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(54) Titre : MAILLET CHIRURGICAL
(54) Title: SURGICAL MALLET

(57) Abrégé/Abstract:
A surgical mallet (1d) has a head (2d) of a substantially cylindrical shape and provided with at least one recess (6d) in which a device (17d) for inserting and/or extracting implants, in particular intramedullary nails and Kirschner wires, can be received. According to the invention, the recess (6d) comprises at least two separate zones, namely an insertion channel (7d) and a locking chamber (9d) in which the insertion and/or extraction device (17d) can be locked. Moreover, according to the invention, the base (5d) of the mallet head is self-contained.

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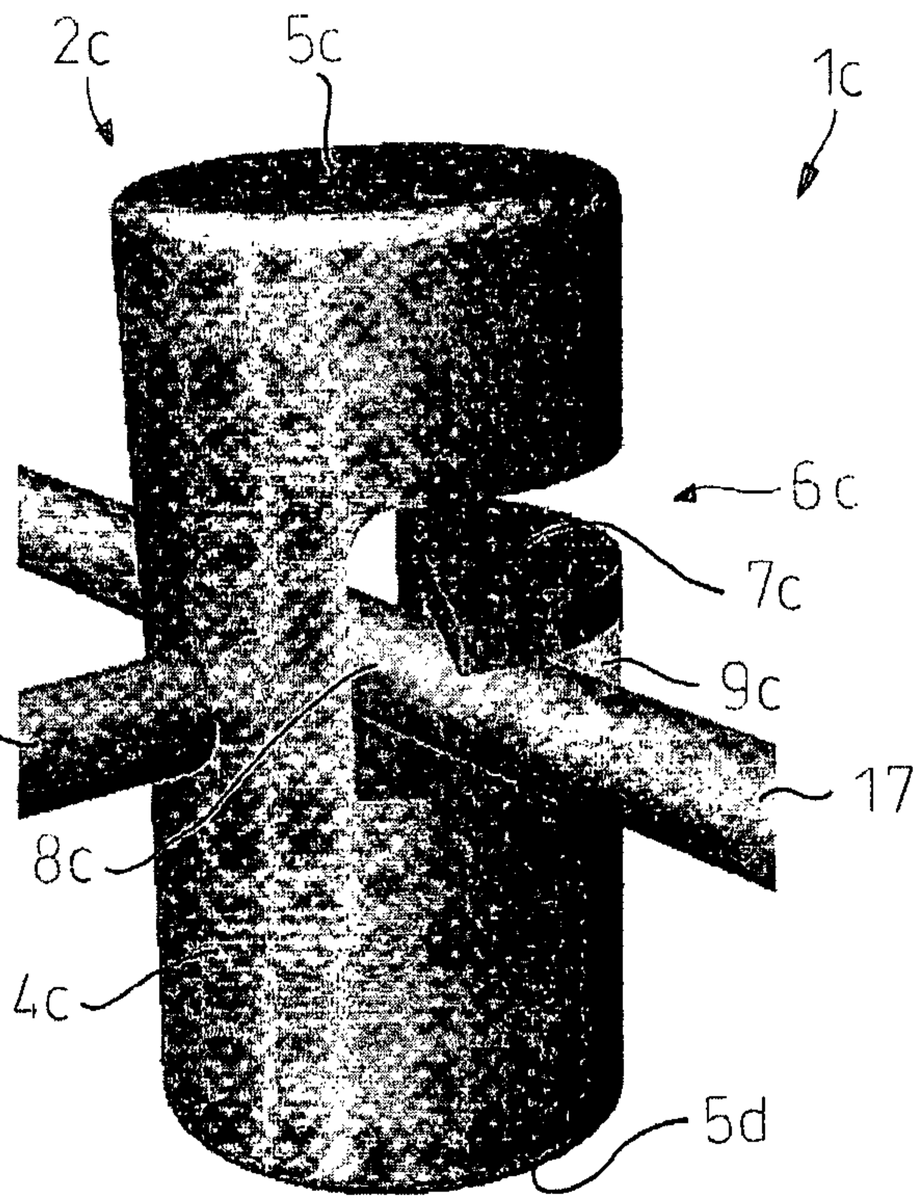
(54) Title: SURGICAL MALLET

(54) Bezeichnung: CHIRURGISCHER HAMMER



(57) Abstract: A surgical mallet (1d) has a head (2d) of a substantially cylindrical shape and provided with at least one recess (6d) in which a device (17d) for inserting and/or extracting implants, in particular intramedullary nails and Kirschner wires, can be received. According to the invention, the recess (6d) comprises at least two separate zones, namely an insertion channel (7d) and a locking chamber (9d) in which the insertion and/or extraction device (17d) can be locked. Moreover, according to the invention, the base (5d) of the mallet head is self-contained.

(57) Zusammenfassung: Die Erfindung betrifft einen chirurgischen Hammer (1d), der einen Hammerkopf (2d) aufweist, wobei der Hammerkopf eine im Wesentlichen zylindrische Gestalt hat und mit zumindest einer Ausnehmung (6d) versehen ist, in der eine Vorrichtung (17d) zum Inserieren und/oder Extrahieren von Implantaten, insbesondere von intermedullären Nägeln und Kirschner-Drähten, aufnehmbar ist. Erfindungsgemäss ist die Ausnehmung (6d) durch mindestens zwei gesonderte Bereiche gebildet, nämlich durch Einführkanal (7d) und Verriegelungsraum (9d), wobei die Vorrichtung (17d) zum Inserieren und/oder Extrahieren im Verriegelungsraum verriegelbar ist. Ferner ist erfindungsgemäss die Grundfläche (5d) des Hammerkopfes in sich geschlossen.

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Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

Surgical mallet

The invention relates to a surgical mallet which is intended for the insertion and/or extraction of implants, in particular intramedullary nails and Kirschner wires, but also for other mallet applications in surgery.

US-A-5,476,467 and WO-A1-80/00534 disclose surgical mallets which are guided on devices for the insertion and/or extraction of implants, in particular intramedullary nails. These mallets have the shape of a cylinder and are provided with a centred bore which follows the longitudinal axis and by means of which the mallet slides over the insertion or extraction device. A disadvantage of these mallets is that guidance of the mallet is difficult since the surgeon can only exert force on the mallet by gripping the cylinder on its lateral surface with his hand. Another disadvantage is that these mallets can be used only with the respective insertion device.

Improved surgical mallets are disclosed in US-A-5,913,860 and in DE-C1-198 60 569, which, similarly to the documents cited above, disclose mallets which have a cylindrical mallet head but additionally have a mallet shaft by means of which the guidance of the surgical mallets is facilitated. Furthermore, the surgical mallet of US-A-5,913,860 not only has a cylindrical bore but a recess so that the surgical

mallet can be introduced after assembly of the insertion device. Furthermore, this surgical mallet is therefore also universally applicable; thus, it can also be used as a mallet for directly driving in, for example, nails. However a disadvantage is that the guidance of the mallet on the insertion device is complicated in that, owing to the slotted design, the mallet head is no longer securely held on the implantation device, for example the guide rod, but, on moving the hammer, the surgeon must ensure that it does not slip off the guide rod. As a result, firstly the precision is impaired and secondly the danger of injury for the surgeon and the personnel surrounding him increases.

A further disadvantage is that the base surface of the cylindrical mallet head, which is usually used for striking during hammering, is slotted. As a result, the handling during striking is complicated since it is necessary to ensure that the nail head or the nail end or other instruments which are used for insertion are struck not with the slot but with the intact surface. Mallets designed in this manner are therefore usually used as an impact instrument by using the lateral surface as such. In the case of the slotted design of the mallet head, however, this has the disadvantage that the mallet head tends to be springy on striking.

