

Jan. 8, 1963

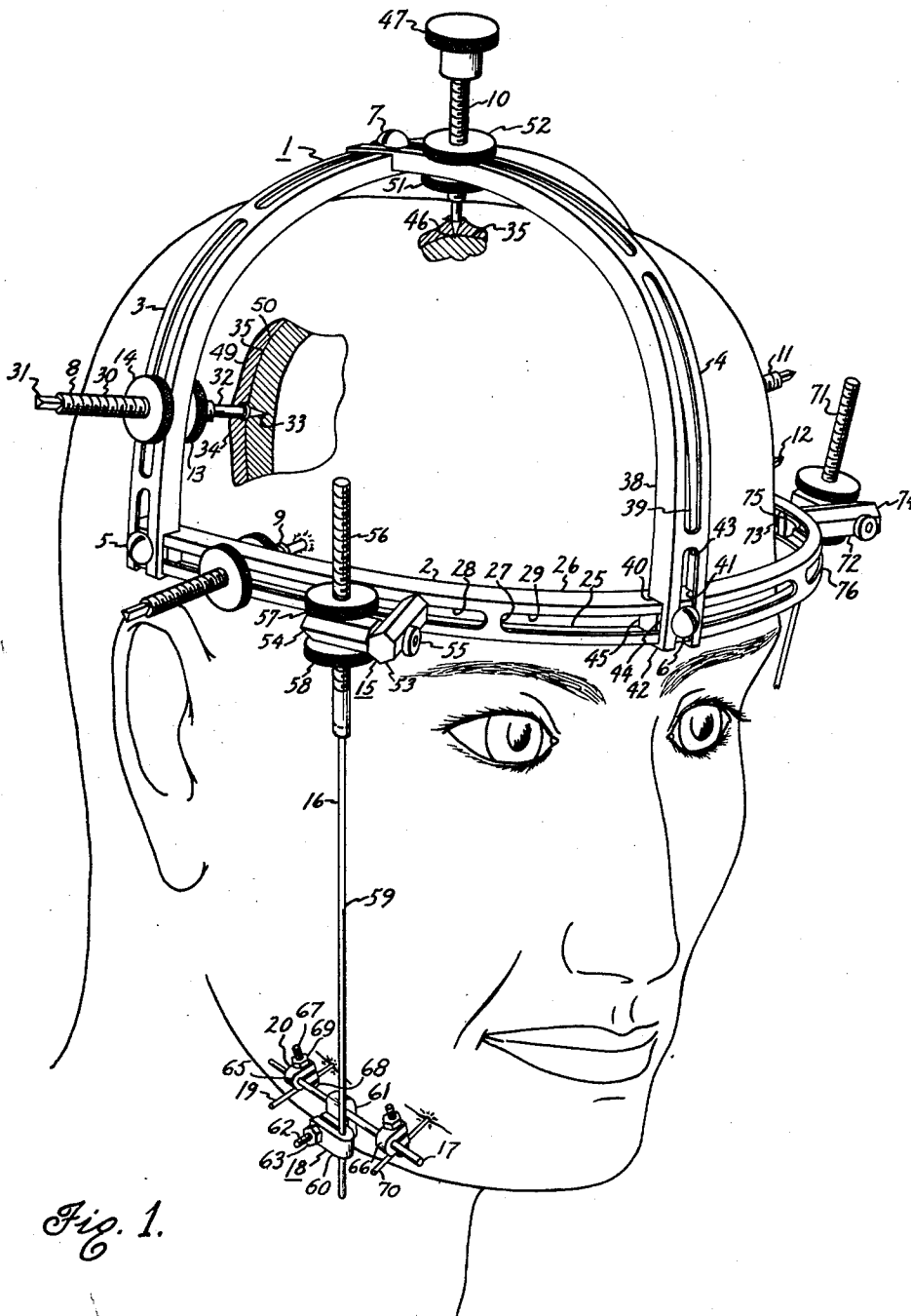
R. G. STANDERWICK ET AL

3,072,118

FRACTURE APPLIANCE

Filed Dec. 26, 1957

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

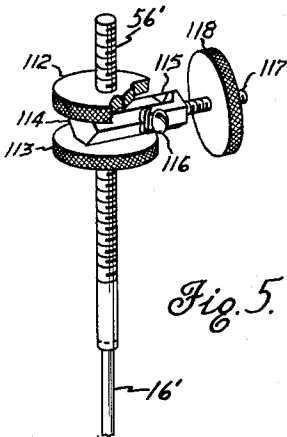


Fig. 5.

