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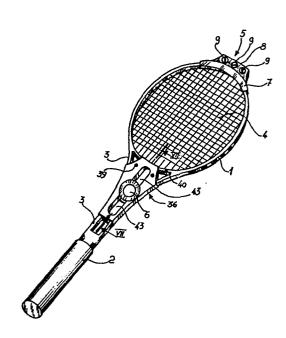
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(5) Vibration-damping device particularly for tennis rackets.

The device comprises a holder (7, 43) for application to the shaft of a tennis racket, particularly either (7) in a front region (1) or (43) in the handle region (3) extending between the handgrip (2) and oval frame (1). The holder carries damping cells (9, 44) formed preferably by cylindrical chambers with their axes perpendicular to the plane of the racket and being part-filled with a heavy liquid or completely filled with two liquids having different densities or with a granulate medium. Vibration generated in the racket result in the heavy liquid or granulate medium being shaken and dissipate energy, thus damping such vibration.



" VIBRATION-DAMPING DEVICE PARTICULARLY FOR TENNIS RACKETS"

This invention relates to a vibration-damping device particularly for tennis rackets.

It is a known fact that in playing tennis, as the ball impinges upon the racket with some force, setsit into a vibratory state which propagates through the handle and to the wrist and forearm of the tennis player.

Such vibrations are the cause of considerable inconvenience to the player, and frequently result in a painful inflammatory state of the elbow articulation.

In order to attenuate the effects of vibration, special handles have been developed which are lined with sponge-like or soft materials, but their performance has proved unsatisfactory.

It is an object of this invention to provide a device for application to a tennis racket, which can dampen vibrations generated in playing tennis.

A consequent primary object is to provide a device which can be easily applied to existing rackets without involving any alterations thereof.

Another object is to provide a device which may be variously positioned to fit both the racket type and player's playing habits.

A further object is to provide an element which is completely independent of the racket and can be easily assembled and disassembled.

A not least object is to provide a device which

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is particularly simple and effective, and of no excessive cost.

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These and other objects, such as will become apparent herein below, are achieved by a vibration-damping device particularly for tennis rackets, characterised in that it comprises a holder associable with a selected location on a tennis racket and matingly shaped to it at said location, said holder being formed with at least one recess part-containing an incoherent heavy medium, a means being also provided for securing the holder to the racket and have access to the recess.

Further features and advantages of the invention will become apparent from the following detailed description of some preferred embodiments thereof, given herein by way of example and not of limitation with reference to the accompanying drawing sheets, where:

Figure 1 is a perspective view of a tennis racket
incorporating the device according to the invention;
Figure 2 is a detail view of the forward portion
of a tennis racket accommodating a damping
device:

Figure 3 shows the forward portion of a tennis racket employing a second type of damping device;

Figure 4 shows a section taken along the line IV-IV of Figure 2;

Figure 5 shows a section taken along the line V-V of Figure 3;

30 Figure 6 shows an equivalent device of that shown

in Figure 5, with changes to its configuration; and Figure 7 is a longitudinal section taken along the line VII-VII of Figure 1.

With reference to the cited drawings,

shown in Figure 1 is a tennis racket where the numeral

designates the elliptical frame portion of the racket, 2

the handgrip, 3 connecting portion between

the handgrip 2 and the elliptical portion 1, and 4

the strings of the network.

10 On the racket shown in Figure 1, there have been mounted two damping devices, and specifically a first type of a front damping device 5 and another damper type for the handle, indicated at 6.

The front damper 5 is composed of a holder 7 shaped to mate with forward portion of the elliptical frame 1, and associated therewith by means to be explained herein below.

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Said holder 7 has a forward swell 8 on which there are positioned three damping cells indicated at 9.

Figure 2 shows a similar front damper again composed of a holder 7a which is associated with the elliptical front portion 1 of the racket and has in this case, in the swell 8a, a single damping cell 9a.

Figure 3 shows an inner front damper 10 which still has a holder 11 made rigid with the elliptical frame 1 and extending into the inside of the ellipse formed by the frame 1 with a lug 12 which has, in the network of the strings 4, in the case shown, three damping cells indicated at 12.

Figure 4 shows the configuration of the front damper of Figure 2.

That damper 5a is composed of two complementary parts 13 and 14, respectively, which are joined to each other by fastening means (e.g. screws74) to form the supporting portion 7a and enlarged portion 8a.

