PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Shuttlecock and Method of Making

We, THE CARLTON TYRE SAVING COMPANY LIMITED, of Parkstone Works, Winglitye Lane, Hornchurch, Essex, England, a British Company, and WILLIAM CHARLES CARLTON, of Parkstone Works, Winglitye Lane, Hornchurch, Essex, England, of British nationality, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to shuttlecocks of the type in which the skirt is moulded.

In this specification the cap of a shuttlecock is the part normally struck by the racket, the lower skirt is the vane area remote from the cap, and the upper skirt is the area between the two. Stems which form the upper skirt connect the cap to the lower skirt and merge into it. The stems of the shuttlecock are integral with each other. A rib is a projection grown from a stem during a production process as distinct from being made by the removal of material.

Shuttlecocks with one-piece skirts, featherless vanes, imitation feathers and vanes with stems and holes in the skirt are known, but they have been difficult to make in the degree of delicacy required to emulate the performance of a feather shuttlecock, bearing in mind the necessity for comparable production cost; the present invention differs from the known art in that its characterising feature—the provision of a plurality of ribs grown from each stem during a production operation combined with stems integral with them, and thicker where they leave the cap than material between the stems in the lower skirt, serves two purposes, it enables a lighter skirt than has hitherto been known in a moulded shuttlecock to be made, and, developed further, if holes are required in the skirt it enables a production operation, that of piercing holes after moulding, to be eliminated.

This invention is devoted to a shuttlecock, particularly to the lower skirt of a shuttlecock, which will have strength and delicacy where each is required, and yet may be made extremely quickly in one piece, without assembly operations, apart from the addition of the cap-covering if required.

According to the present invention, a shuttlecock comprising a cap and a moulded skirt, composed of an upper and lower part, and incorporating stems which are thicker where they leave the cap than material between the stems in the lower skirt and are flared outwardly from the cap, and moulded integrally, is characterised in that each stem has, integral with it, and grown from it during a production operation, a plurality of ribs projecting from it in the area of the skirt remote from the cap, this area being referred to as the lower skirt. At least one of the ribs in the lower skirt may make a circumferential connection between the stems.

The weight of the skirt may be reduced by making small holes in it.

The shuttlecock skirt may be made by injection moulding through an end cap a number of stems which are thicker where they leave the cap than material between them in the lower skirt, the injection being made at the big end of each stem, and a plurality of ribs being grown on each side of each stem at a distance from the end. At the fine end of the stem these ribs form part of the lower skirt, and strength is increased if at least one rib makes a circumferential connection between the stems in the lower skirt area.

The area between the ribs can be made into a very fine leaf by clearing the material in the tool between the canals for the ribs and stems to a depth as thin as possible consistent with getting the

material to flow, and if this system is adopted this makes a shuttlecock skirt incorporating ribs with intervening plain vane portions which may afterwards be pierced with holes.

Alternatively, the material may be confined to the ribs, and this will automatically leave holes or gaps between the ribs and the combination of holes or gaps and ribs forms the lower skirt and gives the necessary drag and lightness. This is the preferred method of construction.

A complete shuttlecock less any cap covering required is made in one piece by starting the injection at an earlier stage so that before flowing up the tapered stem spaces, the material flows round a small bowl, and, after removal of the injection pip, this part becomes the cap of the shuttlecock.

The material selected should have a low specific gravity, and it is an advantage under certain conditions such as for storage in humid countries if the shuttlecock is not weakened unduly by water absorption. A specific gravity of less than 1.2 is desirable, and if injection moulding is to be employed the material must flow readily under pressure at least, in a very confined space. It will be understood that in this respect the use of ribs has two advantages, (a) that air gaps can be left between them, and (b) that if ribs with intervening plain vane portions are required the local thickening for the necessary ribs aids the running of the material.

A satisfactory shuttlecock has been made with a material in the polythene range which flows readily, and does not split readily on impact such as a shuttlecock is likely to receive.

The invention is not limited to this material.

In order that the invention may be readily understood and carried into effect, various examples will now be described with reference to the accompanying drawings in which:—

Figure 1 is a side elevation of the skirt of a shuttlecock plus injection pip.

Figure 2 is a side elevation of another form of the invention.

Referring to Figure 1, a pair of tools are made with spaces between them so that when they are mated in the normal operating manner for moulding tools, and a hot plastic is forced through the aperture which eventually causes the pip 1, the material flows via the space left for the end cap 2 to each of the spaces left for the stems 3 and thence along until it branches into the spaces left for the rib 4. The material meets approximately in the middle of the rib and merges into one piece. The material continues to flow along the stem spaces up to and beyond 5 and on leaving 5, the material either continues to the length of the shuttlecock 10, or merges into the lower skirt.

