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(71) Applicant
Orthofix Srl

(Incorporated in Italy)

9 Via delle Nazioni, Z I, 1-37012 Bussolengo, VR, Italy

(72) Inventors
Daniele Venturini
Stefano Rossi
Giovanni Faccioli

(74) Agent and/or Address for Service
Potts, Kerr & Co
15 Hamilton Square, Birkenhead, Merseyside, L41 6BR, United Kingdom

(51) INT CL[5]
A61B 17/58

(52) UK CL (Edition L)
A5R RFB RX4

(56) Documents cited
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US 4913137 A US 4733654 A US 4667664 A

(58) Field of search
UK CL (Edition K) A5R RFB
INT CL[5] A61B 17/16 17/58

(54) Surgical apparatus for fitting, securing and removing intramedullary splints

(57) A surgical apparatus incorporates an assembly jig 2, an intramedullary splint 3 which can be removably secured to and projects from a support 4 carried by the assembly jig 2 and a template 5 carried by the assembly jig 2, together with precision coupling means of the male and female type between the splint 3 and the base of the support 4. The object is to provide a reliable and accurate external reference for the positions of the holes in the splint.

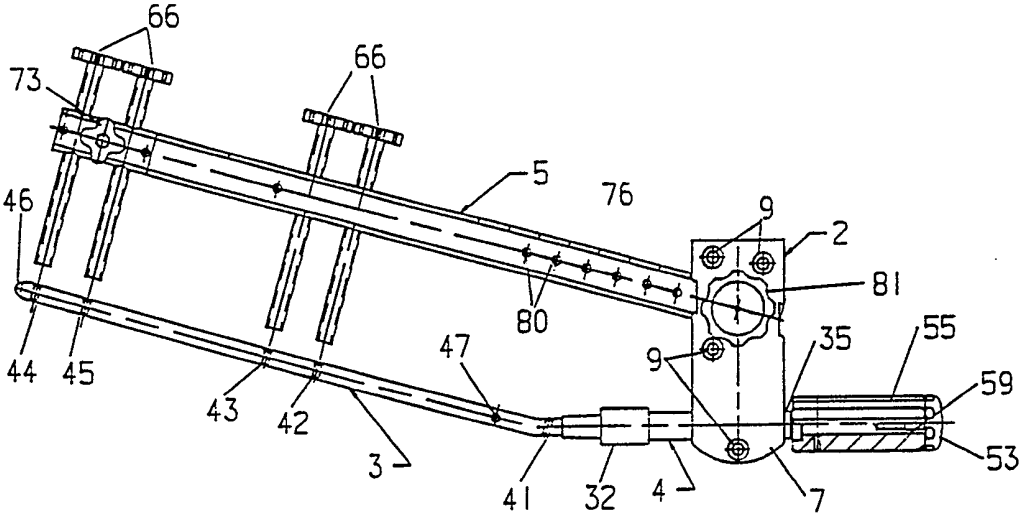


FIG. 1A

GB 2 258 154 A

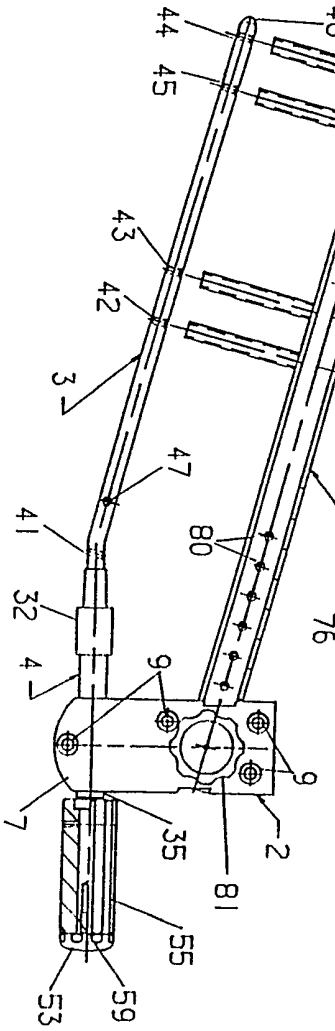


FIG. 1A

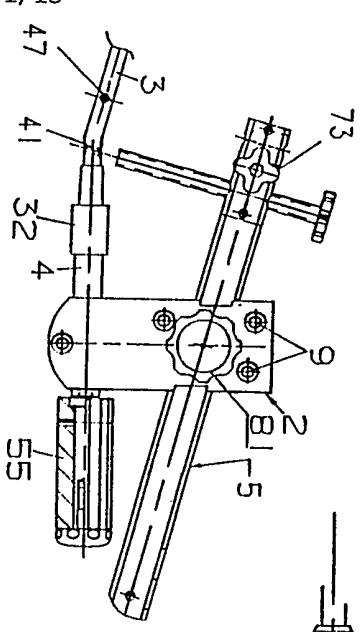


FIG. 1B

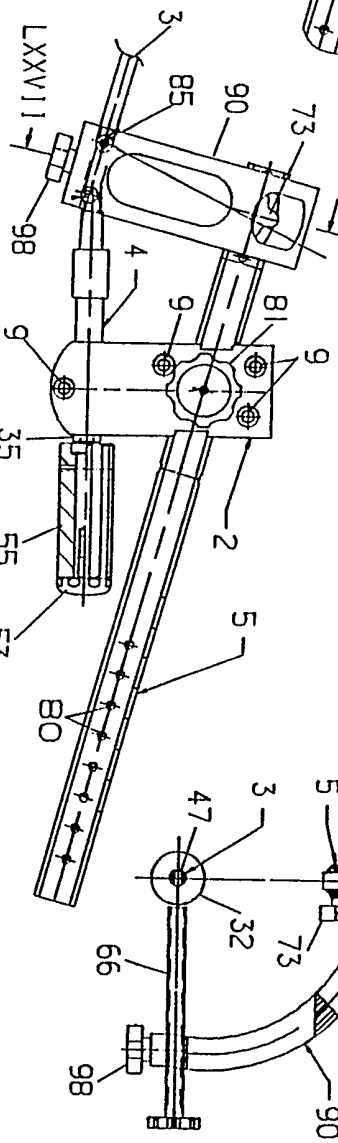


FIG. 76

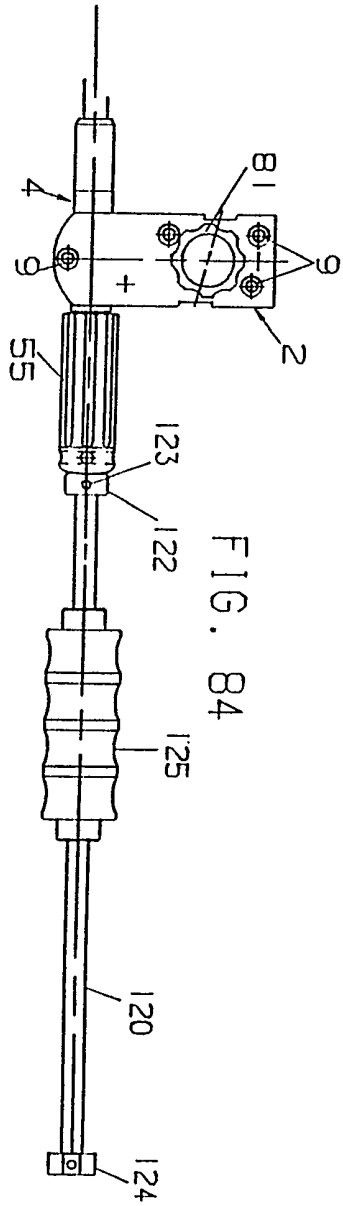


FIG. 84

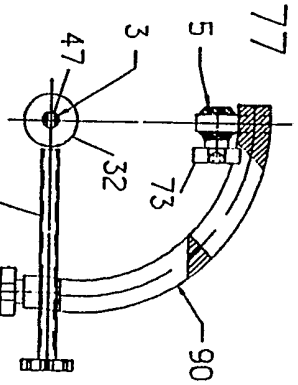


FIG. 77

FIG. 32

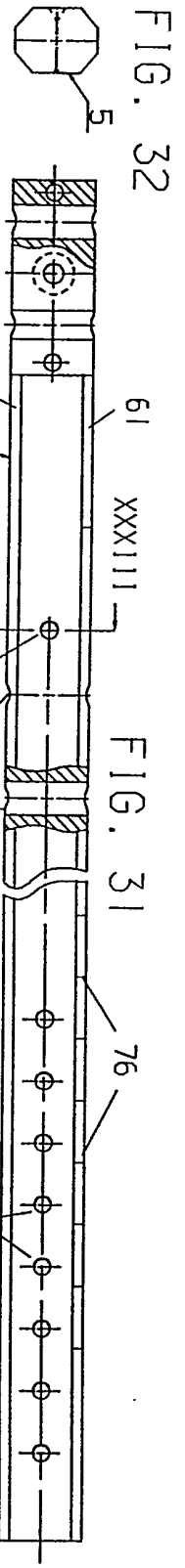


FIG. 31

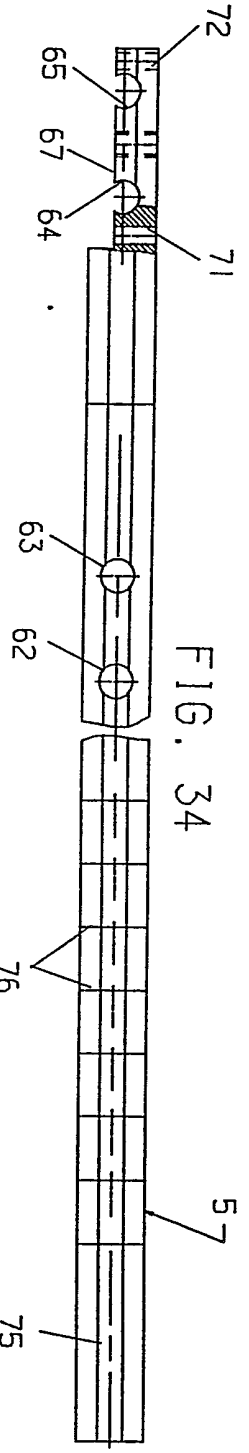


FIG. 34

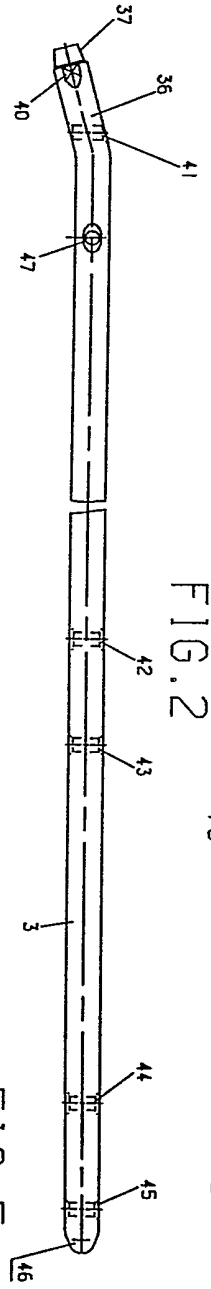
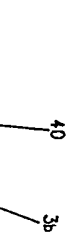


