March 5, 1946. G. K. GEERLINGS ET AL 2,395,864

RACKET

Filed April 1, 1941 2 Sheets-Sheet 1

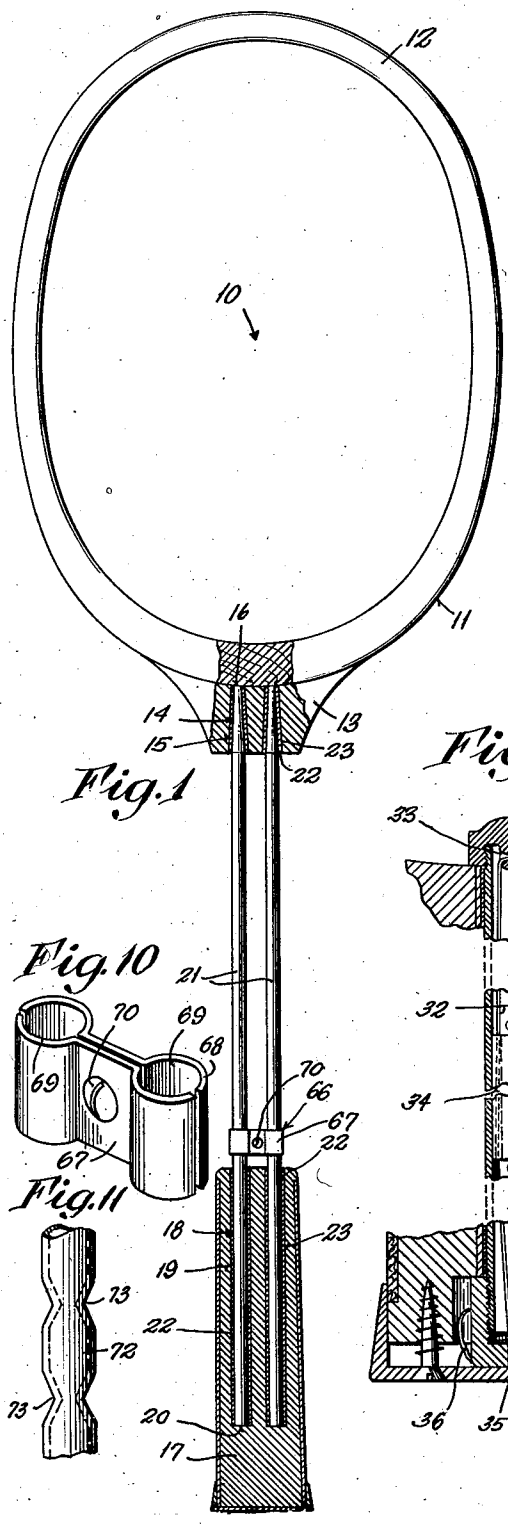

Fig. 1

Fig. 10

Fig. 11

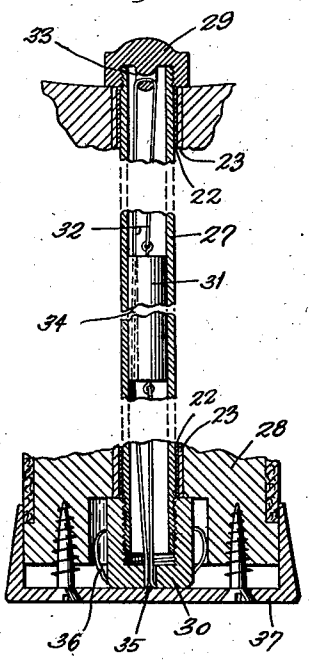

Fig. 3

Fig. 2

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Filed April 1, 1941 2 Sheets-Sheet 2

