one-piece moulded skirt, which skirt is composed of an upper and a lower part, and

includes stems, and the lower part of the skirt being made up of stems and vane area and the shuttlecock being characterised in that, although the skirt is in one piece, part of the vane area is at least 50% higher in tensile strength than other parts of the skirt as a result of a stretching process carried out after the moulding process.

The shuttlecock is preferably of the type in which the stems are integral with each other and the vane area is integral with the stems. Preferably also the lower skirt consists of a number of stems from each of which branch a plurality of ribs, these ribs forming the vane area, and preferably being integral with the stems. Such a shuttlecock would be moulded but the invention is not limited to the above type of shuttlecock because it makes possible, in another manner, one of the features that the integral ribbed construction was designed to achieve, that is, the manufacture of a very light lower skirt. The upper and lower skirts, complete with stems, having been moulded, the skirt is then placed on a suitable tool and the material between the stems is stretched. The stretching can be achieved in a number of ways, for instance, by expanding the male tool or by locating the skirt on a male tool which has been relieved between the stem supports and then forcing both tool and shuttlecock into a fluted female.

The relieved portion of the male will then force the vane area between the stems into the flutes of the female and, since the stems are supported, stretching of the vane area will occur, and the length of the vane area between the stems is increased by the process; the weight of the vane area, however, cannot be increased so a greater vane area for a given weight is obtained. The additional length is used either to make a skirt having a wider flare or to

form flutes between the stems or both. If these flutes are angled unequally to the airstream the shuttlecock may be made to spin if desired. A material which will not be unduly weakened by stretching is required; one such material is nylon but the invention is not limited to this material.

In order that this invention may be clearly understood and readily carried into effect, reference is directed to the accompanying drawings in which :-

Fig. 1. is a side elevation of one stage of production after the moulding operation and before the stretching.

Fig. 2 is a view of fig. 1. in the direction of arrow X.

Fig. 3. is a side elevation of a further development of the invention.

Fig. 4. is a section across the bottom of the skirt of fig. 3. at YY.

Fig. 5. is a section showing a further form of the invention.

Fig. 6. is a section showing a still further form of the invention.

Fig. 7. is a section showing a still further form of the invention.

Fig. 8. is a section showing a still further form of the invention.

Fig. 9. is a diagrammatic view of a typical shuttlecock manufactured according to this invention.

A shuttlecock is moulded according to Fig. 1. consisting of a nose portion A, stems B and vane area C, between the stems, consisting in this case of a plurality of ribs with air spaces between them which together comprise the vane area. The extent of the lower skirt is indicated by the bracket at C, which also indicates the extent of the vane

area. The lower skirt comprises both vane area and stems in that portion of the shuttlecock indicated by the bracket.

As far as this invention is concerned it is preferable but not essential that the vane area should be made up of ribs; it could be made up of plain vane unbroken by ribs, or the plain vane could be pierced with holes, the basic invention will remain the same.

The subsidiary stems F are for strength purposes and are not connected with this invention. A ribbed vane area is selected because it is the preferred method of construction, and of itself makes a very light skirt and the use of the present invention enables it to be made still lighter.

A view of Fig. 1. in the direction of arrow X is shown in Fig. 2. and for the sake of clarity in the descriptions that follow only the top edge D. of the vane area will be discussed, it being understood that whatever treatment is given to the top edge may be given in varying degree to the whole vane area.

Note should be taken of the size of the maximum perimeter in Fig. 2.

The shuttlecock moulded as in Fig. 1. is now expanded by forcing a steel cone into it until it assumes the shape of the shuttlecock shown in Fig. 3. and the size of the perimeter D. has been increased until it reaches the size D.1. shown in Figs. 3 & 4 and reference to Figs. 2 & 4. will show that the perimeter of the bottom of the skirt of Fig. 4. is considerably greater than it was when originally moulded by reason of the stretching of D. until it reaches the length of D.1. and the vane area of the shuttlecock has, therefore, been considerably increased. The sponge rubber cap E. completes the shuttlecock.

If the known method of manufacture had been used the shuttlecock would have been moulded to its finished shape, that is, to the shape shown by figures 3 & 4. and, assuming that the vane area between the stems is moulded as thinly as possible, the vane area moulded by the known method could not be thinner than the vane area moulded to make the shuttlecock shown in Figs. 1 & 2. but since the perimeter shown in Fig. 2 is smaller than the perimeter shown in Fig. 4. the shuttlecock skirt made by moulding to Figs. 1 & 2 must be lighter, other considerations being equal, than the shuttlecock skirt made by known methods to Figs. 3 & 4. Nevertheless, the shuttlecock moulded to Fig. 1 & 2 has, when expanded to the dimensions of Fig. 3 & 4. a similiar profile to a shuttlecock originally moulded to Fig. 3 & 4. but being lighter in the skirt because the vane area is thinner has a better performance than the shuttlecock moulded in the first instance to Fig. 3 & 4.

This is the main object of the present invention. Many different variations on the same theme are possible and by way of indication and not of limitation further examples are given below.