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The supporting portion 7a has a half-open arcuate recess 15 shaped to mate with the forward portion of the elliptical frame 1 which is contained therein, while the opening 16 in the recess allows the strings 4 to pass through.

In the enlarged portion 8a, there is formed the damping cell 9a which comprises a preferably cylindrical chamber 17 closed at the top by a screw cap 18 and partly filled with a heavy liquid 19.

The chamber 17, as mentioned, has a preferably cylindrical shape and its middle axis lying orthogonal to the plane of lay of the racket.

The heavy liquid 19, which is not to fill the chamber 17 completely, is conveniently mercury.

The portion of the chamber 17 which is not occupied by the mercury may be filled with some other liquid having a different density, and the mercury may be replaced with another liquid so long as the two densities are different.

On shocks and attendant vibrations being applied to the racket shaft, the heavy liquid 19 would be shaken violently and alternately against the inner walls of the chamber 17.

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These shocks dissipate a mechanical energy associated with the vibratory movement of the racket, with the result that the racket vibrations are quickly damped.

To avoid noise emission from the heavy liquid (e.g. mercury) being shaken within the chamber 17, it would be expedient to fill the space unoccupied by the heavy liquid with some other lower density liquid to act as a damper and sound-deafener.

Figure 5 shows in section the damper of Figure 3.

Also in this case, the holder is formed in two complementary parts, a first one indicated at 20 and containing the damping cells or units 12, and a second complementary one indicated at 21 which enables the combination to be fastened to the elliptical portion of the racket frame.

The two parts may be conveniently fastened together by means of screws 22.

In the first part 20, there are formed in this case a number of preferably cylindrical chambers 23 laid adjacent and with parallel axes at a sufficient distance apart to form passageways 24 for the strings 4.

Also in this case, the chambers 23 are closed by a screw cap 25 after they have been part-filled with a heavy liquid 26, and possibly topped up with a second less dense liquid in the portion left over from the heavy liquid.

Figure 6 shows a damper which is the equivalent of that shown in Figure 5, wherein the two parts that make it up are the mirror image of each other.

In fact, a first part 26 is substantially like

a second part 27 to which it is connected by means of screws 28 which are tightened after the two parts 26 and 27 have been placed on opposing sides with respect to the string network such that the strings 4 are accommodated within seats in the form of semicylindrical recesses 29 and 30 present in the two parts 26 and 27.

Each of the parts 26 and 27 has a plurality of damping units respectively indicated at 31 for the part 26 and 32 for the part 27.

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Each said damping unit further comprises a chamber 33 closed by a screw cap 34 and being part-filled with a heavy liquid 35.

In Figure 7, there is shown in section the shape

which the damping device may conveniently take where
it is of the type indicated at 6 in Figure 1, showing
it located on that portion of the handle which extends
from the handgrip 2 to the elliptical frame 1.

In this case, the holder 36

20 comprises two complementary symmetrical halfshells 37 and 38 held together by screws 39 and presenting recesses matingly shaped to both
the shape of the handle 3 and to the portion 40 of
the elliptical frame 1.

In this area, the recess indicated at 41 has a middle opening 42 which lets the strings 4 of the network through.

The holder 36 has a longitudinal throughgoing seat 43 laid along the mid-axis of the handle 3.

30 Within this seat, there is inserted a damping

cell 44 comprising a cylindrical body 45 which has an outside diameter equal to the width of the seat 43 and a widening flange formation 46 on one side adapted to overlap the edges of the throughgoing seat 43 and presenting, at the opposed end 80 projecting beyond the thickness of the holder 36, a thread 47 onto which a ring nut 48 is threaded to lock the cylindrical body at a desired position with respect to the longitudinal seat 43.

Said cylindrical body 45 has on its interior a cylindrical chamber 49 closed by a screw cap 50 and being part-filled with a heavy liquid 51.

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Also in this case, that portion of the chamber 49 which is unoccupied by the heavy liquid 51 may be conveniently filled with a low density liquid.

In this case, the damping cell 44 may be positioned at a greater or lesser distance from the handgrip 2 of the racket to allow seeking of the optimum location to dampen the vibrations which are transferred to the handle, and hence the handgrip, from the elliptical frame, carrying the network.

In this embodiment, firstly the half-shells 37,38 are assembled, then the cell 44 is secured in the suitable position.

