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(54) Handle of tennis racket, method for modification of the tennis racket and set of parts for modification of tennis racket

(57) The invention relates to a modified handle of a tennis racket, **characterised in that**, at the base it is equipped with an ergonomic stabilizer of a grip composed of two separate elements, preferably ball-shaped, anchored separately directly in the base of the racket or in two channels of the frame running in the handle of the racket. In other variants of embodiment of the invention, the modified handle is equipped additionally with stabilizers located in centre or in centre and front zone of walls of the racket handle. The invention relates also to a method of modification a regular racket and a set of elements used for the adaptation.

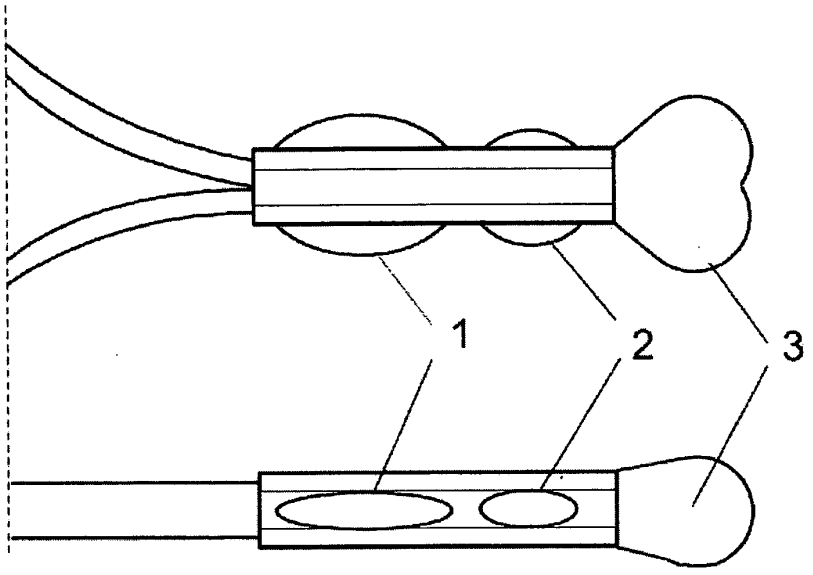

Fig. 1

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Description

[0001] Object of the invention is a modified handle of a tennis racket, the tennis racket equipped with a modified handle, a method of modification of a regular tennis racket and a set of parts for modification of regular racket.

[0002] An altered shape of a racket handle for lawn tennis has been presented, in such a way that the added elements of stabilizers force a safe and elastic grip of the racket, which reduces load of tendons of muscles of forearm caught in the lateral epicondyle of humerus, which makes it possible to reduce a risk of chronic disease commonly referred to as "a tennis player's elbow".

[0003] Tennis rackets produced on a mass scale require a tight grip involving tendons and muscles of the entire forearm. Whereas in case of one-hand forehand strokes, muscles that bend fingers and the wrist act in a concerted way, during one-hand backhander strokes extensors of the wrist are involved, which must overcome resistance of antagonistically acting flexors of fingers firmly holding the racket. Furthermore, the situation is even worsened by a movement stretching an arm in the final phase of backhander stroke made by a triceps muscle of arm, which during the stroke stretches tense muscles of extensors of the wrist and fingers. As the extensors of the wrist and fingers (apart from the thumb and the index finger) have an attachment in the lateral epicondyle of humerus, strains of tendons having an attachment in the lateral epicondyle of arm arise, which in case of people over forty years old results in painful contusions that turn into chronic inflammatory conditions in case of more than one third of players. This manifests how large is the scale of the problem.

[0004] A solution to the problem mentioned above was attained by changing a shape of a racket handle - as shown by way of example in Fig. 1 - to force safer racket grip on a player and to encourage the player to a safer style of play. As a consequence, a load of extensor muscles of the wrist and fingers, which have attachments in the lateral epicondyle of humerus, should be reduced, thereby reducing a risk of contusion.

[0005] Handles of rackets produced on a mass scale have a universal structure, which is adjusted to a naturally shaped anatomic structure of a palm in case of a hammer-type closed grip. Such grip used in tennis results in frequent contusions of the wrist. On the other hand, open grips of "v"-type have a drawback of being weaker and impairing tendons fixed in epicondyles of humerus in case of backhander strokes.

[0006] A natural solution to the problem is a two-handed grip both in case of a backhander and in a forehand stroke. In the tennis history, there were outstanding players that preferred such a play style as Pancho Segura and Monika Seles. At present, among women classified within the first hundred of the WTO list, there are several tennis players that use a two-handed stroke on both sides. Yet, the contemporary tennis is dominated by players employing a one-hand forehand and backhand, although a play style based on the two-handed backhand and one-hand forehand was granted an equal status.

[0007] No publications that disclose the proposed solutions concerning stabilizers of the front and middle part of a racket handle are known. Only a solution provided by Babolat company presented on the internet page http://www.tennis-warehouse.com/technologies.html as Babolat's Smart Grip in the form of ergonomically profiled wrapping of a racket handle to some extent looks like the proposed solution in the form of a middle stabilizer. However, the idea of the solution proposed by Babolat consists in an increase of an area of contact of a palm with a racket and does not account for protection against injuries. In the proposed subject solution called "a stabilizer of a middle part of a racket handle", a different concept has been employed. A profile of the racket is to allow for a hooked grip, a characteristic feature of which is reduction of stresses that appear in extensor muscles of wrists and fingers, having an attachment in the lateral epicondyle of humerus.

[0008] Nor are known the attempts to increase the base (butt-cup) in such a way, that main forces of a grip are concentrated on the index finger and the thumb, the extensor muscles of which have no attachments in the lateral epicondyle of humerus, and an increase in a circumference in the further part of a stabilizing grip of the base (butt-cap) does not fully involve extensors of the remaining fingers.

[0009] On the other hand, the solution called Volkl Twin Absorber presented on the internet page http://www.tennis-warehouse.com/technologies.html is known, wherein there are two elements, in canals of a racket frame, running in a handle and connected with a butt-cap, that dampen vibrations. Novelty of the solution proposed herein compared to that mentioned above consists in that the elements stabilizing the grip of the base (butt-cap) are located on the outside and have contact with the whole palm of a hand.