US-B2-6,592,590 discloses a surgical mallet which has a guide channel for a guide rod, which guide channel is designed so that the mallet head is prevented from

being removed from the guide rod in the lateral direction. However, a disadvantage of this device is that the impact surface of the mallet head is likewise interrupted, so that the mallet can be reliably used only in combination with a guide rod. Furthermore, the guidance is improved in comparison with slotted mallets but the mallet head disclosed there nevertheless tends to slip downwards from the guide rod on even slight canting. This happens comparatively rapidly since it is contradictory to the natural direction of human movement to make an exactly vertical impact movement. It is more advantageous to execute a gentle arc during striking, but it is exactly this which leads to the guide rod slipping out of the guidance in the mallet head.

The inventor consequently recognised that the known systems are disadvantageous, particularly with respect to the following points:

a) the guidance by means of the device for insertion and/or extraction of the surgical implants, for example by means of a guide rod; and

b) the use as an impact instrument, owing to the springy form of the slotted surgical mallet or of the interrupted impact surface.

It is therefore the object of the invention to provide a surgical mallet which provides the device for insertion and/or extraction of the implant with good

guidance, can be inserted therein after assembly and can be reliably used for striking, preferably even outside the device for insertion and/or extraction. It should therefore avoid the stated disadvantages and should be capable of being used even more universally and for striking in a more reliable manner than mallets to date.

This object is achieved by a surgical mallet according to Claim 1. The subclaims relate to advantageous developments.

The surgical mallet according to the invention has a mallet head, the mallet head having a substantially cylindrical shape. It is provided with at least one recess in which a device for insertion and/or extraction of implants, in particular of intramedullary nails and Kirschner wires, e.g. a guide rod, also referred to as extraction rod or sliding rod, can be received. According to the invention, the recess is formed by at least two separate regions, namely by an insertion channel and a locking chamber, in which the device for insertion and/or extraction can be locked. According to the invention the base surface of the mallet head is furthermore cohesive. According to a preferred working example the locking chamber extends substantially in the radial direction.

The region in which the device for insertion and/or extraction is first inserted is referred to below as insertion channel, and the region in which the device

is guided for striking after insertion is referred to below as locking chamber.

The term "device for insertion and/or extraction of implants" covers all devices which can be used for the insertion and/or extraction of an implant, e.g. of an intramedullary nail or Kirschner wire. For the present invention, this is understood in particular as meaning a guide rod, which is also referred to as extraction rod or sliding rod.

The recess and hence the insertion channel and the locking chamber provide guide surfaces for the guidance of the device for insertion and/or extraction, e.g. the guide rod. The device for insertion and/or extraction is not only guided in the recess but locking of the rod takes place in the locking chamber so that said rod cannot become detached from the mallet head during the insertion or extraction process. The arrangement of the components of the recess prevents the device for insertion and/or extraction from coming out during hammering. Even if the mallet were to be driven in a slightly canted manner, the mallet head cannot slip off the guide rod. Another advantage is that the striking direction is more pleasant for the surgeon since a certain play remains in the locking chamber so that it is also possible to execute a gentle arc during striking and the guide rod nevertheless is still reliably guided.

Since the base surface of the mallet head is cohesive,

the mallet can be used as a "normal" mallet for striking. Consequently, two impact surfaces are present, as is usual for a mallet.

According to a first preferred working example, the recess is formed by three separate regions, namely insertion channel, axial channel and locking chamber, which are connected to one another. The regions are separate in that each region by itself occupies a space inside the mallet which does not coincide with a further space or channel. Each channel and also the locking chamber form a guide region for a device for insertion and/or extraction of implants, through the entire extent of which guide region the device must pass before reaching the next, adjacent channel or space. Advantageously, the device, for insertion and/or extraction, in particular a guide rod, thereby experiences improved guidance compared with the devices of the prior art.

Expressed otherwise, the recess is designed so that the device for insertion and/or extraction can be inserted with a bayonet-like connection. The device is consequently threaded into the mallet, but this is possible not, as in the case of the slotted mallets of the prior art, by an individual horizontal or vertical movement or, as in the case of the mallet disclosed in US-B2-6,592,590, by a horizontal and a tilting movement, but the recess is designed so that at least one predominantly horizontal and at least one predominantly vertical insertion movement is required,

it also being necessary to perform a rotational movement.

The recess is therefore angled, the region into which the device is first inserted being referred to below as insertion channel and the region in which the device is guided after insertion for striking being referred to below as locking chamber. The axes of these spaces are not parallel but are arranged at an angle to one another.

Furthermore, it is preferable if insertion channel and locking chamber do not directly intersect. On the contrary, in preferred working examples, their planes are approximately parallel. Insertion channel and locking chamber are instead connected by the axial channel.

According to a further working example of the invention, the insertion channel is arranged at an angle of approximately 20-70°, in particular of approximately 40-50°, to the longitudinal axis of the mallet head. The insertion channel is consequently located obliquely in the lateral surface of the mallet head. Insertion channel and locking chamber are arranged at an angle of approximately 20-70°, in particular of approximately 30-40°, to one another. The locking chamber is consequently preferably oriented radially, as described above. On insertion of the device for insertion and/or extraction, the mallet head is consequently mounted obliquely to said device and

pushed into the insertion channel. Thereafter, the head is turned to the horizontal position and pushed further into the locking chamber. The device for insertion and/or extraction is thereby locked in the locking chamber and the mallet can be used for striking for insertion or extraction. In this working example, the arrangement of the components of the recess also prevents the device for insertion and/or extraction from coming out during hammering. Even if the mallet were to be driven in a slightly canted manner the mallet head cannot slip off the guide rod. Another advantage is that the striking direction is more pleasant for the surgeon since a certain play remains in the locking chamber so that it is also possible to execute a gently arc during striking and the guide rod is nevertheless reliably guided.

According to a preferred working example, the locking chamber is bounded by staggered projections. In addition to the arrangement, according to the invention, of the individual regions of the recess, these projections prevent the mallet head from slipping off the device for insertion and/or extraction. The latter is additionally retained by the projections.

Further developments of the invention and variants thereof are described in the dependent patent claims and in the description of the figures.

Mallets having a non-cylindrical shape are also within the scope of the invention. Thus, the lateral surface

could also be barrel shaped or could comprise cylindrical or flat impact surfaces while the remainder towards the base surfaces is barrel-shaped.

Owing to the design, according to the invention, of the recess in the mallet head, in particular the following improvements are achieved:

- Although the mallet head can be inserted after assembly of the device for insertion and/or extraction, a type of locking of the mallet head by means of the device is achieved. By providing separate regions, namely insertion channel, axial channel and locking chamber, the insertion of the guide rod is so complex that it is possible to remove the mallet head again from the device only through this bayonet connection-like guide in the opposite direction. However, such a movement is not carried out during striking with the mallet; consequently, the mallet head remains locked by the device even during striking.
- The reliable guidance permits precise impacts, which has a noticeable positive effect both when driving in and when driving out implants, since injuries and damage to implants and instruments often occur as a result of imprecise impacts.
- As a result of the design, according to the invention, of the recess in the mallet head, the full impact force is maintained. In the preferred embodiment, the recess is provided exclusively in the lateral surface; the base surfaces thus remain

in principle intact.

- Consequently, the entire base surfaces of the surgical mallet are maintained as impact surfaces. However, even if the recess is positioned so that the base surfaces, too, were to be affected, the impact force via the lateral surfaces is substantially maintained since, owing to the bayonet connection-like arrangement of insertion channel, axial channel and locking chamber of the recess, springiness during striking is substantially prevented.
- If in addition the centre of gravity of the mallet head is located in the extrapolated mallet shaft axis and/or - in the threaded-in state - in the axis of a guide rod, the danger of canting during sliding on the guide rod is also minimised.

