Nov. 30, 1965 C. W. RECTOR 3,220,081

CALVARIUM CLIP

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Fig. 4.

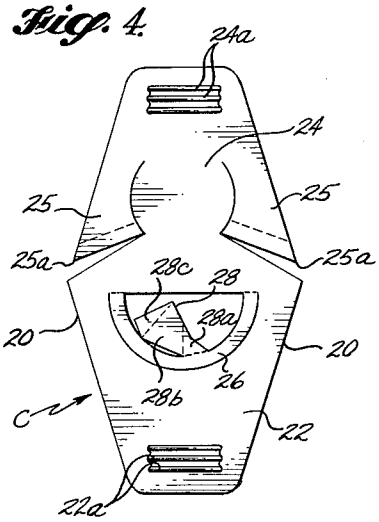


Fig. 2.

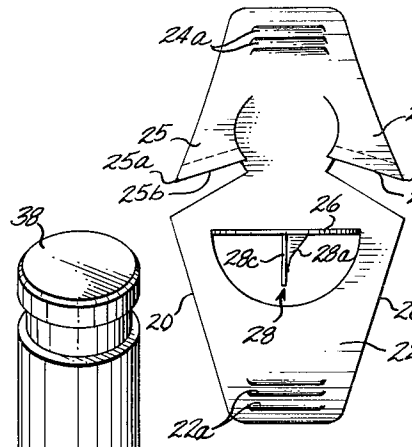


Fig. 3.

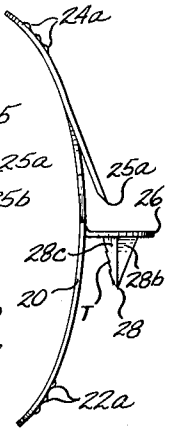


Fig. 5.

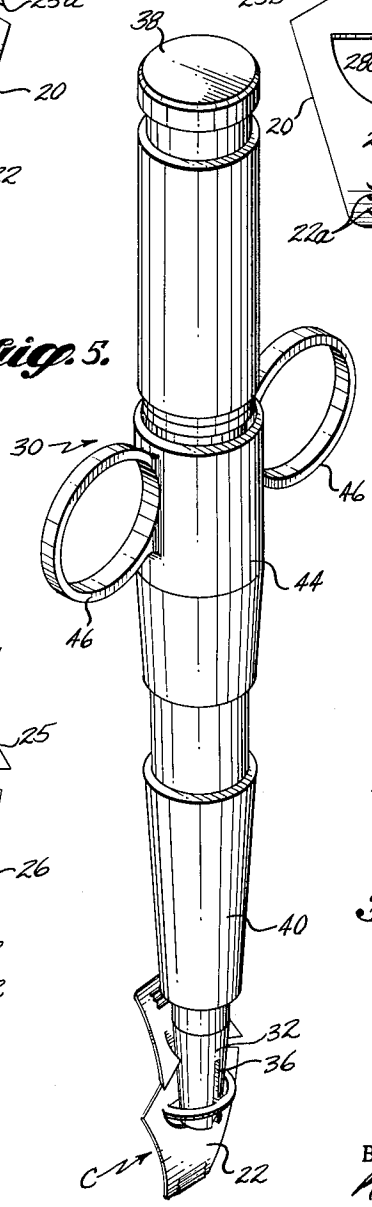
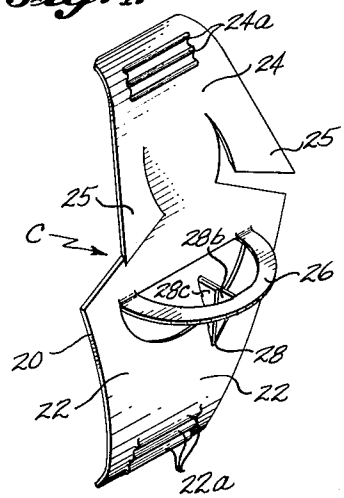


Fig. 1.



