Oct. 22, 1940. A. E. USHAKOFF 2,218,593

SHUTTLE FOR GAME OF BADMINTON

Filed Oct. 18, 1938

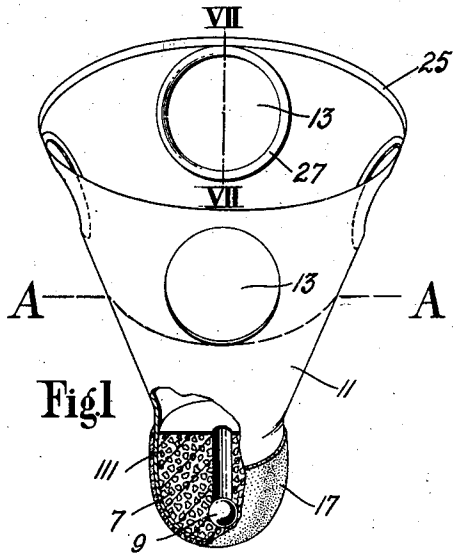

Fig.1

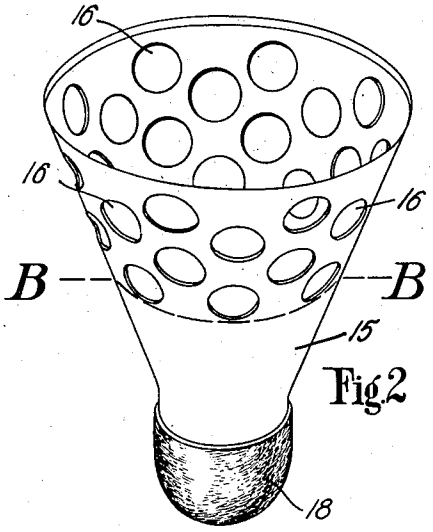

Fig.2

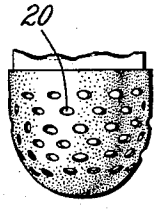

Fig.3

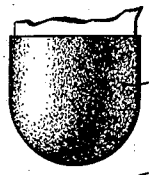

Fig.4

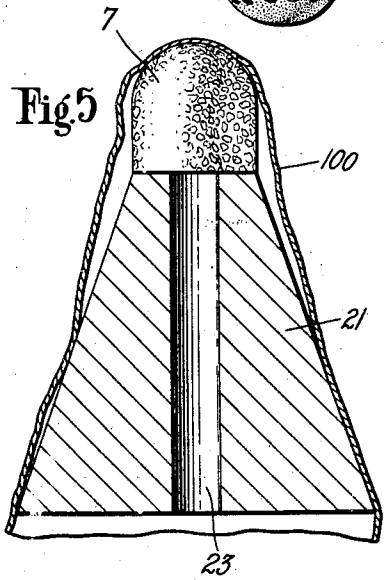

Fig.5

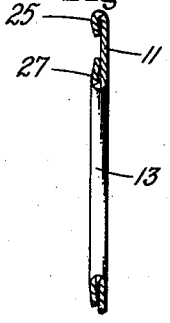

Fig.7

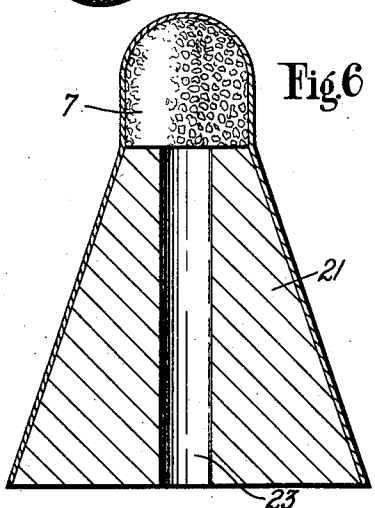

Fig.6

Fig.8

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UNITED STATES PATENT OFFICE

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SHUTTLE FOR GAME OF BADMINTON

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11 Claims. (Cl. 273—106)

This invention relates to shuttles or "birds" used in the game of badminton, such shuttles commonly comprising a head having attached thereto a feathered flight-controlling vane and being adapted to be driven through the air by means of a blow or stroke of a racquet with which the head of the oncoming shuttle is struck.