With substantially similar configurations, dampers having damping cells equivalent of those described, may be attached to any points on the tennis racket.

Thus, it may prove convenient to attach damping elements to the sides of the elliptical frame both symmetrically and asymmetrically, depending on

the player's characteristics.

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Also the cell, which for convenience of construction has been always shown as a cylindrical chamber closed by a screw cap, may be fashioned in other geometric configurations without altering, however, its function and effects.

Also the fastening arrangements which in the foregoing are described as including screws, may be implemented in any other ways.

10 It is particularly convenient, however, that each holder can be readily detached from a racket for replacement with some others, or to use the racket without the damping elements.

As for the liquids contained in the individual

damping cells, it has been ascertained experimentally
that the use of mercury as the heavy liquid is
particularly convenient.

Alternatively to the heavy liquid, it would be possible to use granulate materials, more particularly metal balls.

As for the materials, these may be selected as desired, and the dimensions may be any ones to meet individual requirements.

CLAIMS

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1. A vibration-damping device particularly for
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    tennis rackets, characterized in that it comprises a
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    holder (7,7a;11,36) associable on a tennis racket and
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    matingly shaped to it at a connection location, said
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    holder being formed with at least one damping cell
6
    (9,9a,12,31,32,44) filled at least partially with an
7
    incoherent heavy medium (19,26,35,51), means (74,22,28,39)
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    being also provided for securing the holder to the
9
    racket.
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         2. A device as in claim 1, characterized in that
    said holder (7,7a,11,36) comprises two complementary
2
3
    parts (13,14;20,21;26,27;37,38) forming together a
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    recess (15,41) shaped to mate with the area of the
5
    racket frame at the connection location.
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         3. A device as in claim 1. characterized in that
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    said damping cell (9,9a,12,31,32) comprises a chamber
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   (17,23,33,49) formed in the thickness of said holder
4
    (7,7a,11,36), closed by a stopper (18,25,34,50) and
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    partly filled with said incoherent heavy medium.
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         4. A device as in claim 1, characterized in that
2
    said holder (17,23,33), for connection at the elliptical
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    frame region (1) of the racket, presents a substantially
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    arcuated portion (7) to be connected to said frame
    region and a dampening portion (8,8a) with said at
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6
    least one damping cell (9,9a) on the convex side of
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    said substantially arcuated portion.
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         5. A device as in claim 1, characterized in that
2
    said holder (11), for connection at the elliptical
3
    frame region (1) of the racket, presents a substantially
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arcuated portion to be connected to said frame region
 4
     (1) and a dampening portion with said at least one
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6
     dampening cell (12) on the concave side of said sub-
     stantially arcuated portion, said dampening portion
7
    having recesses (24) for the passage of the strings (4)
8
     and said at least one dampening cell (12) being arranged
9
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     at the interspaces between said string passage recesses
11
     (24).
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          6. A device as in claim 1. characterized in that
 2
     said holder (36), for connection to the racket handle,
 3
     at the region between the handgrip (2) and elliptical
 4
     frame (1), has a recess (43) for positioning said at
 5
     least one damping cell (44), said damping cell being
 6
     provided with means of attachment to said holder (36).
 1
          7. A device as in claims 1 and 6, characterized
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     in that said at least one damping cell (44) comprises
 3
     a hollow cylindrical body (45) containing the incoherent
 4
     heavy medium (51) and having an outside diameter equal
 5
     to the width of the recess (43), said cylindrical
 6
     body having at one base an outside flange formation
 7
     (46) with diameter greater than the width of said
 8
     recess and at the other base an external thread (47)
 9
     cooperating with a ring nut (48) greater than said
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     recess width, the length of said cylindrical body being
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     greater than the depth of said recess.
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          8. A device according to any of claims 1-7, character-
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     ized in that each damping cell (9,9a,12,31,32,44) has
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a preferably cylindrical chamber, said chamber having

holder (7,7a,11,36) and being preferably closed by a

symmetry axis perpendicular to the plane of the

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- 6 screw cap or snap-on cap.
- 9. A device as in claim 1, characterized in that
- 2 each damping cell is part-filled with either a heavy
- 3 liquid or metal balls, while the remainder of the
- 4 chamber is left empty or filled with a low density
- 5 liquid.
- 1 10. A damping device as in claim 9, characterized
- 2 in that said heavy liquid is preferably mercury.