The invention is further explained by way of example and in a non-limiting manner with reference to drawings. The figures are described as a whole. Identical elements bear identical reference numerals. Elements having similar functions but a different formation bear identical reference numerals with different indices. The description of the figures, list of reference numerals and patent claims supplement one another in the context of the disclosure of the invention.

Fig. 1 shows a schematic diagram of a surgical mallet according to the invention in its use according to the invention;

Fig. 2 shows a schematic diagram of the movement of the device for insertion and/or extraction in the recess of the mallet according to the invention;

Fig. 3 shows a preferred working example of a surgical mallet in different views;

Fig. 4 shows the mallet head of the surgical mallet in different views;

Fig. 5 shows a perspective diagram of a front view of a surgical mallet according to the invention;

Fig. 6 shows the mallet of Fig. 6 in a rear view;

Fig. 7 shows a further working example of a surgical mallet according to the invention in plan view (A) and side view (B);

Fig. 8 shows the mallet head of the mallet of Fig. 7 in various views; and

Fig. 9 shows the mode of operation of the mallet head of Fig. 7 and 8.

Fig. 1 schematically shows a surgical mallet on a guide rod 17 according to the invention. The surgical mallet 1a has a mallet head 2a and a mallet shaft 3a. The mallet shaft 3a is shown only in rudimentary form. A guide rod 17 is inserted into the mallet 1a, the position of the guide rod 17 immediately after the insertion into the recess 6a being indicated by the dash-dot guide rod 17'. The end position of the guide rod 17, i.e. the position in which the mallet 1a is guided via the guide rod and in which the impact force is exerted with the mallet, is represented by the solid

line of the guide rod 17. Furthermore, since it is conventional, the guide rod 17 is not shown in its entire form and length.

The mallet head 2a has a lateral surface 4a and two base surfaces 5a. A recess 6a which has an insertion channel 7a, an axial channel 8a and a locking chamber 9a is formed in the mallet head 2a. The recess 6a is slot-like. The size of the slot depends on the device to be inserted, i.e. the diameter of the recess 6a is adapted to the diameter of the guide rod 17. In any case, the recess 6a is substantially shorter in the radial direction - relative to the longitudinal axis 11 of the mallet head - than conventional slots in conventional slotted mallets; however, it is of about the same length as in the case of the mallet according to US-B2-6592590, the insertion channel 7a according to the invention, in contrast thereto, being arranged out of centre so that it is a greater distance away from the recess 6a than in the case of the known insertion channel according to US-B2. As a result - particularly in comparison with conventional slotted mallets - there is less risk of vibration when the upper base surface 5a is used for striking.

It is clear from Fig. 1 that the insertion channel 7a and the locking chamber 9a are arranged not parallel to one another but at an angle. This angle is approximately 20-160°, in particular approximately 30-150°.

It is preferable according to the invention if the angle is in any case chosen to be so large that the guide rod 17 does not slip out again via the axial channel 8a during normal sliding/impact operation.

In the working example of Fig. 1, insertion channel 7a and axial channel 8a are arranged at a different angle to the locking chamber 9a. However, the insertion chamber 7a can also be arranged at a different angle to the axial channel 8a and the locking chamber 9a. All that is advantageous is that the insertion channel 7a and the locking chamber 9a are positioned at an angle to one another and are connected to one another by a third region, referred to as axial channel 8a.

This is clear from a consideration together with the movement diagram in Fig. 2. Fig. 2A shows the movement which is executed on inserting the guide rod 17 if the surgical mallet or recess 6a is designed according to Fig. 1. All designations of the direction of movement in the description of Fig. 2 relate to the longitudinal axis 11 of the mallet head 2a from Fig. 1.

On insertion of the guide rod 17 into the recess 6a, a radial movement 14 is therefore first executed. Thereafter, the guide rod 17 is guided parallel to the longitudinal axis 11 of the mallet head 2a; an axial movement 15 is executed. Thereafter after reaching the plane of the locking chamber 9a a rotational movement 16 is executed.

In another development, shown in Fig. 2b, a rotational movement 16 is first executed. This means that the guide rod 17 is inserted into the insertion channel and then immediately rotated. Thereafter, an axial movement 15 is once again executed, followed by a radial movement 14. As a third alternative, it could also be possible to design the axial channel so that the rotational movement is performed by the guidance in the axial channel so that the directions of movement in the insertion channel and in the locking chamber are always radial whereas the movements in the axial channel are both axial and rotational. The rotational movement in the embodiment of Fig. 1 always takes place about the longitudinal axis of the mallet head.

It is clear that other developments of the mallet head or of the recess in the mallet head are also possible provided that a plurality of separate regions are provided, by means of which locking which ensures good guidance is permitted after insertion of the guide rod 17.

It is furthermore clear from Fig. 1 that - for mallet operation without a guide rod - the base surfaces 5a are retained as impact surfaces. The recess 6a is provided in the lateral region of the cylindrical mallet head 2a. The base surfaces 5a remain intact. The base surface 5a is consequently cohesive.

However, an alternative embodiment envisages that the recess be formed in the base surface 5a and in the

lateral surface 4a. In this case, the axial channel 8 is approximately perpendicular to the longitudinal axis 11 of the mallet head 2. Expressed otherwise, the axial channel 8 is arranged radially. In the working example of Fig. 1, on the other hand, the axial channel 8a is arranged approximately coaxially with the longitudinal axis 11 of the mallet head 2a.

The provision of a mallet shaft 3 is merely a preferred embodiment. In combination with a guide rod, it is in principle also possible, as known in the prior art, to form only a mallet head 2 without a mallet shaft 3. However, in order to be able to use the surgical mallet 1 with all its advantages, the formation of a mallet shaft 3 is preferred. This preferably has an anatomically shaped handle with, for example, two approximately parallel gripping surfaces which are each in a plane normal to the base surfaces 5b.

Fig. 3 shows different views of a preferred working example of the surgical mallet 1b. Fig. 3A shows the surgical mallet 1b in side view, Fig. 3B in front view and Fig. 3C in plan view. The mallet 1b has a mallet head 2b and a shaft 3b. The mallet head 2 and shaft 3 are preferably welded to one another. A handle 10 is provided on the shaft 3b. The handle 10 is preferably connected to the shaft 3 by pins. The handle 10 preferably has at least one flattened side, with the result that the grip is improved and with the result that it is ensured that the mallet 1 according to the invention always lies in the correct position in the

hand.

The handle 10 is preferably formed from a comparatively warm material which has a good grip but which is readily sterilizable, for example from a plastic material.

The mallet head 2b and the shaft 3b preferably consist of a metallic material which is suitable for medical purposes, for example 5CrNiCuNb16-4.

From a consideration of Fig. 3 and 4 together, the design of the exemplary mallet head 2b is furthermore evident. Fig. 4 shows different views of the mallet head 2b. Fig. 4A shows the mallet head in side view, Fig. 4B in front view, Fig. 4C in a perspective overall view and Fig. 4D in plan view.

The diagrams have all been chosen so that lines and elements lying in the interior of the mallet head 2b are also shown.

The mallet head 2b has a substantially cylindrical shape. Preferably, rounded edges 18 are provided between lateral surface 4b and the base surfaces 5b, resulting in a difference from the design according to Fig. 1.

The arrangement of the recess 6b is clear. The recess 6b is once again formed by an insertion channel 7b, an axial channel 8b and a locking chamber 9b.

