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N. G. GEORGIADÉ ET AL

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CRANIAL FIXATION APPARATUS

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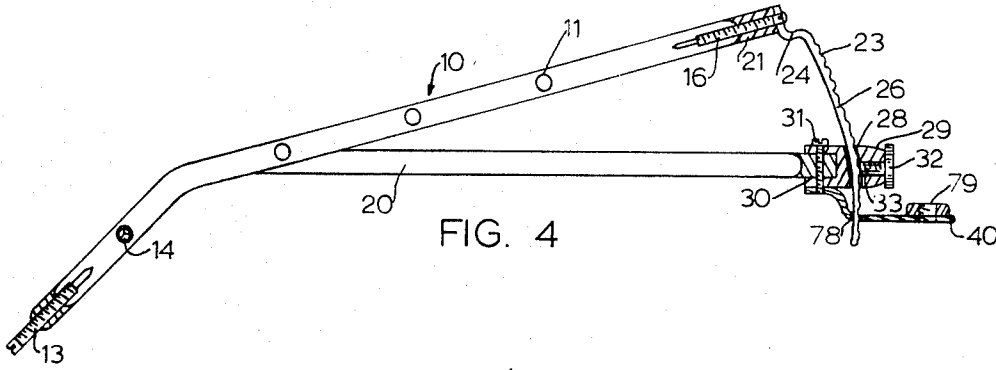


FIG. 4

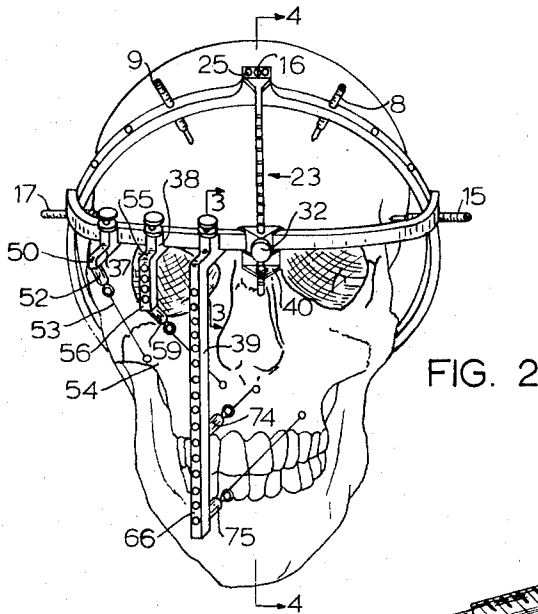


FIG. 2

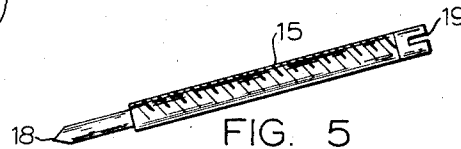


FIG. 5

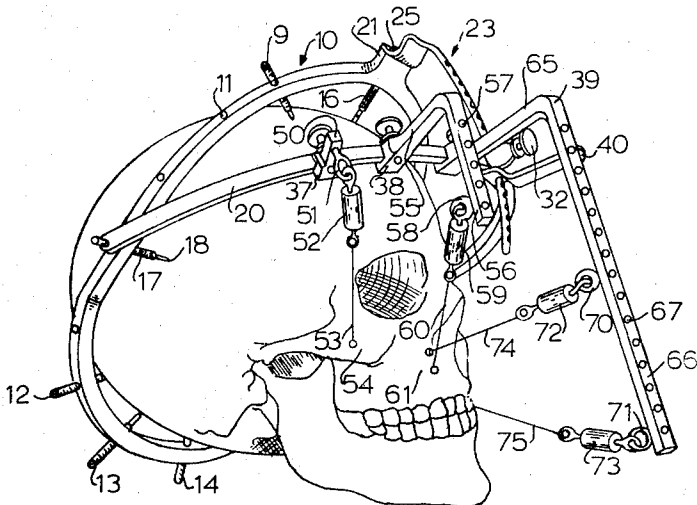


FIG. 1

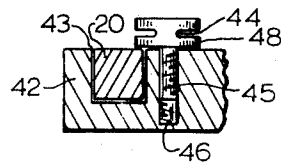


FIG. 3

INVENTORS  
Nicholas G. Georgiade  
Thomas H. Nash, Jr.

BY

*B. B. Olive*  
ATTORNEY

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## CRANIAL FIXATION APPARATUS

Nicholas G. Georgiade, 2527 Wrightwood Ave., Durham, N.C. 27705, and Thomas H. Nash, Jr., Durham, N.C.; said Nash assignor to said Georgiade  
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This invention relates to a head apparatus useful in treating fractured facial bones and, more particularly, to a maxillofacial fixation apparatus which is positioned on the cranium and which is adapted to immobilize fractured facial bones during the knitting thereof.

