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INSTRUMENT FOR SPIKING FRACTURED BONES

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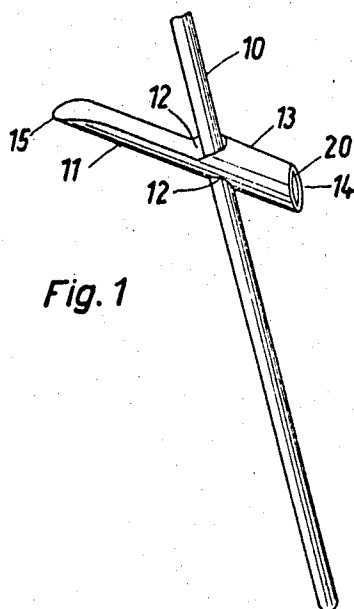


Fig. 1

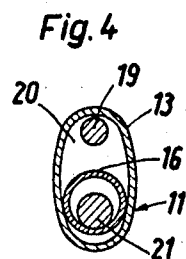


Fig. 4

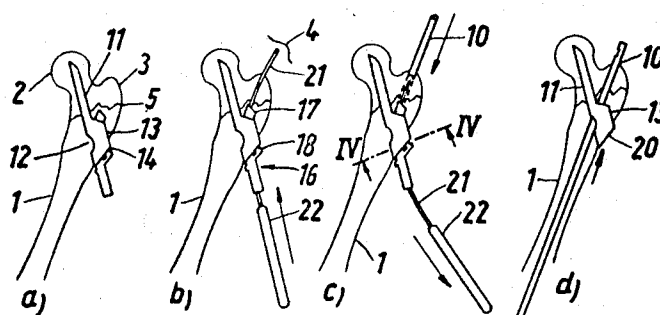


Fig. 2

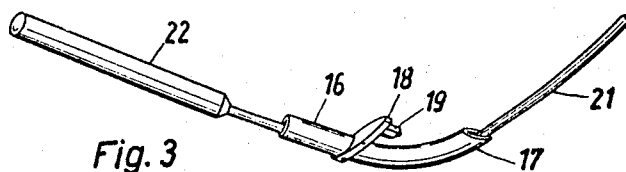


Fig. 3

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INSTRUMENT FOR SPIKING FRACTURED BONES

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2 Claims 10

ABSTRACT OF THE DISCLOSURE

An instrument for facilitating the guidance of a second surgical bone spike through a transverse opening in a previously inserted first bone spike, as required for the Y-spiking technique, comprising a rigid, hollow, longitudinally arcuate guide inserted in the hollow head of the first bone spike, and an elongated probe inserted into said guide and being directed by said guide to the skin surface at a point aligned with the transverse opening of said first spike.

The invention relates to an instrument for facilitating the spiking of fractures, especially fractures of the neck of the femur, whereby a medullary spike, nail or peg driven into the trochanter from the outside thereof intersects an opening provided in a portion of a spike for the neck of the femur which later spike has been driven into the bone before the medullary spike is being driven in. Spiking of this type is known as Y-nailing or Y-spiking.

There are known spikes for use in case of fractures of the femur in the area of the neck of the femur, i.e. so-called femoral neck spikes, which are provided with a special profile for ensuring better retainment in the bone and for providing more favourable conditions when the spike is driven in and is extracted later on.

Moreover, there are known medullary spikes for the treatment of fractures in the area of the bone stem, which spikes are driven percutaneously longitudinally through the tip of the trochanter into the medullary canal and which bridge the point of fracture in the stem on either side thereof.

It is also known for facilitating the driving of femoral neck spikes at first to advance a thin, straight guide wire from the outside of the fractured limb in the direction of spiking into the bone under observation by means of X-rays, and thereafter to drive femoral neck spikes e.g. of V-shaped lamella configuration along said guide wire in the direction of the tip thereof. After the spike has been driven in, the guide wire is removed. Further, it is also known in the so-called wire extension treatment wherein relatively thin wires of low stiffness only are inserted into the bone transversely of the bone stem, to use means which support the guide wires externally of the bone in a straight line so that the wires do not bend or kink or even break when inserting them into the bone.