FIG. 2



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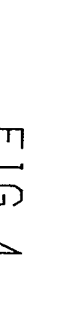


FIG. 4

FIG. 33

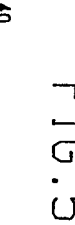


FIG. 5

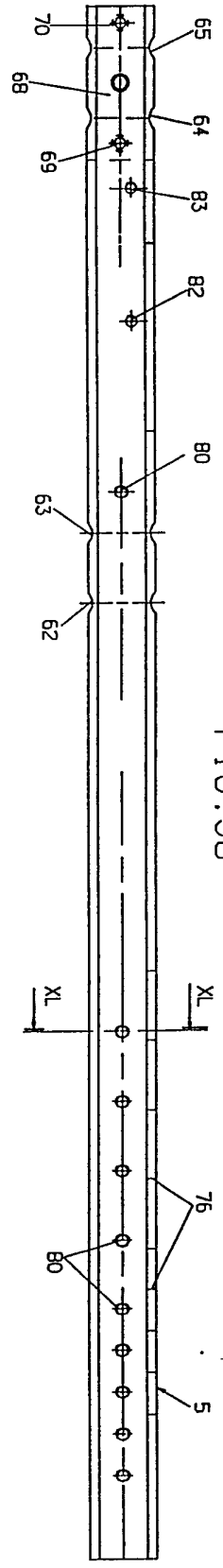
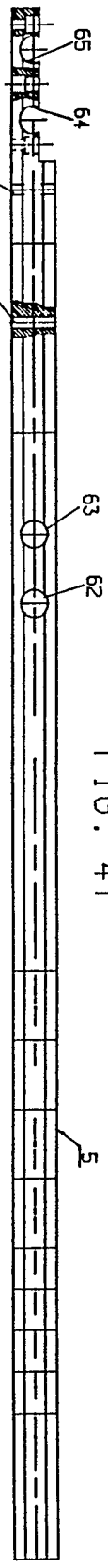


FIG. 38



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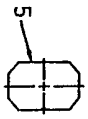


FIG. 39

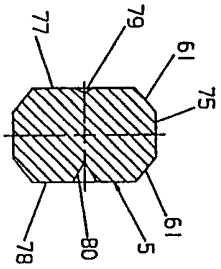


FIG. 40

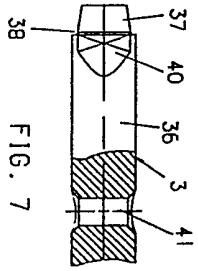


FIG. 7

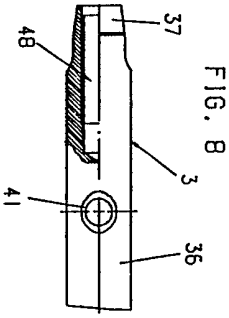


FIG. 8

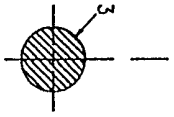


FIG. 9

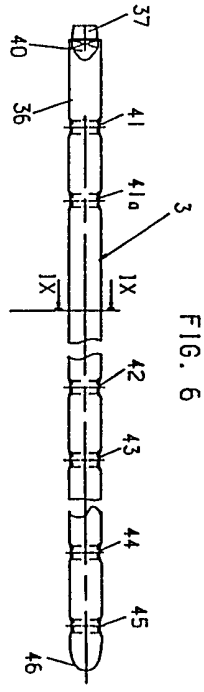


FIG. 6

FIG. 10

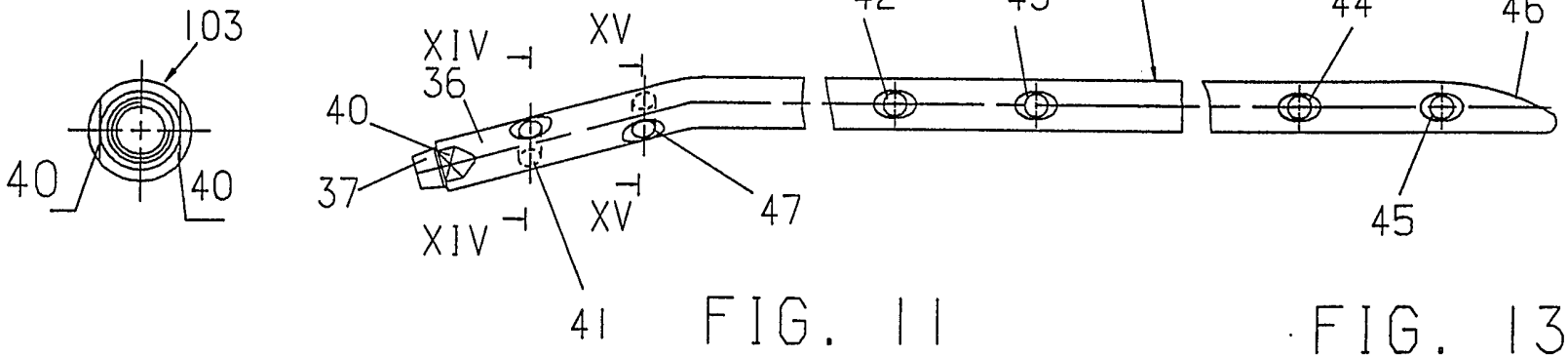
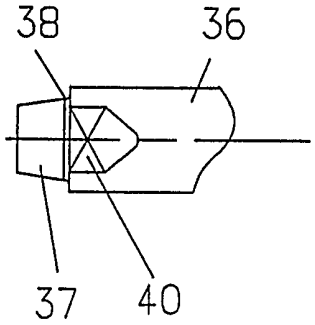
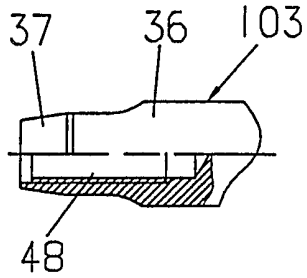


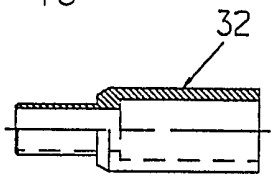
FIG. 12

FIG. 11

FIG. 13







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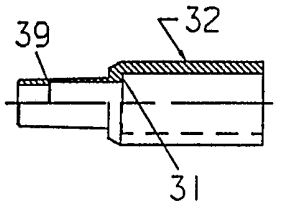


FIG. 20

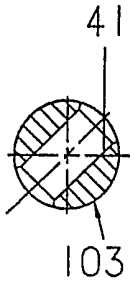
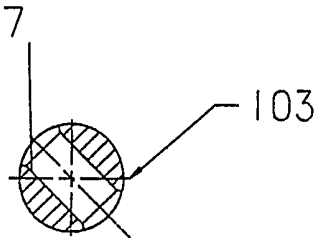