[0010] The solution disclosed in Application No. P-382205 of 17-04-2007 is aimed at facilitation of executing rotation strokes, and not at protection of tendons of extensors of forearm, having an attachment in the lateral epicondyle of the humerus. A handle of the racket presented therein is simplified, because a base (butt-cap) of the racket is ended with a single ball, and the handle of the racket is equipped only with one type of shaped elements causing that the handle has a flat elliptic shape.

[0011] In one variation of the invention, a handle of the racket is equipped with a two-element stabilizer located at the butt-cap of the racket. In another variation, the handle is equipped additionally with stabilizers located on a handle of the racket, but only in its middle zone. In still another variation, a handle of the racket is equipped with stabilizers of a

grip located in three zones of the handle i.e. front stabilizers of the racket handle, middle stabilizers of the racket handle and a stabilizer of the racket base (butt-cup).

[0012] Object of the invention is a modified handle of a tennis racket, **characterised in that** it is equipped with an ergonomic stabilizer of a grip at the base (butt-cap), composed of two separate elements, preferably ball-shaped, anchored separately directly in the base (butt-cap) or in two canals of the frame running in the handle of the racket.

[0013] Object of the invention is also a tennis racket **characterised in that** it is equipped with a modified handle of the racket defined above.

[0014] Object of the invention is also a method of modification of a regular tennis racket,
characterised in that a stabilizer composed of two separate elements, preferably ball-shaped, is fixed on the racket butt-cap, the elements preferably being screwed, each one separately, in canals of the racket frame profile, preferably using anchor screws, or being mounted directly in the racket handle.

[0015] Preferably, during fastening of the stabilizer elements, their shape is modelled with a glue paste, preferably with a thermosetting glue paste.

[0016] Preferably free spaces in the handle are filled in with a glue paste, preferably a thermosetting glue paste.

[0017] Object of the invention is also a set of parts for modification of a regular tennis racket, **characterised in that** it includes a stabilizer of the base (butt-cap) composed of two separate ball-shaped elements.

[0018] Object of the invention is also a modified handle of a tennis racket, **characterised in that** it is equipped with ergonomic stabilizers of a grip, on walls of the handle and at the base (butt-cap), stabilizers located on the handle walls having a form of flattened shaped elements of a flat elliptic base and being located only in the middle zone of the handle, and the stabilizer of the racket base (butt-cap) being composed of two separate elements, preferably ball-shaped, anchored separately directly in the racket butt-cap or in two canals of the frame running in the racket handle.

[0019] Preferably stabilizers located on walls of the handle have an elliptic, semicircular or boat-shaped longitudinal cross section.

[0020] Preferably stabilizers are equipped with furrows for fingers.

[0021] Preferably stabilizers in the form of flattened shaped elements are located on two opposite walls of a racket handle determined by any of axes of the racket handle.

[0022] Object of the invention is also a tennis racket **characterised in that** it is equipped with a modified handle of the racket defined above.

[0023] Object of the invention is also a method of modification a regular tennis racket,
characterised in that stabilizers in the form of flattened shaped elements of a flat elliptic base are mounted on walls of a handle of a regular tennis racket in the middle of the handle, and a stabilizer composed of two separate elements, preferably ball-shaped is mounted at the base (butt-cap) of the racket, and stabilizers in the form of flattened shaped elements are preferably screwed, riveted, glued or these techniques are combined, and the stabilizer of the butt-cap in the form of two elements preferably is screwed in canals of the racket frame profile, preferably using anchor screws, or are mounted directly in a handle of a racket, and each of the elements of the stabilizer of the butt-cap is mounted separately.

[0024] Preferably, during fixing the stabilizers, their shape is modelled with a glue paste, preferably with a thermosetting glue paste.

[0025] Preferably free spaces of a handle are filled in with a glue paste, preferably a thermosetting glue paste.

[0026] Object of the invention is also a set of parts for modification of a regular tennis racket, **characterised in that** it includes a two-element stabilizer of the base (butt-cap) composed of two ball-shaped elements, and stabilizers of a grip in a form of flattened shaped elements of flat elliptic base having an elliptic 10, semicircular 11 or boat-shaped 12 longitudinal cross section .

[0027] Object of the invention is also a modified handle of the tennis racket, **characterised in that** it is equipped with ergonomic stabilizers of a grip in the three zones: the front zone, the middle zone and the butt-cap zone, the front and middle stabilizers located on the racket handle walls having a form of flattened shaped elements of a flat elliptic base and the stabilizer of the racket base (butt-cap) being of oval shape and having thickened ending compared to the butt-cap dimension, and two stabilizers located next to each other on the same wall of the racket handle are optionally combined into one element.

[0028] Preferably stabilizers of the front and middle zone or combined stabilizers are located one by one or pairwise, symmetrically on opposite walls of the racket handle or asymmetrically on different walls of the racket handle .

[0029] Preferably stabilizers of the front zone, middle zone and combined stabilizers have an elliptic 10, semicircular 11 or boat-shaped 12 longitudinal cross section .

[0030] Preferably stabilizers are equipped with furrows for fingers.

[0031] Preferably the stabilizer of the racket base (butt-cap) is ball-shaped 17, lenghwise ball-shaped 18 or heart-shaped 19.

[0032] Preferably the stabilizer of the butt-cap is composed of two separate elements, preferably ball-shaped, anchored separately directly in the racket base (butt-cap) or in two canals of the frame running in the racket handle.

[0033] Preferably front and middle stabilizers or combined stabilizers are located on two opposite walls of the racket

handle determined by any axis of the racket handle.

[0034] Preferably the stabilizer of the racket butt-cap has a flattened shape and is located at the base (butt-cap) in conformance with any axis of the racket handle, preferably in position 18a, 18b, 18c or 18d.

[0035] Object of the invention is also a tennis racket **characterised in that** it is equipped with the modified handle of the racket defined above.

[0036] Object of the invention is also a method of modification of a regular tennis racket,
characterised in that the front and central stabilizers, or the front and central stabilizers combined into one element, in the form of flattened shaped elements of a flat elliptic base are mounted on walls of the handle of a regular tennis racket, and a stabilizer which has an oval shape and has a thickened ending compared to a dimension of the base (butt-cap) or stabilizer composed of two separate elements, preferably ball-shaped is mounted at the butt-cap of the racket and the stabilizers in the form of flattened shaped elements are preferably screwed, riveted, glued or these techniques are combined and the stabilizer of the butt-cap preferably is screwed in channels of the racket frame profile, preferably using anchor screws, or is mounted directly in a handle of a racket and in case when the stabilizer of the butt-cap is a two-element stabilizer, each of them is mounted separately.