For treating fractures in the area intermediate the femoral neck and the bone stem, neither femoral neck spikes nor medullary spikes alone are suitable; rather, only an assembly comprising a combination of both types of spikes is capable of providing the firm connection being necessary for the point of fracture. When applying these so-called Y-spikes, first there is driven a femoral neck spike and thereafter a medullary spike into the bone so that the latter crosses the femoral neck spike, preferably in such manner, that both spikes are firmly held relative to each other. To this end, the portion of the femoral neck spike which when the spike has been driven in, is disposed in an intermediate portion of the medullary canal, is provided

with an opening through which the medullary spike must be driven.

However, it is by no means easy to find this opening provided in the femoral neck spike with exactness or at least sufficient exactness when the medullary spike is driven in from the tip of the trochanter. To this end, under certain circumstances it on principle could be thought of using guide wires extending externally of the bone; however, this necessarily would require control by X-ray observation during insertion of the guide wire, and would result in still other difficulties. On the other hand, the requirements of the exactness with which the medullary spike must be aligned with the opening provided in the femoral neck spike, are of substantially greater importance than e.g. in the case of merely centering a medullary spike within the medullary cavity in the bone stem. That is, whereas certain directional variations of the medullary spike within the bone stem are compensated for by its transverse elasticity over its length, in case of not meeting the opening in the femoral neck spike with sufficient exactness or precision, there exists the possibility for a displacement of the fracture and/or of the femoral neck spike which might result in loosening of the connected bone portions and thus in failure of the complete spiking operation.

It is an object of the invention to avoid these disadvantages of the known methods for the Y-spiking by providing an instrument by means of which a spike probe can be advanced through the trochanter from the head end of the femoral neck spike and guided within the profile of the instrument toward the medullary spike opposite to the direction of insertion of the latter into the trochanter, until said probe comes under the skin of the injured limb, in order to enable the medullary spike to be guided exactly when it is driven in by engagement with the tip of the spike probe through the tip of the trochanter in direction of the intersecting opening provided in the femoral neck spike, whereby the spike probe is withdrawn approximately simultaneously in the same direction.

In order to ensure exact insertion of the spike probe, the instrument according to the invention mainly comprises an arcuate guide means for the spike probe which is driven into the bone from the head side of the femoral neck spike axially thereto and laterally guided through an enlargement on the head portion of the femoral neck spike, namely in such manner that the forward end of the arcuate guide extends until it reaches the intersecting opening in the femoral neck spike or even passes partially through said opening, and that its direction of guidance is exactly aligned with the intended point of spike insertion on the tip of the trochanter. Thereupon, an arcuate spike probe being adapted to the configuration of the instrument according to the invention is driven through said arcuate guide means toward the medullary spike, which spike probe effectively aligns the direction in which the medullary spike is driven in, with the intersecting opening, since its tip is held within the forward end of said medullary spike.

More particularly, the invention provides an instrument for spiking bone fractures, especially fractures of the neck of the femur, whereby a pair of spikes, such as a femoral neck spike and a medullary spike, being driven into the bone from the outside thereof, cross each other at the location of an opening provided in the one of said spikes, which is characterized by a rigid hollow arcuate guide means adapted to be inserted in axial direction into the head portion of the femoral neck spike, and a spike probe being provided with a handle and adapted to be inserted into said bone through said arcuate guide means and having approximately the same curvature as said arcuate guide means, for piercing the bone by advancing said spike probe

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to a point at least directly beneath the skin from said intersecting opening substantially opposite to the intended direction of driving said medullary spike. In such instrument, the arcuate guide means may be provided with a stop adapted to limit the length of insertion of said guide means into the bone and to ensure maintenance of the intended direction of the arc and/or may be provided with means engaging into the head portion of the femoral neck spike and adapted to ensure insertion and anchoring of the arcuate guide means within the femoral neck spike under the proper angle of rotation.

