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(54) Improved racket handle

(57) An improved handle for tennis rackets and the like is equipped with a hand grip which has, on one side, three arcuate depressions and, on the other side, a single arcuate depression. The first arcuate depression (10) on said one side serves as a hooking/gripping and force applying point for the forefinger, the second depression (11) serves for receiving the second finger and the third depression (12) serves for receiving the third and fourth fingers in a descending order from the upper end of the racket handle. The arcuate depression on the other side serves to receive the thumb. The hand grip also has a convex portion (14) to facilitate the handle-holding motion performed by the centre of the palm.

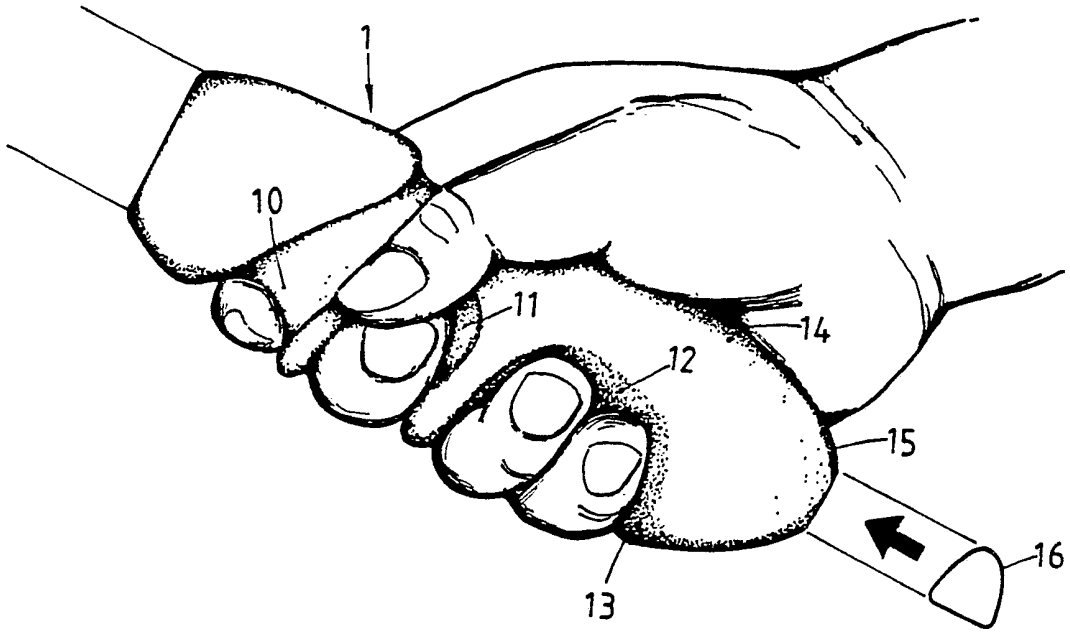

FIG. 4

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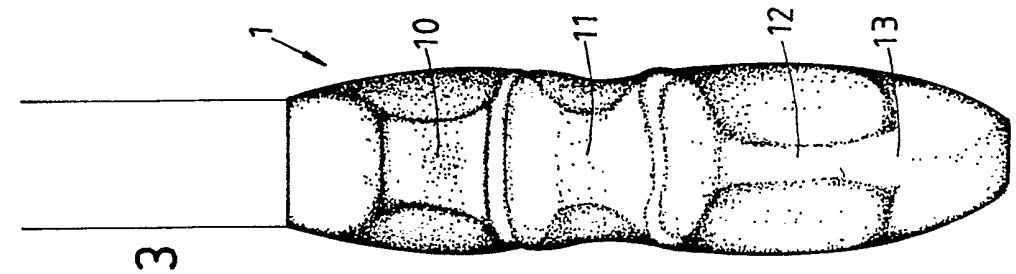