In the fixation of fractured maxillae and other facial bones, the prior art teaches the use of plaster head caps which form a base of fixation to which various wires, rods and the like may be attached in order to supply traction to the broken bones. A considerable amount of time and energy is consumed in applying the plaster head cap to the patient; also, the plaster head cap is uncomfortable and is not particularly adapted to aid in the fixation of all maxillofacial fractures. The prior art also shows other traction fixation apparatus which are strapped on the skull or are provided with pins which anchor in the skull. Appliances of this type have one characteristic disadvantage which is that they cannot be secured to the cranium tightly enough to prevent movement of the supporting devices.

The apparatus of this invention overcomes the disadvantages of the aforementioned plaster skull cap and appliances, for this apparatus is adapted to counteract any force necessary to advance the fractured facial bones anteriorly, superiorly or laterally as the individual situation warrants. Therefore, an object of this invention is to provide an external cranial fixation apparatus which is adapted to be securely anchored on the cranium for supporting fractured facial bones as required by each individual situation.

Another object of the present invention is to provide an external cranial fixation apparatus which is easy to apply to the patient and which requires a minimum of maintenance.

A still further object of this invention is to provide a cranial fixation apparatus which may be anchored to the skull with greater rigidity and which is light in weight and comfortable to the patient.

Yet another object of this invention is to provide a cranial fixation apparatus with an adjustable visor which is adapted to receive a traction anchor when connected by suitable means to maxillofacial bones.

Still another object of the present invention is to provide a cranial fixation apparatus with a traction anchor which is adapted to be connected to a broken maxillofacial bone and to exert a force on the same either in an upward, outward or downward direction.

Other objects and advantages of this invention will become apparent when the following detailed description is read in conjunction with the appended drawings, specification and claims. A preferred embodiment of this invention will now be described with reference to the accompanying drawings, in which:

FIGURE 1 is a perspective view of the external cranial fixation apparatus shown in position on a patient's skull and supporting selected facial bones;

FIGURE 2 is a frontal, pictorial view of the invention showing the visor pivotally mounted on the halo structure;

FIGURE 3 is a fragmentary sectional view taken along lines 3—3 of FIGURE 2 showing a traction anchor connected to the visor;

FIGURE 4 is a sectional view of the invention taken along lines 4—4 of FIGURE 2 showing the visor adjusting mechanism; and

FIGURE 5 is a side view of one of the mounting pins.

One embodiment of this invention is comprised of a light weight aluminum bar of square cross section and contoured to resemble an elliptical halo which threadably receives a plurality of inwardly extending pins. The pins are selectively spaced around the halo structure and have sharp conical inwardly extending ends which adapt the pins to be screwed into the cranium of the patient and thus secure the elliptical halo structure about the head. The posterior section of the elliptical halo structure taken in relationship to the face of the user is bent downwardly so that the pins residing in that bent portion contact the cranium in the lower occipital portions thereof so as to counteract any downward force on the anterior portions of the halo structure. The anterior frontal pin is used for proper stabilization and balance of the apparatus during use and the lateral cranial pins engage the cranium at a point distal to the thinnest portions of the cranium.

A visor which is also formed from an aluminum bar of square cross section and which is semicircular in shape is pivotally mounted on the elliptical halo structure and extends anteriorly therefrom. The visor is adjustably connected to the anterior portions of the halo structure by means of a visor support and can be raised or lowered in accordance with the individual fixation problem. The visor is adapted to receive a plurality of adjustably mounted traction anchors, selected ones of which extend downwardly so that when it is attached to the facial bones by means of a wire and turn buckle arrangement, an outward force from almost any angle may be exerted on that selected facial bone.

The invention is illustrated in connection with the accompanying drawings in which the figures are illustrative of the preferred embodiment of the invention.

An elliptical halo structure 10 is formed from square section aluminum bar and is provided with a plurality of radially extending threaded holes 11 which are adapted to receive threaded pins such as indicated at 8, 9, 12, 13, 14, 15, 16 and 17. Each pin is provided with a sharp conical point 18 at its inwardly extending end which is adapted to pierce the skin and engage the skull with selected penetration into the bone. Each pin is also provided with an outwardly extending slotted end 19 which adapts it to be screwed inwardly and outwardly through elliptical halo structure 10. As can be seen in FIGURE 4, the rear portions of elliptical halo structure 10 are bent downwardly so that pins 12, 13 and 14 are placed in the posterior skull area in the undercut thereof. This bent structure allows pin 16 which is in the forward or anterior portions of halo structure 10 and which extends into the superior regions of the cranium to counteract the rearward pull exerted by pins 12, 13 and 14 in the posterior position and thereby counteract the pressure applied thereto. Furthermore, this bent structure at the rear of the halo allows the front of the halo to reside on the head of the user at a minimum elevation. Pins 17 and 15, which are laterally positioned to extend into the sides of the cranium, are also adapted to pivotally receive the ends of U-shaped visor 20.