FIG. 14



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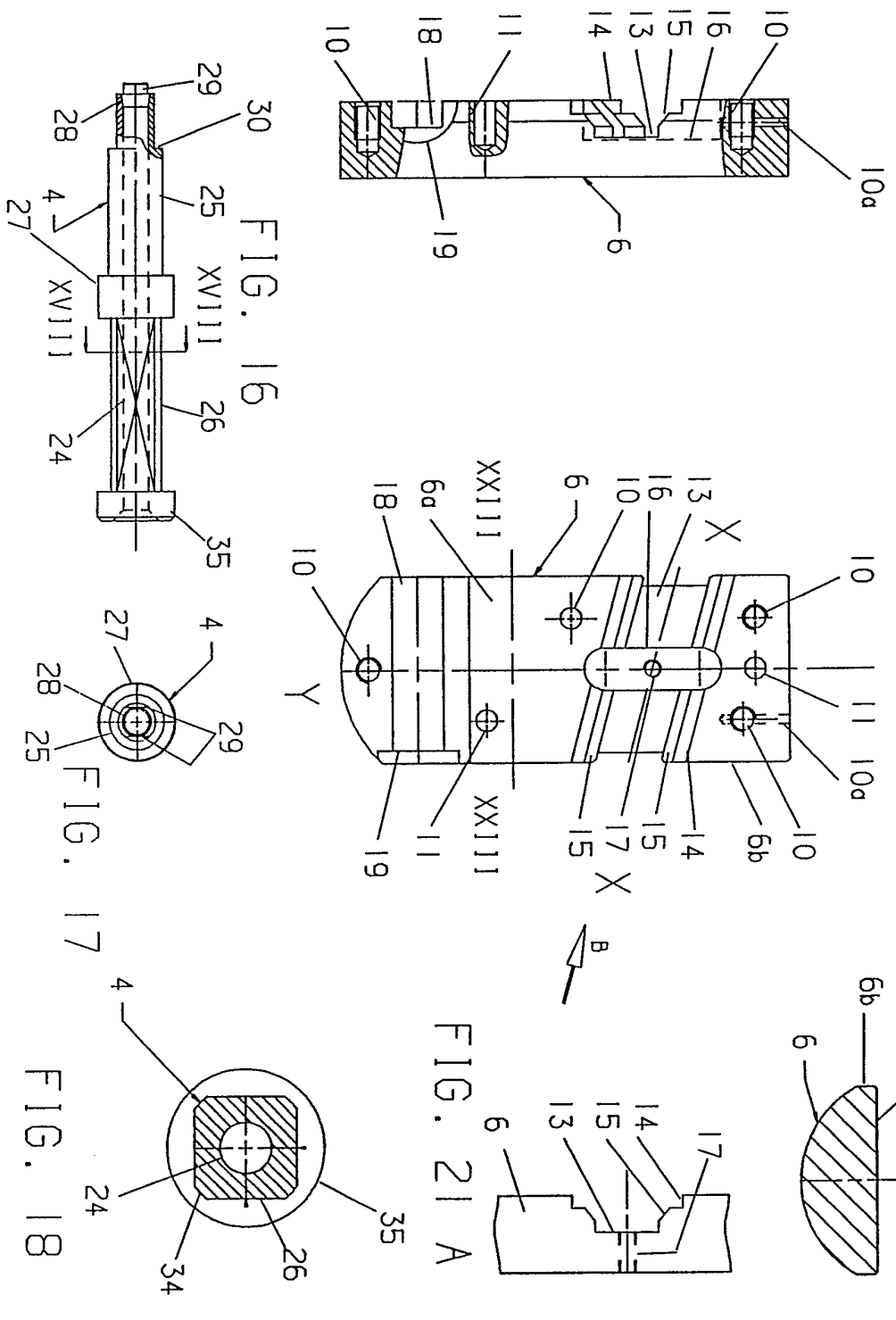