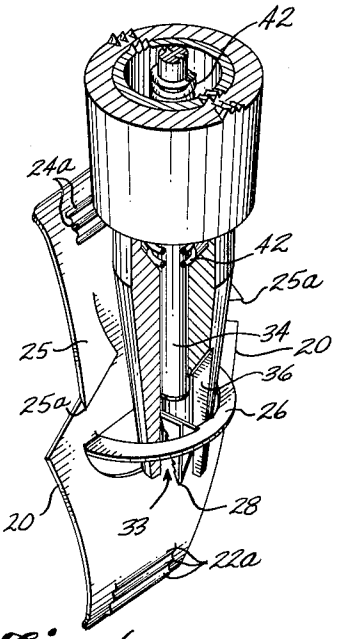


Fig. 6.

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Fig. 7.

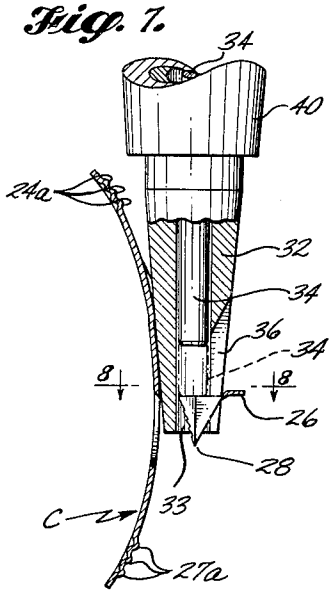


Fig. 8.

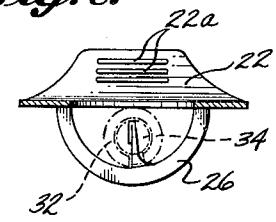
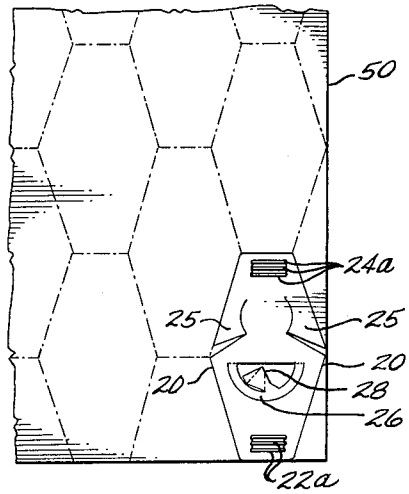


Fig. 9.



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CALVARIUM CLIP

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Fig. 10.

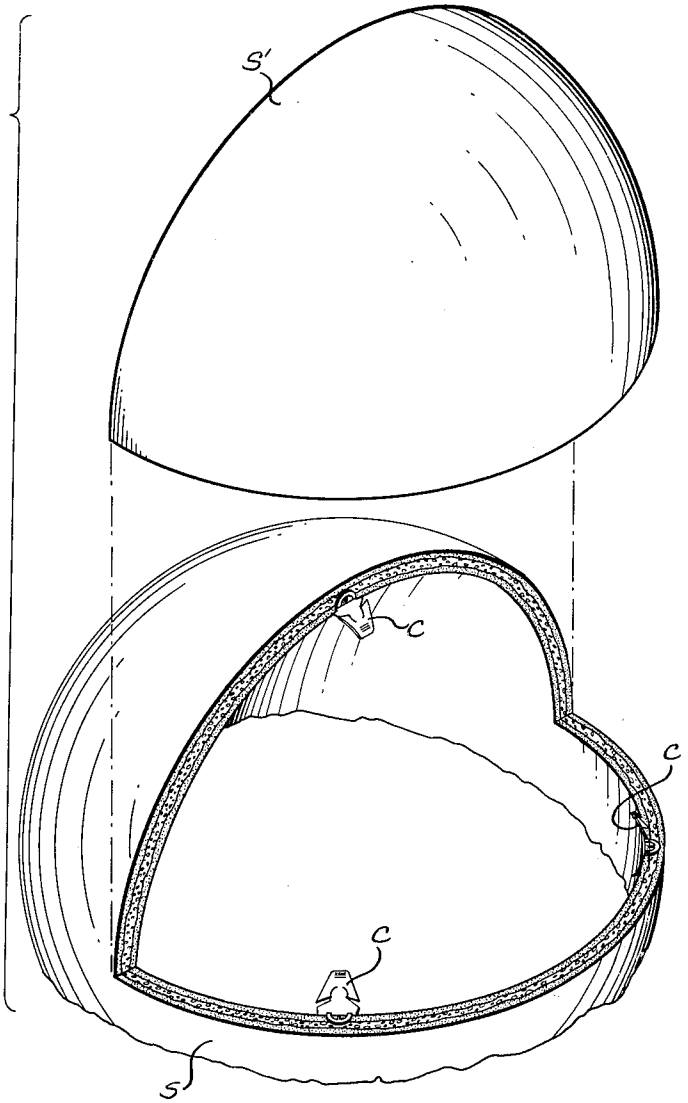


Fig. 11.

