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A. T. SAUNDERS

2,212,079

SHUTTLECOCK AND METHOD OF MAKING THE SAME

Filed June 5, 1937

Fig. 1.

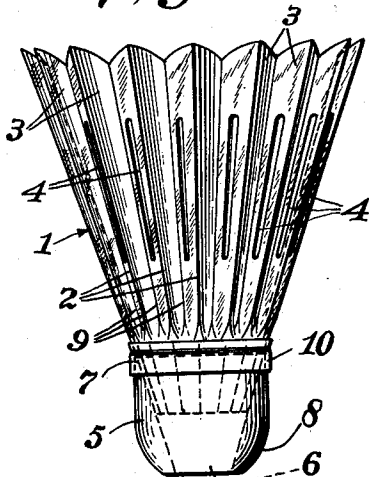


Fig. 2.

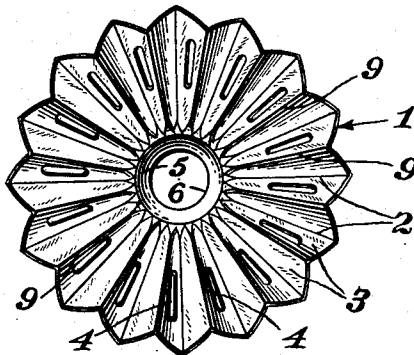


Fig. 3.

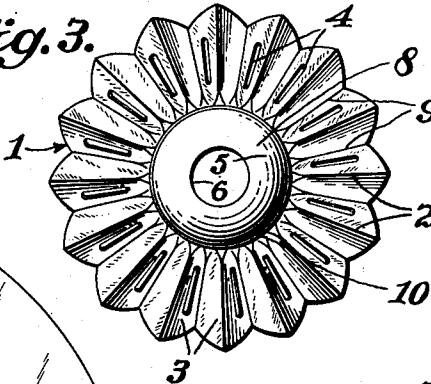


Fig. 4.

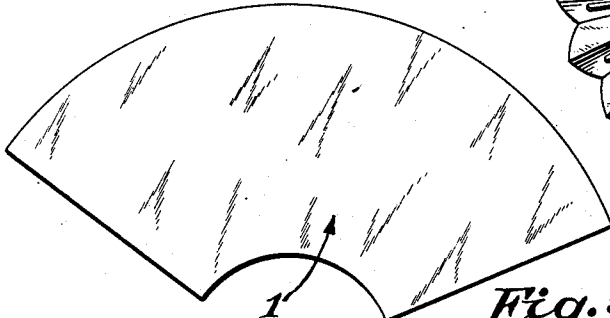


Fig. 5.

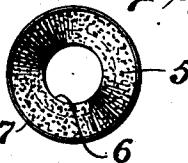


Fig. 7.

Fig. 6.

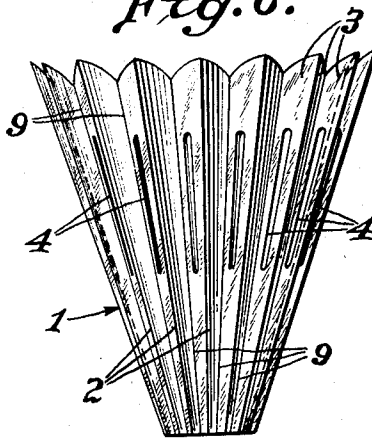
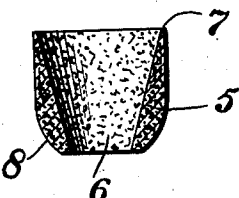
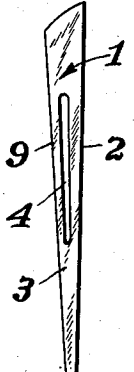


Fig. 8.



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UNITED STATES PATENT OFFICE

2,212,079

SHUTTLECOCK AND METHOD OF MAKING
THE SAME

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mesne assignments, to A. G. Spalding & Bros.
Inc., a corporation of Delaware

Application June 5, 1937, Serial No. 146,681

25 Claims. (Cl. 273—106)

The invention consists in improvements in shuttles for the game of badminton and the like, and method of making the same.

The two principal elements in the badminton shuttle in general use are a cork head of cylindrical shape, rounded at the nose and carrying a group of feathers with their shafts inserted in its periphery, their vanes overlapping, forming a continuous vane.

A principal fault in the natural feathers for this construction and use is that when struck obliquely or upon the vane ends their shafts are broken and the vanes crushed down and rendered unfit for further play.

A principal object of my invention is to produce a badminton shuttle of greater endurance, better playing qualities and at less cost than that of the feathered type.

An object of the invention is the provision of a vane for the shuttle which is strong and durable while possessing graduated stiffness and terminal yieldability or resilience, as in the usual feathered shuttle, and the provision of novel and simple means for effecting the same.