A shuttlecock is moulded according to Fig. 1 & 2 and then placed between a male and female cone in such a way that the vane area between the stems is held by a number of fingers. Intermediate fingers, bearing on the stems B. are then caused to expand outwards so that the shuttlecock skirt takes the form shown in Fig. 5. The stems B. now take up new positions and become B.2. The stretching in this case causes flutes D.2. between the stems B.2.

This form of the invention has three further advantages beyond lightness of the skirt, (1) for the same size in side elevation as a shuttlecock made by known methods

the shuttlecock has a smaller head on area and this allows more filling in the skirt thus making the shuttlecock easier to see and (2) the fluting may be made off-set in relation to the stems as shown at flutes D.3. off-set in relation to stems B.3. in Fig. 6. thus causing the air to impart a rotary motion to the shuttlecock or, if the shuttlecock is already spinning in the opposite direction, to cause the shuttlecock spin to be retarded, and (3) when the shuttlecock is hit by the racket the vane area is protected by the stems.

In Fig. 7. a similar tool to that used for Fig. 5. has been used but this time the stems B.4. have been held and the vane area between the stems D.4. has been stretched outwards by the expanding fingers. In Fig. 8. the fluting D.5. has been off-set in relation to the stems B.5. and this again imparts a rotary force to the shuttlecock. An alternative form of the invention would be to mould the shuttlecock according to Fig. 3 & 4. and then stretch the vane area inwards to form a perimeter as shown at Fig. 5.

This method would not make a lighter skirt but would increase the vane area and would permit fluting and stretching so that some of the benefits of the invention would be obtained.

It is to be understood that the vane area C shown in Fig. 1. refers to the overall dimensions of this area.

The fact that the individual ribs are narrowed by the stretching is a peculiarity of this method of manufacture and does not affect the principle involved.

THE embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A shuttlecock of the type which consists of a cap and a one-piece moulded skirt, which skirt is composed of an upper and a lower part, and includes stems, and the lower part of the skirt being made up of stems and vane area, and the shuttlecock being characterised in that, although the skirt is in one piece, part of the vane area is at least 50% higher in tensile strength than other parts of the skirt as a result of a stretching process carried out after the moulding process.

2. A shuttlecock as in Claim 1 and characterised in that the stretched vane area includes a plurality of ribs integral with the stems.

3. A shuttlecock as in Claim 1 and characterised in that it is made by an injection moulding process followed by a stretching process applied to part of the moulded skirt.

4. A shuttlecock as in Claim 1 and 3 and characterised in that the perimeter of the trailing edge of the skirt is increased by the stretching process.

5. A shuttlecock as in Claim 1 and 3 and characterised in that the stretching causes fluting in the shuttlecock skirt.

6. A shuttlecock as in Claim 1 and 3 and characterised in that at least part of the fluting is offset in relation to the stems.

7. A shuttlecock as in Claim 1, and characterised in that the vane area is inboard of the stems.

8. A shuttlecock as in Claim 1 and 3 and characterised in that the vane area is outboard of the stems.

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FIG. 1.

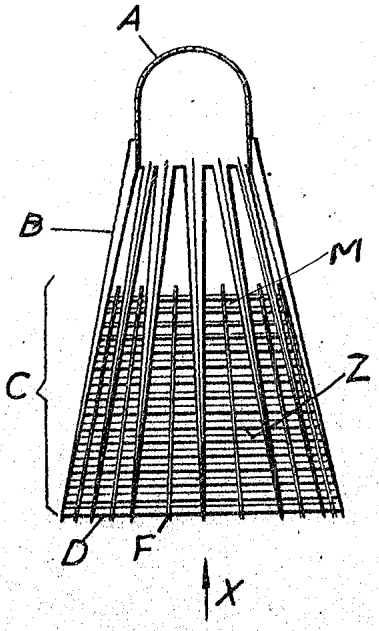

FIG. 3.

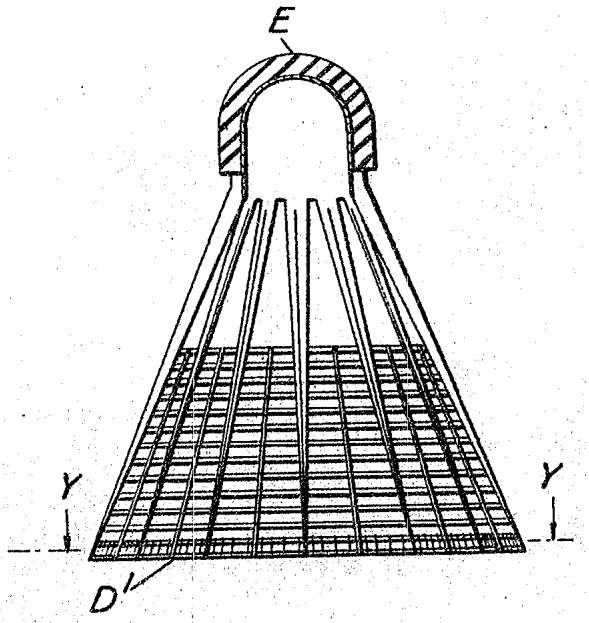

FIG. 2.