When the shuttlecock is struck hard in play, a considerable load is imposed on the material between 2 and 5, and collapsing occurs in this area; considerable air passages 6 and 7 should also be provided in this area otherwise the reversal of the shuttlecock after impact appears to be poor; this area should also be reasonably rigid; the stems, therefore, are thick at leaving 2 and continue substantial between 2 and 5 and then diminish in thickness either by merging into the lower skirt edge 11 or as they continue to the trailing edge. The object of this is to make the trailing edge very light as this is necessary for good performance.

The material continues on its way through the stem spaces spreading out into the ribs 21 which would in practice be distributed between each pair of stems, and which as shown are connected. The material can then either be confined to the ribs or permitted to spread from the ribs into the whole lower skirt area.

Referring now to figure 2, the method suggested in figure 1, is now still further developed to include the cap of the shuttlecock. It will be seen that the end-cap 2 has been replaced by a cap 22 which is bowl-shaped and serves the same purpose as the end-cap 2 in facilitating the injection moulding operation, but in addition, replaces the usual cork cap fitted to a badminton shuttlecock. The cap 22 may have a covering fixed to its surface.

Referring again to figure 2, a series of circumferentially connected ribs have been made in the lower skirt by cutting a series of canals to join the spaces left for the stems in the tool. Flow to areas other than canals has been blanked off so that the resulting shuttlecock is complete with holes 30 direct off the moulding operation. This makes for economy in production time and tooling. The ribs may be formed by the canals so that they are formed to interfere with the air stream.

What we claim is:—

1. A shuttlecock comprising a cap and a moulded skirt composed of an upper and a lower part, and incorporating stems which are thicker where they leave the cap than material between the stems in the lower skirt and are flared outwardly from the cap, and moulded integrally, and characterised in that each stem has integral with it and grown from it during a production operation a plurality of ribs projecting from it in the area of the skirt remote from the cap this area being

material to flow, and if this system is adopted this makes a shuttlecock skirt incorporating ribs with intervening plain vane portions which may afterwards be pierced with holes.

Alternatively, the material may be confined to the ribs, and this will automatically leave holes or gaps between the ribs and the combination of holes or gaps and ribs forms the lower skirt and gives the necessary drag and lightness. This is the preferred method of construction.

A complete shuttlecock less any cap covering required is made in one piece by starting the injection at an earlier stage so that before flowing up the tapered stem spaces, the material flows round a small bowl, and, after removal of the injection pip, this part becomes the cap of the shuttlecock.

The material selected should have a low specific gravity, and it is an advantage under certain conditions such as for storage in humid countries if the shuttlecock is not weakened unduly by water absorption. A specific gravity of less than 1.2 is desirable, and if injection moulding is to be employed the material must flow readily under pressure at least, in a very confined space. It will be understood that in this respect the use of ribs has two advantages, (a) that air gaps can be left between them, and (b) that if ribs with intervening plain vane portions are required the local thickening for the necessary ribs aids the running of the material.

A satisfactory shuttlecock has been made with a material in the polythene range which flows readily, and does not split readily on impact such as a shuttlecock is likely to receive.

The invention is not limited to this material.

In order that the invention may be readily understood and carried into effect, various examples will now be described with reference to the accompanying drawings in which:—

Figure 1 is a side elevation of the skirt of a shuttlecock plus injection pip.

Figure 2 is a side elevation of another form of the invention.

Referring to Figure 1, a pair of tools are made with spaces between them so that when they are mated in the normal operating manner for moulding tools, and a hot plastic is forced through the aperture which eventually causes the pip 1, the material flows via the space left for the end cap 2 to each of the spaces left for the stems 3 and thence along until it branches into the spaces left for the rib 4. The material meets approximately in the middle of the rib and merges into one piece. The material continues to flow along the stem spaces up to and beyond 5 and on leaving 5, the material either continues to the length of the shuttlecock 10, or merges into the lower skirt.

When the shuttlecock is struck hard in play, a considerable load is imposed on the material between 2 and 5, and collapsing occurs in this area; considerable air passages 6 and 7 should also be provided in this area otherwise the reversal of the shuttlecock after impact appears to be poor; this area should also be reasonably rigid; the stems, therefore, are thick at leaving 2 and continue substantial between 2 and 5 and then diminish in thickness either by merging into the lower skirt edge 11 or as they continue to the trailing edge. The object of this is to make the trailing edge very light as this is necessary for good performance.