FIG.3

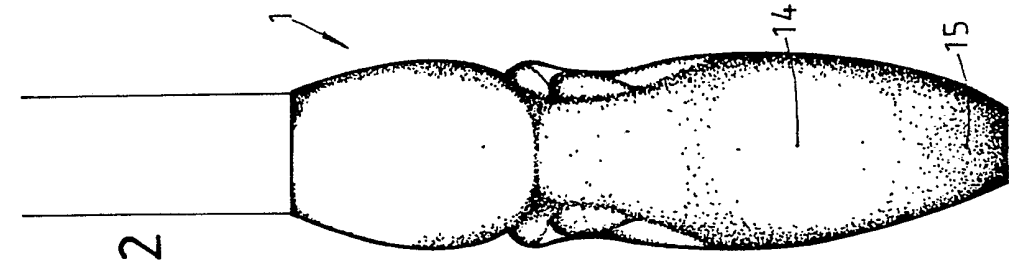

FIG.2

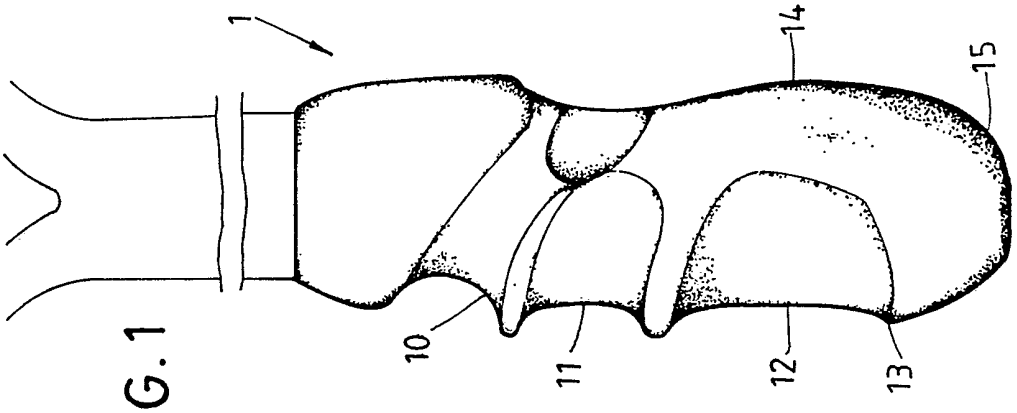

FIG.1

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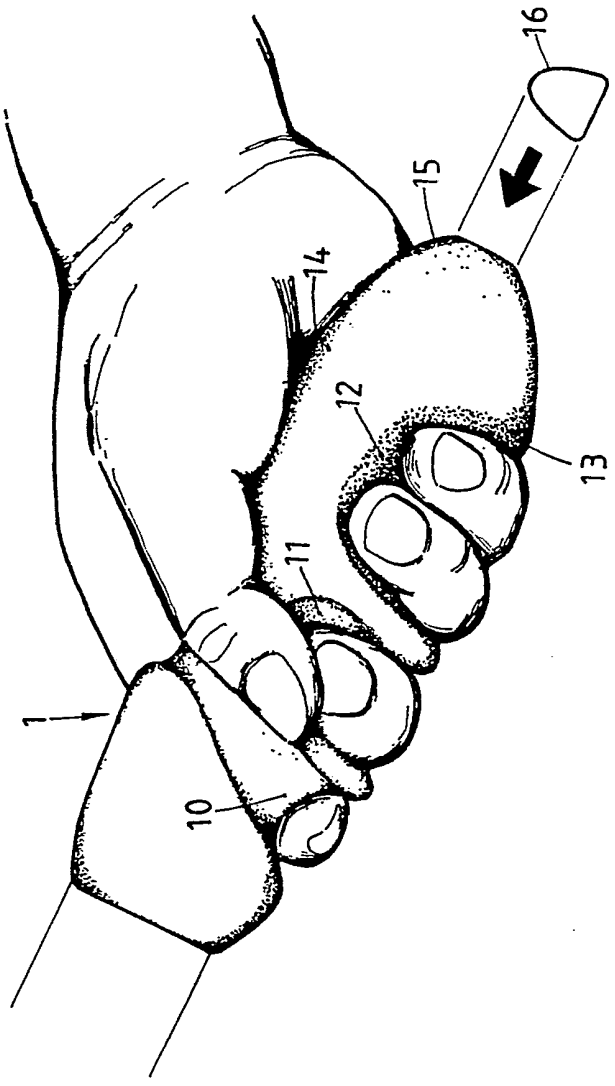

FIG. 4

Title: IMPROVED RACKET HANDLE

This invention relates to improvements in the handles of tennis, squash, badminton and racketball rackets. The majority of such handles in current use are more or less either of a conventional octagon or oval shape. The face and the entire structure of a racket or even the materials used are often subject to changes or replacement. The object being sought for by such changes is to obtain the greatest explosive force when the ball is being struck or to achieve a more skilful performance. However, little attention has been paid to the design of a racket handle which can cope more effectively with the bio-engineering of the human body. It seems that the mode of grasping the handle of a racket or the technique of ball striking was directly involved with the players and coaches but had little or nothing to do with racket manufacturers. This is no doubt an explanation for the injuries caused to beginners and some professional players and a racket which will not only bring its ball striking effect to the fullest but will also prevent the players from being injured is something which is highly sought after. The inventor therefore focussed his research on the following defects which exist when a player is using a conventional racket having an octagon handle:

1. Stress is given to the force applied by the middle finger, little finger and the thumb, without a player being aware that the force of the forefinger has not been fully applied on the handle.