FIG. 22

FIG. 16

FIG. 17

FIG. 21

FIG. 18

FIG. 21A

FIG. 23

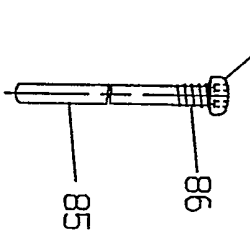

FIG. 46

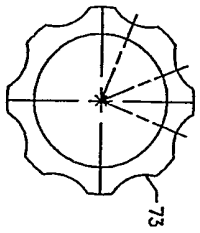

FIG. 75

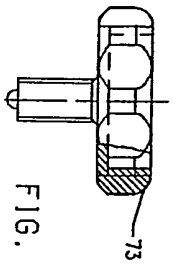

FIG. 74

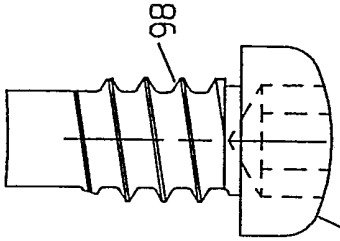

FIG. 48

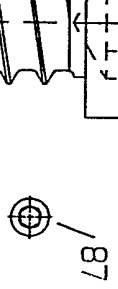

FIG. 47

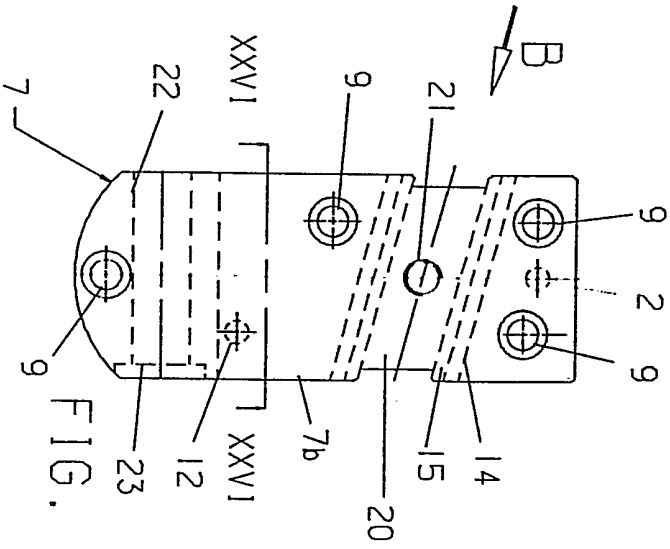

FIG. 24

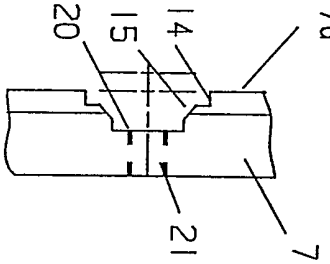

FIG. 24a

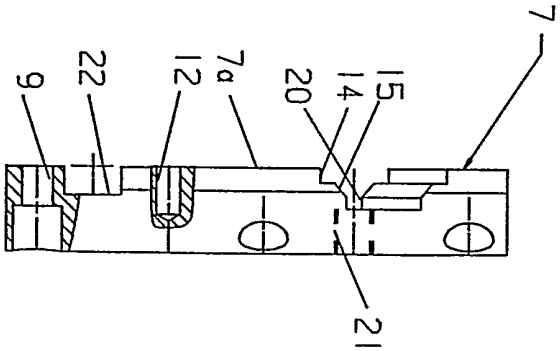

FIG. 25

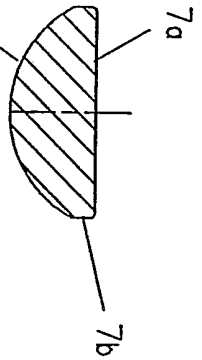

FIG. 26

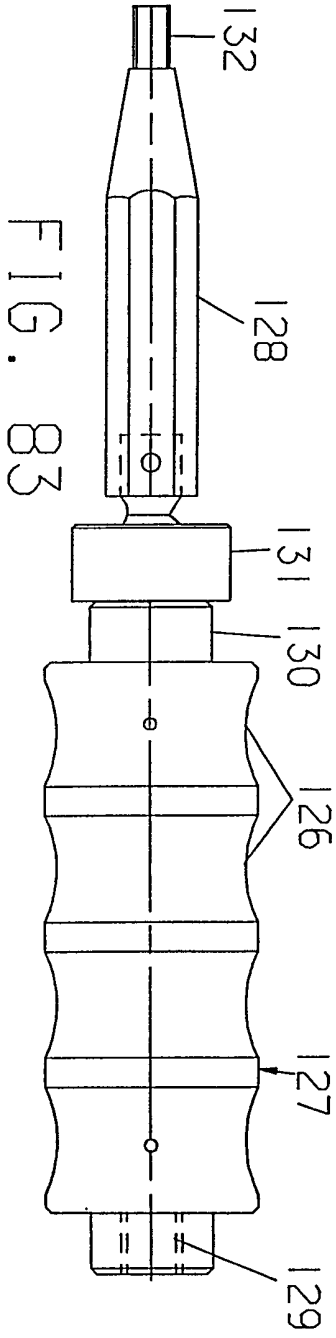

FIG. 83

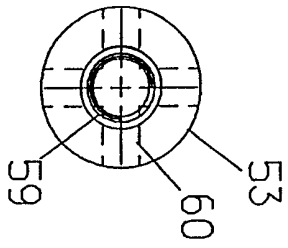

FIG. 28

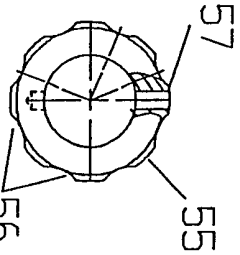

FIG. 30

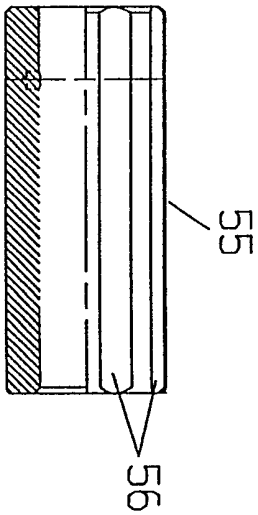

FIG. 29

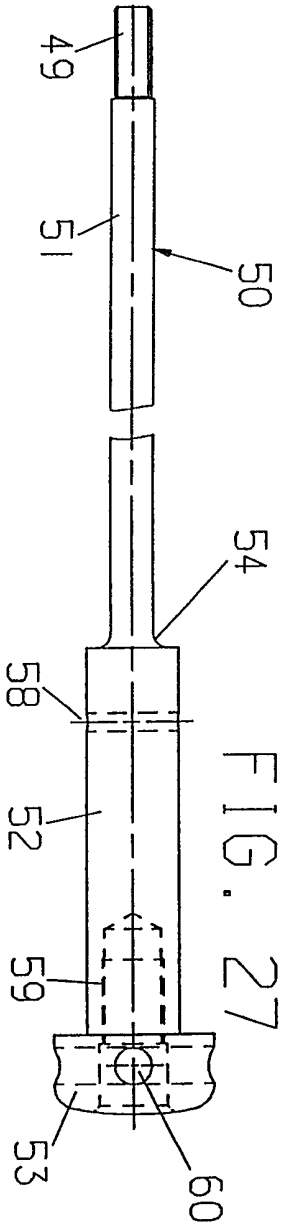

FIG. 27

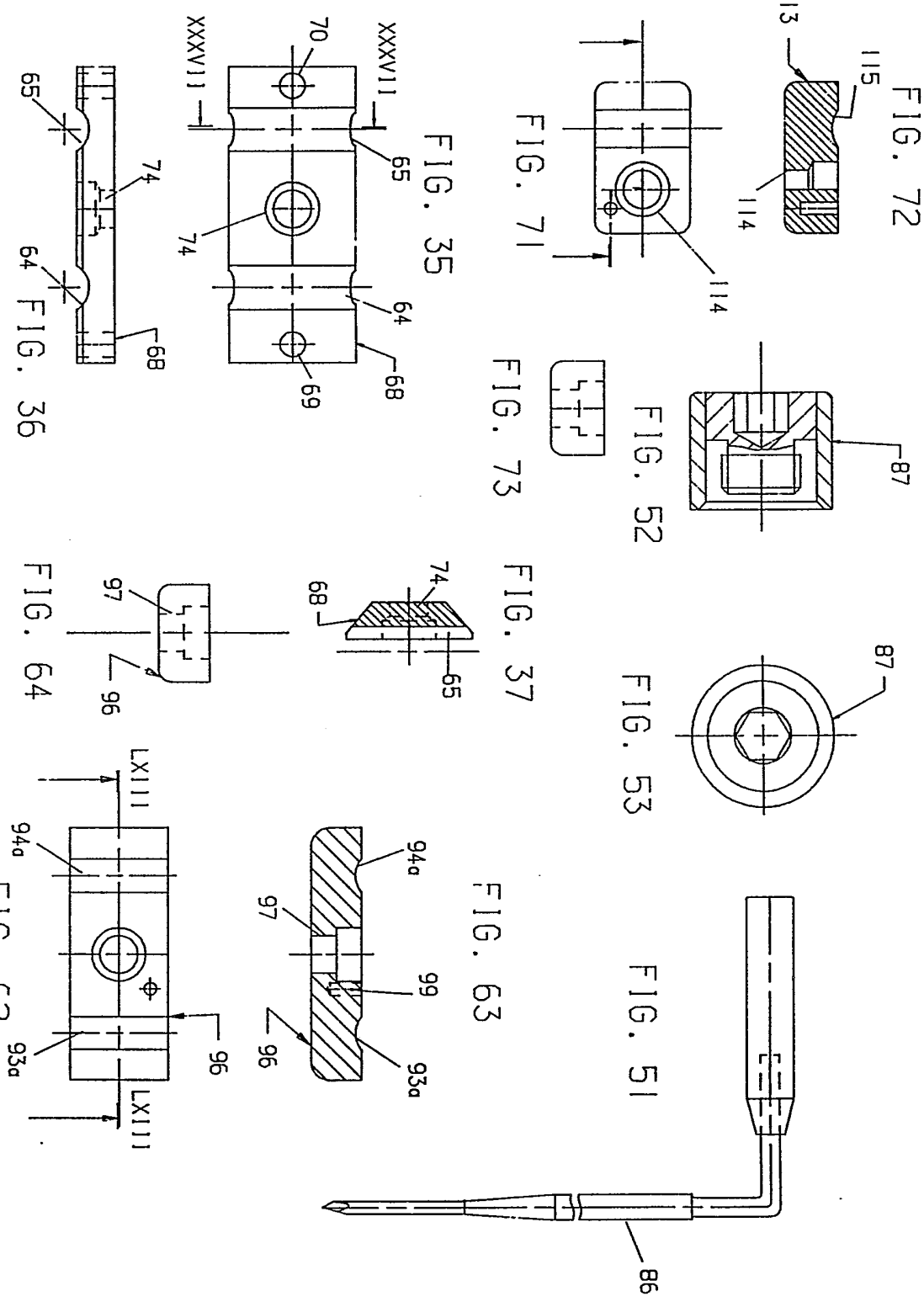
FIG. 72
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FIG. 71
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FIG. 35
XXXVII
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FIG. 62
LXIII
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93a
LXIII