A further object is to provide a shuttle construction which will function in simulation of the action of the usual feathered type of shuttle throughout the playing of the game.

Another object is the provision of means to permit release of the air in the cone-shaped shuttle during the moment of tail-first flight following the striking of the shuttle on the nose or head.

Another object is to provide a head of a tough composition which requires no cover member.

Other objects will appear from the accompanying disclosure of the invention.

Referring to the drawing:

Figure 1 is a view of the completed shuttle of the present invention in elevation.

Fig. 2 is a top end view of the shuttle.

Fig. 3 is a fragmentary bottom end view of the same.

Fig. 4 shows the sheet of fabric for the vane diagrammatically on a reduced scale prior to the folding or fluting thereof.

Fig. 5 is a fragmentary view showing in plan view one wall or face of a fold or flute in the vane, and provided with a perforation or opening therein.

Fig. 6 is a view of the cone-shaped vane prior to its assembly with the head.

Fig. 7 is a top end view of the head prior to assembly with the vane.

Fig. 8 shows the head in cross-section prior to assembly with the vane.

In the drawing, 1 represents the cone-shaped vane of the shuttle of the present invention in which folds or flutes 2 are formed having walls 3, which are tapered from the large end of the cone-shaped vane toward the small end thereof. The folds or flutes 2 are preferably formed to extend throughout the entire length of the cone-shaped vane from end to end thereof, and thus the flutes or crimps 2 provide tapering ridges stiffening the vane against any forces tending to collapse the same.

In one of the walls 3 of each flute is provided a perforation or opening 4 in the form of an elongated slot preferably tapering as shown from its widest portion toward the large end of the vane to its smallest portion toward the small end of the vane. The perforated wall 3 of each flute or ridge 2 corresponds with all the others throughout the cone-shaped vane, so that the perforations 4 are in corresponding side walls 3 of the flutes 2.

Preferably the edge at the large end of the cone-shaped vane is scalloped or notched as shown with the upper edge of each wall 3 curved outwardly toward its ridge 2.

The manufacture of the shuttle is simple as to both the vane and the head, as also is the assembling of the parts.

A piece of the light, preferably pyroxylin-coated, fabric of right dimensions and shape to form the vane when crimped, such as shown in Fig. 4, is run through a crimping device with the intermeshing teeth of the device heated to a temperature of 210° to 220° F. The crimp is formed instantaneously and the piece cools at once with the sharply angled folds permanently set.

The perforations are then died out, the piece accurately trimmed, if necessary, the two opposing edges brought together and cemented with pyroxylin cement, with a slight overlap of the fabric as shown. This lap or union, running parallel with and in a groove, is not conspicuous. An instant's pressure with flat, narrow, hot pincers corrects any slight line of distortion of the cemented seam.

That part of the stiffened fabric piece which is to form the smaller-end portion of the vane may be reenforced by an added layer of the stiffened fabric, or may be strengthened by a heavier coat of the stiffening cement.

By another improvement I supplement the action of the perforated grooves in releasing the air

compressed in the cone during the moment of tail-first flight when struck on the nose. This I do by employing instead of a solid cork head (as is used in the feather shuttle) a hollow head 5, as shown, which is open clear through, permitting the trapped air to flow out in the line of the center of pressure.

I am enabled to use a head of this form by making it of a material or compound of a tough, non-friable character, preferably a mixture of gutta, India rubber, shredded cork and glue in about the following proportions, all by weight:

Formula

Take:

	Parts
Gutta -----	50
India rubber -----	25
Glue -----	25
Shredded cork -----	40

The gutta, India rubber and glue are mixed on a mill hot enough to soften the gutta, before adding the cork. The cork is then milled in until well distributed. Slugs are formed of required weight and moulded in the usual manner of moulding rubber, but at a temperature of about 210° F. Cooling is carried out in the moulds. No vulcanization is necessary.

I do not wish to be restricted to these materials nor proportions. They can be substituted by other adhesive plastics, and the proportions varied within the scope of the invention. For instance, the cork can be used in varying proportions to bring the total weight of the head to just the desired point.

There is a growing demand for a heavier badminton head than that obtained with cork in its natural state. This is usually met by inserting in the solid cork a slug of lead. This method is not adapted to the hollow head. As indicated above I get the result in a degree by variations in the proportions and ingredients in the compound. And in greater degree I get this by adding to the mixture in the required proportion a heavy mineral, preferably a comminuted or "atomized" lead, which combines perfectly with the other ingredients. It is however desirable to concentrate the weight as much as possible in the outer end or "nose" of the head. To get this result I mix the lead with the other ingredients of the compound on the mill in as high proportions as practicable and consistent with good cohesion, and in forming the head I place in the "nose" of the mould a slug of this heavy mixture of the required weight to yield, in combination with the lighter compound, the desired total weight, and upon this I load in the mould the required quantity of the above formula to fill out the complete form which I then mould under heat as described.