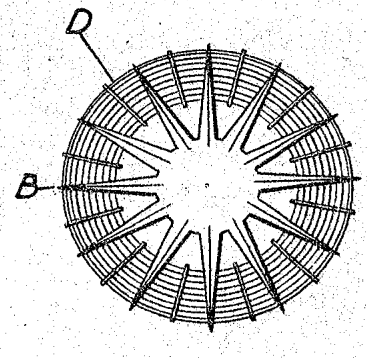

FIG. 4.

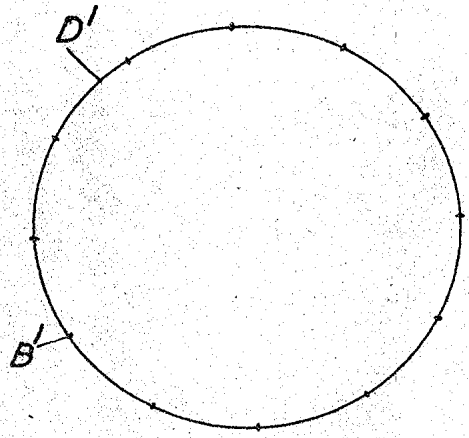

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FIG 5.

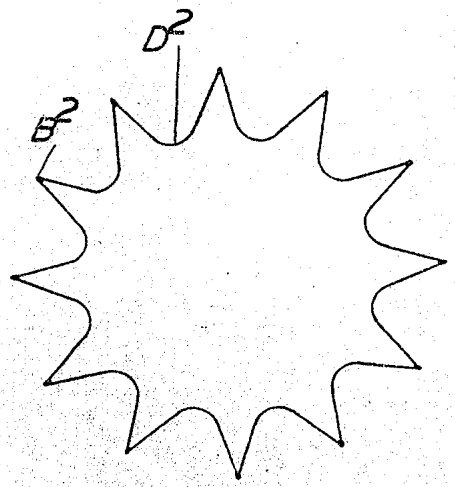

FIG. 6.

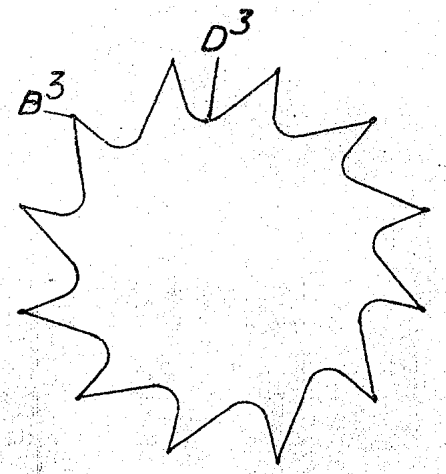

FIG. 7.

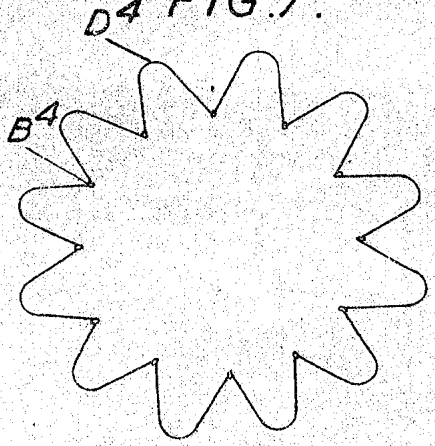

FIG. 8.

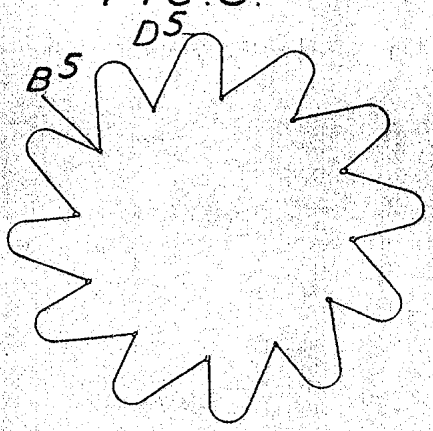

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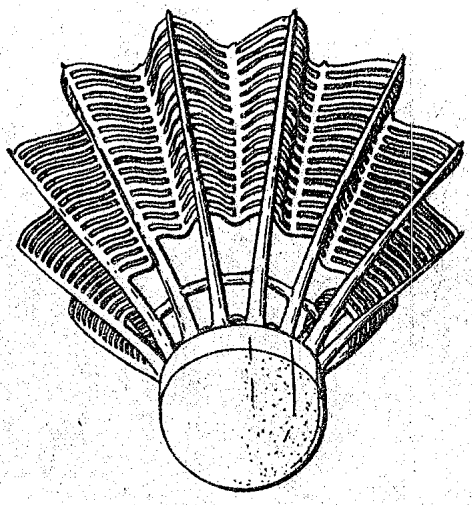
FIG. 9.



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