[0037] Preferably, during fastening of the stabilizers, their shape is modelled with a glue paste, preferably with a thermosetting glue paste.

[0038] Preferably free spaces of the handle are filled in with a glue paste, preferably with a thermosetting glue paste.

[0039] Object of the invention is also a set of parts for modification a regular tennis racket, **characterised in that** it includes a one-element stabilizer of the base (butt-cap), which has an oval shape, a thickened ending compared to a dimension of the racket butt-cap and preferably is ball-shaped 17, lengthwise ball-shaped 18 or heart-shaped 19, or a two-element stabilizer of the butt-cap composed of two ball-shaped elements, and furthermore includes either separately front and middle stabilizers of a grip in the form of flattened shaped elements of a flat elliptic base having elliptic 10, semicircular 11 or boat-shaped 12 longitudinal cross section, or front and middle stabilizers 1a combined in pairs into one element.

[0040] Object of the invention in various embodiments is illustrated on appended drawings, on which the front stabilizer of a grip of the racket handle 1, central stabilizer of a grip of the racket handle 2, and stabilizer of a grip of the racket base (butt-cap) 3 are designated. In Fig. 2. a method of integration of the front and central stabilizer (combined stabilizer 1 a) is presented.

[0041] Defining that stabilizers are ergonomic as regards their shape is to be understood in such a way that their shapes make it possible to grip the racket comfortably with palms. Thus, the shapes are determined by a shape of a closed palm when holding a tennis racket. Griping a racket with a palm at a handle is different from griping at its ending. Accordingly, stabilizers located on a handle of the racket should have a flat base adapted to a surface of a handle, and should be gently convex (flattened) from a side of a palm griping them e.g., they can have an elliptic 10, semicircular 11 or boat-shaped 12 longitudinal cross section. They should not include edges to avoid injuries. If the employed shaped elements acting as stabilizers are not sufficiently smooth and have a shape e.g., of a polyhedron, their shape can be modelled during fastening, and thus one can shape the handle, by means of a glue paste, preferably a thermosetting paste. Moreover, free spaces are filled using the same materials.

[0042] Front stabilizers of a grip of the racket 1 are shaped elements made of workable materials, i.e. from plastics or metal. Their role is to force a hooked grip (fig. 3), which protects against contusion of the elbow. A size and shape of that element should be customized to a player's hand. For most tennis players it will be a boat-shaped element of length 2-6 cm, width 0.5 -1.5 cm and height 0,5 - 1,5 cm. These stabilizers can constitute an integral part of commercially manufactured rackets, i.e. they can be a plastic cast or a metal form of the racket handle . They can also be a separate element fastened to side walls of the racket handle by means of screwing, riveting or gluing, or by combined techniques. Stabilization of a hooked grip can also be additionally effected by suitable profiling of thickness of wrapping of the racket handle or by sealing profiling elements in the wrapping.

[0043] The middle stabilizer of a grip of the racket 2 is composed of shaped elements made of workable material. Their role is to force a hooked grip on the index finger and the thumb, which protects against contusion of the elbow. A size and shape of that element should be customized to a player's palm. For most tennis players it will be a boat-shaped element of length 2-6 cm, width 0.5-1.5 cm and height 0.5-1.5 cm. These stabilizers may constitute an integral part of commercially manufactured rackets, i.e. they may be a cast from plastic or a metal mould of the racket handle. They may also be a separate element fastened to side walls of the racket handle by means of screwing, riveting or gluing, or using combined techniques. Stabilizing of the hooked grip can also be effected through suitable profiling of thickness of the wrapping of the racket handle or through sealing profiling elements in the wrapping.

[0044] A distance between individual stabilizers should be customized taking into account an anatomic structure of a palm and a play style. However, one can accept as a rule that a distance between the middle stabilizer and the butt-cap stabilizer should make it possible to make a hammer-type grip.

[0045] Combining front and central stabilizers into one element 1a consists in combining function of a stabilizing grip of a leading hand (i.e. a right hand - in case of a right-handed player) with a function of a stabilizing grip of a complementary

hand (i.e. a left hand - in case of a right-handed player). It applies in particular, when a player uses two-handed grip to a backhander and a one-handed grip to a forehand stroke. The combined stabilizer performs at the same time functions of the front and central stabilizers, thus its shape and dimensions are related to features of individual front and central stabilizers.

[0046] The stabilizer of a grip of the racket butt-cap 3 is an element having oval, soft shape e.g., it is a ball-shaped 17, lenghtwise ball-shaped 18 or heart-shaped 19 element fastened to the racket base (butt-cap), made of a mechanically or heat-treatable material. These elements can also be solids of oval, cone-shaped, ellipsoidal, conical-ellipsoidal, paraboloidal shape or of other shapes of that type. A role of these solids is to shape a grip of a leading hand of a tennis player to reduce work of extensor muscles of the wrist and fingers having an attachment in the lateral epicondyle of humerus. It is attained through extension of the butt-cap by such a length that the index finger and the thumb will close (touch) at the bottom of the butt-cap, and the remaining fingers will rest on a thickened ending of the stabilizer. When a stabilizer of the butt-cap has an other shape, then it plays a role of fitting (a support) of a leading hand to the middle stabilizer. A size of the stabilizer should be adjusted to a palm of a player, however for most tennis players these will be ball-shaped elements of diameter 2-4 cm fastened to the butt-cap and suitably cut off. These stabilizers may also constitute an integral part of commercially manufactured rackets, i.e. the may be a plastic cast or a metal mould of an enlarged butt-cap of the racket handle.

[0047] In another variation of the invention the handle of the racket is equipped with a two-element stabilizer of a grip of the butt-cap. It is a stabilizer like that described above, but it consists of two separate elements anchored separately in channels of the racket frame running along the length of the racket handle, and in case of rackets, frame profiles of which end at a beginning of the handle and behind that there is a homogeneous space, the anchoring is made in the material of the racket ending or in a metal profile of the handle by means of pouring a hardening paste - as a filling - to the racket ending. The matter of novelty of the invention consists in utilizing a phenomenon of friction between touching elements for damping racket vibration. Thus, in the friction zone one can employ materials having vibration damping properties. Two elements stabilizing grip of the butt-cap are located on the outside and have a contact with the entire palm of a hand, and at the same time the vibration damping is effected through a friction zone 21 located between two touching elements of a stabilizer of a grip of the butt-cap. Each wave flowing along the racket length is split in the end part of the racket and flows farther in two elements that stabilize grip of the racket butt-cap. Because of different stresses arising in the butt-cap of the racket, waves flowing in stabilizers of the butt-cap have mutually shifted phase and length, which at a contact of the two elements of stabilizer results in friction between them, which in turn damps the vibrations.