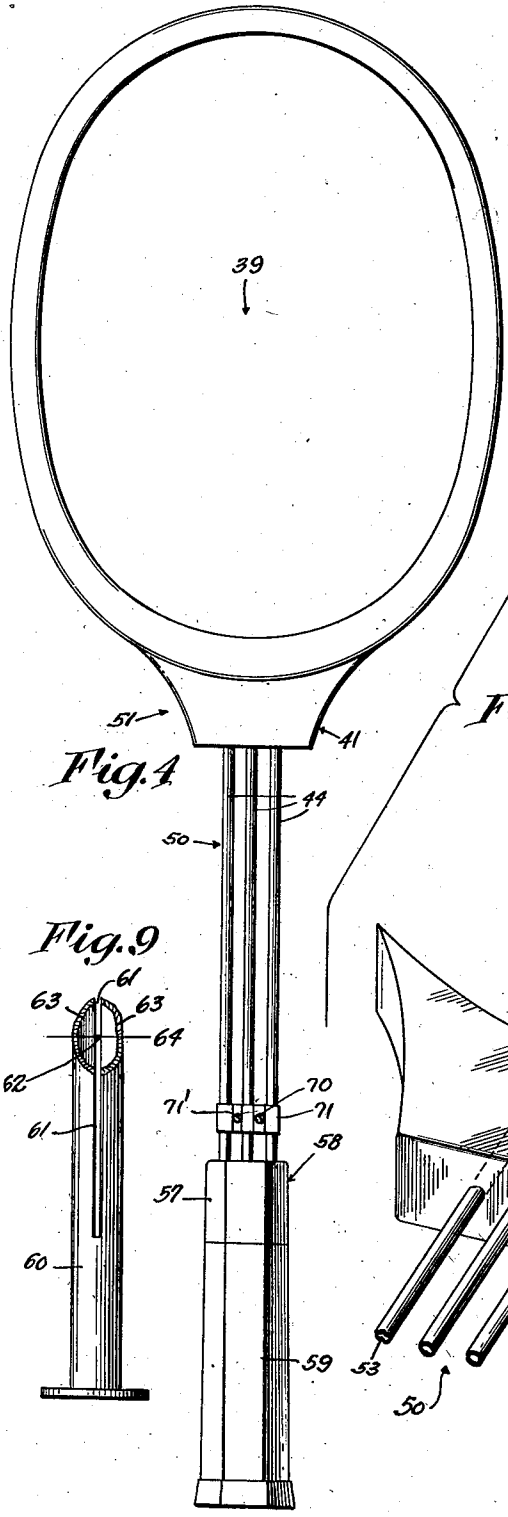

Fig.4

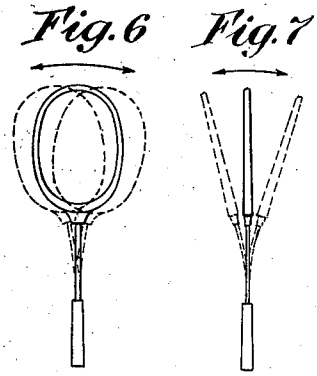

Fig.6

Fig.7

Fig.8

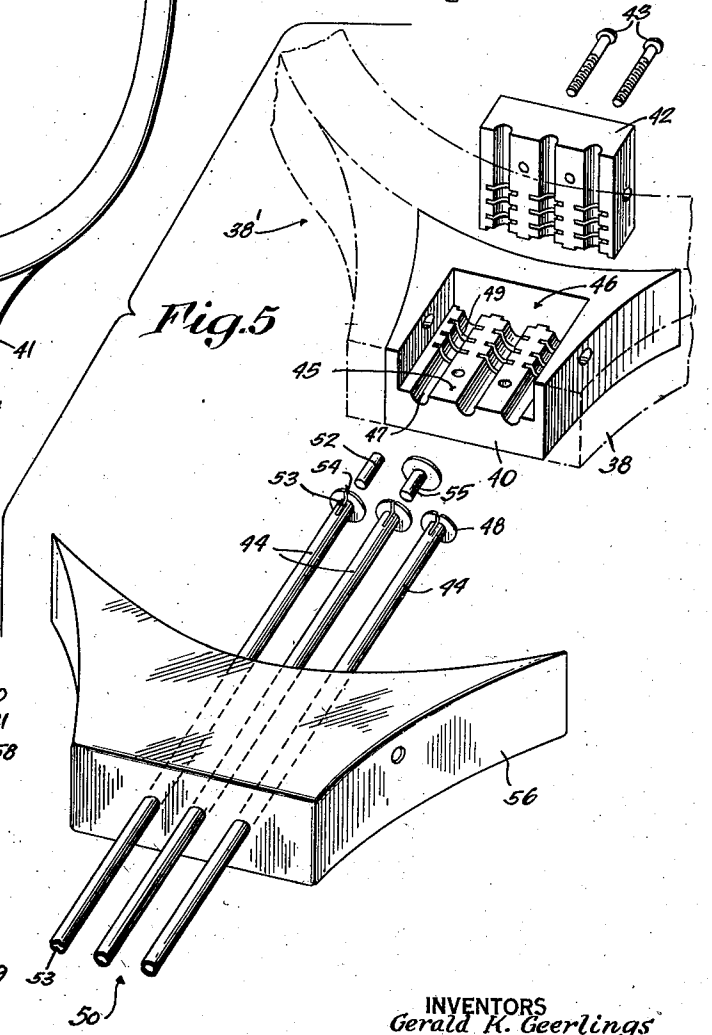

Fig.5

Fig.9

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RACKET

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Application April 1, 1941, Serial No. 386,278