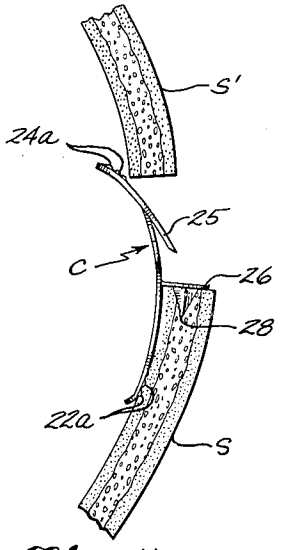
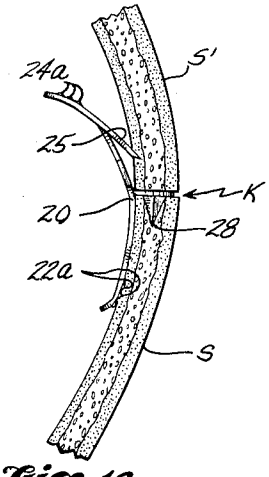


Fig. 12.



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United States Patent Office 3,220,081 Patented Nov. 30, 1965

3,220,081

CALVARIUM CLIP

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Filed Apr. 12, 1963, Ser. No. 272,722
14 Claims. (Cl. 27—21)

This invention relates to the mortuary art, and more particularly to means for use by morticians to resecure a calvarium section after autopsy of the brain in the cranial cavity. While the invention is herein illustratively described in terms of the preferred form thereof, it will be recognized that certain changes and modifications may be made therein without departing from the essential features involved.

In the past various means have been used for refastening portions of the skull bone removed for autopsy or other purposes. One common technique has been to drill holes adjacent the saw kerf and employ needles to suture or wire the calvarium section onto the basal skull section. This, however, is a tedious and time-consuming operation. A second technique has been to embed needles or screws or other fastening means on opposite sides of the saw kerf and to secure the sections together by means of wires or metal strips extending between the fasteners and across the kerf. This not only is a fairly troublesome method, but the screws, wires, etc. protrude from the surface of the skull and are later visible through the skin which is replaced over them. A third technique has been to employ clamps which grip between inner and outer jaws both the base of the skull and the calvarium section to hold the latter in place, but such devices also have the disadvantage that they are later visible through the replaced skin covering. The clamps also involve greater cost in their construction from spring steel or the like which is necessary for their operation.

It is the purpose of this invention to provide a device for securement in place of the calvarium section, which device is extremely simple to install and which has no protruding parts, but is completely hidden from view after installation.

A further object hereof is to provide such a calvarium closure device, hereinafter called a calvarium clip, which constitutes a guide whereby to facilitate placement of the calvarium section on the basal skull section with greater accuracy and speed and which is stable and permanent after installation. A further and highly important object is to provide a calvarium clip which is adapted to be installed by means of an existing and well-known, spring-loaded needle injector device.

Another object is to provide such a device which is of simple, one-piece construction, can be stamped out of a thin piece of material in large numbers, using a minimum amount of construction material, hence is constructed with minimum waste, and is therefore lower in cost to the mortician.

With the above purposes in view the invention consists in a clip having a sharp bone-entering point thereon adapted to be embedded in the bone of either the basal skull section or the calvarium section itself to anchor the clip thereto. A guide element or plate member connected to the point is adapted when the clip is installed to extend transversely of the saw kerf between the sections and at least in part to bear against the inside surface of the other skull section, thereby to insure alignment, or flush relationship, of the cut edges of the sections when fastened in edge-abutting relationship. The guide element further includes at least one sharp spur or the like projecting therefrom toward the kerf to permanently grip the inside surface of the skull section opposite that into which the point is driven, thereby to hold the two sections together.