The general object of the present invention is to provide a featherless shuttle which is not only equal but superior to the feathered shuttle in flight characteristics and is stronger, more durable and less expensive than the feathered shuttle.

The vanes of shuttles now on the market and in use consist of a handmade assembly of goose feathers which of themselves are unlike; and the flight characteristics of shuttles having such vanes are non-uniform and not wholly satisfactory. These shuttles, moreover, are comparatively expensive and are easily broken, particularly when they are not kept somewhat moist or humidified. Shuttles provided with featherless vanes have been proposed in United States Patents Nos. 1,620,922 and 1,924,259; but these shuttles have not, so far as I am aware, been successful or even at all acceptable, due to the fact that the vanes apparently have been designed in an effort to simulate the general shape and appearance of feathered vanes without an appreciation or application of the factors which govern the flight of shuttles.

In the game of badminton the shuttle is driven back and forth from one player to another by striking the head of the shuttle with a racquet; and every time the shuttle is struck its direction of flight is reversed or at least greatly changed. When the direction of flight of the shuttle is thus changed its initial tendency is to wobble or oscillate; and one of the main functions of the vane is to damp these oscillations so as to cause them to disappear—that is to cause the energy of oscillation to be absorbed—and to do this as quickly as possible so that the shuttle may assume a stable directional flight. Another function of the vane is to control the distance of the flight of the shuttle, that is to ensure that the shuttle shall not fly too far when it is struck a blow of maximum force. The vane should therefore be so constructed (1) that the drag exerted by it will limit the extent of the flight of the shuttle to a certain distance even when it is struck a hard blow and (2) that, whether it is struck a hard blow or a light one, the oscillatory energy imparted to it by suddenly changing the direction of flight shall be quickly absorbed.

The illustrated shuttle of this invention is provided with a vane consisting of a thin seamless generally conical member of homogeneous colloidal material provided in the larger end with flight-controlling holes of substantial aggregate area, as hereinafter more fully set forth. The unbroken conical surface of a featherless vane, as heretofore proposed, offers insufficient resistance to the passage of air over it to accomplish these ends. I have discovered, however, that the holes offer a considerable resistance to the flow of air through them and cause a turbulence. They thus induce a drag which limits the distance and controls the trajectory of the flight of the shuttle; and at the same time, being located near the larger end of the vane where the amplitude of oscillation is greatest, are very effective in absorbing quickly the oscillatory energy of the shuttle whether the shuttle is struck a light or a heavy blow and in maintaining its flight directionally stable.

Referring now to the accompanying drawing which illustrates the preferred embodiments of my invention:

Fig. 1 is a perspective of a shuttle in which the present invention is embodied, the vane of the shuttle being provided with large holes, part of the lower or head end of the shuttle being shown in section;

Fig. 2 is a perspective of a shuttle having smaller holes in its vane;

Fig. 3 is an elevation of a portion of a shuttle the head of which carries a perforated rubber cover;

Fig. 4 is a view similar to Fig. 3 but showing a cover made of sponge rubber;

Fig. 5 is a section of a frusto-conical mold that may be used in making the shuttle, there being shown a shuttle head on the top of the mold and a blank of shrinkable colloidal material in place over the head and mold;

Fig. 6 is a section similar to Fig. 5 after the blank has shrunk about the head and mold and the surplus has been trimmed off;

Fig. 7 is a section on an enlarged scale through a portion of the vane 11 on the line VII—VII of Fig. 1 showing a structure by which the edges of the holes and the upper edge of the vane may be strengthened; and

Fig. 8 is a section also on an enlarged scale through a portion of a vane and a hole, showing a somewhat different structure by which the edges of the holes may be strengthened.