8 Claims. (Cl. 273—73)

This invention relates to sport rackets, such as are used for tennis, badminton, squash, etc., and particularly to rackets adapted to possess a resilient action in play. It relates to the connecting members joining the handle and bow portions of sport rackets, and also to means for controlling the moment of inertia, flexibility, center of balance, length of stem, weighting and other properties of sport rackets.

Ordinarily the ends of a wooden bow member of a racket are extended downwardly to cooperate with flank members to constitute a handle, as exemplified by the drawings in Williamson Patent 1,630,683, May 31, 1927, hereinafter sometimes designated as a conventional racket. However, the bow has sometimes been formed separately from the handle, as exemplified by the disclosure of Reissue Patent 20,684 to John B. Dickson, April 5, 1938. A racket of the type illustrated in said patent will hereinafter sometimes be designated as a Dickson racket. It includes a single resilient metallic stem connecting separate bow and handle sections.

Sidewise movement refers to movement of the bow with respect to the handle in the plane defined by the stringing. Arcuate movement or rotational movement refers to movement of the bow with respect to the handle about the longitudinal axis of the handle. Backward and forward movement refers to movement in a plane including the longitudinal axis of the handle, said plane being perpendicular to the plane of the stringing. Sport rackets inherently possess at least an infinitesimal trace of sidewise resiliency, arcuate resiliency and forward-backward resiliency. Athletes differ greatly regarding the desired amount of each of said resiliencies. Heretofore, there has been no satisfactory method of or structure for providing exactly the desired degree of each of said resiliencies in a sport racket; or, at least such characteristics were not interchangeably provided in individual rackets.

Some players prefer heavy rackets and others desire rackets of light weight. Heretofore, storekeepers have sometimes had to stock several weights of each model of racket. Similarly, some players prefer long stems; some prefer short stems; and others prefer stems of medium length. There has also existed a lack of uniformity of preference regarding not only such properties of rackets as flexibility, stem length and racket weight but also such properties as center of balance, type of handle, moment of inertia and other properties of rackets. Heretofore, storekeepers have had to stock large quantities of rackets to supply the demand of particular sportsmen.

Sport rackets have heretofore been bulky when packed for shipment. Moreover, they have occupied considerable space in the store. Because rackets are in demand only during certain seasons in many sections of the country, storage space for the out-of-season goods constitutes an important problem for the storekeeper.

It is an important object of the present invention to provide a racket in which the amount of resilient backward and forward movement of the bow relative to the handle can be accurately controlled and/or adjusted.

Other objects are: to substantially eliminate all sidewise movement of the bow; to provide a racket in which the amount of resilient absorption of the arcuate force can be accurately controlled and/or adjusted; to provide a racket having adjustable weighting means; and to provide sport rackets which can be easily modified to fulfill a specific set of requirements not only as to the aforementioned resiliency and weighting means, but also as to length of stem, center of balance, type of handle, moment of inertia of the bow about the longitudinal axis of the handle, moment of inertia of the racket about the average instantaneous center of the racket in play, and other properties.

It is an object of the present invention to provide a racket requiring a minimum of space for shipment and/or storage.

A further object of the present invention is to provide a process of economically manufacturing rackets.

An important feature of the present invention is the provision of a racket having a plurality of flexibly resilient shafts adapted to provide a predetermined amount of flexibility of forward and backward movement of the bow and to substantially prevent any sidewise movement of the bow.

Another feature of the present invention is the provision of a variety of metallic shafts differing as to flexibility, length, weight and other properties.

Another feature is the provision of a process by which a racket can be readily assembled by a storekeeper, according to the specific requirements of a customer as to flexibility, length of stem, center of balance, moment of inertia, type of handle and other such properties.

Another feature is the locating of stem members an appreciable distance from the longitudinal axis of the handle.