At least the guide element portion of the clip is preferably of resilient construction and is positioned, when the clip is fastened to one section by embedding the point therein, so that when the sections are placed together the guide element is bent toward the inside of the skull and the resilient reaction force thereof holds the spurs permanently in contact with the inside surface of the section engaged thereby. Thus in actual use the clips are placed around the saw kerf with substantially equal spacing so that when completely installed the guide elements of the different clips bear outwardly in substantially opposite directions, thereby cooperating each with the others to hold the calvarium section against the basal skull section and retaining it in proper position.

In its preferred form the clip includes a spacer element adapted to extend transversely to the guide element and into the saw kerf between the sections. The spacer element is of a thickness substantially equal to the width of the kerf, thereby to substantially replace the spacing lost by the bone material which has been cut away. The anchoring point preferably extends from this spacer element in a position to be driven into the cut edge of the softer diploeic section of the bone.

Another preferred and very important feature of the invention is that it is adapted to be secured to the bone section by means of a spring-loaded needle injector of a popular type possessed by most morticians. The injector referred to has a substantially cylindrical or slightly tapered head and a radial slot leading into an endwise-opening hollow center of the head, and includes an axially movable spring-driven hammer element in the hollow head. A portion of the spacer element of the clip is adapted to extend into the radial slot of the injector. The bone-entering point itself is carried by this portion of the spacer element and is adapted to fit within the hollow center of the head to receive the blows of the hammer element. So that the clip will fit onto and be carried by the needle injector head prior to installation, the spacer element is preferably adapted to extend around the head of the injector, so that the injector head fits into an opening between the guide element and the spacer element. The anchor point preferably extends from the spacer element into the radial slot from the side farthest away from the guide element. In addition, the spurs on the guide element engage the cylindrical head to assist in holding the clip on the head before operation of the injector to install the clip.

These and other features, objects and advantages of the invention will become more apparent from the following detailed description taken in connection with the accompanying drawings which illustrate the preferred form thereof.

FIGURES 1, 2 and 3 in the drawings are, respectively, perspective, frontal and side views (enlarged) of the calvarium clip in its preferred and finished form.

FIGURE 4 is a front view of the clip just before final stages of forming in the preferred technique of manufacturing the same from a single flat piece of material.

FIGURE 5 is a perspective view of the calvarium clip fitted to the aforementioned needle injector and ready for installation.

FIGURE 6 is another somewhat enlarged perspective view of the clip fitted to the head of the needle injector, with portions of the latter cut away to illustrate the manner of fitting together and cooperation of the injector and the clip.

FIGURE 7 is a fragmentary sectional view of the clip and injector head fitted together, taken substantially along the vertical midline of both.

FIGURE 8 is a sectional view taken on the line 8—8 of FIGURE 7, and showing by dotted lines the position of the injector head when fitted to the clip.

FIGURE 9 illustrates the manner in which a plurality of the clips may be stamped or blanked from a single sheet of construction material with minimum waste.

FIGURE 10 is a simplified representation of a calvarium section and the human skull from which it is cut and showing the positioning of calvarium clips around the cut edges of the skull.

FIGURE 11 is a transverse sectional view of portions of the skull bone before being placed together with a calvarium clip installed by embedding the clip's anchor point into the skull bone, and showing how the clip serves to guide the skull portions together.

FIGURE 12 illustrates the position of the clip while holding the calvarium section in place.

This illustrated calvarium clip C comprises a plate or strip **20** that has a generally continuous curvature from end to end, and that has lower and upper end portions **22** and **24**. One or a pair of spurs **25** stands out at the convex side from the upper end portion **24**. A spacer element **26** extends transversely from the center or median portion of the plate **20**, and a bone entering point **28**, located along the longitudinal center line of the clip, is attached to the spacer element **26** and extends generally parallel to the plate, directed towards the lower end portion **22**. The clip is designed to remain completely hidden after installation. Thus the plate **20** is convexly curved to conform generally to the inside surface of a human skull of average size, but is resiliently flexible to adapt to different curvatures, and to insure that its spurs are urged into engagement with the skull. The point **28** is adapted to be driven into the cut face of the bone (FIGURE 11) and the spacer element **26**, of a thickness corresponding to that of the kerf, is adapted to fit within the kerf between the cut sections of bone when these sections are placed together (FIGURE 12). The lower end portion **22** of curved plate **20** serves as a base in cooperation with the spacer element **26** and point **28**, while the upper end portion **24** serves as a guide element for positioning the separated bone portions together, and carries the securing spurs **25**.