[0048] Technique of assembling anti-injury stabilizers is based on known methods used for customizing commercially manufactured rackets to individual needs of players. On the internet page http://www.tennis-warehouse.com/LC/Customizing/customize.html techniques of modification are shown, yet they are confined to a change in weight, balance and circumference of a racket. Novelty of the solution proposed by the present Authors consists in employing known techniques to a new objective, which is protection of players from contusion of an elbow. In case of most conventional rackets, their customizing will consist in fastening a boat-shaped, elliptic or round, shaped elements of middle stabilizers of a grip through screwing, riveting or gluing, or using combined techniques. Good effects are obtained by using a glue paste 22 for modelling a shape of the stabilizer, and the paste may be put directly on walls of the racket handle, reinforced with screws 23 or fastened with profiles made of hard plastic 24 or other analogous material as shown on Fig. 9. Stabilizers of a grip of the butt-cap may be screwed down in channels of the racket frame profile e.g., on anchor screws or directly in the racket handle. For filling free spaces, a thermosetting paste 22 fed e.g., by means of so-called Glutomatic, should be used.

[0049] The proposed solutions according to the invention are aimed at a change of a universal racket handle into a handle, which prompts to a safe two-handed play style. In case of the one-handed play style, the solution helps to eliminate a mistake connected with a grip, which also reduces a risk of contusions. From a point of view of safety of an elbow, one should distinguish between three main play styles:

1) a preferred two-handed backhander and forehand stroke,
2) a recommended two-handed backhander and one-handed forehand stroke, and
3) not recommended one-handed backhander and one-handed forehand stroke,

In case of the first, two-handed play style, the solution consists in an increase in a circumference of the racket handle in its part close to the racket head, called front stabilizer of a grip of the racket 1, and/or a size of the racket base (butt-cap), called hereafter a stabilizer of a grip of the racket butt-cap 3, is increased. A consequence of that is a change of a way a racket is hold both in left as well as in right hand. In case of right-handed players during backhander stroke, fingers bowed in a hook-like way of left hand as shown on Fig. 3 can conveniently adjust an inclination angle of the racket towards the ball. An impact force is transferred mainly through joints between metacarpal bones and proximal phalanxes of fingers 8. In case of such hooked grip, first of all a distant flexor muscle, which has no attachment in arm epicondyle, is involved. On the other hand, muscles - extensors of the wrist and fingers having attachments in the lateral

epicondyle of right humerus are not involved. Furthermore, finger tips are well nerved, which improves precision of the impact. Flattening of the racket handle makes it possible to utilize hooked properties of phalanxes of other fingers i.e. distal phalanxes 7 and medial phalanxes 6. The right hand during two-handed backhander strokes forms first of all - safe for the elbow -a thrust on an end of lever through the stabilizer 3, a point of support of which is the left hand resting on the stabilizer 1. An additional point of support at a two-handed grip is the index finger and the thumb of the right hand, which however do not have attachments in the lateral epicondyle of arm. Profiling an ending (the butt-cap) of the racket accounts for these relationships and makes it possible to close a grip of the right hand with the index finger and the thumb (at the neck of the handle) and to arrange comfortably the three remaining fingers on a thickened end of the racket handle.

[0050] As regards the first play style, a forehand stroke is two-handed without change in a hand arrangement compared with a backhander stroke. Here are two techniques possible. The first method, when the left hand performs a radical pulling movement while maintaining hooked arrangement of fingers, and the right hand takes advantage of a lever effect in relation to the left hand while utilizing also pulling attachment supported on the thumb and the index finger. The second method consists in a conventional forehand stroke with a gentle utilizing of the left hand to reinforce a grip of the racket. Here is possible a formation of a short lever having point of support on a joint of the metacarpal bone and the proximal phalanx 8 of the index finger of the right hand, while utilizing three of the remaining fingers to form a pressure on such a lever system. In the first case (the long lever) extensors are not used, and only flexors are used. In the second case (the short lever), and also in case of a one-hand forehand, extensors of the index finger and the thumb may be involved, which do not have attachments in the lateral epicondyle of arm of the right hand.

[0051] In case of the first play style, a symmetric arrangement of the front stabilizer 13 and the butt-cap stabilizer in position 18a on an axis k-k as in case of conventional continental grip is the most universal solution. The consequence is a parallel arrangement of forearms and utilizing of a hooked grip from one side i.e. without a hooked grip of the thumb. Such a grip is used in a conventional tennis, an example being a two-hand backhander of Andre Agassi. Such type of a grip has its advantages, as it involves tricepses to block the elbow joint, thus loosening tendons of forearm fixed in epicondyles of humerus. However, that grip results in a risk of other contusions i.e. of local wearing of bones of the elbow because of a slight range of movement. Furthermore, that type of a grip may be used by advanced players because of a distance between a player and a ball and a necessity of taking a precise position to perform a stroke. Considering safety of strokes, the better solution is to use a hooked grip of all fingers of a palm, including also the thumb.