Particularly from the views of Fig. 3C and 4D, it is clear that the insertion channel 7b and the locking chamber 9b are arranged at an angle to one another. Firstly, the longitudinal axis of the guide rod in the insertion channel 7 is shown in Fig. 4D designated by the reference numeral 19.

Secondly, the longitudinal axis of the guide rod in the locking chamber 9b is shown in Fig. 4D, designated by the reference numeral 20.

In the working example of Fig. 3 and 4, the angle a is about 80°. However, this is only a preferred embodiment.

From Fig. 3 and 4, the arrangement of the mallet shaft 3b on the mallet head 2b is furthermore evident. It is clear that the mallet shaft 3b is arranged out of centre. The mallet shaft 3b is arranged in particular so that the centre of gravity of the mallet head passes through the extrapolation of the mallet shaft axis 12. Owing to the recess 6b, one region of the mallet head 2b is in fact lighter than the other region.

In the diagram of Fig. 4, the upper region of the mallet head 2b is provided with the recess 6b and is therefore lighter than the lower region, which is predominantly solid. Consequently, the attachment 13 of the mallet shaft 3b is displaced in the direction towards the lower region of the mallet head 2b as shown in the Figure.

It is furthermore clear that locking chamber 9b and attachment 13 of the mallet shaft 3 are approximately in the same plane. This too is to be regarded as advantageous since the guidance by means of the guide rod 17 is facilitated.

Fig. 5 (front view) and 6 (rear view) show the mallet 1c according to the invention as a perspective view. It likewise has a mallet head 2c and a mallet shaft 3c, once again shown only partially. The guide rod 17 is shown in Fig. 5 and 6 in the position in which it is locked and in which the mallet head 2c is moved over it in order to achieve the extraction or the insertion of an implant via a guide rod 17.

The arrangement of insertion channel 7c, and axial channel 8c and locking chamber 9c is clear. Three regions are therefore formed in the mallet head 2c: a middle region in which the insertion channel 7c, the axial channel 8c and the locking chamber 9c are present and which is surrounded by one region each which is without passages and therefore solid.

The base surfaces 5c and 5d are therefore excellent solid impact surfaces free of passages, in particular the base surface 5d being particularly suitable as such. It is also clearly evident that the base surfaces 5c and 5d are intact since the recess 6c is formed in the lateral surface 4c.

Below, the mode of operation of the mallet according to the invention is to be described briefly.

During the use of the mallet 1 in the axial direction, the longitudinal axis of the mallet head 2 once again being used as a reference point, the mallet 1 is to be used in a conventional manner by using the base surfaces 5 as impact surfaces. After rotation through 90° about the shaft direction, the mallet head 2 can be threaded onto a guide rod 17. By tilting the mallet 1, the recess 6 can be guided via the insertion channel 7 over the guide rod 17. The mallet is now moved axially in the axial channel 8 until the locking chamber 9 is reached. In this region, a rotational movement of the mallet head 2 around the guide rod 17 is now possible. This is finally followed by a rotation through an angle between +60°/-60°, preferably between +40°/-40°.

Alternatively, the cut in the mallet head by which the locking chamber 9 is formed could also be formed asymmetrically, for example at an angle of +40°/-50°. Owing to the slight asymmetry, the locking of the guide rod 17 in the locking chamber 9 may be improved.

The locking chamber and the insertion channel should be about 10 mm apart if they are substantially parallel, so that, with the chosen mallet material there is a sufficient dimension between the two spaces and the mallet is held in a sufficiently stable manner.

The attachment 13 of the mallet shaft 3 and the

insertion channel 7 can be produced approximately the same distance from the edge of the mallet head 2. The axial channel 8 forms the connection between the insertion channel 7 and the locking chamber 9 and should have the same chosen diameter, such as, for example 10.5 mm.

The edges of the axial channel 8 and of the locking chamber 9 should be rounded; a suitable rounding could be about 5 mm.

Fig. 7-9 show a further working example of surgical mallet 1d according to the invention. Fig. 7 shows the mallet 1d in plan view (A) and in side view (B). Fig. 8 shows the mallet head 2d in various views. Fig. 8A and 8C are front views and Fig. 8B is a side view. Fig. 9 shows the mode of operation of the surgical mallet in detail. For this purpose, various stages of the insertion of the guide rod 17d are shown in various views. Fig. 9A-C show the mallet head 2d in each case in perspective front view. Fig. 9D, F and G show in each case plan views and Fig. 9G shows a perspective side view.

The surgical mallet 1d has a mallet head 2d and a shaft 3d which has a handle 10d. The handle 10d is preferably flattened, as is evident from the comparison of the diagrams of Fig. 7A and 7B. The longitudinal axis 12d of the hammer 1d has been shown by a dashed line in Fig. 7B.

From a comparison of the diagrams of Fig. 7A and 7B, it is furthermore evident that the base surface 5d is cohesive. The recess 6d does not extend into the base surface 5d but is limited to the region of the lateral surface 4d. A consequent advantage is that the two impact surfaces of the mallet 1d are fully retained. The mallet according to the invention can consequently also be used as a "normal" mallet, i.e. for striking, in contrast to mallets known from the prior art. Consequently the surgeon needs only one mallet with which, when the guide rod has been threaded on, he can carry out the insertion/extraction and with which he can also strike as with any customary mallet.

The working example of Fig. 7-9 shows a further embodiment of a recess 6d. This has an insertion channel 7d and a locking chamber 9d. The locking chamber 9d is radially oriented. It is approximately horizontal or, expressed otherwise, approximately perpendicular to the longitudinal axis 11d of the mallet head.

The insertion channel 7d and the locking chamber 9d are arranged at a certain angle a to one another, as is clear from Fig. 8A. The longitudinal axis 24 of the locking chamber 9d and the longitudinal axis 23 of the insertion channel 7d make the angle a which is approximately 20-70°, preferably 40-50°. In the working example of Fig. 6-8, it is approx. 50°. Furthermore the longitudinal axis 23 of the insertion channel 7d and the longitudinal axis 11d of the mallet

head 2d make an angle β. This is in the range of approx. 20-70°, preferably 40-50°. In the working example of Fig. 7-9 it is approx. 40°. The insertion channel 7d is consequently arranged obliquely on the mallet head 2d relative to the longitudinal axis 11d thereof, as is clearly evident from Fig. 7-9. The insertion channel 7d is formed so that it permits the insertion of the guide rod 17d.

The locking chamber 9d is in the form of an elongated hole. The guide rod 17d runs in this slot. Locking chamber 9d is moreover obliquely formed so that it is possible to rotate the guide rod 17d about the centre of the mallet head, as shown in Fig. 9F and 9G. Towards the outside, the locking chamber 9d is bounded by at least one projection 21, preferably two projections 21. These projections 21 are staggered relative to one another. More precisely, one projection 21 each is arranged on each side of the insertion channel 7d as is clearly evident, for example, from Fig. 8A.

The mode of operation of the mallet head 2d is illustrated in detail by the sequence of figures in Fig. 9. The guide rod 17d is always oriented vertically, with the exception of Fig. 9E. For insertion the mallet head 2d is first mounted obliquely on the guide rod 17d so that the latter can be introduced into the insertion channel 7d (Fig. 9A). The mallet head 2d is then rotated to the horizontal position (Fig. 9B, 9C). The mallet head 2d is now

pushed further until the guide rod 17d comes to rest in a central position (Fig 9D, 9E). In this state, the mallet head 2d has been threaded onto the guide rod 17d. The surgeon can now actuate the guide rod by an up-and-down movement, i.e. can insert or extract the implant, depending on requirements.