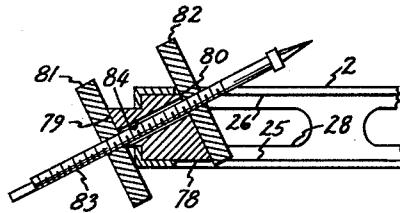


Fig. 2.

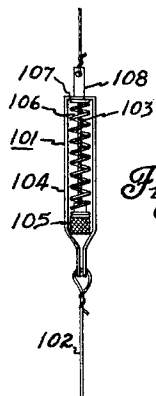
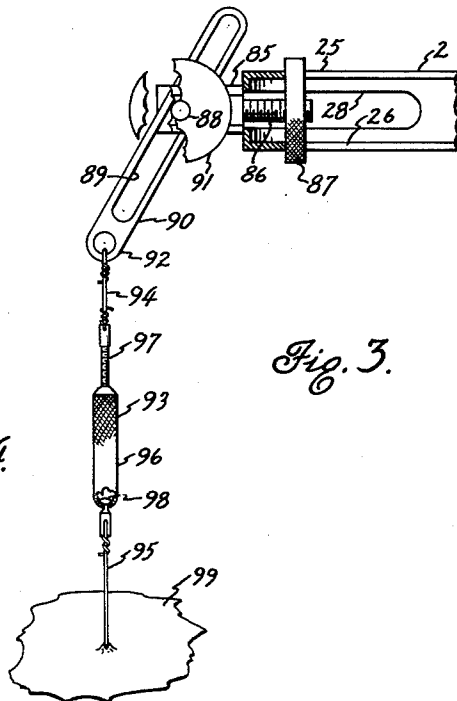


Fig. 4.



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FRACTURE APPLIANCE

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This invention relates to head appliances particularly useful in treating fractures, and specifically to craniomaxillofacial fixation apparatus, and the invention particularly contemplates the provision of a skeletal frame comprising means for fixed anchoring to the cortical bone of the skull.

A general object of the invention is to provide an improved appliance which is adapted for fixation to the skull.

Another object is to provide an improved craniomaxillofacial fixation apparatus, of particular utility in the case of fractures of maxillary or facial bones.

In the fixation of fractured facial bones, common technique includes the application of a plaster head cap to form an extraoral base of fixation to which various rods, wires, pins, and the like, may be attached and which are used to apply traction to the maxillary bones. Such a cap is never rigidly stable, since it moves with the scalp, pressure necrosis often results from its use, hair must be cut off before the cap is applied, the cap is heavy, hot, and conducive to the growth of fungi or secondary skin infection, and its use may result in osteomyelitis of the skull. Lacerations of the scalp, skull damage or brain injuries may require that a head cap not be used.

The appliance of this invention overcomes the aforementioned and other disadvantages of a plaster head cap, and similar disadvantages of other less commonly employed arrangements for the purpose of fixation of fractured facial bones, and it has utility in other fields in which it may be desired to provide an attachment to the skull or head of a patient. For example, in the case of a vertebral fracture, it may be desired to provide traction between the head and lower parts of the body, and the skull-attached frame of this invention is useful to provide, in such instances, the necessary connection to the head.

It is, accordingly, a further general object of the invention to provide an element which may be fixed with greater rigidity to the skull and which will be comfortable, light, readily applied and not subject to the disadvantages of plaster head caps and the like.

A further object is to increase the adaptability of a skull appliance to the solving of a large variety of problems encountered in face and neck injuries. More particularly, it is an object of the invention to provide a skull-attached frame adapted to receive any of several attachments, and to increase the facility with which such attachments can be connected to the frame, to provide ready adjustability of the positions of such attachments and a wide selection of such positions, and, in general, to simplify and to make possible the more rapid application of the frame, of the attachments and of the connections between the attachments and other parts of the body, such as fractured maxillary bones.

A still further object is to provide a device useful in brain surgery or treatment to establish fixed points of reference, permitting accurate location of areas for selective injections to parts of the brain or therapeutic destruction of deep structures, for example.