Another feature of the present invention is the

provision of weights which can be positioned in the stem, bow and/or handle for the purpose of controlling the weight, center of balance and moment of inertia.

Other objects, features and advantages will hereinafter appear.

Referring now to the drawings, it will be seen that:

Figure 1 represents a front view of a preferred form of the present invention.

Fig. 2 is a front view of an alternative form of the present invention.

Fig. 3 represents a detailed front view of a portion of Fig. 2.

Fig. 4 represents another alternative form of the invention.

Fig. 5 represents a detailed plan view of a portion of Fig. 4.

Fig. 6 is a diagrammatic representation of sidewise movement.

Fig. 7 is a diagrammatic representation of forward and backward movement.

Fig. 8 is a diagrammatic representation of rotational movement.

Fig. 9 is a fragmentary view representing a modification of a portion of the present invention.

Fig. 10 is a perspective view of the balance control weight.

Fig. 11 is a fragmentary view of a modified form of shaft.

Before describing the present improvements and mode of operation thereof in detail it should be understood that the invention is not limited to the details of construction and arrangement of parts shown in the accompanying drawings, which are merely illustrative of the present preferred embodiments, since the invention is capable of other embodiments, and the phraseology employed is for the purpose of description and not of limitation.

In a preferred and simple form of the invention shown in Fig. 1, there is provided a racket 10 having a bow 11 formed by bending a peripheral member 12 such as a laminated ash strip into a closed curvilinear shape such as an oval. Stringing may be secured to the bow 11 in the usual manner. A throat member 13 is glued to a portion of the bow 11 and is provided with holes 14 defined by cylindrical walls 15 and end walls 16.

Positioned apart from the bow 11 is a gripping member such as a handle 17, provided with bores 18 each defined by a cylindrical wall 19 and an end wall 20.

Of particular importance it should be noted that a plurality of metallic shafts 21 connect the handle 17 and the bow 11. The upper ends of the shafts 21 pass into the holes 14 of the throat member 13. Interposed between the shaft 21 and cylindrical walls 15 of the holes 14 are cloth sleeves 22 containing heat-sensitive adhesive material 23 such as thermoprene, polystyrene, etc. Glue, Bakelite or other adhesive material may be used if desired. The shafts 21 are affixed to the handle 17 by the cloth sleeves 22 and adhesive 23. The shafts abut against the end walls 16 and 20 of the throat member 13 and handle 17, respectively.

The process of manufacturing the racket 10 includes the steps of forming a bow 11, placing the sleeves 22 and the shafts 21 in the holes 14 and 18. The handle 17, throat member 13, shafts 21 and cloth sleeves 22 are then secured together by the adhesive 23. For example, if a heat-sensitive material is used the assembly may be heated so that the adhesive material 23 is forced into some of the pores of the wooden throat member 13 and handle 17, and so that the cloth sleeve 22 is securely adhered to the metallic shafts 21 and to handle 17 and throat member 13. If it becomes desirable to change the metallic shafts, the heat-sensitive adhesive material 23 can be heated and the shafts withdrawn from the holes.

It should be particularly noted that the shafts 21 are positioned so that their axes lie substantially in the plane defined by the bow 11 of the racket 10, which plane also contains the longitudinal axis of the nonmetallic handle 17. Thus, the shafts 21 (sometimes herein designated as members or connectors) brace each other to substantially prevent all sidewise movement of the bow 11 relative to the somewhat cylindrical handle 17. Sidewise movement is diagrammatically represented in Fig. 6. Because the shafts of the racket 10 are both in the same plane, a relatively high degree of flexibility and resilient backward and forward flexing movement (diagrammatically represented in Fig. 7) is possible, provided reasonably flexible material is used for the shafts. Thus, the racket 10 can have the characteristic of absorbing shock and of absorbing a substantial amount of shock, so that the hand receives relatively little shock even when a ball is driven a considerable distance. If, however, it is desirable to change the racket to a stiff racket, it is only necessary to remove the flexible shafts and substitute stiff shafts. The cost of substituting shafts is only a small portion of the cost of substituting an entire racket.

Attention is directed to the fact that if the racket is provided with very stiff shafts not only sidewise and backward and forward movement is prevented but rotational movement is also prevented, inasmuch as the two shafts brace each other in preventing rotational movement. A Dickson racket permits a certain amount of rotational movement inasmuch as a metallic member inherently has torsional resiliency. The Dickson racket is able to function somewhat as a torsional pendulum. The racket 10, however, may be provided with two off-center rigidly stiff stem members adapted to brace each other to minimize rotational movement. Moreover, rotational movement of the bow is decreased by the increased moment of inertia, incident to positioning the weight of the stem members a substantial distance from the cylindrical axis of the handle. Rotational movement is also resisted by the stiffness of two members instead of one.