2. The handle cannot cope with the space created by the centre of the palm so that the handle is not fully grasped by the palm.

3. Due to the protrusive or plain straight shape formed at the end of a conventional octagon or oval handle, the handle of the racket cannot be fully grasped by the centre of the palm.

The present invention seeks to provide a racket handle which avoids these disadvantages.

A racket sport is a term collectively denoting the games of tennis, squash, badminton and racketball which provides a thorough body movement for the player. It involves such motions as catching and striking of a ball and in the instance when a ball is being served at the extreme end of the playground. The key motion of the forementioned sports can be traced back from the face part of the racket to the point of contact with the human body in the order of fingers, palm, wrist, forearm, upper arm, shoulder, etc., among which the fingers, palm and wrist are the actual points of contact, to which the command given by the brain will be finally conveyed. At that moment, whether the palm and fingers of the player fit exactly and comfortably with the handle of the racket or not will directly affect the full conveyance of the command given by the brain and the excessive or insufficient control to be exerted over the force applied on the handle. Such influence can be gradually felt by a beginner soon after he started a racket lesson. One has to go through a considerable

long period of handle holding and ball control practice before he/she can manage to regulate the conveyance of the command of the brain through the execution of the palm and fingers to vary the mode of handle holding and ball striking. However, this is also a period during which sporting injury is most likely to happen and thus shorten the career of a sportsman. In view of these defects, the focal point of research of the present invention lay in the study of the issue of the muscles of arms, palms and bones of the human body, as well as the principle of their distribution, trying as much as possible to avoid changing forcibly the natural structure of the human body, so as to design a mode which will be most favourable for the handle holding of a racket and will prevent muscle injury by strain from happening.

According to the invention, there is provided a handle for a tennis racket or the like, said handle being equipped with a hand grip having, on one side, three arcuate depressions shaped to receive, respectively, the forefinger, the second or middle finger, and the third and fourth fingers and, on the other side, a single arcuate depression shaped to receive the thumb of a player's hand, the remaining surfaces of the hand grip being shaped to the contours of a player's hand and including a convex portion adapted to the shape of the palm.

By means of the racket handle according to the invention, a point on which the force of the forefinger is applied is provided to produce an excellent grasping effect for a player. Further, the convex portion proves suitable for grasping by the centre of the palm.

Preferably, the end of the handle remote from the depression for receiving the forefinger is of increasingly diminished cross-section. This construction enables the palm of a player to grasp the handle in a more natural and easier manner to meet the requirements of the bio-engineering of the human body, enhancing the controlling capability of the ball and the accuracy of the motion. Moreover, it will also reduce the possibility of injury caused by strain to such ligaments categorised under the flexor muscle system of the forearm as tennis elbow.

The invention will now be further described, by way of example, with reference to the drawings, in which:-

Fig. 1 is a side view of one embodiment of a racket handle according to the invention;

Fig. 2 is a rear view of the racket handle shown in Fig. 1;

Fig. 3 is a front view of the racket handle shown in Fig. 1; and

Fig. 4 shows the racket handle shown in Figs. 1 to 3 grasped in a hand.

Referring to the drawings, a racket handle 1 according to the invention has three arcuately concave depressions 10, 11 and 12 at one side. The first depression 10 serves to receive the index finger of a player by means of which the force of handle holding can be applied.

The second concave depression 11 serves to receive the middle finger and the third concave depression 12 serves to receive the ring and the little fingers of the hand of a player. A protrusion 13 at the extreme end of the arcuate depression 12 serves as a checking point. The other side of the racket handle opposing the aforementioned three concave depressions has the shape of a curve which includes a convex portion 14 at its middle section close to the end of the handle which is shaped to receive the palm of the hand of a player. A further concave depression 17 is provided in this side of the handle for receiving the thumb. The end of the handle tapers away at 15 towards the bottom end 16 (Fig. 4). It can be seen from Figs. 2 and 3 that the racket handle according to the invention is designed strictly according to the shape of the fingers, so as to enable the palm of the player to hold the racket handle 1 in a most comfortable manner.