The technical advance provided with the instrument according to the invention resides in that it substantially completely avoids the disadvantages of the prior art, and particularly results from the extraordinarily great exactness with which the direction of insertion of the medullary spike can be guaranteed relative to the intersecting opening. The principle of solution according to the invention consisting of the use of an arcuate guide means within the bone and of a correspondingly arcuately shaped spike probe not only ensures facilitated guiding of a medullary spike when the latter is driven in, even without monitoring by means of X-rays, but also provides extraordinarily safe and great exactness for the reason that the arcuate guide means aligns the spike probe and, by means of the latter, aligns the medullary spike in an increasingly exact and positive manner, the more the spike approaches the intersecting opening in the femoral neck spike, since any resilient deflection of the spike probe is eliminated with decreasing free and unguided length of the probe.

The following describes one embodiment of the instrument according to the invention in connection with the accompanying drawing, wherein:

FIG. 1 is a perspective view of a so-called Y-spike comprising a femoral neck spike and a medullary spike;

FIGS. 2a to 2d are a graphic showing of the instrument according to the invention in various positions of the spike probe and of the medullary spike;

FIG. 3 is an enlarged perspective view of the spike probe and of the arcuate guide means of the instrument according to the invention; and

FIG. 4 is an enlarged cross-sectional view approximately on line IV—IV in FIG. 2c, on enlarged scale.

FIG. 1 shows a so-called Y-spike or Y-nail comprising a femoral neck spike 11 and a medullary spike 10 passing through the intersecting opening 12 of the former. The femoral neck spike 11 corresponds to the conventional types of spikes having V-shaped cross-sectional profile, and has a tubular enlargement 13 adjacent its head portion 14. The other end 15 of the femoral neck spike tapers into a tip. The medullary spike 10 passing 11 is also of already known construction.

FIGS. 2a to 2d show the upper portion of a femoral bone 1 including its articular portion 2 and trochanter 3; these views are shown diagrammatically in connection with the instrument of the invention. The femoral neck spike 11 has been driven into the femoral neck beyond the fracture 5, while the medullary spike 10 is driven in from the tip of the trochanter 3 longitudinally of the bone stem through the intersecting opening 12 aligned in the area of the medullary canal.

The instrument of the invention shown on an enlarged scale in FIG. 3 and serving for spiking bones, comprises an arcuate guide means 16 as well as a spike probe 21 having a handle 22 at the rear end thereof. The arcuate guide means 16 is formed by an arcuately bent tube, whereby the linearly extended tube axis at the forward end 17 of the arcuate guide means and the extended tube axis at the rear end thereof define an angle which most closely corresponds to a value of 180° less the angle defined between the longitudinal axis of the bone stem and the direction of insertion of the femoral neck spike 11. The spike probe 21 is arcuately shaped so as to correspond to the curvature of the arcuate guide means 16.

As shown in the figures, the arcuate guide means 16

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has such outer diameter that it may be driven from the head end 14 of the femoral neck spike 11 in the direction of the axis of the latter between the walls of the enlargement 13 of the femoral neck spike to extend some distance into the bone; that is, to such extent that its forward end 17 at least reaches the intersecting opening 12 provided in the femoral neck spike 11 or extends beyond this opening. When inserted into this position within the bone, the rear end of the arcuate guide means 16 is located within the cross-sectional area of the femoral neck spike 11 and is supported by the latter in axial alignment therewith, while the front opening of the tubular arcuate guide means 16 in the curved transitional portion is accurately directed toward the tip of the trochanter 3. Approximately in the center portion, the tubular arcuate guide means 16 has attached thereto a stop or abutment 18 which on the one hand may serve as a working abutment face when the guide means is driven into the bone 1; it also, however, provides an end stop which ensures that the arcuate guide means can be driven into the bone over an exactly predetermined distance only so that the guide opening of the front portion 17 of the arcuate guide means 16 is positively aligned with the intersecting opening 12 in the femoral neck spike 11 on the one hand, and with the tip of the trochanter on the other hand.

The spike probe 21 passed through the arcuate guide means 16 which has been driven in previously, is of such length and has such strength that its tip is capable of piercing the trochanter from the inside thereof so that it may be advanced to a point directly beneath the skin 4 of the fractured limb in order that the probe channel may be located by feeling from externally of the limb. As shown in FIGS. 3 and 4, the inner diameter of the arcuate guide means 26 preferably is somewhat greater than the diameter of the spike probe so that the curvature of the latter may be adjusted as necessary.