In the alternative form of the invention shown in Figs. 2 and 3, there is provided a racket 26 somewhat similar to the racket 10 shown in Fig. 1, but differing therefrom in the following particulars. In addition to the two off-center shafts 21 the racket 26 is provided with a central shaft 27 of tubular shape. The shaft 27 is secured to the bow 11 and a handle 28 by means of the adhesive 23 impregnated sleeves 22 and cap nuts 29 and 30. Within the central shaft 27 is a weight 31 to which is attached an endless belt 32 of rawhide, nylon or the like, which passes through an eyelet 33 on the cap nut 29, through a hole 34 in the weight 31, and through hole 35 in the cap nut 30. A loop 36 of the belt 32 is frictionally positioned between the cap nut 30 and a cap 37 normally fitting onto an end of the handle 28. Thus, the weight 31 is securely positioned within the central shaft 27 by means of the end-

less belt 32 which cannot move because of the frictional gripping by the cap 37, and cap nut 30. However, when the cap 37 is removed, the loop 36 is free and can be used to move the endless belt 32 and to thereby move the weight 31 along the cylindrical axis of the central shaft 27.

It should be particularly noted that the racket 26 has shafts 21 having ends in abutting relation with end walls 16 and 20 of the bores 14 and 18 of the throat member 13 and of the handle 28, thereby preventing the throat member and handle from coming any closer together. The central shaft 27 and the cap nuts 29 and 30, however, prevent the throat member 13 and handle 28 from going farther apart. Thus, the racket 26 includes a doubly effective securing means to maintain the bow, handle and shafts detachably but normally firmly together, said means including the adhesive-impregnated cloth sleeves 22, the cap nuts 29 and 30 and the push-pull combination of the metallic shafts 21 and 27.

In another alternative form of the invention, shown in Figs. 4 and 5, a peripheral member 38 of a racket 39 may, if desired, extend only partially about the oval shape, and be glued to two opposite sides of a throat member 40, thereby forming a bow 38'. It should be particularly noted that a novel interlocking means 41 is provided within the throat member 40. A slotted and grooved cover block 42 is detachably secured to the throat member 40 by means of screws 43 and is normally allowed to press firmly substantially against a plurality of the shafts 44 and against a bottom face 45 of a cavity 46 of the throat member 40. Grooves 47 are provided in the bottom face 45 adapted to position a plurality of the shafts 44. Flanges 48 of the shafts 44 fit within slots 49 provided in the bottom face 45 of the cavity 46. A plurality of the slots 49 may be provided for each groove 47, so that the length of a stem 50 of the racket 39 can be adjusted, not merely by the use of shafts 44 having a suitable length, but also by the positioning of each flange 48 in the most suitable one of the slots 49. The slotted and grooved cover block 42 cooperates with the slots 49, grooves 47 and cavity 46, and throat member 40 and screws 44 to constiute a clamp 51 securely maintaining the bow 38' and the stem 50 together.

Attention is directed to the novel weighting means provided in the racket 39. A weight 52, such as a rubber-covered lead plug, or a litharge-filled rubber plug, is placed in a cavity 53 at the end of the shaft 44. The shaft 44 is bifurcated to provide a slot 54 which is expanded by the weights 52 as the latter is inserted between the two fingers of the bifurcated shaft 44. When the clamp 51 is tightened by securing the block 42 to the throat member 40 by means of the screws 43, the weight 52 is held firmly by the two fingers of the shaft 44, which are brought closer together by the action of the clamp 51. The clamp 51 can be adapted to additionally secure the weight 52 and/or other weights. For example, a weight 55 may be placed in the groove 47 and may be positioned by the slot 49 in the bottom face 45. In any case, the clamp 51 additionally secures the weight when the screw 43 is tightened. The weight 52 may have a higher density at the tip than at the head, and in this manner the balance of the club may be adjusted along the longitudinal axis of the stem 50.