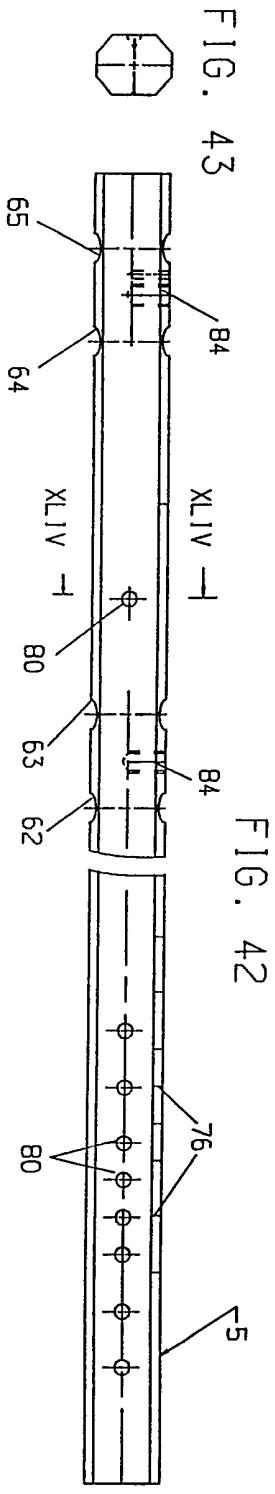


FIG. 42

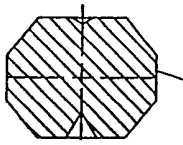


FIG. 44

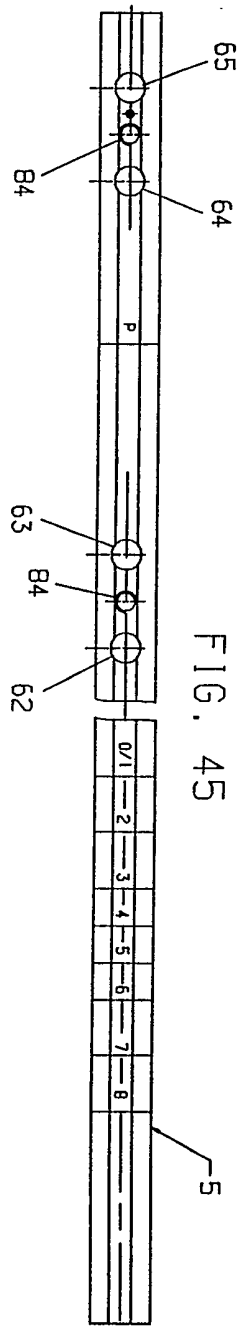


FIG. 45

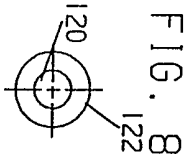


FIG. 81

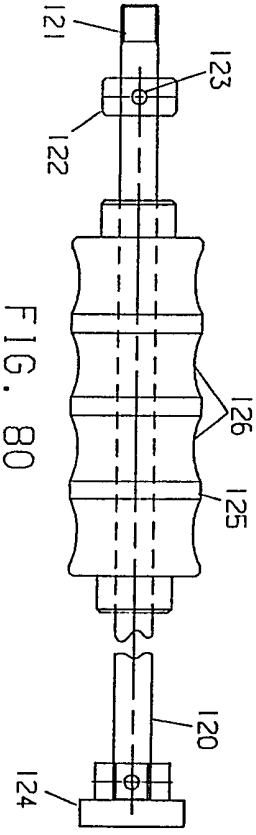


FIG. 80

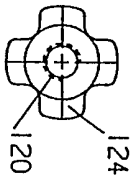


FIG. 82

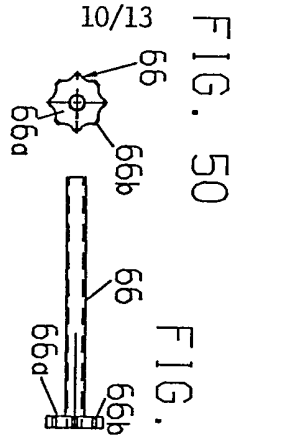


FIG. 50

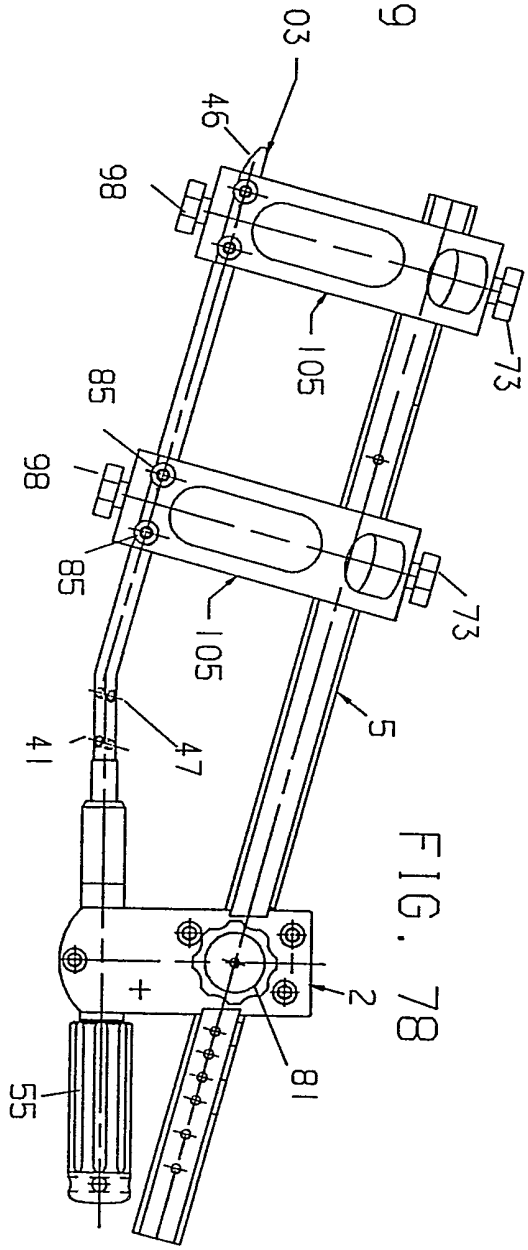


FIG. 49

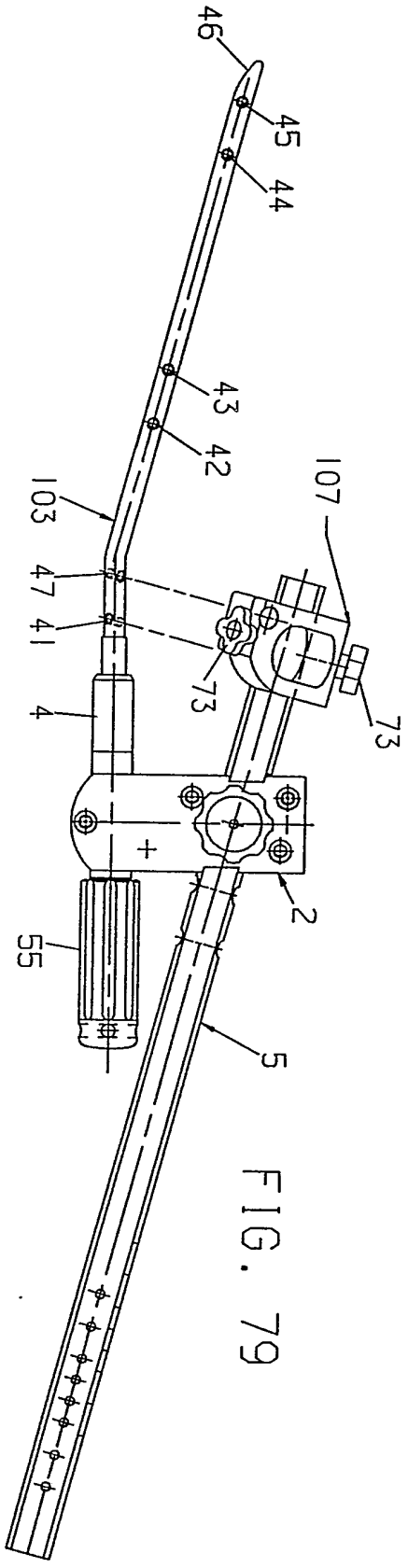
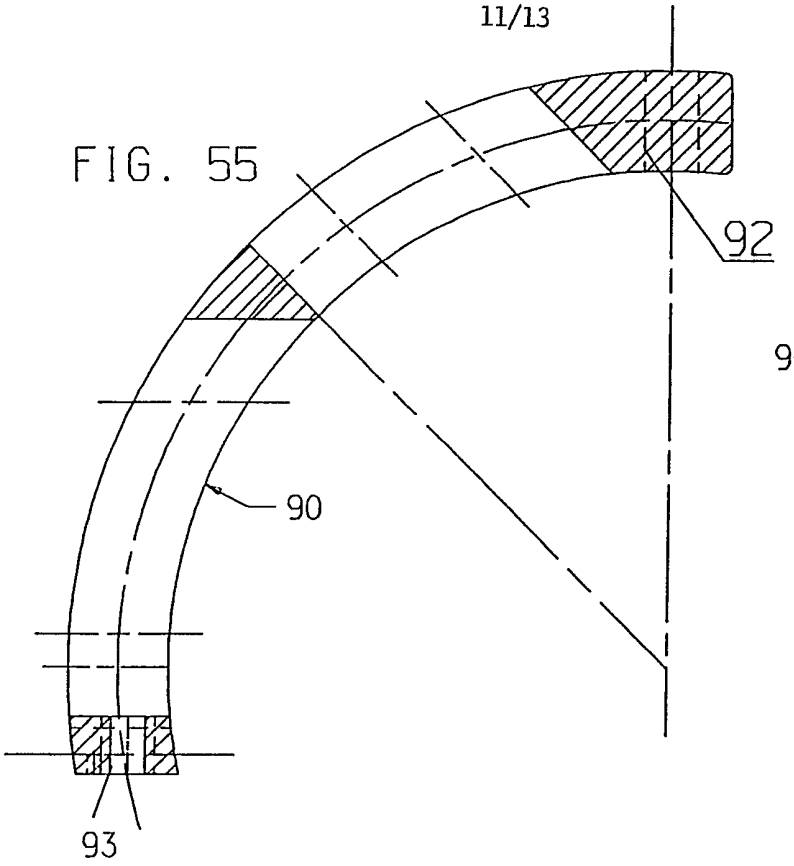


FIG. 78

FIG. 79

FIG. 55



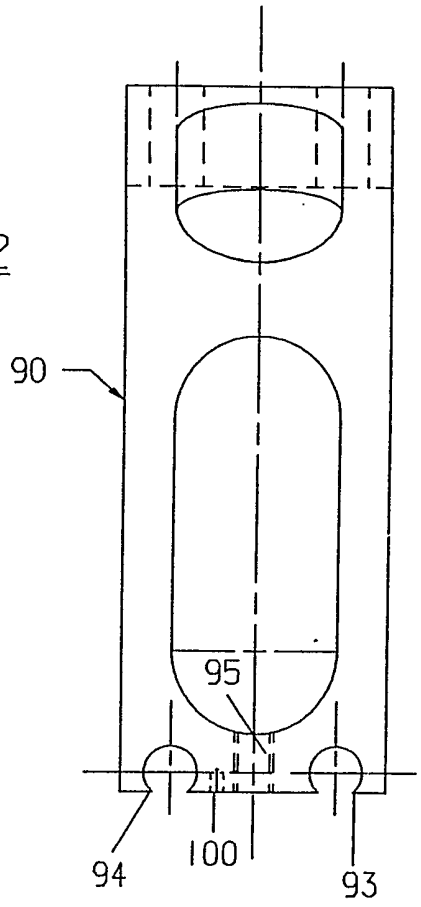


FIG. 56

FIG. 54

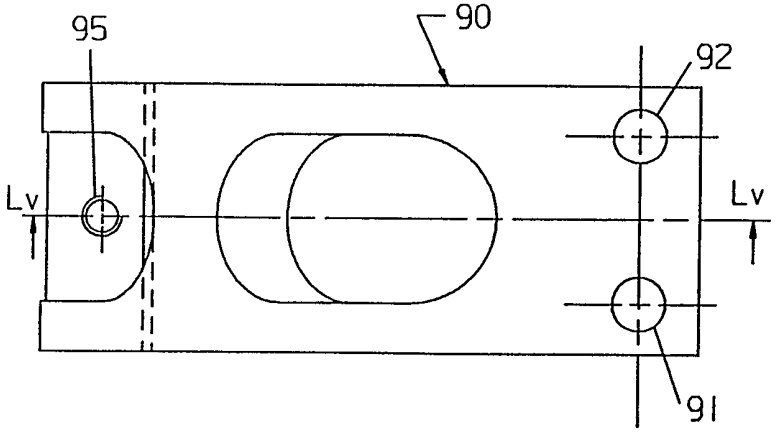
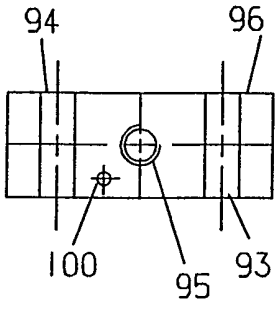