[0052] Therefore when using the hooked attachment of a thumb, a change of an angle of the arrangement of the hand in relation to walls of the racket handle is nearly 90 degrees compared to the continental grip and to a greater extent it resembles a grip called as "half-western". In the description we will use names of axes, on which stabilizers will be located (Fig. 6) being conscious that names of directions do not correspond to the names accepted for "v"-grips. When arranging stabilizers on the k-k axis, forearms of the right and the left hand form in the starting position an angle of about 90 degrees, but during a stroke the forearms are opened up to 180 degrees. It has the virtue of a greater range of movement in the elbow joint, which intensifies an effect of "lubricating" elbow joints, thus reducing a risk of injuries (wearing) of bones, which is the case at a slight range of movement at a high load. As in practice of playing tennis four basic grips rotated in relation to each other of about 45 degrees (eastern, continental, half-western, western) are employed, then - in a similar manner for hooked grips - there is a combination of 4 x 4 = 16 variants of associating the front stabilizer and the stabilizer of the butt-cap arranged on individual axes of the handle depending on a play style. However, one should assume, that variants of grips, where an angle between forearms of the right and the left hand is outside the range of 90-180 degrees, are risky for the elbow and the wrist. This reduces a number of preferred arrangements of associating front stabilizer and that of the butt-cap to the four variants:

1) hooked half-western backhander and hooked half-western forehand stroke (hpz-hpz)
2) hooked half-western backhander and hooked eastern forehand stroke (hpz-hw)
3) hooked eastern backhander and hooked half-western forehand stroke (hw-hpz)
4) hooked eastern backhander and hooked eastern forehand stroke (hw-hw).

At the double system of stabilizers from the viewpoint of protection against injuries, grips should be maximally natural and use swinging movements of upper extremities. List of four recommended variants of arrangements of stabilizers are given in Table 1.

Table 1.

Positions of stabilizers for preferred strokes in a two-handed play style					
		Type of preferred strokes	Position of front stab. 1	Position of the butt-cap stab 3	Angle between forearms (stroke)
1	hpz-hpz	Backhander - wide range Forehand stroke - wide range	k-k, 13	k-k, 18a	180°
2	hpz-hw	Backhander - wide range Forehand stroke - flat and rotated drives	k-k, 13	z-z, 18b	135°
3	hw-hpz	Backhander - flat and rotated drives Forehand stroke - wide range	w-w, 14	k-k, 18a	135°
4	hw-hw	Backhander - flat and rotated drives Forehand stroke - flat and rotated drives	w-w, 14	z-z, 18b	90°

[0053] In case of the second play style involving a two-handed backhand and a one-hand forehand, the solution consists additionally in an increase in a circumference of the racket handle in the middle part of the racket called a central stabilizer of a grip of the racket 2 to improve forehand strokes. The central stabilizer makes it possible to utilize better extensors of the index finger and the thumb, which are safe, because do not have attachments in the epicondyle of the humerus. In case of a forehand stroke also two techniques are possible. The first one takes an advantage of a hooked grip based on the index finger and the thumb. Then, in case of a western grip for high top-spin balls, it would be recommended to locate stabilizers symmetrically on an axis w-w 14. In the second technique, i.e. at the conventional eastern grip, stabilizers located symmetrically on an axis w-w 14 can play a role of separating the index finger from the remaining fingers, which is often practiced among tennis players. Such separation of fingers improves reliability and efficacy of strokes through a better racket control. One can also execute top-spin stroke holding only for an enlarged butt-cap at a relatively loose grip because of considerable widening of circumference of an ending of the racket handle (the butt-cap). The resulting whip effect (wave motion transferred from hand to the racket) ensures higher safety of tendons fastened in epicondyles of arm.

[0054] In case of the third play style involving a one-hand backhand and a one-hand forehand, the solution consists in employing only the central stabilizer of a grip of the racket 2 and/ or the stabilizer of a grip of the racket base (butt-cap) 3 without necessity of using the front stabilizer of a grip of the racket 1. A purpose of stabilizers is to loosen a grip and to arrange the racket precisely in relation to the coming ball, because "impure" strokes at strongly tense muscles of forearm result in contusions. However, the problem cannot be fully overcome, as the most players are accustomed to play with a different backhander grip and a different forehand grip. Improvement of a backhander grip may worsen a forehand grip and vice versa. The solution consists in balancing efficacy in a play and safety for player's individual preferences (e.g.: muscles strength, habits). Individual manipulation of a size and position of individual stabilizers can help to solve that question. When training particularly difficult strokes e.g., with a western grip, stabilizers - individual and/or arranged in sets - located on walls of the racket as 15 or 16 and the system of the butt-cap as in 18c or 18d, may be used.

[0055] As regards other strokes, such as serve and smash, advantages of the racket can be utilized in a similar manner as in case of one-hand forehand strokes, i.e. by utilizing the index finger supported on the central stabilizer to improve precision of the impact or through griping the stabilizer of the racket butt-cap and utilizing the whip effect to increase rotation and strength of the impact. In case of situational strokes with a one-hand backhand it is possible to utilize extensor muscles of the thumb and of the index finger, which do not have attachments in the lateral epicondyle of humerus.

[0056] The racket of the new structure has greater weight and balance (centre of gravity) shifted to the handle, which reduces vibrations of the racket transferred to the hand, thus protecting from injuries. Vibrations are also reduced by a two-element stabilizer of a grip of the butt-cap through utilizing the friction effect between these two elements. In Fig. 9. friction zone 21 damping vibrations of the racket is shown. Furthermore, shifting of balance of the racket in the direction of the handle improves manoeuvrability, which reduces stresses of muscles of forearm, which in turn protects from

injuries of tendons.

[0057] Object of the invention in various embodiments is illustrated on the appended drawings. In Fig. 1 stabilizers 1, 2 and 3 located in three zones of the racket handle are shown in horizontal and vertical projections, in Fig. 2 integration of front and central stabilizers located on a handle of the racket is shown, in Fig. 4 shapes of stabilizers: elliptic 10, semicircular 11 and boat-shaped 12 are shown, in Fig. 5 furrows for fingers on stabilizers located on a handle of the racket are shown , in Fig. 6 designation of walls of the racket and position of front and middle stabilizers 13, 14, 15 and 16 in cross section (view from a side of the butt-cap) is shown, in Fig. 7 shapes of one-element stabilizers of the racket butt-cap are shown, and in Fig. 8 positions of a stabilizer of the butt-cap of the grip of the racket in cross section are shown (positions of the stabilizer of the butt-cap were designated as 18a, 18b, 18c and 18d, view from a side of the butt-cap).

[0058] In fig. 3, a hooked grip is shown and the stabilizer of a grip 1, the metacarpal bone 4, the proximal phalanx 5, the medial phalanx (farther) 6, the distal phalanx (farther) 7 and the phalanx-metacarpal joint 8 as well as a handle of the racket in the cross section 9 are shown.

[0059] The method according to the invention is explained in a more detailed way on a base of the embodiment presented in Fig. 9, in which technique of assembling stabilizers with a use of screws and a glue paste is shown. In Fig. 10, the handle of the racket with one stabilizer and with two-element stabilizer of the racket butt-cap prepared by the method according to the invention - depicted in Fig. 9 - is shown.