The illustrated shuttle of Fig. 1 comprises a head 7 of cork or other suitable material in the

form of a cylinder having a hemispherical end and carrying near said end and below the center of the sphere a weight in the form of a lead ball 9. The vane 11 is a thin, flexible, seamless, jointless member of homogeneous colloidal material of generally conical shape having the head attached thereto and having near its larger end a plurality of comparatively large equally spaced flight-controlling holes 13. In order to strengthen the shuttle and to facilitate its manufacture, the thin seamless, jointless member, of which the vane 11 is a part, has integral with it a sheath or socket 111 which fits about and firmly holds the head 7. For convenience of description, the shuttle will be considered as occupying its upright position, and it will be noted that the holes are located in the upper or larger half of the vane, that is in that part of the vane above a plane A—A perpendicular to the axis of the shuttle and located halfway between the top of the cork head 7 and the upper, larger end of the vane.

The vane 11 of the shuttle of Fig. 1 is provided with four large equally spaced holes 13 each having a diameter of about one inch. The vane 15 of the shuttle of Fig. 2 is provided with two rows of equally spaced holes 16 each having a diameter of about three-eighths of an inch, all located in the upper half of the vane above the plane B—B. Assuming that the sum of the areas of the holes is the same in any given cases, I have found that in general the bigger the individual holes the shorter is the distance and the steadier is the flight of the shuttle so that by increasing or decreasing the size of the individual holes the flight characteristics of the shuttle may be predetermined and varied, and shuttles of different pace, that is, fast, medium or slow, may be provided. There is, of course, a limit to the amount of material which can be removed from the vane—that is to the aggregate area of the holes—without objectionally weakening the vane; and there is also a minimum limit to the size of the individual holes since they should be large enough so that they permit a sufficient amount of air to flow through them. This minimum limit for satisfactory flight is about three-eighths of an inch and not less than one-quarter of an inch. The aggregate area of the holes should be substantial, being in the case of the shuttle of Fig. 1 about 28% and in the case of the shuttle of Fig. 2 about 24% of the area of the upper half of the vane, these shuttles being of medium size and weight, and their exact dimensions appearing in Fig. 6.

It has been stated that the holes, whatever their size, are located in the upper half of the vane. The shuttle will fly satisfactorily if additional holes are provided in the lower half of the vane, since holes so located have little appreciable drag effect. Such holes, however, weaken the vane in a locality where strength is particularly desirable and necessary to withstand the shock of hard blows.

In order to provide a surface upon which the racquet will not slip when the shuttle is struck, particularly by a glancing or "cut" shot, there is provided a cover 17 of rubber, or a cover of felt 18 (Fig. 2) cemented in place. In Fig. 3 there is shown a cover of solid rubber provided with perforations 20 in its upper part. A cover of this sort requires no weight such as that shown at 9 since the perforations are so located as to concentrate the weight of the cover somewhat in its lower end. In Fig. 4 there is shown a cover of sponge rubber 22, and here again the separate weight 9 may be dispensed with by choosing sponge rubber 22 of the proper density.

The shuttle of this invention may conveniently be made by the use of a frusto-conical mold or form 21 such as is shown in Figs. 5 and 6. The head 7, the diameter of the cylindrical portion of which is substantially the same as that of the top of the mold, is placed on said top as shown. There is provided a suitably shaped blank 100 of colloidal material in swollen shrinkable form such as a hydrated ester of cellulose which may contain, if desired, fillers, plasticizers, coloring dyes, pigments, etc., to improve its appearance or physical qualities. This blank is placed over the mold and head and allowed to shrink into a hard, tough, flexible and resilient film to form the combined vane 11 and socket or sheath 111 of the shuttle of Fig. 1 or the vane 15 and socket or sheath (not shown) of the shuttle of Fig. 2, the head being thus very firmly attached to this member. The projecting portion of the blank is trimmed off flush with the base of the mold, and a fluid may be forced into the passageway 23, if desired, to facilitate the removal of the article from the mold. A cover such as one of those shown in Figs. 1 to 4 may be cemented in place and the holes made in the vane.