It should be noted that the novel weighting means provided by the present invention makes it possible, not only to alter the total weight of the racket, but also to alter the position of the weights. The center of balance, or leverage weight, can thereby be materially modified in a racket without changing its total weight. Of even greater importance, however, the moment of inertia of the racket can be modified by reason of the fact that the weights may be positioned at substantially any point from the end of the handle to the bow. Moreover, the weights can be positioned to effect a sidewise weighting to compensate for tendencies to incorrectly hit the racket, or for other reasons. When weights are positioned in each of the outermost of the shafts 44, the rotational moment of inertia is increased, so that the tendency of the bow to rotate with respect to the handle (see Fig. 8) is decreased. Because at least some of the metallic shafts are positioned apart from the axis of rotation, the metallic shafts themselves increase the moment of inertia of the stem to decrease the tendency of the bow to rotate. Fig. 8 schematically shows the arcuate or rotary movement of the bow with respect to the handle.

A ferrule 56 is disposed over the throat member 40 and related parts so that the interengaging means 41 is normally covered. Similarly a ferrule 57 covers an interengaging means 58 by which the shafts 44 are attached to a handle 59. The interengaging means 41 and 58 are substantially similar and function to make possible the convenient separation of the handle 59, stem 50 and bow 38'.

The adjustable length structure and weights 52 and 55 hereinbefore described in connection with the bow end of the racket 39 may alternatively and/or additionally be similarly incorporated in the interengaging means 58 at the handle end.

Particular attention is directed to the fact that the shafts 44 are easily detachable from the handle 59 and bow 38'. If the ferrules 56 and 57 are slid down, and if the blocks 42 are removed, the shafts 44 are thereby exposed for removal. Thus, it is possible to manufacture bows 38', handles 59 and shafts 44, and to store them compactly. Then when a racket of a given set of requirements is ordered, it may be built according to the customer's requirements.

Alternatively, the bows, handles and shafts may be packed compactly and shipped to a storekeeper. It should be particularly noted that the disassembled racket 39 requires very little space for shipment or storage. Both conventional rackets and Dickson rackets are bulky in shipment and storage. Packaging bows, stem shafts and handles separately makes possible a high degree of compactness. Storekeepers can assemble a few rackets to demonstrate the wide range of properties which are possible by means of the many varieties of detachable metallic shafts of divers properties, making at least one racket with very flexible shafts, so that the racket possesses a great amount of resilient backward and forward movement, diagrammatically represented in Fig. 7, and making some with very rigid shafts to provide an illustrative racket having substantially no resilient backward and forward movement. After customers have tried illustrative rackets to make certain of the properties which they desire, the storekeeper can, in effect, build custom-built rackets according to the customer's requirements. Inasmuch as there is a great lack of uniformity among athletes regarding each of the properties of a racket, such as length of stem, flexibility, center of balance, type of handle, moment of inertia, the possibility of the storekeeper

assembling a racket to meet the specific set of requirements of each customer is an important advantage over the previous practice of stocking a large variety of rackets in the hope of having the kind desired.

The racket described above may be manufactured according to the process which includes the steps of: forming a plurality of bows of divers properties; forming a plurality of handles of divers properties; forming a plurality of metallic shafts of divers properties; forming a plurality of weights; determining the specific requirements for a racket; selecting a suitable group from said bows, handles, weights and shafts; and assembling said group to provide a racket including a bow, a handle and a plurality of metallic shafts therebetween, complying with said requirements and having a "custom-built" set of properties.

Although the shafts have generally been illustrated as cylindrically tubular, it should be understood that other shapes may be used. It should be particularly noted that a tubular member, when provided with a longitudinal slot or slots, permits substantially greater flexibility in one direction than in another. In Fig. 9 there is shown a shaft 60 having two slots 61, a transverse slot axis 62 passing through the slots 61 and perpendicular to the longitudinal axis, two segments 63 and a transverse segment axis 64 passing through the midpoints of the segments. The segment axis 64 is perpendicular to the slot axis 62 and to the longitudinal axis of the shaft 60. A given force will produce a greater amplitude of flexing of the shaft 60 about the slot axis 62 than about the segment axis 64. Moreover, the shafts can be arcuately adjusted. Thus, a racket having slotted shafts can be changed from one having little backward-forward resiliency to one having a substantial degree of such resiliency by merely arcuately adjusting the slot axis 62 of shafts by rotating them ninety degrees. The shafts 60 are preferably detachably attached to the bow and handle, as by clamps 51, and it is a simple matter to merely loosen the clamps to thereby loosen the shafts, and to rotate at least one, and preferably all of the shafts ninety or less degrees to modify the resilient characteristics of the racket by positioning the slot axes 62 at the most suitable of divers resilient positions.