Example of modification a regular racket

[0060] Two central stabilizers in a form of shaped elements made of plastic of elliptic shape are screwed with screws in the middle part of the racket handle, at the same time applying a layer of a glue paste i.e. a typical thermosetting resin, on a flat base of elliptic stabilizers and on a surface of the racket handle. The stabilizers are mounted symmetrically on opposite walls of the racket handle. Two ball-shaped elements of the racket butt-cap are mounted, each of them separately, with screws (with wall plugs) in channels of the racket frame profile (fig. 9). The remaining free spaces and edges, which can cause superficial injuries are filled in with a glue paste, e.g., a thermosetting paste.

[0061] In another variation shaped elements made of plastic 24 were screwed on a handle of the racket. The stabilizers on the racket handle were modelled with a use of glue paste. Space inside the shaped element as well as outside were filled in with the paste, to obtain an elliptic shape of stabilizers.

[0062] In still another variation, stabilizers were prepared by screwing three screws constituting an elliptic outline of the stabilizer on a wall of the racket handle and the space between them were filled in with the glue paste i.e. the thermosetting paste (fig. 9). An elliptic stabilizer of the racket handle was obtained through modelling it directly on the handle.

[0063] The invention comprising the above described elements is suitable for commercial applications. Mass production of rackets including the above described elements will enable tennis players to return into tennis-courts after contusions called "a tennis player's elbow". Because of its anti-injuries character, the new type of the racket will have first of all application in rehabilitation and recreation, but also it will ensure successes of most professional players. It will have particular application in training of tennis grips and in long training cycles at high loads. The racket will protect from injuries through loosening of a grip and precise arrangement (adjusting) of a palm to a racket handle. Furthermore, the racket makes it possible to master symmetric techniques of strokes i.e. two-handed forehand and backhand, which is of importance for both young and elder tennis players. Elements presented here may be an integral part of commercially manufactured rackets or elements assembled separately in the traditional rackets.

Claims

1. Modified handle of the tennis racket **characterised in that** on the base of the handle or on its base and its side walls there are ergonomic grip stabilisers and the stabiliser situated on the base consists of two separate parts, preferably ball-shaped, fixed separately directly in the base of the racket or in two channels running in the handle of the racket, while stabilisers on the side walls are situated in the middle zone of the handle and have elliptic base and are flattened.

2. Modified handle of the tennis racket according to claim 1, **characterised in that** the stabilisers situated on the side walls of the handle are in longitudinal cross-section elliptic, semi-circular or cigar-shaped and possibly they are grooved to fit the fingers.

3. Modified handle of the tennis racket according to claim 1, **characterised in that** the flattened stabilisers are situated on two opposite sides of the handle.

4. Method for modification of regular tennis racket, **characterised in that** on the base of the racket or on its base and its side walls one fixes grip stabilisers and stabiliser on the base consists of two separate parts, preferably ball-shaped, and these parts are preferably screwed, each separately, into channels in the handle of the racket, preferably by use of anchor screws, or they are fixed directly in the handle of the racket, while stabilisers mounted on the side walls of the racket handle in its middle zone, have elliptic base and are flattened and are preferably screwed, riveted or glued into the handle or are thereto fixed by use of combination of these techniques and while fixing the stabilisers their shape is possibly adjusted by use of glue paste, preferably thermosetting, possibly the empty spaces in the handle are also filled with glue paste, preferably thermosetting.

5. Set of parts for modification of regular tennis racket, **characterised in that** it contains base stabiliser which consists of two separate ball-shaped parts and possibly grip stabilisers which are flattened and have in longitudinal cross-section elliptic shape (10), semi-circular shape (11) or cigar-like shape (12).

6. Modified handle of the tennis racket **characterised in that** in three zones: the front zone, middle zone and base zone there are ergonomic grip stabilisers and stabilisers situated in the front and middle zone are flattened and have elliptic base and possibly two adjacent stabilisers situated on the same side wall of the handle are joined together to form one element, while stabiliser situated in the base zone is oval-shaped and its end is thicker than the base.

7. Modified handle of the tennis racket according to claim 6, **characterised in that** stabilisers situated in the front and middle zones are fixed individually or in pairs, symmetrically on the opposite sides of the racket handle walls or asymmetrically on different walls of the racket handle.

8. Modified handle of the tennis racket according to claim 7, **characterised in that** the stabilisers situated in front and middle zones and the joined stabilisers have in longitudinal cross-section elliptic shape (10), semi-circular shape (11) or cigar-like shape (12) and are possibly grooved to fit fingers.

9. Modified handle of the tennis racket according to claim 6, **characterised in that** the stabiliser situated in the base zone is ball-shaped (17), lengthwise ball-shaped (18) or heart-shaped (19)

10. Modified handle of the tennis racket according to claim 6, **characterised in that** the stabiliser situated in the base zone consists of two separate parts, preferably ball-shaped, fixed independently directly in the base of the racket or in two channels running in the frame of the racket handle.

11. Modified handle of the tennis racket according to claim 7, **characterised in that** the stabilisers situated in the front and middle zones or the joined stabilisers are placed on two opposite sides of the racket handle.

12. Modified handle of the tennis racket according to claim 6, **characterised in that** the stabiliser situated in the base zone is flattened and is fixed on the base in line with any of axis of the racket handle, preferably in position 18a, 18b, 18c and 18d.

13. Method for modification of the regular tennis racket, **characterised in that** on the walls of the regular racket handle one fixes flattened and having elliptic base front and central stabilisers, separate or joined together, while on the base of the racket one fixes a stabiliser which is ball-shaped and which has an ending thicker than the base or a stabiliser consisting of two separate, preferably ball-shaped elements, and the front and central stabilisers are preferably screwed, riveted or glued into the handle or are thereto fixed by use of combination of these techniques, while base stabiliser is preferably screwed into channels in the handle of the racket, preferably by use of anchor screws, or is fixed directly in the handle of the racket and when the base stabiliser consists of two elements, they are fixed independently, while fixing the stabilisers their shape is possibly adjusted by use of glue paste, preferably thermosetting, possibly the empty spaces in the handle are also filled with glue paste, preferably thermosetting.