The conventional mode of racket handle holding differs from the daily mode of article holding. In order that the mode of handle holding can be kept as much as possible in such a posture that an obtuse angle will be formed between the racket handle and the forearm of the player so that the force exerted by the arm will be fully conveyed to the handle and the face of the racket, it is so designed that, at the time of holding the handle, the central line of the handle will be slantingly extended from the base of the first section of forefinger across the entire length of the palm face until it reaches the outer lateral section close to the wrist of the palm face. In other words, the

aforementioned central line is located at the so-called Hypothenar eminence. Now, by observing the basic mode of racket handle holding, it can be seen that the aforementioned mode of racket handle holding is characterised by having the forefinger stretched forward and so positioned that it is separated slightly from the other fingers. The side of the forefinger close to the middle finger will suffer a loss of its force of application due to the lack of a section on which the said force can be applied. Consequently, the force provided by the forefinger cannot be fully exerted. By analysing the structure and the function of the muscles of the forefinger, it can be seen that the three flexor muscles which exerted their control over the holding of articles in an inward direction by the functioning of the three sections of the forefinger are categorised as follows:

(1) Mm. Lumbricales: activates the inward bending motion of the first section of the finger;

(2) M. flexor digitorum profundus: activates the inward bending motion of the second section of the finger; and

(3) M. flexor digitorum profundus: activates the inward bending motion of the third section of the finger.

Speaking in terms of the aforementioned three muscles, it is found that, when a player is holding a conventional racket handle with strain, only the Mm. Lumbricales of the forefinger will exert a full strain to sandwich the handle in synchronisation with the thumb, while the rest of the M. flexor digitorum

superpicialis and the M. flexor digitorum profundus will fail to exert their full force owing to the lack of a stable point of hooking or gripping. If a full force is being exerted, the forefinger is apt to shift its position and thus will weaken its effort over the racket handle. What is most important of all is that the forefinger has to conduct the longest and most slantingly hooking motion on the handle, though it is comparatively shorter in length than the middle finger. However, this is contrary to the principle of Bio-Engineering. It will reduce the force of control exerted and the function provided by the palm over the entire racket handle. On the contrary, the design of the handle according to the invention is characterised by having the concave depression 10 for receiving the forefinger and the face on which a force is to be applied is set in proportion to the degree of arc and the length of the face of the finger to shorten its long slanting distance to further enable the muscles of the other fingers to apply their force evenly, so as to strengthen the capability of control exerted by the fingers over the handle. In addition to the aforementioned functions, the arcuate depression 10 also enables the force exerted on the handle to be no longer concentrated in the narrow areas of the thumb, the middle and the ring fingers. By bringing the hooking/holding motion of the forefinger into its full play, the force of the other fingers will then be exerted evenly, and the proper posture and accuracy of ball striking will also be improved because the end of the forefinger has a very sensitive nerve and such instinct functions as direction guidance and command giving.

The convex portion 14 helps the palm to fit more firmly with the handle. As the shape of that particular part of a conventional racket handle is either plain and straight or concaved, some sportsmen will, in an attempt to hold the handle firmly in their hand, allow their palms to hold firmly at the slightly convexed section of the extreme end of the handle. This will leave the Hypothenar eminence of their palms and little fingers free from engagement. They only know how to grasp the handle tightly with their fingers but cannot, at the same time, pay attention to see whether their palms can also fit tightly with the handle. Analysing in terms of the shape and the structure of the face of the palm, it can be seen that the face of the palm is somewhat in the shape of a shallow dish. The two lateral parts close to the wrist are protrusive muscles but the palm becomes more concave towards its centre. By analysing the muscular tissue of the interior of the centre of the palm, it can be seen that its interior layers which extend inwardly comprise the Aponeurosis palmaris, Lig. Palmare transversum subcutaneum, Vagira tendinum mm. flexorum digitorum communium and the M. flexor digitorum superficialis and profundus. If the centre of the palm cannot fit exactly to the racket handle, the shape of holding the handle would be somewhat like clipping it between the sections of fingers and the ball-shaped muscle of the thumb, instead of having it thoroughly held by the entire palm and fingers. Since the palm cannot hold the handle fully within its grip, the various M. flexor digitorum superficialis and profundus in the interior of the palm have to produce a stronger load of force, though the effort produced is

comparatively small. On the contrary, if the slightly convex portion 14 of the racket handle according to the invention is provided, the palm will then be able to hold the handle in its full grip wherein the force of the M. flexor digitorum superficialis and profundus will be exerted in full on the racket handle to produce a greater effort on the racket handle with a smaller force, so as to obtain better stability and control exerted by the palm on the racket handle thereby attaining higher accuracy in ball striking and catching.