As mentioned before, when treating a fracture there at first is driven in, in conventional manner, a femoral neck spike 11, aligned with the axis of the femoral neck, with its tip 15 extending into the articular portion 2 of the bone 1. In contrast with the known methods, when using the instrument of the invention, passing of a medullary spike 10 through the opening 12 of the femoral neck spike 11 now can be facilitated by driving in the arcuate guide means 16 of the present instrument from the head 14 of the femoral neck spike, initially in the same direction substantially within the confines of the cross section of the femoral neck spike 11, up to the stop 18 of the guide means, so that the tube axis of the forward end 17 of the arcuate guide means 16 extends through the intersecting opening 12 of the femoral neck spike and is aligned with the tip 3 of the trochanter. Thereafter, the spike probe 21, by taking hold of the handle 22 and with corresponding movement thereof, is advanced through the arcuate guide means 16 and the tip 3 of the trochanter into a position beneath the skin surface 4. After a small incision at the point of contact of the spike probe beneath the skin (see FIG. 2b), the tip of the medullary spike is pushed over the tip of the spike probe (see FIG. 2c) and the medullary spike is driven into the medullary canal through the tip of the trochanter whereby it is guided by the front end of the spike probe, and whereby the probe is withdrawn simultaneously. After the tip of the medullary spike has substantially reached the front portion 17 of the arcuate guide means 16, the spike probe 21 is finally withdrawn from the guide means 16, whereupon the arcuate guide means itself is removed from the head portion 14 of the femoral neck spike. However, the medullary spike is now fixed in its driving direction and exactly aligned with the intersecting opening 12 in the femoral neck spike 11 in such manner that it now, if necessary after short X-ray examination, finally and positively can be driven into the medullary canal through the intersecting opening provided in the femoral neck spike.

In order to avoid rotational movement of the arcuate

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guide means also when it is passed into the femoral neck spike, which movement could result in an angular displacement out of the plane including the femoral neck spike and the medullary spike, an enlargement 13 provided on the head portion of the femoral neck spike 11 serves to laterally support the arcuate guide means 16 during insertion thereof. Besides, the stop 18 is provided with means 19, preferably in form of a pin, engaging into a recess 20 in said enlargement 13 so that additional anchoring of the arcuate guide means against angular movement relative to the bone and the femoral neck spike is provided, especially while the arcuate guide means 16 is driven in and the medullary spike 10 is guided by the spike probe 21.

It can be seen that the technical advance in comparison with the prior art, mentioned at the beginning of this specification is obtained by the construction of the instrument of the invention as described above. The construction of the invention has shown its usefulness as an indispensable aid in making Y-spikings in practical tests.

Due to the fact that the basic idea of the invention seems to be directly applicable to a number of similar treatments of bones, the preceding specification is not intended to limit the scope of the general inventive idea.

I claim:

1. An instrument for use in surgically spiking bone fractures by the Y-spiking technique in which a first bone spike is driven into the opposed parts of the fractured bone, said first bone spike having an enlarged hollow head defining a first axial opening and a second transverse opening intersecting said first opening to receive a second spike driven through said second opening at an angle to said first spike, said instrument comprising:

- (a) a rigid, hollow, longitudinally arcuate guide element adapted to be inserted in the axial direction through the head portion of said first spike so as to bring the inner open end of said guide element into alignment with the axis of said transverse opening in said first spike, and
- (b) a spike probe having a handle at one end and a

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piercing and guiding tip at the other end and being longitudinally curved at approximately the same curvature as said arcuate guide element, said spike probe being inserted in said guide element and being of such length as to pass through said guide element and thence along the axis of the transverse opening of said first bone spike and pierce the bone to a point at least directly beneath the skin and substantially lying on the axis of the transverse opening in said first spike, said guide element being provided with a stop means and an orientation configuration adapted to cooperate with said first spike to limit the distance of insertion of said guide element into the first spike and establish a proper angular orientation about the axis of said first spike,

- (c) whereby the second spike, inserted through the skin at said point, may be guided precisely to the transverse opening of said first spike by the tip of said spike probe as the latter is withdrawn through said guide element concomitantly with the advance of said second spike.

2. An instrument in accordance with claim 1, in which said orientation configuration comprises an eccentric pin on said guide element.

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U.S. Cl. X.R.

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