14. Set of parts for modification of regular tennis racket, **characterised in that** it contains one-element base stabiliser, which is oval-shaped and has an ending which is thicker than racket base and which is preferably ball-shaped (17), lengthwise ball-shaped (18) or heart-shaped (19) or it contains two-element base stabiliser consisting of two ball-shaped parts, and it also either contains separate, flattened and elliptic based grip stabilisers located in front and middle zone of the racket handle, having in longitudinal cross-section elliptic shape (10), semi-circular shape (11) or cigar-like shape (12) or it contains front and central stabilisers joined together to form one element (1a)

15. Tennis racket **characterised in that** it contains the modified racket handle as described in claim 1 or 6.

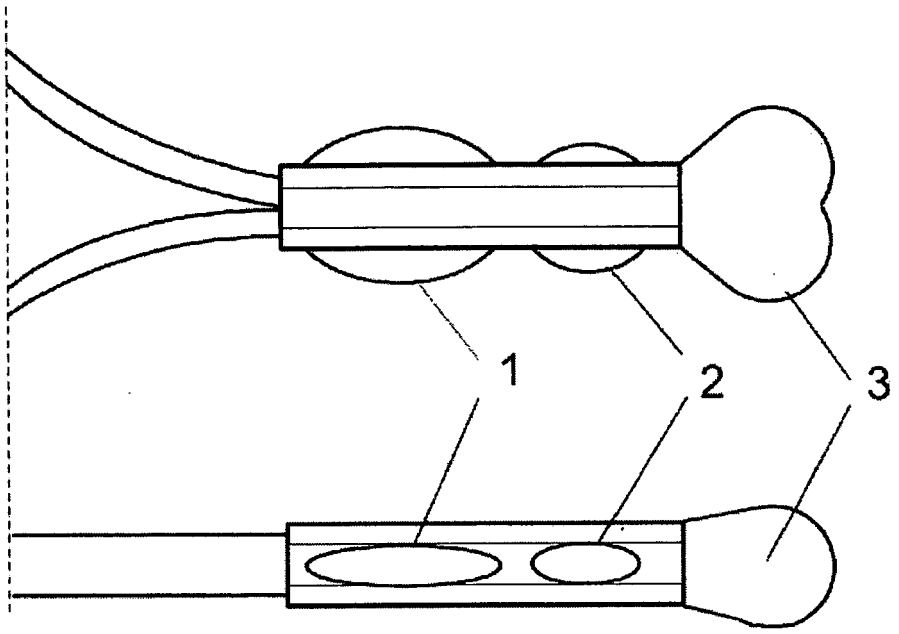

Fig. 1

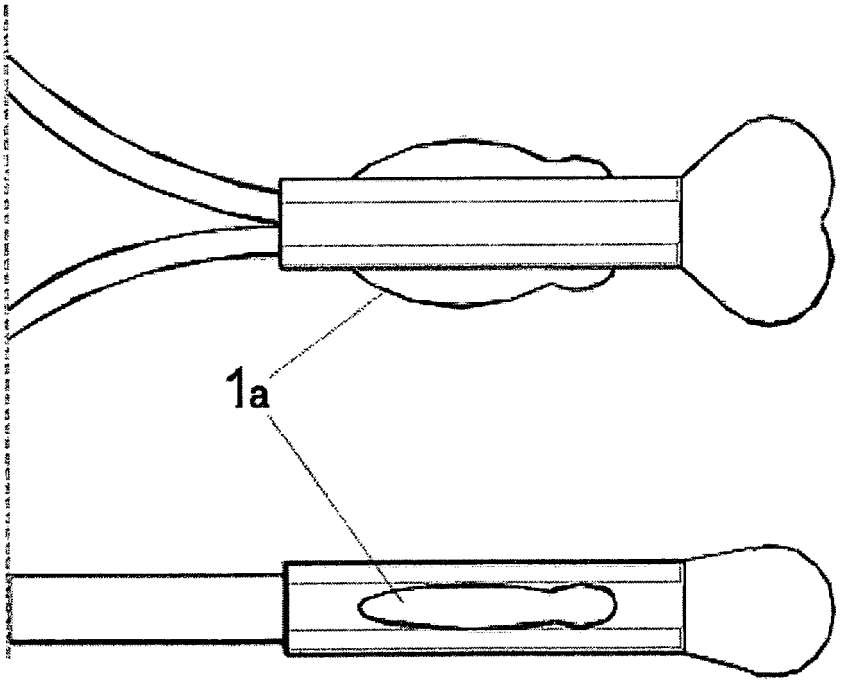

Fig. 2

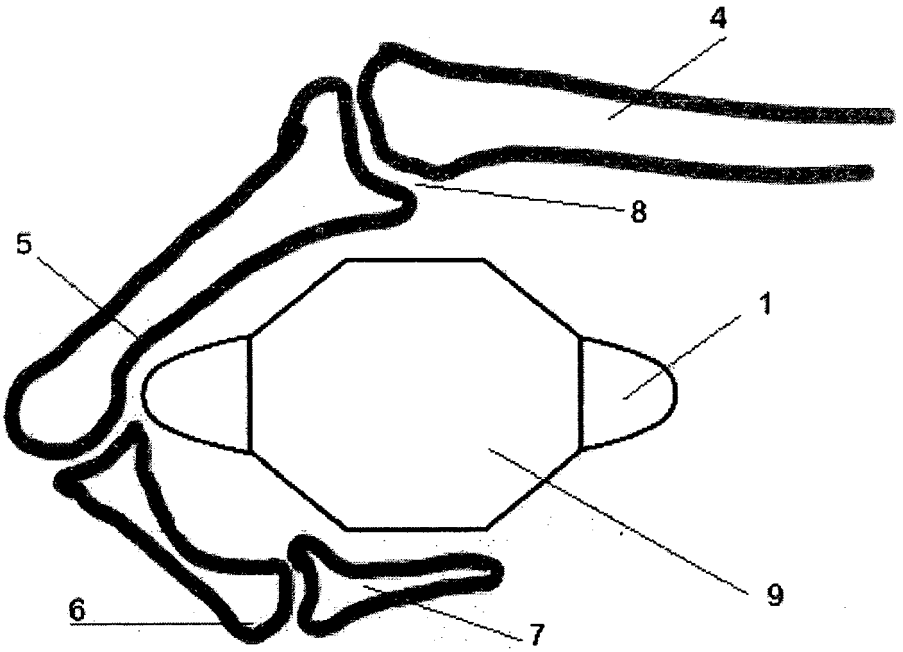

Fig. 3

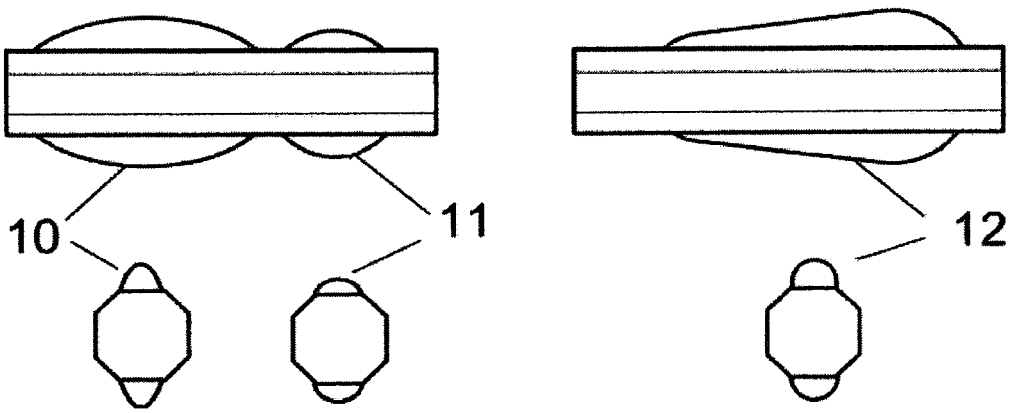

Fig. 4

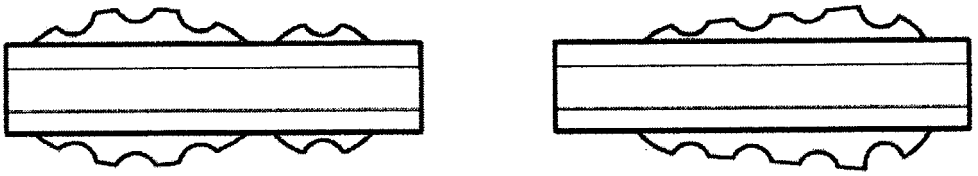

Fig. 5

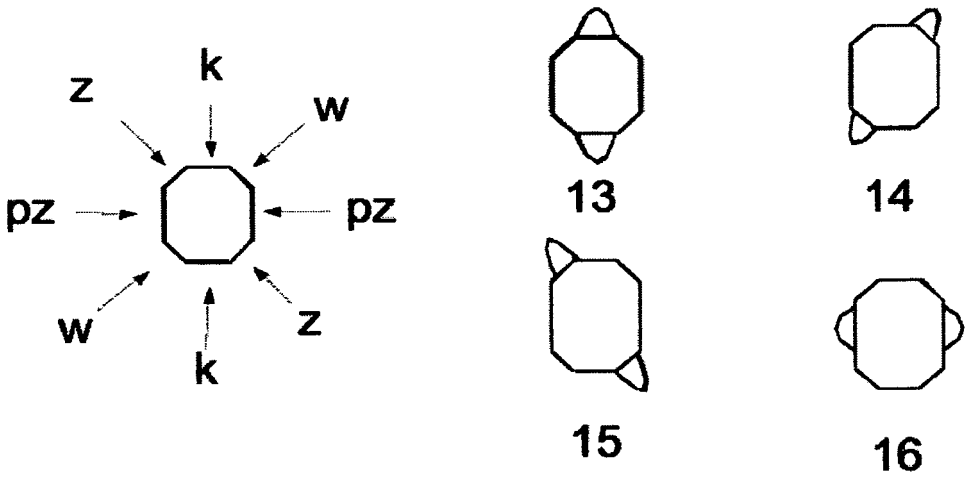

Fig. 6

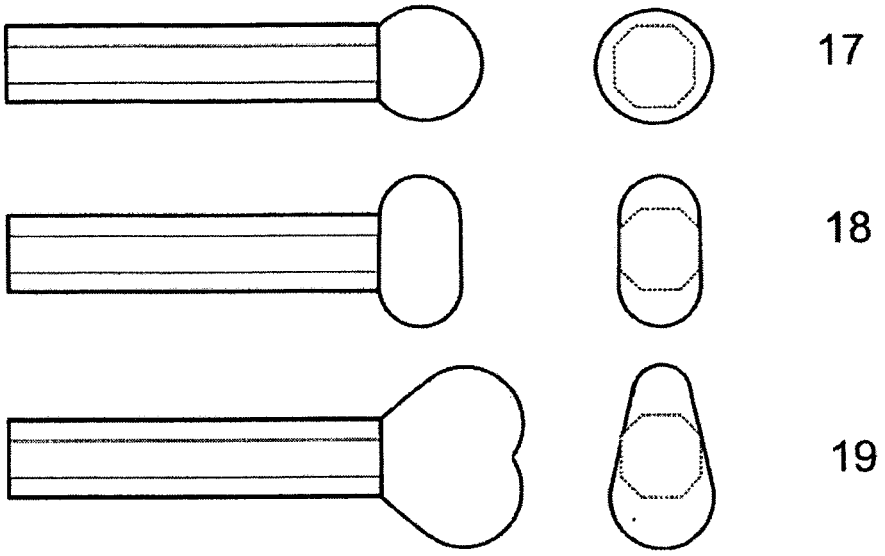

Fig. 7

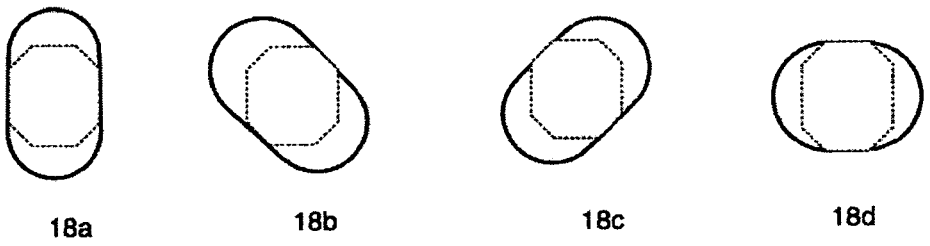

Fig. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 08 16 9076

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A63B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	13 July 2009	Squeri, Michele

CATEGORY OF CITED DOCUMENTS

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