The novel features which are believed to be characteristic of this invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be

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understood by reference to the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is a perspective view of a fracture appliance shown in position on the head of a patient;

FIG. 2 is a front elevational view, partially in section, of a fragment of a head frame and a mount for connection thereof to a skull, the mount being modified to afford increased stability of the frame when the frame is used to apply traction to the head;

FIG. 3 is a front elevational view, partially in section, of a fragment of a head frame with a modified traction attachment connected thereto;

FIG. 4 is a tension element which may be substituted for the turnbuckle of the traction attachment assembly of FIG. 3; and

FIG. 5 is a modified attachment means for attaching a traction rod to the head frame, which may be substituted for the attachment means shown in FIG. 1.

Referring to FIG. 1, a craniomaxillofacial fixation apparatus is shown as it may appear in use in connection with a fractured lower jaw. The apparatus includes a head frame 1, comprising three rigid arcuate or curved bars 2, 3 and 4, connected together as by bolts 5, 6 and 7, a plurality of mounting or fixing skull pins, such as pins 8, 9, 10, 11 and 12, each pin being adjustably connected to one of the frame bars, such as by manually operable nuts 13 and 14, one or more attachments, such as attachment 15, to which suitable connecting rods or traction transmitting elements, such as rod 16, are attached, and an anchor arrangement, including a small sub-frame or bar 17, an attachment device 18 connecting bar 17 to rod 16, and suitable anchor pins, such as pin 19, attached by clamp 20 to the subframe.

Bars 2, 3 and 4 of the head frame may be formed from the same stock, and each preferably comprises an elongated curved shape, of aluminum or other light weight, strong material, the shape having rigidifying side flanges, such as flanges 25 and 26 of member 2, connected by a web or lattice, such as web 27. The web 27 is interrupted by apertures, preferably in the form of elongated slots such as slots 28 and 29. Pin 8 is seen to comprise a threaded body portion 30 on which thumb nuts 13 and 14 are threaded, and the body portion terminates outwardly in a shank 31 formed and arranged for gripping in the chuck of an external device of the nature of a hand drill by means of which the pin may be rotated. The pin further comprises a smooth barrel portion 32 extending toward the skull from the body portion, terminating in a bone-piercing drill point 33. An outwardly projecting shoulder or collar 34 is formed on the pin to separate the barrel portion from the drill point. The shoulder 34 prevents the drill point from entering too far into the skull, and it should be located to limit, by contact with the outer skull surface 35, penetration of the point into the skull beyond a maximum distance of about one-quarter inch and, preferably, between three-sixteenths and one-quarter inch. The drill point will thus pass into and through the outer hard table of the skull and into but not through the diploe, and the surgeon will exercise care to avoid forcing the shoulder 34 into the skull. As the drill point of the pin breaks through the outer table of bone, as may be readily determined by the feel of the drill, rotation of the pin is stopped or is continued with decreased force and greater caution until the shoulder engages the bone surface.

The bars of the head frame are joined rigidly by providing a socket at the end of one bar and fitting the other bar into the socket. For example, flanges 38 and 39 of bar 4 are cut at 40 and 41, respectively, and an end portion 42 of the web 43 of the bar is folded inwardly to

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form a socket 44 into which bar 2 fits. A solid block 45 is inserted between the flanges of bar 2, and bolt 6 is threaded into block 45 and tightened to complete the joint. Similar joints are provided at bolts 5 and 7 and, of course, at the hidden corner of the frame opposite bolt 5.

Pin 10 at the top of the cranium is a stabilizing pin, rather than a mounting pin, and comprises merely a sharp conical point 46 at its inner end to pierce the skin and engage the skull with very little penetration into the bone. Since this pin is not drilled into the bone, it preferably carries a manually engageable knob 47 rather than a shank adapted to be received in a drill chuck.