FIG. 57



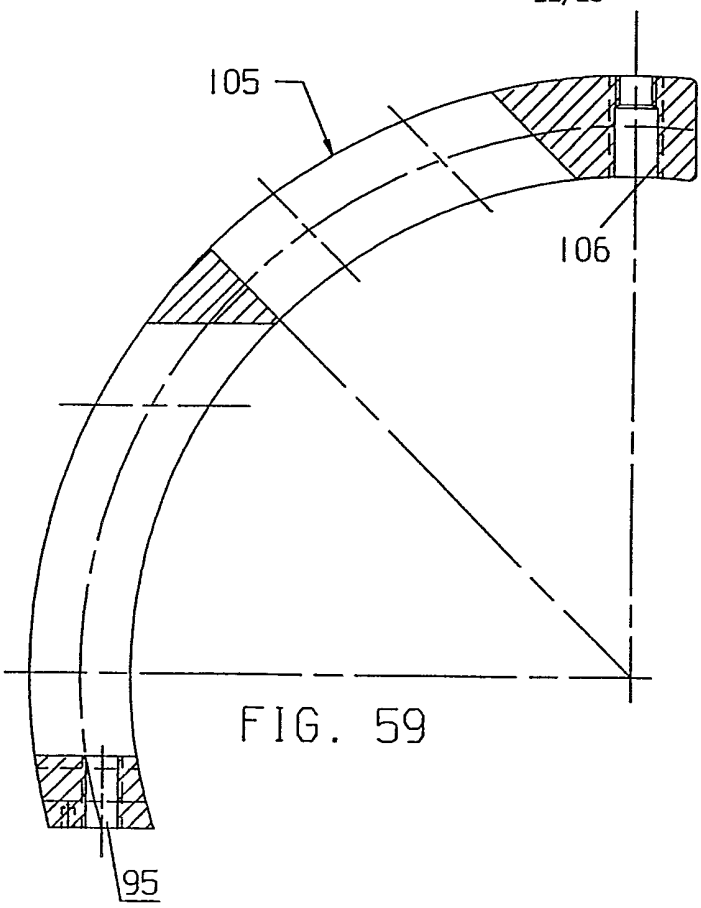


FIG. 59

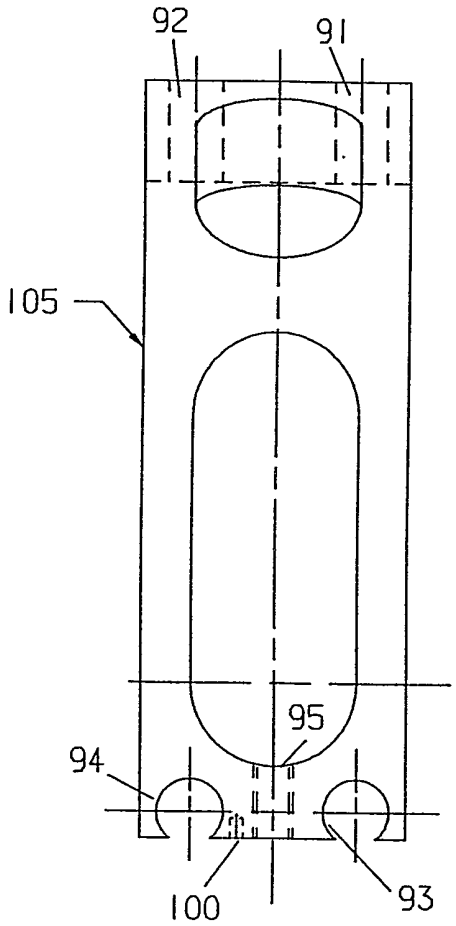


FIG. 60

FIG. 58

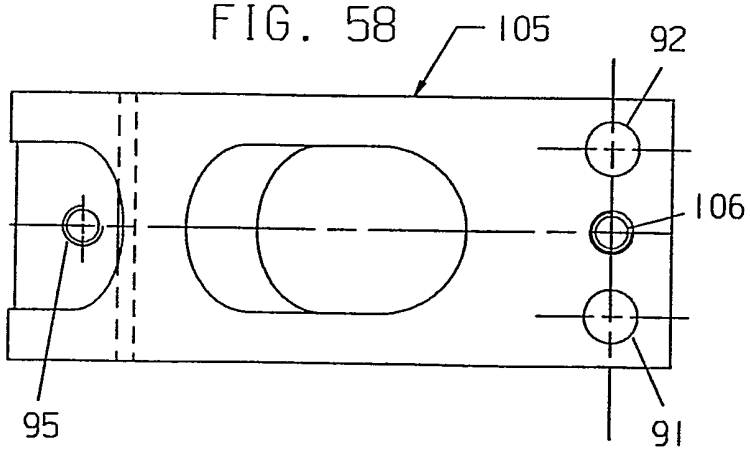


FIG. 61

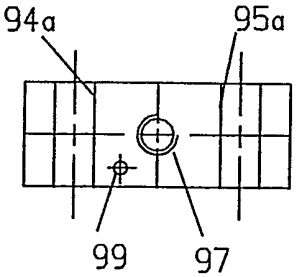


FIG. 69

FIG. 70

FIG. 65

FIG. 66

FIG. 67

FIG. 68

"SURGICAL APPARATUS FOR FITTING, SECURING AND REMOVING INTRAMEDULLARY SPLINTS"

This invention relates to surgical apparatus for fitting intramedullary splints and securing them in place with bone screws or pins, particularly for the treatment and cure of fractures of the long bones, such as the femur, tibia, humerus, fibula and the like.

Various types of apparatus for securing intramedullary splints in place along and between two or more consecutive portions of bones affected by a fracture by means of bone pins or screws which can be located transversely to and extend through both the bone and the intramedullary splint have already been proposed. For this purpose the intramedullary splint has two or more spaced holes or pairs of holes which in use lie against the fracture and in line with which the surgeon, after having fitted the splint, must cut the muscular part of the affected limb transversely and drill the bone through precisely opposite the holes in the splint so that the required number of bone screws or pins to secure the splint can subsequently be inserted.

Determination of the point or points where the muscle has to be penetrated and the bone has to be drilled precisely opposite the holes provided in the intramedullary splint already in situ is a critical operation and is generally performed with the help of X-rays. This is however rather risky because it means that the patient and the personnel tending him will suffer the consequences, which are well known to be harmful to health, associated with repeated and prolonged exposure to X-rays, even which, under the best circumstances of operating technique, in practice

require an average time of the order of a few minutes for each pin.

An object of this invention is to at least minimise the abovementioned disadvantages.

Another object of this invention is to provide a surgical apparatus which is capable of providing a reliable and accurate external reference for the positions of the holes provided in an intramedullary splint implanted in a fractured bone which is undergoing treatment so that the splint when fitted can be quickly fixed in position by the insertion in one reliable operation of transverse bone screws or pins which pass through both the bone and the splint without having recourse to any other means or auxiliary technique to see through or otherwise expose the working area.

Another object of this invention is to provide a surgical apparatus of high accuracy and reliability which is easy to handle by the surgeon and is of relatively simple construction.

According to the present invention there is provided a surgical apparatus having an assembly jig, an intramedullary splint which is removably secured to and projects from the assembly jig and a template borne by the assembly jig, which is characterised in that it comprises means for accurate attachment between the splint and the supporting base.

Advantageously, the accurate means of attachment comprise a first male and female taper coupling between the tang of the splint and means of attachment fixed to the assembly jig for accurate

attachment of the splint to the assembly jig and an interlocking coupling between at least one machined portion of the tang and a corresponding internal portion of the fixed means of attachment to prevent rotation and/or inclination of the splint.

The present invention will be further illustrated by way of example, with reference to the accompanying drawings, in which:

Figs. 1A and 1B are plan views of an instrument for a humerus with a template bearing two distal and two central bone pins or screws respectively and one posterior proximal bone pin or screw.

Fig. 2 is a plan view of an intramedullary splint for a humerus;

Fig. 3 is a partial view which illustrates on an enlarged scale the attachment tang for quickly attaching the splint of Fig.2 to a support;

Fig. 4 is a partial view in half cross-section of the attachment tang of Fig. 3 rotated through 90° about its own longitudinal axis;

Fig. 5 is a lateral view of Fig. 3 seen from the left;

Fig. 6 is a plan view of an intramedullary splint for a femur;

Fig. 7 is a partial view with parts in cross-section on an enlarged scale of the attachment tang of the splint of Fig. 6;

Fig. 8 is a view with parts in cross-section of the tang of Fig. 7 rotated through 90° about its own longitudinal axis;

Fig. 9 is a transverse cross-section along the line IX-IX of Fig. 6;

Fig. 10 is a plan view of an intramedullary splint for a tibia;

Fig. 11 is a partial view on an enlarged scale of the attachment tang for the splint of Fig. 10;

Fig. 12 is a lateral view of Fig. 11 from the left;

Fig. 13 is a view half in cross-section of the splint of Fig. 11, but rotated through 90° about its own longitudinal axis;

Figs. 14 and 15 are transverse cross-sections respectively along the lines XIV-XIV and XV-XV of Fig. 10;

Fig. 16 shows a splint support with parts removed;

Fig. 17 is a lateral view of the splint support of Fig. 16;

Fig. 18 is a view in cross-section along the line XVII-XVII of Fig. 16;

Figs. 19 and 20 show, half in view and half in cross-section, of reinforcing and stabilising bushes

for the support for a splint for a tibia and humerus respectively;

Fig. 21 is a plan view of the base of the hand grip or connecting body for the apparatus of Fig. 1;

Fig. 21A is a view taken along arrow B of Fig. 21;

Fig. 22 is a lateral view of the base of Fig. 21;

Fig. 23 is a transverse cross-section taken along the line XXII-XXII of Fig. 9;

Fig. 24 is a plan view of the cover for the hand grip or connecting body of Fig. 21;

Fig. 24A is a view taken along arrow B of Fig. 24;

Fig. 25 is a lateral view of the cover of Fig. 24;

Fig. 26 is a transverse cross-section taken along the line XXVI-XXVI of Fig. 24;

Fig. 27 shows a tie rod securing the splint through the support;

Fig. 28 is lateral view of the tie rod of Fig. 27;

Fig. 29 shows half in view and half in cross-section a grip for the tie rod of Figs. 27 and 28;

Fig. 30 is a lateral view of the grip of Fig. 17;

Fig. 31 is a plan view with parts in cross-section of a template or reference rod for the humerus for the apparatus of Fig. 1;

Fig. 32 is a lateral view of Fig. 31;

Fig. 33 is a transverse cross-section taken along the line XXXIII-XXXIII of Fig. 31;

Fig. 34 is a view of the template of Fig. 31 rotated through 90° about its own longitudinal axis;

Fig. 35 is an elevational view of a fastening for a humerus template;

Fig. 36 is a view of the fastening of Fig. 35 from above;

Fig. 37 is a view in transverse cross-section taken along the line XXXVII-XXXVII of Fig. 35;

Fig. 38 is a plan view of a template and a reference rod for a femur;

Fig. 39 is a lateral view of the template of Fig. 35;

Fig. 40 is a transverse cross-section taken along the line XL-XL of Fig. 35;

Fig. 41 shows the template of Fig. 38 rotated by 90° around its own longitudinal axis;

Fig. 42 shows a template or reference rod for a tibia;

Fig. 43 is a lateral view of the template of Fig. 42;

Fig. 44 is a transverse cross-section taken along the line XLIV-XLIV of Fig. 42;

Fig. 45 shows the template of Fig. 42 rotated through 90° about its own longitudinal axis;

Figs. 46 and 47 are a view in elevation and a view in plan respectively of a securing pin or dowel for a tibia;

Figs. 49 and 50 are a view in elevation and in plan respectively of a pin guide;

Fig.51 illustrates a punch for a tibia with a handle;

Fig. 52 is a view in longitudinal cross-section of a threaded protective plug for a splint for a tibia-humerus when fitted;

Fig. 53 is a lateral view of the plug of Fig. 52;

Fig. 54 is a plan view of an arched support which can be anchored to and projects from the template for a humerus;

Fig. 55 is a section taken along the line LV-LV of Fig. 54;

Fig. 56 is a lateral view of the arched support of Fig. 55;

Fig. 57 is a front view of the lower end of the support of Fig. 56;

Fig. 58 and 61 are similar views to those in Figs. 54 to 57 illustrating an arched support which can be secured to and projects from the template for a tibia;

Figs. 62,63,64 show a view in plan, elevation and longitudinal cross-section and a lateral view respectively of a tightening cover for a projecting support for a humerus;

Fig. 65 is a view from above of an arched support which is secured centrally to a template for a tibia;

Fig. 66 is a view in cross-section taken along the line LXVI-LXVI of Fig. 65;

Fig. 67 is a lateral view of the support of Fig. 66 from the left;

Figs. 68,69 and 70 are views along arrows A,B and C respectively;

Figs. 71,72 and 73 illustrate a plan view, elevation view and longitudinal cross section and a lateral view respectively of a right hand fastening for the 45° support of Figs. 62 to 67;

Figs. 74 and 75 are a view in elevation with parts in cross-section and a view from above respectively of a securing screw with a grip;

Fig. 76 is a plan view of an apparatus according to the invention provided with an arched support secured to and projecting from the template for a humerus in a position corresponding to the anterior proximal pin;

Fig. 77 is a view in cross-section taken along the line LXXVII-LXXVII of Fig. 76.