From Fig. 9B and 9C, it is clear that the guide rod 17d is locked in the locking chamber 9d by the projections 21. The projections 21 bound the locking chamber 9d towards the outside. As a result of the design, according to the invention, of the recess 6d, however, the projections 21 do not constitute an obstacle when inserting the guide rod 17d.

The latitude of movement which the surgeon has when using the mallet 1d for the insertion or extraction of implants, e.g. intramedullary nails, is clear from Fig. 9F and 9G. The mallet head can be moved over the guide rod 17d through a large angle of approx. 80° about the centre of the mallet head, as indicated by the arrow 22. Consequently, the surgeon can execute an arc-like movement during insertion or extraction, which very closely resembles the natural striking movement.

The mallet head 2 according to the invention therefore firstly allows the surgeon considerable latitude in the actuation of the device for insertion and/or extraction and secondly provides exact guidance and prevents the mallet head 2 from slipping off the device for insertion and/or extraction. Finally the mallet 1 can

also be used in the manner of a conventional mallet, so that it is universally applicable.

In an advantageous development, the mallet head 2 has been rounded at its edges with a radius of about 3 mm. The bore for the shaft in the mallet head has a dimension of about 10 mm and extends about 10 mm into the mallet head. The lateral surface of the mallet head has a total height of, for example, about 73.5 mm, the bore for the shaft being made in the mallet head about 32 mm to about 33 mm away from the edge of the mallet head.

If the device for the insertion or extraction of implants is round and has a diameter of about 10 mm, the recess 6 should be in the region of about 10.5 mm in order to afford reliable guidance and at the same time to afford secure retention in combination with sufficient play. All recesses 6 are preferably rounded.

In order for the handle 10 to rest comfortably in the hand, it should be about 120 mm to 130 mm, e.g. about 129 mm, long, while the total shaft with handle should be about twice the length, i.e. 260 mm long.

List of reference numerals

1- Surgical mallet
2- Mallet head
3- Mallet shaft
4- Lateral surface
5- Base surface
6- Recess
7- Insertion channel
8- Axial channel
9- Locking chamber
10- Handle
11- Longitudinal axis of mallet head
12- Longitudinal axis of mallet shaft
13- Attachment of the mallet shaft
14- Radial movement
15- Axial movement
16- Rotational movement
17- Guide rod
18- Rounded edge
19- Longitudinal axis of 17 in 7
20- Longitudinal axis of 17 in 9
21- Projection
22- Arrow
23- Longitudinal axis of 7
24- Longitudinal axis of 9

Patent claims

1. Surgical mallet (1), having a mallet head (2), the mallet head having a substantially cylindrical shape and being provided with at least one recess (6) in which a device (17) for insertion and/or extraction of implants, in particular of intramedullary nails and Kirschner wires can be held, characterized in that the recess (6) is formed by at least two separate regions, namely by insertion channel (7) and locking chamber (9), the device (17) for insertion and/or extraction being capable of being locked in the locking chamber, and in that the base surface (5) of the mallet head is cohesive.

2. Surgical mallet according to Claim 1, characterized in that the locking chamber (9) extends substantially in the radical direction.

3. Surgical mallet according to Claim 1 or 2, characterized in that insertion channel (7) and locking chamber (9) are arranged at an angle (a) of approximately 10-160°, in particular of approximately 20-150° to one another.

4. Surgical mallet according to any of the preceding Claims, characterized in that the recess (6) additionally has an axial channel (8), and in that the insertion channel (7) and the axial channel (8) are arranged at an angle (a) of approximately

20-160°, in particular of approximately 30-150° to the locking chamber (9).

5. Surgical mallet according to any of the preceding Claims, characterized in that the insertion channel (7) is arranged at an angle (a) of approximately 20-160°, in particular approximately 30-150° to the axial channel (8) and the locking chamber (9).

6. Surgical mallet according to any of Claims 3 to 5, characterized in that the angle (a) is approximately 80°.

7. Surgical mallet according to any of the preceding Claims, characterized in that the recess (6) is formed so that the mallet can be inserted by a radial (14), axial (15) and rotational (16) movement relative to the longitudinal axis (11) of the mallet head (2).

8. Surgical mallet according to any of the preceding Claims characterized in that the axial channel (8) is arranged with its central axial plane at least approximately in the longitudinal axis (11) of the mallet head (2).

9. Surgical mallet according to any of Claims 4 to 7, characterized in that the axial channel (8) is arranged at least approximately perpendicularly to the longitudinal axis (11) of the mallet head (2).

10. Surgical mallet according to any of Claims 1 to 3, characterized in that the insertion channel (7) is arranged at an angle (β) of approximately 20-70°, in particular of approximately 40-50° to the longitudinal axis (11) of the mallet head (2).

11. Surgical mallet according to Claim 3 or 10, characterized in that insertion channel (7) and locking chamber (9) are arranged at an angle (a) of approximately 20-70°, in particular of approximately 30-40°, to one another.

12. Surgical mallet according to any of Claims 1, 2, 3, 10 and 11, characterized in that the locking chamber (9) is bounded by at least one projection (21), preferably a plurality of projections (21), these projections being arranged in particular staggered relative to one another.

13. Surgical mallet according to any of Claims 1, 2, 3, 10, 11 and 12, characterized in that the locking chamber (9) is in the form of an elongated hole.

14. Surgical mallet according to any of the preceding Claims, characterized in that the impact direction of the mallet (1) when the device (17) for insertion and/or extraction has been introduced is substantially perpendicular to the longitudinal axis (11) of the mallet head, it being possible

for the mallet head (2) to rotate during the striking movement, preferably about its longitudinal axis (11).

15. Surgical mallet according to any of the preceding Claims, characterized in that a mallet shaft (3) is fixed to the mallet head (2).

16. Surgical mallet according to any of the preceding Claims, characterized in that the recess (6) is positioned so that the centre of gravity of the mallet (1) is present approximately in the extrapolation of the longitudinal axis (12) of the mallet shaft (3).

17. Surgical mallet according to either of Claims 15 and 16, characterized in that the mallet shaft (3) is arranged out of centre on the mallet head (2).

18. Surgical mallet according to any of the preceding Claims characterized in that additional locking elements, such as, for example, spherical pressure pins or the like, for additional locking on a device (17) for insertion and/or extraction are provided in the locking chamber (9) of the mallet head (2).

19. Surgical mallet according to any of Claims 15 to 18, characterized in that the mallet shaft (3) has a handle (10), in particular a handle which is flattened on at least one side.

Application number: numéro de demande: IB04/02601

Figures: 5, 6,

Pages:

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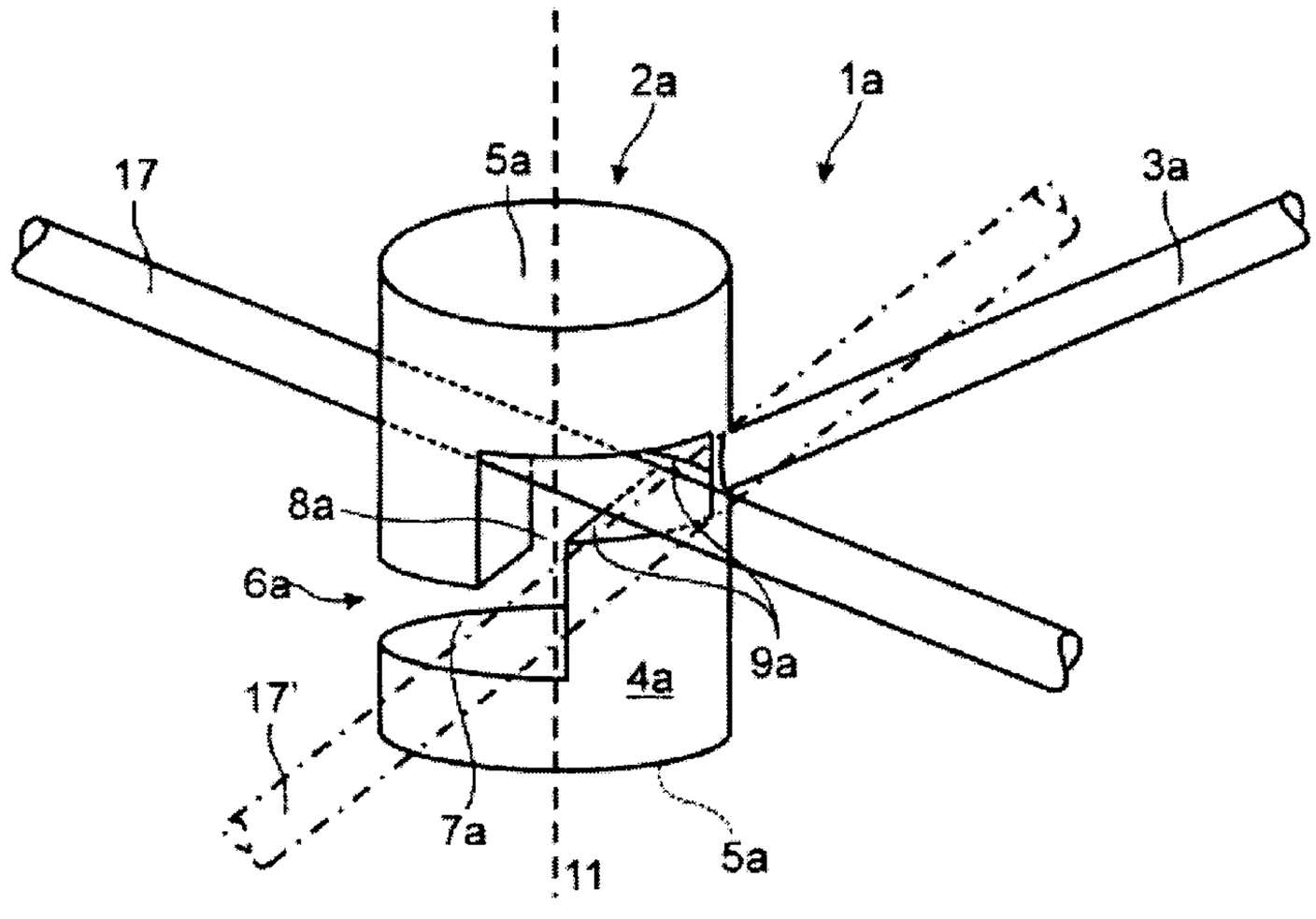


Fig.1

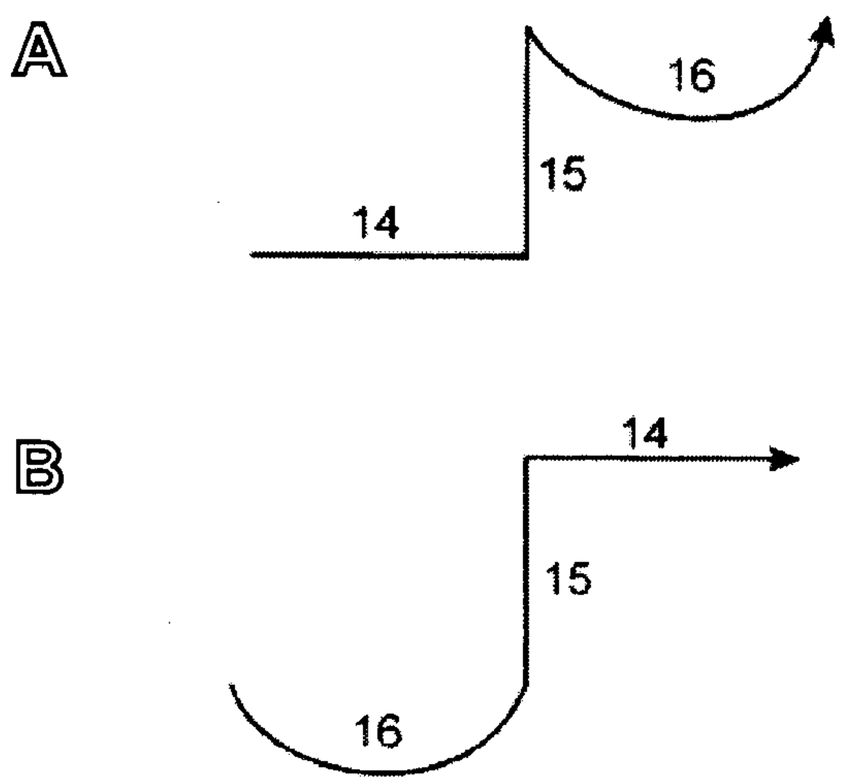
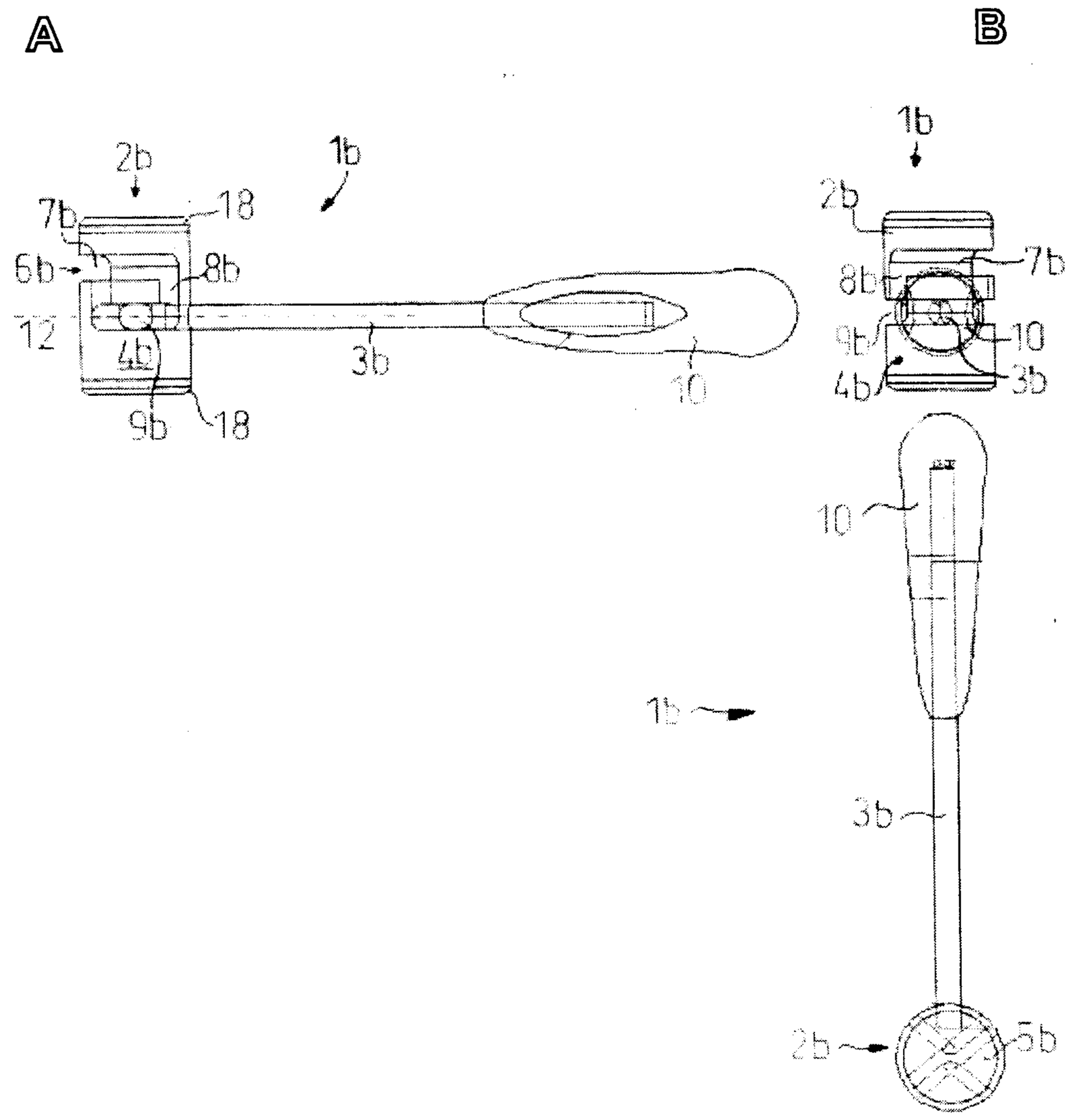