The material continues on its way through the stem spaces spreading out into the ribs 21 which would in practice be distributed between each pair of stems, and which as shown are connected. The material can then either be confined to the ribs or permitted to spread from the ribs into the whole lower skirt area.

Referring now to figure 2, the method suggested in figure 1, is now still further developed to include the cap of the shuttlecock. It will be seen that the end-cap 2 has been replaced by a cap 22 which is bowl-shaped and serves the same purpose as the end-cap 2 in facilitating the injection moulding operation, but in addition, replaces the usual cork cap fitted to a badminton shuttlecock. The cap 22 may have a covering fixed to its surface.

Referring again to figure 2, a series of circumferentially connected ribs have been made in the lower skirt by cutting a series of canals to join the spaces left for the stems in the tool. Flow to areas other than canals has been blanked off so that the resulting shuttlecock is complete with holes 30 direct off the moulding operation. This makes for economy in production time and tooling. The ribs may be formed by the canals so that they are formed to interfere with the air stream.

What we claim is:—

1. A shuttlecock comprising a cap and a moulded skirt composed of an upper and a lower part, and incorporating stems which are thicker where they leave the cap than material between the stems in the lower skirt and are flared outwardly from the cap, and moulded integrally, and characterised in that each stem has integral with it and grown from it during a production operation a plurality of ribs projecting from it in the area of the skirt remote from the cap this area being

referred to as the lower skirt.

2. A shuttlecock as in Claim 1 and characterised in that at least one of the ribs makes a circumferential connection between the stems in the area of the lower skirt.

3. A shuttlecock as in Claim 1 or Claim 2 and characterised in that air spaces are left between the ribs in the area of the lower skirt.

4. A shuttlecock as in Claim 1 or Claim 2 and characterised in that the lower skirt incorporates ribs with intervening plane vane portions.

5. A shuttlecock as in Claim 1 or Claim 2 and characterised in that the moulding material used is one having a specific gravity of less than 1.21.

6. A shuttlecock substantially as described in the specification and illustrated in the accompanying drawings.

W. C. CARLTON.
For and on behalf of:
THE CARLTON TYRE SAVING COMPANY LTD.,
W. C. CARLTON,
Director.

PROVISIONAL SPECIFICATION

Shuttlecock and Method of Making

We, THE CARLTON TYRE SAVING COMPANY LIMITED, a British Company, of Parkstone Works, Winglitye Lane, Hornchurch, Essex and WILLIAM CHARLES CARLTON, of British nationality of the same address do hereby declare this invention to be described in the following statement:—

This invention relates to methods of manufacturing shuttlecocks of a type that might be used in the game of Badminton.

The first object of the present invention is to enable the upper skirt of a shuttlecock, complete with air gaps and stiffeners to be made from one mass of material.

The second object of the invention is to enable the upper and lower skirts of a shuttlecock to be made from one mass of material.

The third object of the invention is to enable the upper and lower skirts and the cap (less any covering of leather and/or the like) to be made of one mass of material.

The fourth object of the invention is to enable a shuttlecock made according to the methods already mentioned to be provided with free edges for the purpose of increasing drag.

The fifth object of the invention is to enable a shuttlecock made according to the methods already mentioned to be provided with a still lighter lower skirt at least equally effective in causing the desired drag.

The sixth object of the invention is to enable a shuttlecock made according to object three to be made in different weights from one mass of material although the outline normally visible during flight will remain the same.

The seventh object of the invention is to enable a shuttlecock made according to object three to be made with a roughened or knurled exterior to the cap thus making the use of a fine leather covering less necessary.

The eighth object of the invention is to enable a shuttlecock to be made which will make a very distinctive noise when hit by the "wood" on a badminton racket.

The ninth object of the invention is to enable a shuttlecock to be made which will automatically compensate in some degree for changes in temperature so that the same blow will drive the shuttlecock approximately the same distance even though the density of the air varies through temperature change.

The first object of the invention is achieved by injection moulding a number of fine tapered rods, the injection being made at the big end of each rod and arms being made on each side of the rod at a distance from the end so that the injected material will unite at the ends of these arms and thus make one mass. Suitable plastic materials are used.

The second object of the invention is achieved as in the first object, except that the invention is, that in addition to the arms growing from each rod, a leaf is made to grow under pressure at the fine end of each rod and the group of leaves forms the lower skirt.

The third object of the invention is achieved by starting the injection at an earlier stage so that before flowing up the tapered rods the material flows round a small bowl and after removal of the injection pip this part becomes the base of the shuttlecock.

The fourth object of the invention is achieved by making small slits in the lower skirt of the shuttlecock and forming the material about these splits so that it will intercept air flow.