In terms of the condition under which the handle is held by the fingers, the best central point to be held and gripped by the three fingers other than the thumb and forefinger is the face of the central bone of the fingers (i.e. the second section of the fingers) because the force exerted when it is being applied leans toward a straight direction of the space between the centre of the palm and the ball-shaped muscle of the thumb (i.e. the point of support of stress). In addition, because of the irregular length of the fingers, the distance at which the faces of the various middle sectioned bones of the fingers corresponding to the plane at the upper direction of the racket handle when the handle is being held (i.e. the ball-shaped muscle of the thumb will grip and press against the force applied face of the racket handle) is also irregular. Therefore, a conventional racket handle which is equal in its peripheral length and has a plain and straight shape is not considered as an ideal model for players. It would be ideal if the peripheral length of a racket handle could be set proportional to the length of the various fingers to

provide an excellent force applied position and direction for the fingers and further to produce corresponding points for the ball shaped muscle of the thumb and the edge of the palm, so as to achieve an even wrapping force to the racket handle. The racket handle according to the invention seeks to achieve this by providing the second concave depression 11 for the middle finger and the third concave depression 12 for the ring finger and the little finger. These two depressions are separated to allow the flexible muscles of the fingers to wrap and grip the racket handle in a slightly radial direction and prevent them from being widely separated. Furthermore, as the ring finger and the little finger are usually of a synchronised motion, it is deemed a natural design to have the aforementioned two fingers set in the same depression so that no position moving will be affected by the exertion of force, as well as to fully enable the forefinger, the palm and the thumb to wrap and hold in a more perfect mode to match with the shape of the palm and fingers.

The shape of the section located at the Hypothenar eminence of conventional racket handles is either plain or of increased section (because it is close to the end of the handle) and is contrary in shape to that of the interior space of the Hypothenar eminence when the palm is holding the handle. When the palm is being unfolded, the highest point of Hypothenar eminence lies at a location close to the wrist, the second highest point lies at the exterior lateral side and, then, it will gradually move toward the centre of the palm until it

becomes concave in shape. When the handle is being partially held, the area of this section will gradually diminish until it becomes protrusive. When the handle is being full held, the centre of the palm and the bottom end line of the racket handle will form an obtuse triangular angle having its bottom edge rising until it gradually descends into the centre of the palm to form a concave shape and, the variance of its height is found to be greater than that of the palm when it is being unfolded. Therefore, in order to match with the protrusive shape formed at the bottom edge, the shape of the racket handle at the point at which the handle is held firmly by the centre of the palm until it is contacted by the Hypothenar eminence should stretch backward to form a concave shape (the tapered section 15 located at the extreme end of the racket handle in Fig. 1). If the aforementioned section has a rising part similar to the handle of a conventional racket, the centre of the palm is likely to be kept in a high position away from the racket handle. No obvious checking effect will be produced other than causing an uncomfortable feeling to the bone of the wrist. Because no backward force for exertion to the protrusive handle sleeve has been produced at the outer lateral slope of the Hypothenar eminence, the force actually produced lies in the wrapping/holding force produced at the slope of the centre of the palm corresponding to the grip made by the forefinger. Therefore, the rising part located at the extreme end of the third depression 12 as shown by Fig. 1 is the actual checking point of the aforementioned force.

The analysis of the above-mentioned features of the invention focussed on explaining, in terms of the bio-engineering of the human body, the various effects provided by the racket handle according to the invention. The prevention or reduction of sporting injuries provided by the racket handle according to the invention will now be discussed.

(1) Lateral epicondylitis is a disease which usually causes pain to a person when the common extensor tendon and the lateral collateral ligament are pressing down. That is to say, these two sections are injured by tearing.

(2) The radiohumeral burisit at the joint of the radius and the ulna.

(3) Annulau ligament strain.