Fig.2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1b
7b
18
6b
8b
12
4b
3b
10
9b
18
B
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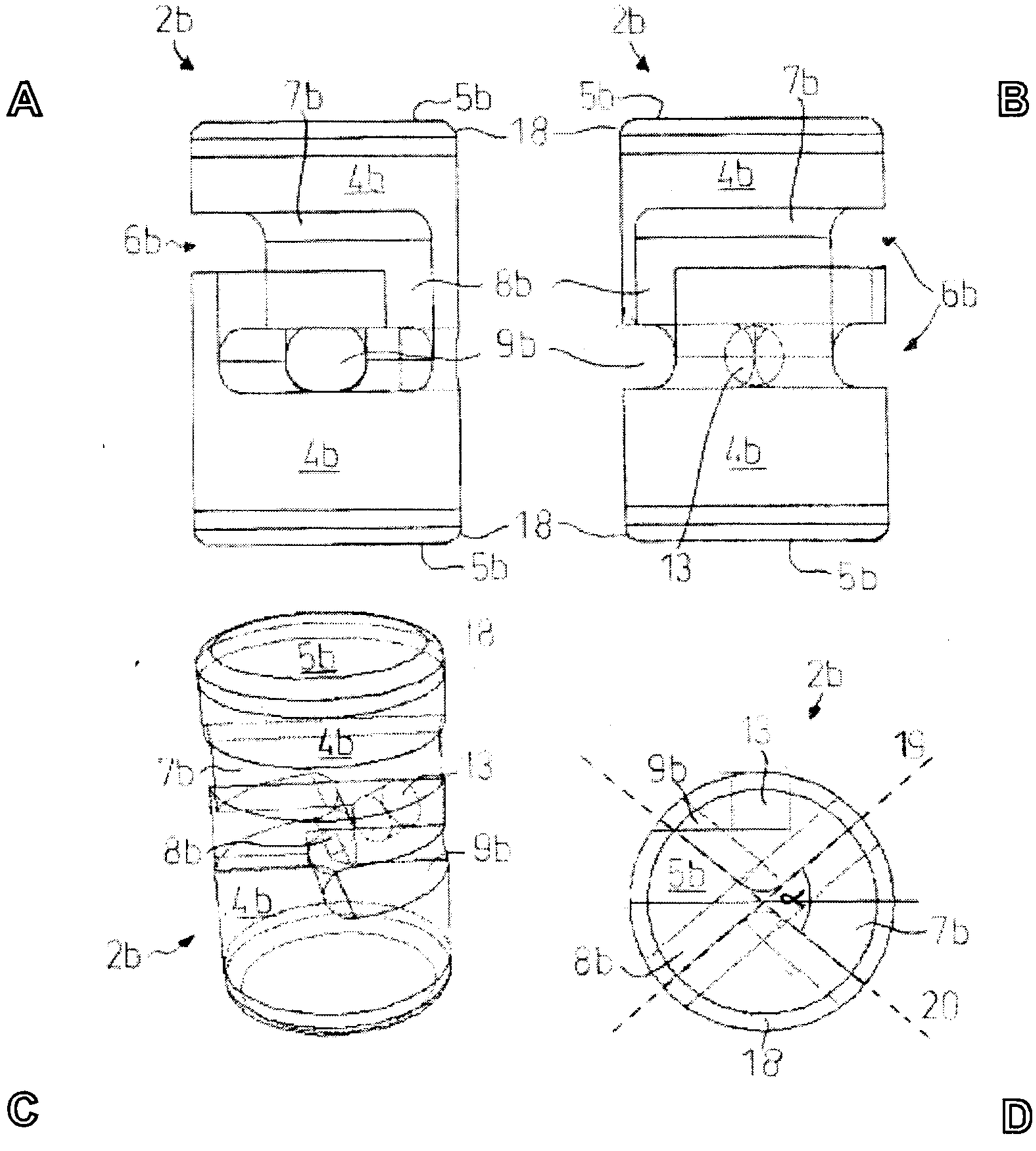
10
1b
3b
2b
5b
C

Fig.3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13
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C
18
5b
4b
7b
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19
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7b
8b
20
18