In other to strengthen the edges of the holes, if desired, a construction such as that shown in Figs. 1 and 7 or that shown in Fig. 8 may be employed. According to the construction shown in Figs. 1 and 7 the margins around the holes are bent through approximately 180° as indicated at 27, thus thickening the edges of the holes. According to the construction shown in Fig. 8 the margins around the holes are bent through less than 180° as indicated at 29. This bending, it should be understood, may take place inwardly or outwardly, and will preferably take place outwardly in the construction shown in Fig. 8. In both cases the depth of the holes is greater than the thickness of the body portion of the vane, and the edges of the holes are strengthened. The upper edge of the vane may also be similarly thickened and strengthened, for example as shown best in Fig. 7 at 25, by bending the margin inwardly.

It will be appreciated from the foregoing that my invention provides a shuttle that is simple, easily manufactured, and particularly one the construction and material of which gives strength and durability. More important still, there is attained uniformity of weight, balance and symmetry which, with the aerodynamic design of vane, provides a shuttle of predetermined and excellent flight characteristics.

Having described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A shuttle for the game of badminton comprising head and vane portions, said vane portion consisting of a thin seamless, jointless generally conical member of homogeneous colloidal material provided in its upper half with drag-inducing holes of substantial aggregate area whereby the distance of flight of the shuttle is limited and the direction of its flight stabilized.

2. A shuttle for the game of badminton comprising head and vane portions, said vane portion consisting of a thin seamless, jointless generally conical member homogeneous throughout having distributed in its upper half a plurality of flight-controlling holes of substantial aggregate area.

3. A shuttle for the game of badminton comprising a head and a vane attached to the head, said vane consisting of a thin seamless generally conical member homogeneous throughout having in its upper half a plurality of flight-controlling holes, said vane having integral with it a socket to receive and firmly hold the head.

4. A shuttle for the game of badminton comprising a head and a thin seamless member of colloidal material, said member including a portion shrunken over and firmly holding the head and a generally conical vane having in its upper half a plurality of flight-controlling holes.

5. A shuttle for the game of badminton comprising a head in the form of a cylinder having a rounded end, and a hollow seamless, jointless member of colloidal material, a portion of said member fitting about and attached to the sides and rounded end of the head, and the remainder of said member being of generally conical shape and having in its upper half a plurality of flight-controlling holes.

6. A shuttle for the game of badminton comprising a head in the form of a cylinder having a rounded end, and a hollow seamless, jointless member of colloidal material, a portion of said member fitting about and attached to the sides and rounded end of the head, and the remainder of said member being of generally conical shape and having in its upper half a row of substantially equally-spaced flight-controlling holes extending around its circumference.

7. A shuttle for the game of badminton comprising head and vane portions, said vane portion consisting of a thin seamless, jointless generally conical member of homogeneous colloidal material provided in its upper half with drag-inducing holes, the depth of the holes being greater than the thickness of the body portion of the vane.

8. A shuttle for the game of badminton comprising head and vane portions, said vane portion consisting of a thin seamless, jointless generally conical member of homogeneous colloidal material provided in its upper half with drag-inducing holes, the thickness of the vane in a narrow area around the holes being greater than the thickness of the body portion of the vane.

9. A shuttle for the game of badminton comprising a head, a thin seamless, jointless member comprising a socket in which the head is received and to which the head is attached and a generally conical vane having flight-controlling holes in its upper half, and a cover of relatively soft resilient material attached to the outer wall of the socket in which the head is received.

10. A shuttle for the game of badminton comprising a head, a thin seamless, jointless member comprising a socket in which the head is received and to which the head is attached and a generally conical vane having flight-controlling holes in its upper half, and a rubber cover attached to the outer wall of the socket in which the head is received.

11. A shuttle for the game of badminton comprising a head, a thin seamless, jointless member comprising a socket in which the head is received and to which the head is attached and a generally conical vane having flight-controlling holes in its upper half, and a fabric cover attached to the outer wall of the socket in which the head is received.

ALEXIS E. USHAKOFF.