To affix the head frame in place, it is prepared by inserting each of pins 8, 9, 10, 11 and 12 through appropriate slots in the bars, with the thumb screws on the pins, but backed away from the bars, whereby the pins are loose and movable along the slots and in and out toward and away from the head. The pin 10 may now be set by engaging its point with the skin or bone at the top of the head as a guide in locating the frame. The surgeon then chucks one of the mounting pins, such as pin 8, in a hand drill, moves the pin along the slot in the bar to the desired position, and operates the drill to cause the pin to penetrate through the skin layer 49 and into the skull bone 50. The drill is disconnected from the pin, and the thumb nuts 13 and 14 may be brought into loose engagement with the bar. The remaining pins 9, 11 and 12 are similarly drilled into the skull, one after the other, and the thumb nuts of each are adjusted in a manner generally to equalize the forces on the several pins and to avoid strain or warping of the frame and are finally tightened against the respective bar. The pin 10, at the top of the skull, is also screwed down, through its lower nut 51, until its point penetrates slightly into the skull bone, and then nut 52 is tightened to lock this pin to the frame.

With the head frame now rigidly in place, rod 16 for fixation of a facial bone is attached. The attachment device comprises a pair of blocks 53 and 54 joined by a bolt 55 which threads into block 54. The upper end 56 of rod 16 is threaded and passes through an opening in block 54, being held thereto in an adjustable position by means of thumb nuts 57 and 58. Below its threaded upper end, the rod 16 is of reduced diameter, and it carries at a selected point along the length of its reduced portion 59, the attachment device 18. This device consists of two integral resilient clamp portions 60 and 61 extending at right angles to each other, and a bolt 62 passing through the clamp portions with a nut 63 threaded thereon. With rod portion 59 engaged in one clamp portion and bar 17 engaged in the other, nut 63 is tightened to close the clamp portions, thereby to lock bar 17 securely in desired position on rod 16. Two smaller clamps 65 and 66 are mounted on bar 17, each engaging around the bar. The bolt 67 of clamp 65 has a head 68 underlying anchor pin 19 and, when nut 69 is tightened on bolt 67, the pin 19 is rigidly retained by being drawn against the clamp, while, at the same time, the clamp is squeezed to grip the bar 17. Clamp 66 is similarly arranged to connect pin 70 to bar 17. Each of pins 19 and 70 may be of the type known as Roger Anderson pins, and each is threaded or otherwise secured into the mandible, for example, on respective sides of the fracture which it is sought to immobilize. A rod 71 is shown opposite rod 16 for use in immobilizing the opposite side of the mandible, and the attachment means for rod 71 are like those for rod 16, block 72 of the former corresponding to block 53 of the latter. The specific arrangement for connecting blocks 53 and 72 to the bar 2 of the frame is best illustrated by block 72, which, it will be seen, carries an oblong head 73 joined to the body 74 of the block by a reduced throat 75. The width of head 73 is a little less than the width of slot 76 of bar 2, while its length is greater than the width of

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the slot. By rotating block 72 from its position in FIG. 1, the head 73 may be made to pass through slot 76 and the block may thus be released from or attached to bar 2. The length of throat 75 should be approximately equal to the thickness of web 27 and its diameter to the width of slot 76, whereby the block is reasonably firmly attached when in the position of FIG. 1. When the traction rod 16 or 71 is in place, with the thumb nuts tight, the respective block 53 or 74 is prevented from rotating into the position which would permit its removal from the bar 2.

The head frame of this invention is adaptable to several uses, and, if it is to serve as a skull connection to permit the head to be pulled upwardly, such as may be desirable in the treatment of upper vertebral injuries, the pins 9 and 12, in the areas of the temporal bones, are preferably directed inclinedly upwardly and inwardly by providing, as shown in FIG. 2, an angled plug 78 fitted between the flanges 25 and 26 of bar 2, and also extending in part through the slot 28. The faces 79 and 80 of the plug are appropriately inclined to be engaged by thumb nuts 81 and 82 for the pin 83 when the pin is positioned in the inclined bore 84 of the plug. The proportions of the plug permit the thumb nuts to bear on the bar 2 when tightened, thus to cause the pin and plug to be held against displacement from the desired position along or with respect to bar 2.

FIG. 3 shows a modified attachment and traction applying arrangement comprising a block 85 having an inwardly extending threaded shank portion 86 passed through slot 28 of bar 2. The block is rigidly attached in a desired adjustable position to bar 2 by means of thumb nut 87 on shank 86 tightened against the flanges 25 and 26.