Visor 20 which is formed of aluminum bar substantially square in cross section is adjustably supported below the anterior portions of halo structure 10 by means of a visor support 23. Visor support 23 includes an L-shaped base 24 which is connected to a protrusion 21 which is an integral extension of halo structure 10. Visor support 23 is rigidly mounted on protrusion 21 by means of screws 25 or the like and has an integral and downwardly extending slotted arm 26 which is slidably received by vertical bore 28 of post 29. Post 29 is provided with a grooved extension 30 which is mounted on visor 20 and is rigidly held thereon by set screws 31. Post 29 is also provided with a laterally extending threadably mounted locking screw 32 which extends through and is thread-

ably received by threaded opening 33. Locking screw 32 is adapted to be screwed inwardly and engage a selected slot of slotted arm 26 and thereby adjustably positions visor 20 relative to elliptical halo structure 10 so that the necessary alignment can be carried out depending on the individual fixation problem.

Visor 20 is provided with a plurality of adjustably mounted traction anchors which are given the reference numerals 37, 38, 39 and 40. Each of the traction anchors may be moved laterally and positioned so as to adapt the device to meet almost any individual circumstance. Each of said traction anchors is adjustably positioned on visor 20 by means of the clamp bolt structure best shown in FIGURE 3. The visor receiving end 42 of each traction anchor is provided with a groove 43 which laterally extends therethrough and which substantially encloses a length of visor 20. To secure visor 20 in visor receiving end 42, a threaded clamp bolt 44 is adapted to be received by a threaded passageway 46 which is positioned in visor receiving end 42 substantially adjacent groove 43. Clamp bolt 44 is provided with a flange 48 which upon the inward turning thereof pinches against visor 20 and frictionally holds the respective traction anchor in place thereon.

Each of said traction anchors as shown in FIGURE 1 is of a different design and serves a different purpose and each may be shifted in accordance with the needs of the individual patient. Traction anchor 37, for example, is provided with a short post portion 50 which has a threaded passageway in the end thereof which receives an eye bolt 51. A turnbuckle 52 is swingably connected to eye bolt 51 and in the application illustrated in FIGURE 1 has a wire 53 extending therefrom which is connected to a facial bone 54. When turnbuckle 52 is tightened, the pull on facial bone 54 is upwardly due to the short length of post portion 50. Traction anchor 38 is L-shaped in design having legs 55 and 56 with leg 56 extending substantially perpendicularly downwardly from leg 55. Leg 56 is provided with a plurality of spaced and inwardly pointing threaded passageways 57 each of which is adapted to receive an eye bolt 58. Eye bolt 58, more than one of which may be received by leg 56, receives turnbuckle 59 which is connected to and adapted to tighten wire 60 which is also connected to a facial bone 61. Facial bone 61 is pulled upwardly and outwardly by wire 60. Traction anchor 39 is provided with legs 65 and an elongated leg 66 which perpendicularly extends downwardly from leg 65 and which is provided with a plurality of inwardly pointing threaded holes 67. Eye bolts 70 and 71 are threadably received by selected holes 67 and are respectively provided with turnbuckles 72 and 73. Turnbuckles 72 and 73 are respectively connected to facial bones 61 by means of wires 74 and 75. From FIGURE 1, it can be seen that wire 74, when tightened by turnbuckle 72, will pull facial bone 61 outwardly and wire 75, when tightened by turnbuckle 73, pulls facial bone 61 outwardly and downwardly. Traction anchor 40 which is mounted directly in the center of visor 20 and positioned thereon below post 29 is provided with a hole 78 which adapts arm 26 to extend therethrough and with a threaded bore 79 which is adapted to receive an eye bolt (not shown).

In applying this appliance to the cranium of a patient, halo structure 10 is positioned so that pins 12, 13 and 14 may be embedded in the skull in the posterior area and in the undercut thereof and pin 16 is embedded in the anterior portions of the skull to insure proper stabilization of the appliance during use. Lateral pins 15 and 17 which are embedded on the lateral sides of the skull insure a proper balance. The angle between the anterior portions of halo 10 and visor 20 is obtained by moving visor 20 relative to halo structure 10 and tightening locking screw 32 against leg 26. Subsequently, a number of traction anchors such as those represented by numerals 37, 38 and 39 are adjustably positioned on visor 20 by manip-

ulating their respective clamp bolts. Traction anchors 37, 38 and 39 are then connected to the facial bones to be set by the turnbuckle and wire arrangement as shown in FIGURE 1.