Fig. 78 is a plan view of an apparatus for a tibia fitted with two arched supports at 90°, one in the distal position and the other in the central position;

Fig. 79 is a view similar to that in Fig. 78, but of an apparatus for the tibia fitted with an arched support secured centrally and located in a proximal position;

Fig. 80 illustrates a percussion hammer slide rod;

Fig. 81 is a front view of a percussion ring which can be attached to the rod of Fig. 80;

Fig. 82 is a front view of a terminal stop grip which can be fixed to the rod of Fig. 80;

Fig. 83 is a side view of a striking hammer; and

Fig. 84 schematically illustrates an apparatus according to the invention fitted with a percussion hammer for inserting or removing intramedullary splints.

In the drawings, identical or similar parts or components are identified by means of the same reference numerals.

The apparatus for a humerus illustrated in Figs. 1A,1B,2 to 5, 16,17,18,20 to 37, 46 to 50, 52 to 57, 68 to 77 and 80 to 84 comprises a load-bearing member formed of an assembly jig 2, an intramedullary splint 3 for a humerus which can be removably secured to and projects from a support 4 carried by assembly jig 2 and a template 5 which is also carried by assembly jig 2 so as to lie at a distance from splint 3 but substantially parallel thereto.

The assembly jig in Fig. 2 is formed of a base 6 (Figs. 1A, 1B and 21 to 26) and a cover 7 which can be removably fixed to base 6, for example by means of four fixing pins 8 which pass through corresponding holes 9 in the cover and screw into an equal number of threaded holes 10 made in the base. Holes 9 advantageously have two diameters to house the head of pin 8 as well. Two holes, 11 and 12 respectively, for two pins, not shown, are also provided in base 6 and cover 7.

If desired a small head hole 10a (Figs. 21 and 22) which takes a securing pin, which is not shown, may be provided transversely to at least one threaded hole 10.

On the side 6a of base 6 which is to receive cover 7, there is a transverse recess 13 having stepped side 14 and smooth sides 15 which are complementary to the configuration of the template in order to provide a good shape-interlock with template 5 as will be described below. Recess 13 is straight and extends along an inclined axis x-x', e.g. at 75° with respect to the longitudinal axis y-y of the base. A longitudinal lightening recess 16 with rounded ends, which extends in the direction of axis y-y beyond the width of sides 14 of the recess is provided some half way down recess 13. A threaded through hole 17 is provided at the centre of recess 16.

Adjacent the distal end of recess 13 there is a milled recess 18 having three flat walls which extend perpendicular to axis y-y and one widened bored-out end 19 of semi-circular cross-section opposite a lateral face 6b of the base 6.

Face 7a of cover 7, which is intended to oppose face 6a of the base 6, in turn has a straight transverse recess 20 complementary to recess 13 which is designed to encompass therewith a space to receive template 5 in a slideable manner and has an identical but slightly larger perimeter than the template itself. Recess 20 therefore extends along an axis z-z which is in practice parallel to axis x-x and inclined at 75° with respect to the longitudinal axis w-w of the cover having stepped sides 14 and smooth sides 15. A through threaded hole 21 is provided at the centre of recess 20.

Near the end of the cover 7 away from recess 20 there is a milled recess 22 with three flat walls complementing and coextensive with recess 18 made in

the base and extending perpendicular to axis w-w. Recess 22 is provided with a bored-out widened end 23 of semi-circular cross-section facing a lateral side 7b in the cover 7.

In use, recesses 18 and 22 bound a transverse through hole of substantially square, or in any event polygonal, cross-section which is designed to receive a supporting length 4 for the splint which is illustrated in greater detail in Figs. 16 to 18. Support 4 in fact comprises a sleeve with an axial hole 24 and is externally subdivided into two lengths 25 and 26 separated by an annular step or enlargement 27.

Length 25 may be externally turned and its free end has an internal conical or excavated space 28 from which a pair of diametrically opposing projections 29 having a flat inside face project. The terminal portion of length 25 advantageously has a reduction in its external diameter bounding a shoulder 30 which is designed to act as a stop against an internal shoulder 31 in a reinforcing bush 32 illustrated in Fig. 20 which can be fitted onto the stub end as will be described below.

Length 26 has a cross-section with a polygonal external profile similar to the transverse space defined by recesses 18 and 22 within which it is designed to be housed and may, for example, have a square transverse cross-section with bevelled angled 34 so that when inserted in jig 2 it cannot rotate. Length 26 is also provided with an enlarged rounded terminal head 35 which is designed to seat partially in openings 19 and 23.

Support 4 is designed to engage the tang 36 of splint 3 of special stainless steel which may be at an angle of approximately 15° with respect to the tang itself (see in particular Figs. 2 to 5).

Tang 36 has a free frustoconical end 37 which is designed to be removably engaged with the internal tapering space 28 in sleeve 4 so as to centre the splint with respect to supporting base 2 and bounds an annular shoulder 38 which is designed to abut against an internal shoulder 39 in bush 32 placed on support sleeve 4. Two diametrically opposed lateral flats 40 capable of abutting against a corresponding projection 29 from support or sleeve 4 are provided adjacent to shoulder 38 to prevent the splint from rotating or slipping with respect to support 4 as it is inserted into the medulla of a bone. Of course other means of interlocking, for example mortices and tenons, which ensure that a predetermined angular orientation is maintained between the splints and the sleeve may be provided instead of the flats.

Splints 3 may have one or two proximal through holes 41 and 41a (Fig. 6) in the tang, possibly a pair of intermediate through holes 42 and 43, and a pair of distal through holes 44 and 45, i.e. closer to the round-tipped tapering point 46 of the splint itself. Holes 41 to 45 are generously countersunk, for example at 120°, at both ends and their axes lie in the same diametral plane perpendicular to both tang 76 and the straight body of the splint.

In the case of the humerus splint, through hole 47, again with countersunk ends, but directed perpendicularly with respect to the axis of the other

holes (41-45), is provided between proximal hole 41 and intermediate hole 42.

Tang 36 of the various splints also has a blind threaded axial hole 48 which extends for a certain length from frustoconical end 37 without reaching transverse hole 41 (Figs. 4 and 5).

The threaded tip 49 of a tie rod 50 (Figs. 27 to 30), which incorporates a thin turned length 51 ending at tip 49 and a length 52 having a larger diameter with an enlarged head 53, is designed to screw into hole 48. A shoulder 54 remains between length 51 and 52 and this is designed to abut against the head 35 of support 4 when length 51 is rotatably inserted into axial hole 26 to engage splint 3 and fix it in position.

A grip 55, which may have external longitudinal ribs 56 to aid manipulation of the instrument, is attached to tie rod 50, for example by means of a fixed pin (not shown). The fixed pin may be capable of insertion into a radial hole 57 (Fig. 30) which corresponds to a diametral through hole 58 provided in length 52 of the tie rod.

If desired, a threaded axial hole 59 which also partly extends into length 52 and a through transverse hole 60 may be provided in the vicinity of head 53 for the attachment of an accessory as will be explained below.

Rotation of grip 55 in one direction causes end 49 of the tie rod to be screwed into hole 48 in the splint which is thus very accurately firmly fixed in position as a result of the tapering coupling between

the tang and the support and remains supported by an projecting from assembly jig 2, while rotating it in the other direction causes it to be unscrewed and thus release the splint from apparatus 1.

Template 5, which is illustrated in greater detail in Figs. 31, 37, can be inserted into the receiving space bounded by recesses 13 and 20 provided in the base and cover of jig 2. Template 5 may advantageously consist of a straight bar of high strength light aluminium alloy, for example oxidised "anticorodal" alloy, and have a substantial rectangular cross-section with bevelled angles 61 which slidably engage bevels 15 in recesses 13 and 20. Two pairs of through transverse holes are provided along the template, i.e. intermediate holes 62 and 63 and terminal holes 64 and 65, all aligned in the same median longitudinal plane, into which the same number of guide pins 66 may be inserted (Figs. 1A, 49 and 50). Holes 64 and 65 are in part located opposite a longitudinally split terminal length 67 and in part opposite a catch or cover 68 (Figs. 35 to 37). The latter can be fixed in position by means of two pins (not shown) which can be fixed to cover 68 in corresponding through holes 69 and 70 which extend perpendicular to partial holes 64 and 65 and are designed to be inserted into corresponding holes 71 and 72 provided in the template, or may be forced into holes 71 and 72 of the template and be inserted into holes 69 and 7 in the cover, together with a screw clamp 73 (Fig. 1A) which passes through a central hole with two diameters 74 provided in the cover.