A threaded post portion 88 of block 85 is disposed outwardly of bar 2, extends through the slot 89 of an arm 90 and carries a thumb nut 91 which may be tightened against arm 90 to retain it in selected position. The lower outer end 92 of arm 90 has a turnbuckle 93 attached thereto, such as by a length of surgical wire 94, and connects wire 95 to the arm. Turning of sleeve 96 of the turnbuckle with respect to threaded turnbuckle rod 97 permits adjustment of the length, or longitudinal position, of wire 94. Swivel 98 prevents twisting of wire 94 during turnbuckle adjustments. The wire 94 may extend through the skin of the face 99 for attachment at its lower end to, for example, a fractured superior maxillary bone (not shown).

A modified arrangement which may be substituted for the turnbuckle 93 of FIG. 3 is shown in FIG. 4. The device 101 of FIG. 4 is connected in series with a surgical wire 102 and comprises a threaded rod 103 extending into a casing 104 carrying an adjustable nut 105 within the casing. The nut retains a compression spring 106 which is arranged to be compressed between the nut and the upper end 107 of the casing when a tension greater than the desired maximum tension is imposed on wire 102. The enlarged upper head portion 108 of the rod meets the upper end 107 of the casing to define a minimum length of the device, and elongation occurs from a tension on wire 102 great enough to overcome the spring force, resulting in the lowering of the casing along the rod. With proper selection of spring and adjustment of the nut, the device may be set to hold a tension of a predetermined amount, such as an ounce or a few ounces, and if the tension is applied through wire 102 to a bone which is out of place, and which it is desired to pull, by the tension on the wire, a short distance, such as one-eighth inch, into proper position, the device may be arranged by appropriate adjustment of parts, such as arm 90 of FIG. 3, to draw head 108 one-eighth inch above the end 107 of the casing. The spring force is thus exerted on the wire 102 until the bone has shifted the desired distance, whereupon head 108 meets casing end

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107 and the spring tension is no longer applied to the wire.

The modified attachment device shown in FIG. 5 comprises a threaded rod portion 56' and a rod 16' corresponding to portion 56 and rod 16 of FIG. 1. The rod is held in place adjustably by nuts 112 and 113 to a block 114 which, in turn, is supported by a yoke member 115 for pivoting on bolt 116. The yoke member has a threaded mounting shaft 117 which may extend through a slot of any selected one of the head frame bar members, and nut 118 may be tightened against the bar to fix yoke 115 to the bar in selected position. Bolt 116 may be tightened to squeeze the yoke and thus clamp member 114 in fixed position if desired. The attachment means according to FIG. 5 has the advantage of providing a more rigid fixing of the rod 16' to the frame, but this attachment is not so quickly attachable as the corresponding similar arrangement 15, for example, of FIG. 1.

The arrangement of FIG. 3, modified by the substitution of the spring turnbuckle 101 of FIG. 4 for turnbuckle 93, has proved particularly useful in applying traction to nasal bone fragments, and in such use, it may be appropriate to attach the block 85 to the bar 4 of FIG. 1 rather than to the horizontal bar 2.

The frame may be utilized to provide fixed points of reference for brain treatment, and in connection with therapeutic destruction of deep structures, for example, appropriate background coordinates may be established by pneumoencephalographs as measured from points on the bars of the frame or from attachments positioned on such bars. Such attachments may take a number of different forms. Assemblies such as shown at 10, 47, 51, 52 may provide a reference point, for example, for such use.

Under certain conditions it may be desired to utilize tension wires, such as wire 94, to apply immobilizing force to a mandible or portions thereof, or to use Roger Anderson pins to immobilize superior maxillary or other facial bones. The head frame of this invention has the desirable feature of flexibility in permitting a variety of arrangements of the attachment elements shown as required by the specific circumstances of each case.

Considerable latitude in the location of the mounting pins, as well as of the attachments, is possible, in that the bars of the head frame are slotted, and in case of skull damage, or scalp lacerations, the surgeon may so locate the mounting pins as to avoid interference with damaged scalp or skull areas.

The patient finds the head frame comfortable, and it is to be noted that the back of the head may rest normally on a pillow. At the same time, the frame provides an extremely firm and rigid base permitting facial bones to be fixed in position with respect to the skull with greatly reduced danger of any inadvertent movement thereof and with minimized working of bone portions at a fracture, substantially reducing knitting time.