Furthermore, the shafts 21, 27, 44 and 60 hereinbefore described extending between and connecting the separate bow and separate handle may all or interspersedly be of solid or tubular wood, or of material other than tubular metal. For example, referring to Fig. 2, the center shaft 27 may be of tubular metal as shown and the two side shafts 21 of wood, vice versa, or all three may be of wood. Furthermore, although there are certain advantages in having shafts, such as the shafts 21, bottoming in the bow and/or the handle as shown, it is possible to make the holes full length so that they extend through the bow and/or the handle similarly to the shaft 27. Also, slots, such as the slot 61 in shaft 60, may be provided in any of the foregoing wood and other alternative shaft constructions, for divers degrees of flexibility.

As shown in Figs. 1 and 10, the shafts may also serve as a guide and holding means for an external adjustable weight 66 including weight plates 67 and 68 with channels 69 adapted to engage and grip the shafts 21, for example, when a screw 70 passing through plate 69 is tightened in a conventional screw-thread connection with plate 68. The weight 66 is tightened on the shafts 21 near the bow when it is desired to have the bow section additionally weighted, or near the handle when it is preferred to have the weight there. A similar weight 71 (see Fig. 4) may be provided for a three-shafted racket by merely providing an additional channel for the third shaft and preferably an additional screw 70', as will be readily appreciated by viewing Fig. 4. One or more of the weights 66 or 71 may be used on a single racket.

With weights such as 66 or 71 underweight rackets can be brought up to or over regulation weight, and standard weight rackets can be made heavier, if desired.

Fig. 11 shows a modified form of shaft 72, which may be used in place of shafts 21, 44 or 60, including the provision of one or more depressions 73 which tend to stiffen the shaft against bending in a plane tangential to the depressions. Such a construction may be used in place of the slot 61 to achieve the control and adjustable resiliency advantages described hereinbefore in detail in connection with Fig. 9.

Other variations and modifications may be made within the scope of this invention, and portions of the improvements may be used without others.

Having thus described the invention what is claimed as new is:

1. In a racket, the combination of a wooden bow; a handle; a plurality of metallic connectors extending between the bow and handle; and means including clamping members detachably associating the connectors with the bow and with the handle and a disengaging fastener adapted to normally maintain the clamping members pressing toward each other and substantially against the connectors.

2. In a racket, the combination of a wooden bow; a handle spaced apart from the bow; a plurality of metallic connectors; enlarged heads at each end of the connectors; detachable securing means associated with the bow and with the handle, adapted to normally engage with the enlarged heads to securely fasten the ends of the connectors to the bow and handle.

3. In a racket, the combination of a wooden bow; a handle spaced apart from the bow; a plurality of metallic connectors; weighting means adapted to fit at least partially within the connectors; and a single means cooperable in maintaining said connectors relative to said bow and said weighting means relative to said connectors.

4. In a racket, the combination of a wooden bow; a handle spaced apart from the bow; a plurality of metallic connectors for uniting the bow and handle, and at least one having a cavity; weighting means within the cavity; and a single means cooperable in maintaining said weighting means in a selected position within said cavity and said connectors relative to said bow.

5. In a sport racket, the combination of a bow; a handle; a plurality of separate members connecting said bow to the handle; and interlocking means associated with said members and having a plurality of positions for maintaining said bow in divers longitudinal positions relative to said handle.

6. In a sport racket, the combination of a bow; a handle; a plurality of separate members connecting said bow to the handle; and means for altering the resiliency of said bow relative to the handle, said means including interconnecting means enabling adjustment of said connecting

members in divers positions relative to said handle and said bow.

7. In a sport racket, the combination of a bow; a handle; a plurality of tubular members connecting said bow to the handle; an external weight shiftable upon said tubular members and having portions embracing said tubular members; and means for locking said weight in divers positions upon said tubular members and said tubular members together.

8. In a racket, the combination of a bow; a handle; a plurality of connectors intermediate said handle and said bow, at least one of said connectors having a cavity therein with the walls thereof being laterally distortable; weighting means in said cavity; and clamp means for gripping said connectors, maintaining said connectors and bow together, and laterally pressing said at least one of said connectors to grip and hold said weighting means in the cavity therein.

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