From the description it can be seen that the structure described is adapted to pull the selected facial bone upwardly, upwardly and outwardly, outwardly and downwardly, and downwardly, as well as to either side in any of the mentioned vertical directions. By the proper mounting of the pins, the visor and the traction anchors, considerable latitude is obtained in setting the broken bone for knitting. Since the bones are rigidly held in place by this appliance, inadvertent movement of the bones is substantially reduced and therefore the knitting time is greatly minimized. Furthermore, the bent arrangement of the halo structure insures a firm and positive grip of the undercut of the skull in the posterior area and allows the front elevation of the halo to remain relatively low.

Many different embodiments of this invention may be made without departing from the scope and spirit thereof. Therefore, it is to be understood that the invention is not to be limited to the specific embodiment shown and described herein, except as defined in the appended claims.

What is claimed is:

1. An external cranial fixation apparatus for aiding in the setting of broken maxillocranial bones for knitting comprising:

- (a) a substantially elliptical rigid bar structure adapted for circumscribing the cranium, said bar structure having a plurality of radially extending, inwardly pointing pins for engaging said cranium and for fixedly spacing said elliptical bar structure about said cranium;
- (b) a U-shaped bar structure having its ends pivotally mounted on opposed portions of the periphery of said elliptical bar structure;
- (c) means connected to and extending between said elliptical bar structure and said U-shaped bar structure for locking said U-shaped structure relative said elliptical bar structure at a selected angle;
- (d) traction element means adjustably and rigidly connected to said U-shaped bar structure; and
- (e) means connected to and extending from said traction element means and adapted to be attached to said broken bone whereby said broken bone is restored to and maintained in its usual anatomical relationship for knitting.

2. The apparatus of claim 1 wherein said means connected to and extending between said U-shaped bar structure and said elliptical bar structure is a bar support rigidly mounted on said elliptical bar structure and having an integral and downwardly extending slotted arm and a locking means securely mounted on said U-shaped bar structure and slidably receiving said slotted arm, said locking means adapted to rigidly clasp said slotted arm at a selected point along the length thereof.

3. The apparatus of claim 2 wherein said traction element means includes a plurality of traction elements, selected ones of which having downwardly extending arms, said arms having at least one means extending therefrom and adapted to be attached to said broken bone whereby said bone may selectively be pulled upwardly, outwardly and downwardly to restore the same to its usual anatomical relationship for knitting.

4. The apparatus of claim 3 wherein said means extending from said traction element to said broken bone is comprised of an eye bolt securely mounted on said traction element, a turnbuckle pivotally connected to said eye bolt and a wire connected to and extending from said turnbuckle and adapted to be attached to said broken bone.

5. The apparatus of claim 4 wherein said elliptical bar structure has a downwardly bent portion along the lengths adjacent the posterior skull area whereby said pins ex-

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tending through said bent portion are adapted to engage the undercut of the cranium.

6. The apparatus of claim 1 wherein said traction element means includes a plurality of traction elements, selected ones of which having downwardly extending arms, said arms having at least one means extending therefrom and adapted to be attached to said broken bone whereby said bone may selectively be pulled upwardly, outwardly and downwardly to restore the same to its usual anatomical relationship for knitting.

7. The apparatus of claim 1 wherein said elliptical bar structure has a downwardly bent portion along the lengths adjacent the posterior skull area whereby said pins extending through said bent portion are adapted to engage the undercut of the cranium.

8. An external cranial fixation apparatus for aiding in the setting of broken maxillocranial bones for knitting comprising:

(a) a substantially elliptical rigid bar structure adapted to be spaced from and circumscribe said cranium, said elliptical bar structure having downwardly bent portions opposite the posterior of said cranium and having a plurality of radially extending threaded holes;

(b) a plurality of elongated threaded pins being threadably received by selected threaded holes and having pointed conical shaped inwardly positioned ends for engaging said cranium whereby said elliptical bar structure is fixedly spaced about said cranium by said pins;

(c) a U-shaped bar structure having its ends pivotally mounted on opposed outer portions of the periphery of said elliptical bar structure in the area adjacent the lateral portions of said cranium, said U-shaped bar structure adapted to extend around the anterior portions of said cranium;

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(d) a bar support rigidly mounted on said elliptical bar structure and having an integral and downwardly extending slotted arm;

(e) a locking means rigidly mounted on said U-shaped bar structure and slidably receiving said slotted arm, said locking means adapted to rigidly clasp said slotted arm at a selected point along the length thereof to fixedly position said U-shaped bar structure relative said elliptical bar structure;

(f) a plurality of traction elements adjustably and rigidly connected to said U-shaped bar structure along the length thereof, selected ones of said traction elements having downwardly extending arms of selected lengths; and

(g) means connected to and extending from said traction element and adapted to be attached to said broken bones whereby said bones may selectively be pulled upwardly, outwardly and downwardly to restore the same to their usual anatomical relationship for knitting.

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