The above-mentioned three sections are the part of origin of most of the extensor muscular system of the forearm. The extensor muscles which are related to racket sports are as follows:-

(1) M. extensor carpi radialis longus;

(2) M. extensor carpi radialis breuis;

(3) M. extensor digitorum communis;

(4) M. extensor carpi uinaris;

(5) M. supinator.

The above-mentioned muscles originate from the lateral or the annular ligament and descend along the forearm. Except the M. supinator, all the rest of these muscles will pass through the lig. carpi dorsale until they reach and stop at the bones of the palm or the fingers. Speaking in terms of racket sport motion, the natural structure of the forearm of the human body or the forelimb of a four limbed animal are usually more fully developed and powerful in their inward bending function than in their stretching function. For instance, the blow, strike and hooking motion in a bending or lateral direction made by the paw or hand are usually powerful. In racket sports, however, there are many unique motions such as striking the racket in a backward direction or an inverted blow. According to the principle of mechanics, the superiority of an inverted blow of the racket sets at the end of the face of the racket to cope with the force exerted by the extensor muscle of the arm which will produce the function of a lever. That is why in a racket sport, a heavier load is expected to be borne by the extensor muscle than in any other sports. Therefore, physical training or a warm-up exercise prior to a contest should be given to the extensor muscle system. Otherwise, any attempt to exhaust the strength as much as possible from the shoulder and the large arm above the waist by using the wrist at will will easily get the extensor muscles involved with the section of the upper innomonate bone and cause injury to the player. If the player uses a racket with a conventional handle, instead of having the availability of a force which can get in touch comfortably with the racket handle so that the stability of handle will be

strengthened, more trouble will be caused. The racket handle according to the invention provides a better and a more accurate wrapping/holding force for the palm over the racket handle. Although a thorough protection to extensor muscular system, the radius and the ulna still cannot be provided, an appropriate protection to the aforementioned section of the human body being affected under a certain direct or indirect good influence has effectively been provided to reduce the possibility of injury. For example:

(1) A good posture of handle holding will help produce an even wrapping/holding force which will reduce the load borne by the extensor muscles. In a ball game, under the influence of the function of resistance exerted by the extensor muscles and the flexor muscles, the load borne by the extensor will be correspondingly reduced.

(2) A handle-holding posture which copes with the principle of bio-engineering will enable various muscles (particularly that of the wrist) to function at a normal position to prevent the performance of any unnecessary or excessively extensive motion. On the contrary, in a conventional racket handle, the holding force is found to be stressed on the thumb, the middle and the ring fingers because no proper grip has been made by the forefinger. The thumb, in particular, has to exert a more powerful force. For the purpose of conducting a powerful grip, strain has to be made frequently by the M. adductor policis in

the interior of the thumb. In so doing, the second and third bones of the palm located at the part of origin is equivalent to the checking point of the long and the short muscles of radius, lateral art, radiocarpicus. At the time of an invert strike or a backward strike, the long and the short muscles of radius, lateral art. radiocarpicus will indirectly bear the force exerted by the M. adductor policis. However, with the racket handle according to the invention, the effort of the Hypothenar eminence and the grip made by the forefinger will enable the extensor muscle to produce a better function to reduce tension and thereby to reduce the possibility of injury.

(3) The handle sleeve rising from the extreme end of a conventional racket handle will, at the time of handle holding, bear directly on the bone of the wrist. It will, at the instance of striking a ball, indirectly convey the vibrating force onto the ligament of the wrist and passing through the ulna until it reaches the annular ligament of the ulna at the upper end. Because the aforementioned is of the nature of a sudden shock force, a more serious injury will be produced compared with that which is caused by an ordinary strain. As the design of the racket handle according to the invention focussed on having the ball-shaped muscles of the Hypothenar eminence as the point of contact, the flesh cushion of this section will help offset or absorb such vibrations, so as to reduce the instant shock force on the ligaments of the radius and ulna and the articular sacciformis.

CLAIMS

1. A handle for a tennis racket or the like, said handle being equipped with a hand grip having, on one side, three arcuate depressions shaped to receive, respectively, the forefinger, the second or middle finger, and the third and fourth fingers and, on the other side, a single arcuate depression shaped to receive the thumb of a player's hand, the remaining surfaces of the hand grip being shaped to the contours of a player's hand and including a convex portion adapted to the shape of the palm.

2. A handle according to claim 1, wherein the end of said handle remote from the depression for receiving the forefinger is of increasingly diminished cross-section.

3. A handle for a tennis racket or the like substantially as described herein with reference to the drawings.

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