From intermediate holes 72, 63 and in the direction of the unsplit end the upper face 75 of the template may advantageously bear a reference scale with

transverse marking lines 76 which can also extend into bevelled area 61 adjacent to face 75.

Lateral sides 77 and 78 of the template each have a plurality of nicks 79 and 80 respectively which are uniformly spaced apart to releasably engage a corresponding ball (not shown) which is spring-loaded and which can be seated in hole 17 of the base and hole 21 of the cover respectively thrust and held in position by a grip 81 (Figs. 1A, 74 and 75) which can be screwed into hole 21 to provide fixed reference points for the positioning of the template with respect to the base.

Figs. 33 to 41 illustrate a template for a femur which is identical to that for the humerus except that the marking lines 76 and nicks 79 and 80 are laid out on a different scale. Two through holes 82,83 perpendicular thereto are also provided between pairs of holes 63 and 64.

The template for a tibia illustrated in Figs. 42 to 44 bears a different reference scale and a blind threaded hole 84 is provided between each pair of holes 62, 63 and 64, 65.

Figs. 46 to 48 illustrate a securing pin 85 for tibia whose shank is partially threaded at 86 with a tapering thread in the proximity of fixing head 87.

Fixing pin 85 can be inserted into a hollow pin guide 66 which can in turn be inserted into a corresponding hole 62 - 65 in the template. A pin guide 66 may have an enlarged head 66a with notches 66b to aid manual holding (Figs. 49 and 50). A punch 86

which acts as a drilling tool may also be inserted through pin guide 66 before a pin is inserted.

Figs. 52 and 53 show a threaded plug 87 which can be inserted into the tang of splint 3 once it has been fitted into the bone which has to be adjusted in order to prevent the growth of connecting tissue upon it which might create problems with separation when the splint is removed after the bone has mended.

An external projection or projecting arched member 90 (Figs. 54 to 57, 76 and 77) may also be mounted on humerus template 5, and one end of that projection may have radial attachment holes 91 and 92 which can be caused to engage holes 64 and 65 respectively of template 5 for fixing it in position on the template by means of screw clamp 73 while the other end has two radial holes 93 and 94 and an intermediate threaded front hole 95. Holes 93 and 94 are open and can be supplemented by means of a front plate or cover 96 (Figs. 62 to 64) having two transverse recesses 94a and 93a supplementing holes 93 and 94, a central threaded hole 97 for attachment to grip 98 (Fig. 77) by means of a bolt in the vicinity of hole 95 in member 90, and a blind hole 99 for inserting a guide pin (not shown) which is also intended to be partly inserted into a corresponding blind hole 100 provided in the front of member 90.

As illustrated in Figs. 76 and 77, arched member 90 is used to insert a proximal pin 85 into hole 47 in splint 3, which lies at 90° with respect to distal holes 44 and 45 and intermediate holes 42 and 43. In Fig. 77 it will be seen how a pin guide 66 is inserted into hole 94 for accurate insertion of splint 85.

Figs. 58 to 61 and 78 illustrate an external projection or arched projecting member 105 which is entirely similar to projecting arched member 90 for the humerus, for which the same reference numbers are used. This also has a radial hole 106 placed between holes 91 and 92 extending parallel thereto for the insertion of a fixing bolt 73 with a grip (Fig. 78). As shown in Fig. 78, arched member 105 makes it possible to insert securing pins 85 into central holes 42 and 43 and distal holes 44 and 45 of a tibia splint 103 which is entirely similar to splint 3 and is illustrated in detail in Figs. 10 to 15.

Splint 103 has two proximal holes 41 and 47 inclined at 90° with respect to each other and by 45° with respect to distal and central holes 44, 45 and 42, 43. When inserting splints into the two proximal holes 41 and 47 it is necessary to use an arched projecting member 107 with a central attachment to template 5 (Figs. 65 to 70 and 79).

Projecting member 107 has two radial holes in the vicinity of its centre: two lateral holes 108 and 109 and one intermediate hole 110. Holes 108 and 109 are centering holes, while hole 110 is threaded and serves to receive a bolt 73 with a grip for fixing it in position on the template. The ends of member 107 have one or two partial radial holes 111 and 112 which can be supplemented by a corresponding cover 113 (e.g. that illustrated in Figs. 71 to 73) which has a threaded transverse hole 114 for removable attachment of the cover by means of bolts (not shown) which can be screwed into a hole in head 114a provided in member 107 and a recess 115 supplementing hole 111 or 112.

As shown in Fig. 79, member 107 is used to centre proximal hole 41 and proximal hole 47 of tibia splint 103.

Figs. 80 to 84 show the possibility of fitting a percussion rod 120 with one threaded end 121 to the free end of grip 55. Rod 120 has an annular stop or percussion ring 122 which can be fixed in position by means of a dial which can be threaded into a radial hole 123 close to threaded end 121 and a star-shaped stop 124 at its other end. A striking hammer 125, advantageously provided with external annular recesses 126 for greater convenience in holding is slidably mounted along rod 120 between percussion ring 122 and stop 124. When the hammer is directed to strike against percussion ring 122 this contributes to causing the splint to penetrate the bone requiring repair, while causing it to strike against stop 124 serves as an aid to its extraction.

From the above description it will be seen how the surgical apparatus according to the invention offers a secure external reference point, which is easy to identify and absolutely accurate, for the position of the distal, intermediate and proximal holes present in an intramedullary splint implanted in a bone which requires adjustment, and does so by means of simple and quickly executable movements.

CLAIMS

1. A surgical apparatus having an assembly jig, an intramedullary splint which can be removably secured to and projects from the assembly jig and a template borne by the assembly jig characterised in that it comprises means for accurate coupling of the splint to the supporting base.

2. A surgical apparatus as claimed in claim 1, characterised in that said precision coupling means comprises an at least partially tapering length on a tang portion of the intramedullary splint, a tubular sleeve support carried by the assembly jig with an internal space having a length which is at least partially tapering to receive therein the said tang portion, thus providing a male/female coupling to centre the splint with respect to the assembly jig in a stable and accurate manner.

3. A surgical apparatus as claimed in claim 2, characterised in that said tang portion and said tubular support have means for mutually engaging each other so that they prevent relative angular displacements between the splint and the tubular support.

4. A surgical apparatus as claimed in claim 3, characterised in that said mutual engagement means comprise at least one flat on the tang portion and at least one corresponding flat or projection on or in the tubular support.

5. A surgical apparatus as claimed in any preceding claim, characterised in that said precision coupling means comprise a tie rod which passes between

and along the sleeve tubular support and has one end which can be abutted against the tubular support and the other end on an extremity which can be screwed to the tang portion of the splint.

6. A surgical apparatus as claimed in claim 5, characterised in that said tie rod has a control grip in the vicinity of the end which can be abutted against the tubular support so that the tie rod and the splint can be engaged and removably secured by screwing.

7. A surgical apparatus as claimed in claim 6, characterised in that it comprises a rigid rod which is projectably supported by the tubular support in the vicinity of the said grip and a striking hammer slidably mounted along the rod between the two stop members integral with the rod.

8. A surgical apparatus as claimed in any one of claims 2 to 7, characterised in that said assembly jig comprises a base portion, a portion or cover which can be removably fixed to the base portion, a first transverse seat bounded between the base portion and the cover portion and designed to house a length of the said tubular support, a second transverse seat bounded between the base portion and the cover portion extending at an inclination with respect to the first seat and intended to engage a length of said template, and removable fixing and securing means between the base portion and the cover portion.

9. A surgical apparatus as claimed in claim 8, characterised in that said second seat has a space of a shape which is complementary to that of the profile of the template in order to ensure a good interlock with the template.

10. A surgical apparatus as claimed in claim 8 or 9, characterised in that said template comprises a plurality of spaced recesses or nicks and in that said second seat has elastically loaded retention means for releasable engagement with one of the said recesses or nicks which constitute predetermined fixed reference points for positioning the template on the assembly jig.

11. A surgical apparatus as claimed in any preceding claim, characterised in that said splint and said template each have at least one proximal transverse through hole each designed to receive a corresponding securing pin, the proximal or each proximal hole and the intermediate or each intermediate hole in the template lying in the same plane when in use and being aligned with a corresponding hole in the splint.

12. a surgical apparatus as claimed in claim 11, characterised in that it includes at least one intermediate through hole designed to receive a corresponding fixing pin.

13. A surgical apparatus as claimed in claim 11 or 12, characterised in that the or each proximal hole in the splint is angularly offset with respect to the or each proximal and intermediate hole.

14. A surgical apparatus as claimed in claim 11, 12 or 13, characterised in that it comprises an arched or externally projecting member which can be removably and projectably secured to the template and bearing at least one distal hole which when in use is aligned with a corresponding proximal hole in the splint for support and passage of a corresponding fixing pin.

15. A surgical apparatus for fitting, securing and removing intramedullary splints substantially as hereinbefore described with reference to the accompanying drawings.

-24-

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number

9123335.3

Relevant Technical fields

(i) UK Cl (Edition K) A5R RFB

(ii) Int Cl (Edition 5) A61B 17/16 17/58

Search Examiner

MISS E M COLEMAN

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

30 JANUARY 1992

Documents considered relevant following a search in respect of claims 1-15

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 1598757 (ATLANTIS) see Figure 10	1,11,12
X	EP 0354395 A2 (ACE) whole specification	1,11,12
X	US 4913137 (AZER) whole specification	1,11,12
X	US 4733654 (MARINO) whole specification	1,11,12
X	US 4667664 (TAYLOR) whole specification	1,11,12
X	EP 0321170 A1 (HOWMEDICA) particularly Figures 1 and 2	1, 11-13

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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