Under the heat the mixtures "flow" sufficiently to blend completely at the point of their contact, but with the leaded mixture remaining practically in its entirety at the nose. This method is adapted also to solid moulded heads.

A marked advantage in this tough head is that it removes the need of the expensive kid leather used as a cover on the easily chipped and broken natural cork head.

I find a coating of elastic paint such as golf ball enamel a good finish for the head, which is also inexpensive.

As shown, the opening 6 in the head 5 is preferably tapered toward the nose or free end, and is of a size at the inner end such that a rela-

tively narrow rim 7 is provided. The head is substantially cylindrical on the outside, but rounded on its nose, as shown at 8. The wall of the head thus varies in thickness, being thicker in its lower central portion than toward its ends, as shown in cross section in Fig. 8. The taper of the bore or opening 6 in the head preferably conforms to the taper of the cone-shaped vane.

To assemble the parts the inside of the head is coated with a pyroxylin solution of high viscosity and the small end of the vane is inserted. The quantity of pyroxylin cement should be great enough to fill out the exterior grooves of the inserted end of the vane when, as the next step, a tapered mandrel of dimensions to expand the inserted portion of the vane against the wall of the head is inserted through the vane.

The mandrel is held in this position until the pyroxylin cement is dry and set.

Upon removal of the mandrel the opening through the hollow head is free, and the vane and head securely joined.

An ornamental, annular, colored band of narrow tape or ribbon 10 may be applied over and strengthening the point of union of the head with the vane and cemented to both.

The thin light conical vane may be formed from textile fabric stiffened with pyroxylin or may be other material of similar properties, or of paper or paper pulp similarly treated.

The vane having the longitudinal ridges 2 and grooves 9 as shown, has the advantage that in extending the length of the vane and having sharp angles at the bottoms of the grooves and in the ridges, they greatly add to the strength and rigidity of the vane, bracing the cone against collapse. With this construction, the perforating of the side walls of the ridges or grooves allows the air that is pocketed in the vane when it is driven large end forward, to escape as it does between the shafts in the feathered shuttle.

Another important improvement which I gain by this construction and the manner of slotting in the grooves, as shown, is a higher rate of rotation in flight than is produced by the slight angular overlapping of the natural feathers. It will be understood that by this increased rotation a steadier, less wavering, flight is secured, as the accuracy of flight of a rifled bullet is increased over an unrifled one by rotation.

This rotation, as will be understood, is secured by making these slots in but one side wall of each of the V-shaped grooves, or ridges, as shown.

It is obvious that were the shuttle in straight flight head on and without the perforations the pressure from the resistance of the air on the two sides of a groove would be equal and no rotation would result. But when one side only of a groove or ridge wall surface is perforated, the pressure of the air is reduced on that side as the air passes through and out the open end of the vane while the unslotted side of the groove or ridge continues to receive the air pressure over the then greater or unperforated area of its surface. And it will be seen that when each groove is perforated only on the same half or wall, rotation is produced as described.

It will be noted that the grooves not only run the full length of the exposed part of the vane but to the end of the fabric inside the hollow head. This is a new feature in joining the vane and head and, when handled by the simple method described, makes a strong union.

It is apparent from the foregoing that the head of the shuttlecock for the game of badminton or

the like, is designed and constructed in thickness and body to receive and sustain the striking or driving impact force or blow of a bat or racket as is requisite in that well known and long established game, and may, therefore, be termed a striking or impact head.

I claim:

1. A shuttle for the game of badminton or the like comprising a head and a cone-shaped vane attached thereto, said cone-shaped vane having flutes formed therein, one side face only of each flute having an opening therethrough.

2. A shuttle for the game of badminton or the like comprising a head and a cone-shaped vane attached thereto, said vane having flutes formed in its surface, one side face only of each flute having an opening therethrough, the said face in each flute corresponding in position to the said face in the other flutes.

3. A shuttle for the game of badminton or the like comprising a head and a cone-shaped vane attached thereto, said vane having flutes formed in its surface, one side face only of each flute being perforated, the perforated face in each flute corresponding in relative position to the perforated face in the other flutes, and the unperforated face in each flute corresponding to the unperforated face in the other flutes.

4. A shuttle for badminton or the like according to claim 1 in which the said opening is elongated and extends longitudinally of the said face.

5. A shuttle according to claim 3 in which said perforation is elongated and extends longitudinally of the said face, and is tapered toward the small end of the vane.

6. A shuttle according to claim 1 in which said opening is disposed intermediate the unperforated large and small end areas of the vane.

7. A shuttle according to claim 3 in which said perforation is elongated and extends longitudinally of said face, and is disposed intermediate the large and small end areas of the vane which are free from openings.