Fig.4

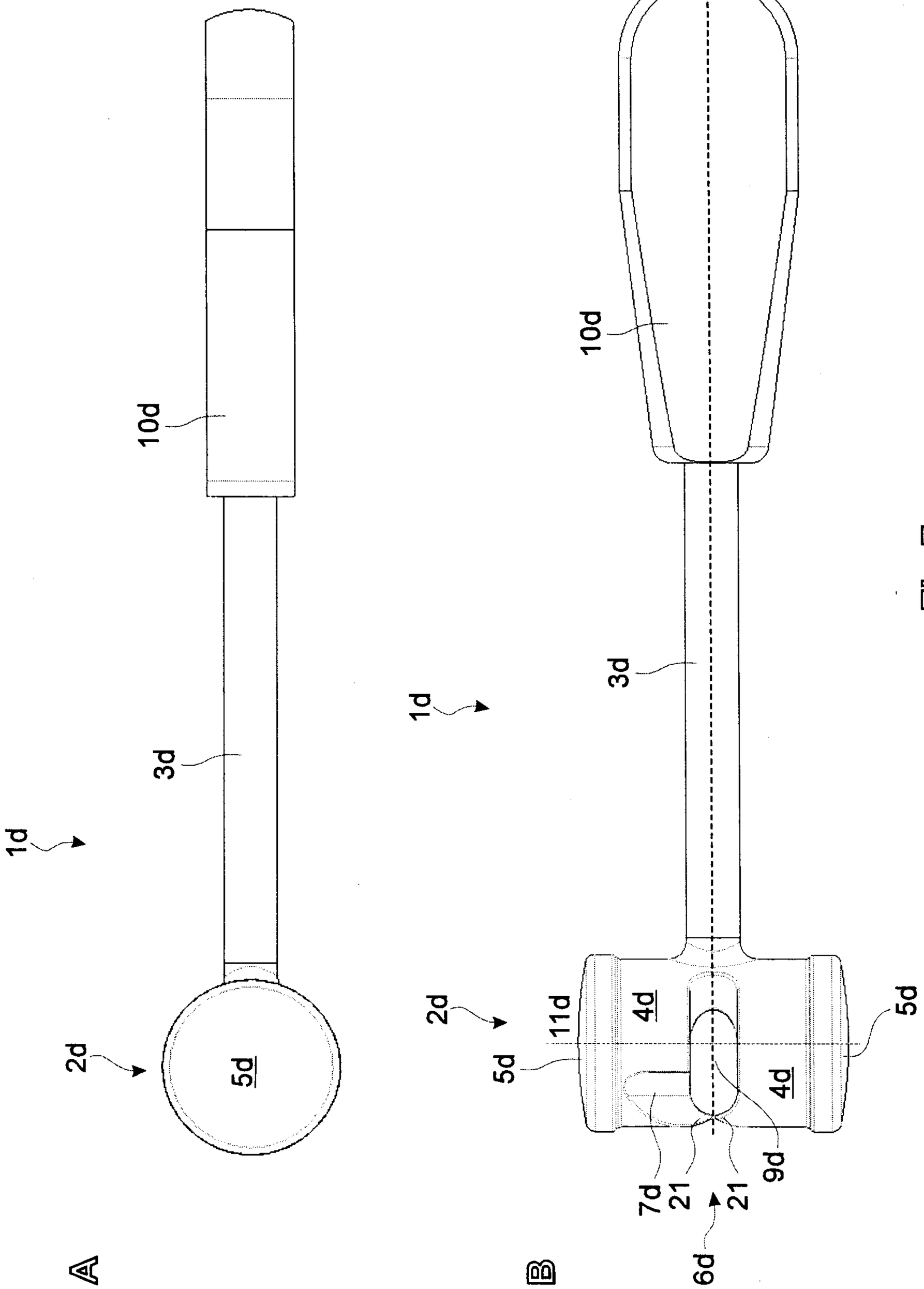
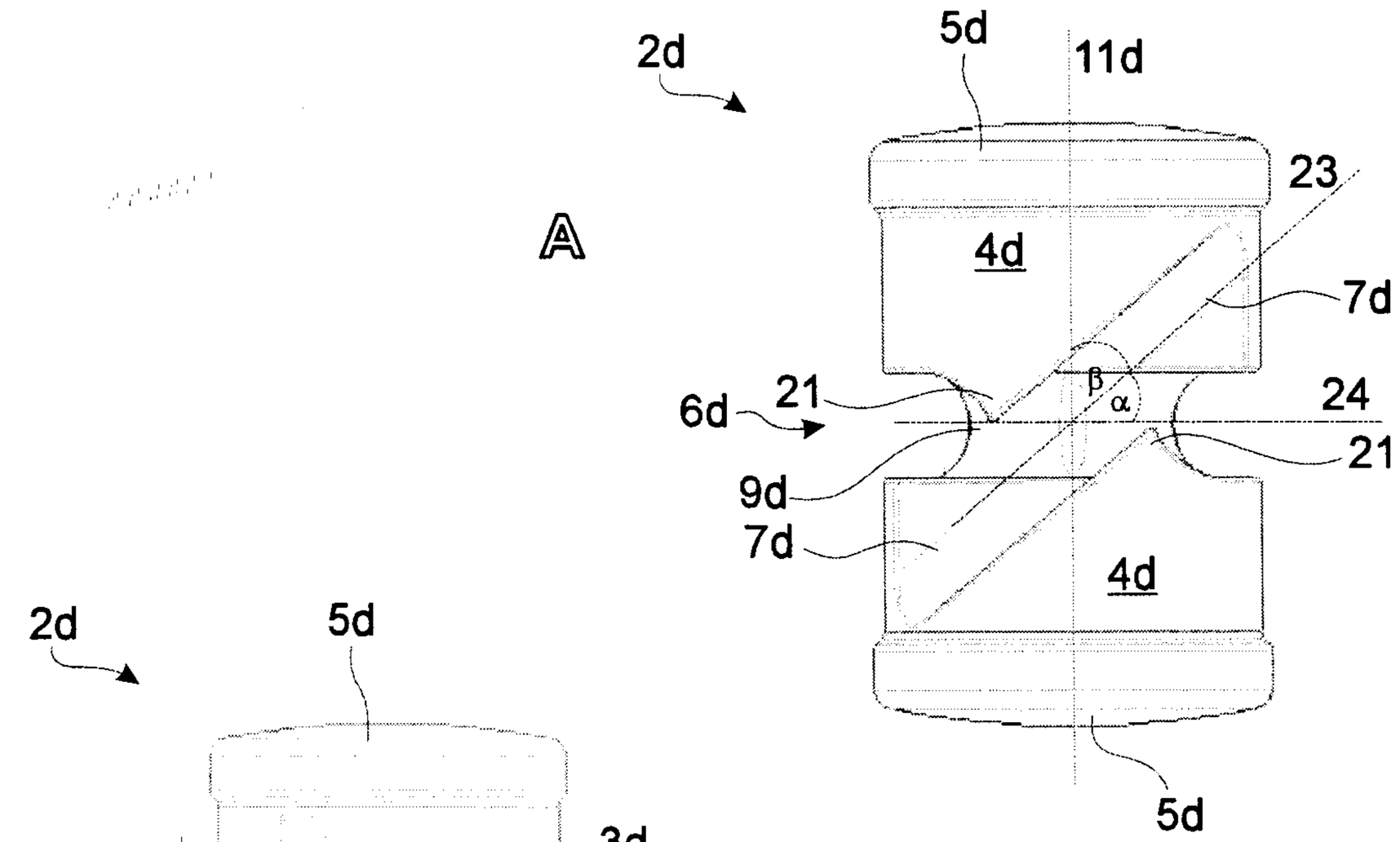


Fig.7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4d
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21
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5d
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6d
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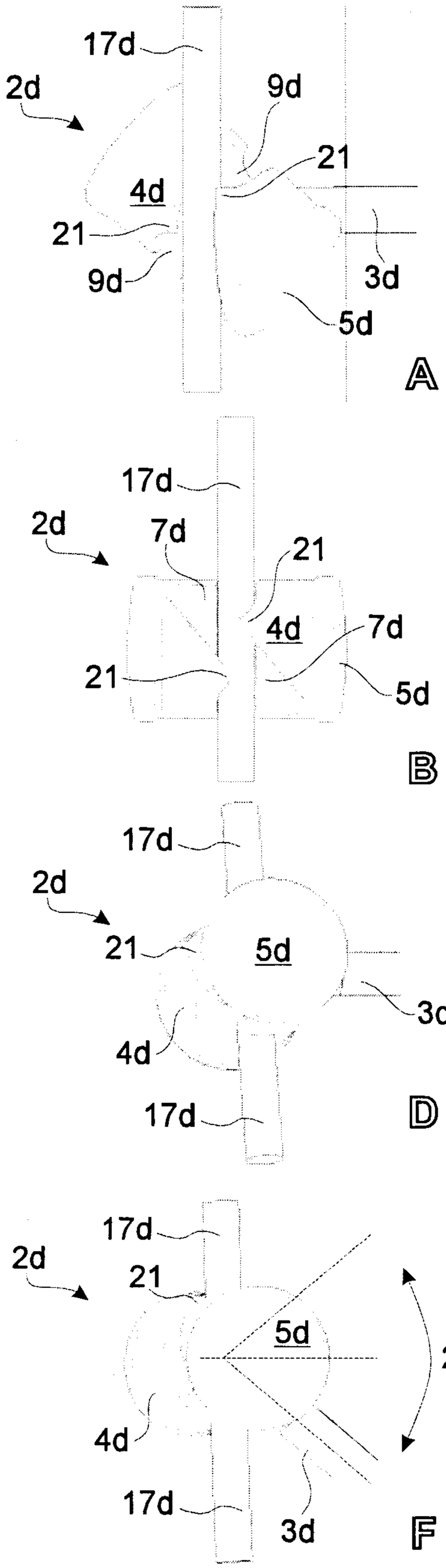
Fig.8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4d
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17d
G

Fig.9