While only certain preferred embodiments of this invention have been shown and described by way of illustration, many modifications will occur to those skilled in the art and it is, therefore, desired that it be understood that it is intended in the appended claims to cover all such modifications as fall within the true spirit and scope of this invention.

What is claimed as new and what it is desired to secure by Letters Patent of the United States is:

1. A head frame comprising a rigid framework including two rigid bar portions disposable on respective opposite sides of and outwardly of the head and curved rigid bar means extending between and rigidly interconnecting said bar portions, said bar means being shaped and arranged to extend curvately around the head between the sides thereof, a respective mounting pin adapted and arranged to drill into the outer table of the skull bone at each side of the head, said bar portions being provided with respective openings freely receiving said pins there-

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through, said pins being freely slidable in the respective openings longitudinally of the respective pin and freely rotatable about their respective axes with respect to the respective bar portion, respective connection means movable along each said pin and engageable with the respective bar portion for rigidly fixing such portion to the respective pin, and a stabilizing pin adapted and arranged to contact the head remote from said mounting pins adjustably connected to said curved bar means.

2. A head frame comprising a plurality of rigidly interconnected rigid bars generally conforming to and adapted and arranged to be disposed outwardly of and adjacent the fore-part of the skull, said bars being slotted, a plurality of pins having inwardly directed drill points adapted and arranged to extend into the skull bones and having threaded body portions passing through respective slots of said bars, and means comprising a respective manually operable nut threaded on each said body portion for rigidly and adjustably connecting said pins to said bars.

3. A head frame comprising a plurality of rigidly interconnected rigid bars generally conforming to and adapted and arranged to be disposed outwardly of and adjacent the fore-part of the skull, said bars being apertured, a plurality of pins having inwardly directed drill points adapted and arranged to extend in the skull bones and having body portions each passing through an aperture of said bars and freely movable therein longitudinally of the pin toward and away from the skull and freely rotatable therein, and means for rigidly and adjustably connecting said pins to said bars.

4. A head frame in accord with claim 3 wherein each said pin comprises an outward shoulder located between substantially one-eighth and one-quarter of an inch from the extreme end of said drill point adapted to contact the skull and prevent the excessive penetration of said point into the diploe.

5. A surgical appliance comprising a plurality of pins adapted and arranged to be drilled into the skull, an open framework, said framework being provided with openings receiving said pins freely therethrough whereby said pins are in freely rotatable relation to said framework and freely movable in relation to said framework in and out toward and away from the skull manually adjustable means movable along said pins for supportingly connecting said framework to said pins, an elongated traction element, adjustable attachment means attaching one portion of said element to said framework, and means for attaching a portion of said element spaced from said one portion thereof to a bone of the face.

6. A head frame comprising a plurality of rigid channel bars rigidly interconnected and forming an open framework, said framework being shaped to extend from one to the other temporal bone across a forward portion of the skull, said bars comprising side flanges connected by slotted webs, and a plurality of skull-engageable pins each having a point for penetrating into the skull and a threaded body, said slots of said webs receiving said pin bodies therethrough, and a pair of thumb nuts on each said pin body disposed respectively inwardly and outwardly of the bar and arranged to be tightened against the bar to lock the pin in adjusted position thereto.

7. A fracture appliance comprising a plurality of rigid channel members having slotted webs, said members being rigidly joined to form a framework, an attachment member comprising a block having a projection from said block extending through a slot of one of said members and connection means on said projection, said block and said connection means engaging said one member on opposite sides thereof anchoring said block to said one member, traction means, means comprising a threaded connector adjustably connecting said traction means to said block, means connected to said traction means adapted for anchoring a fractured bone to said traction means, and means for rigidly mounting said framework to the skull of the patient.

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8. A head-attachable appliance comprising a rigid object shaped to conform generally to the shape of a portion of the human skull and having respective templar portions positioned to lie adjacent each of the two respective opposite templar bones and a third portion positioned to lie adjacent a portion of the skull between the templar bones, a respective pin extending through each of said templar portions of said object and adapted to be drilled into the respective templar bones, a third pin extending through said third portion of said object having a point adapted and arranged to engage said portion of the skull between said templar bones, means to fix each of said pins to said object, said fixing means for at least two of said pins comprising respective adjustment means for adjusting the position of each of said two pins with respect to said object.

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