The fifth object of the invention is

referred to as the lower skirt.

2. A shuttlecock as in Claim 1 and characterised in that at least one of the ribs makes a circumferential connection between the stems in the area of the lower skirt.

3. A shuttlecock as in Claim 1 or Claim 2 and characterised in that air spaces are left between the ribs in the area of the lower skirt.

4. A shuttlecock as in Claim 1 or Claim 2 and characterised in that the lower skirt incorporates ribs with intervening plane vane portions.

5. A shuttlecock as in Claim 1 or Claim 2 and characterised in that the moulding material used is one having a specific gravity of less than 1.21.

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The third object of the invention is to enable the upper and lower skirts and the cap (less any covering of leather and/or the like) to be made of one mass of material.

The fourth object of the invention is to enable a shuttlecock made according to the methods already mentioned to be provided with free edges for the purpose of increasing drag.

The fifth object of the invention is to enable a shuttlecock made according to the methods already mentioned to be provided with a still lighter lower skirt at least equally effective in causing the desired drag.

The sixth object of the invention is to enable a shuttlecock made according to object three to be made in different weights from one mass of material although the outline normally visible during flight will remain the same.

The seventh object of the invention is to enable a shuttlecock made according to object three to be made with a roughened or knurled exterior to the cap thus making the use of a fine leather covering less necessary.

The eighth object of the invention is to enable a shuttlecock to be made which will make a very distinctive noise when hit by the "wood" on a badminton racket.

The ninth object of the invention is to enable a shuttlecock to be made which will automatically compensate in some degree for changes in temperature so that the same blow will drive the shuttlecock approximately the same distance even though the density of the air varies through temperature change.

The first object of the invention is achieved by injection moulding a number of fine tapered rods, the injection being made at the big end of each rod and arms being made on each side of the rod at a distance from the end so that the injected material will unite at the ends of these arms and thus make one mass. Suitable plastic materials are used.

The second object of the invention is achieved as in the first object, except that the invention is, that in addition to the arms growing from each rod, a leaf is made to grow under pressure at the fine end of each rod and the group of leaves forms the lower skirt.

The third object of the invention is achieved by starting the injection at an earlier stage so that before flowing up the tapered rods the material flows round a small bowl and after removal of the injection pip this part becomes the base of the shuttlecock.

The fourth object of the invention is achieved by making small slits in the lower skirt of the shuttlecock and forming the material about these splits so that it will intercept air flow.

The fifth object of the invention is

achieved by making many small holes in the material of the lower skirt and/or forming many rough edges, pips or spikes from/or on the stems or leaves. It is desirable to connect the leaves or stems near the base of the lower skirt to increase strength and trueness of flight.

The sixth object of the invention is achieved by making a number of male tools with varying shapes on the nose. This has the effect of leaving more or less material on the inside of the cap of the shuttlecock which varies the weight where the variation is very effective.

The seventh object of the invention is achieved by roughening that part of the female tool on which parts of the nose of the base of the shuttlecock is formed. This roughness is then reversed on the shuttlecock base. Care must be taken to see that the roughening does not trap the shuttlecock in the tool.

The eighth object of the invention is achieved by making the cap of the shuttlecock hollow and with a thin shell.

The ninth object of the invention is achieved by making a shuttlecock of a thermoplastic material which is sensitive to changes of temperature between 60 and 100 degrees Fahrenheit. The stiffeners or stems in the upper skirt are then shaped so that as the temperature increases the stems give a little more readily when struck by the racket so that although the air is less dense the same blow will drive the shuttlecock approximately the same distance. It should not be necessary for one mix of material to cover the whole temperature range, but the application of this principle will enable one shuttlecock to give satisfactory service in a wider range of temperature than has hitherto been possible.

Once the basic principle underlying the invention are understood it will be apparent that methods other than injection moulding may be used to achieve some of the objects of the invention. For instance, a stamping could be made of the developed shape of the upper skirt of a shuttlecock. This would then be curled and joined at one point and a thinner lower skirt could then be stuck to the stiffeners. To come within the requirements of this invention the material for the upper skirt must be thicker than the material for the lower skirt.

Holes in the lower skirt of the moulded shuttlecock may be made either by piercing after the moulding operation or by blanking off material flow between the male and female tools at the points where the holes are required. This would require considerable care in the design and manufacture of the tools. The holes need not be round for instance, star shaped or triangular holes would be satisfactory but probably more expensive to tool up.

Dated the 22nd day of March, 1950.

W. C. CARLTON.

For and on behalf of:

THE CARLTON TYRE SAVING COMPANY LTD.,

W. C. CARLTON,

Director.

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