8. Steps in a process of making a shuttle for badminton or the like, including applying the small end of a cone-shaped vane within an opening in the inner end of a head member, and cementing the same to the inner side of the wall of the head member.

9. Steps in a process of making a shuttle for badminton or the like, including folding or crimping the entire surface of a sheet of material of a size and shape to form a cone-shaped vane for the shuttle, and joining the ends of said folded or crimped sheet to form the cone-shaped vane, applying the small end of said folded or crimped vane within an opening in the inner end of a head member, and cementing the crimped vane to the inner side of the wall of said head member.

10. A step in a process according to claim 9 comprising expanding the inserted portion of the vane against the wall of the head by inserting a tapered mandrel therein.

11. A shuttle for badminton or the like having a moulded head comprising mouldable material having comminuted weighting material distributed therein and moulded therewith.

12. A shuttle for badminton or the like having an integral moulded head comprising mouldable material in one portion thereof and a mixture of mouldable material and comminuted weighting material in another portion thereof.

13. A shuttle according to claim 12 in which

said comminuted weighting material is moulded in the nose portion of said moulded head.

14. A shuttle according to claim 11 in which said moulded head is moulded with an opening extending lengthwise therethrough.

15. A shuttle for badminton or the like having a moulded head comprising cork compound and comminuted weighting material moulded therewith.

16. In a shuttle for badminton or the like, a head of a compound comprising cork material and bonding material, the nose portion of said head comprising said compound having comminuted weighting material distributed there-through.

17. In a shuttle for badminton or the like, a head of a compound comprising cork material and rubber, the nose portion of said head comprising said compound having comminuted weighting material distributed therethrough.

18. In a method of making a shuttle for badminton or the like, mixing comminuted weighting material with mouldable material, placing a mass of mouldable material in contact with a quantity of said weighted mixture, and uniting them by moulding them in such contact to form a moulded shuttle head comprising said weighted mixture in one portion of said head and said mass of material in another portion of said head.

19. In a method of making a shuttle for badminton or the like, mixing comminuted weighting material with mouldable material, placing the desired amount of said weighted mixture in the bottom portion of a mould to form the nose portion of the head of the shuttle, adding mouldable material upon said weighted mixture in the mould in sufficient quantity to fill the mould to form the head of the shuttle, and moulding the said weighted mixture and superposed mouldable material together causing them to cohere to form a moulded shuttle head of heavier composition in the nose portion thereof.

20. A shuttle for the game of badminton or the like having a striking head of tubular form providing a central opening therethrough to permit the passage of air, said central opening in the striking head being tapered downwardly, the upper end of said tubular head being of relatively narrower wall thickness than lower portions thereof.

21. A shuttle for the game of badminton or the like having a striking head of tubular form providing a central opening therethrough to permit the passage of air, said head being of generally cylindrical form rounded at its free end and tapering downwardly to the mouth of said central opening, said central opening or bore of the head tapering downwardly from the upper end of the head, whereby the wall of said tubular head is thicker in its lower central portion than near its ends.

22. A shuttle for the game of badminton or the like comprising a head and a cone-shaped vane portion of sheet-like material attached thereto, said vane portion having substantially its entire wall composed of longitudinal crimps or folds extending substantially throughout the length thereof, and providing alternate ridges and grooves, the walls of which folds taper from their greatest width at the large end of the cone-shaped vane portion to the small end thereof, said head being hollow and providing a relatively thin walled recess at its upper end, the small end of said vane member being received

within said recess of the head and secured to the inner side of the walls thereof.

23. Steps in a process of making a shuttle for badminton or the like including coating with pyroxylin or the like the surface of a sheet of material of a size and shape to form a cone-shaped vane for the shuttle, crimping or folding the entire surface of said sheet of material in a crimping device the intermeshing teeth of which are heated, removing it from the crimping device and allowing it to cool with the sharply angled folds permanently set, perforating one wall only of each fold or flute, and joining the ends of said folded or crimped sheet to form the cone-shaped vane.

24. In a shuttle for the game of badminton or the like, having a vane, a striking head designed and constructed in thickness and body to receive and sustain the striking or driving impact force or blow of a bat or racket in such game, said striking or impact head having a substantially cylindrical outer surface and said

head having an opening therethrough extending from one end thereof to the other, the outer end or nose portion of said open striking head tapering in substantially a curve or arc inwardly from said substantially cylindrical surface and providing a substantially rounded annular striking or impact surface portion surrounding the outer end of the opening, said opening providing for release of air in the vane through said striking head and nose during the moment of vane-first flight following the striking of said nose or end portion of the head, as when struck by a bat or racket.

25. A shuttlecock for the game of badminton or the like comprising a head and a cone-shaped vane of sheet material having flutes formed therein by folding or crimping said sheet of material, each flute comprising side faces in planes at an angle to each other, and each flute of said sheet of material being perforated.

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