As has been stated, one spur such as **25**, properly located and arranged, will suffice, but preferably two such spurs are employed, equidistant from but located at opposite sides of the longitudinal centerline where the point **28** is located. The spurs **25** themselves are preferably formed by cutting the upper end **24** diagonally in from the edges of the plate and then in the direction of its length, and allowing the cut portions to stand out from the curvature of the remainder of the plate, at its convex side, as the remainder of the plate is bent, to form two points **25***a* widely spaced for greater stability and securing power. The diagonal leading edges of the spurs **25** are sharpened to form chisel-like edges **25***b* for better gripping of the tissue and bone on the inside of the skull at a level wholly above the kerf as shown in FIGURE 12.

The plate curvature may increase slightly at the extremities where small groups of serrations **22***a* and **24***a* are located to facilitate handling of the clips with wet gloves or hands. The lower serrations **22***a* also serve to grip surface tissue.

The spacer element **26** is cut from the plate in semicircular form in the lower portion of the plate and is bent outwardly along its diameter to extend transversely from substantially the center or median portion of the plate. The radius of the semicircular spacer element is great enough so that it extends more than halfway across the kerf to position the point **28** so that it will be driven into the softer central (diploeic) layer of the bone.

The anchoring point **28** formed from the central portion of the semicircular spacer element **26** (see FIGURE 4) comprises a more or less triangular connecting portion **28***a* bent downwardly from the spacer element (FIGURE 2), a web portion **28***b* of the shape of a trapezium, bent transversely to the connecting portion, and a triangular reinforcing portion **28***c* which is doubled back against the web portion **28***b*. The point is thus reinforced to receive blows of the instrument used to install the same. Portions **28***b* and **28***c* are cut so that when folded their upper edges coincide to provide a wider anvil surface for receiving driving blows and transmitting the force to the tip of the point through both portions. Teeth T are formed along the fold between these two portions to retain the point more securely in the bone.

The instrument used for installation in the illustrated case is the injector **30** illustrated in FIGURE 5 and more fully described in U.S. Patent No. 2,212,339. Injectors such as this are possessed by most morticians for injecting special needles used in mouth closures. The present invention takes advantage of that fact in that it is specially adapted to be inserted by the injector in the same manner as the mouth closure needles, thus requiring no additional equipment for its use.

The injector **30** includes a more or less cylindrical or slightly tapered head **32** within the hollow center **33** of which moves the elongated hammer element **34**. The head **32** also has a radial slot **36** leading into the hollow center thereof. The spacer element **26** of the clip C is of a size to permit inserting the head **32** between it and the plate **20**, while the anchor point **28** projects into the center opening **33** through radial slot **36**. The clip is thus held frictionally on the injector head by engagement of the spacer element and plate therewith and additionally by engagement of the spurs **25** on both sides of the injector head, while the point is positioned below the hammer to be driven thereby.

In actual operation the end of the injector head **32** with the clip C carried thereon (FIGURE 5), is placed against the cut face of bone with the lower end portion **22** of the clip projecting along the inside skull surface. Pressure is then applied to the butt end **38** of the injector, causing the head **32** to be retracted within the sleeve **40** against the pressure of spring **42**. This brings the hammer **34** into position against the anchor point **28** as indicated by dotted lines in FIGURE 7. The injector is then operated by retracting the upper sleeve **44** toward the butt end **38** by pulling on the rings **46** with fingers inserted therein. When this sleeve is retracted to a position substantially as shown (FIGURE 5) the hammer **34** is withdrawn to a firing position away from the anchor point, compressing a drive spring (not shown) within the injector body. Upon further retraction the hammer is triggered and driven downwardly against the upper edge of the anchor point by the drive spring. Usually two or three such blows are required to embed the point entirely, though it is driven into the softer diploeic layer of the skull bone.

By the foregoing or equivalent steps the clip is attached to one or the other of the cut-apart sections of bone, usually to the basal skull section S as illustrated in FIGURE 10, rather than to the calvarium section S'. Enough clips are used to assure alignment of the bone section in all directions, the required number depending somewhat on the shape and size of the section. In the case of a quarter section as illustrated, where two saw cuts are made at substantially right angles to each other, three clips will normally suffice, with two clips spaced apart on one cut and one centrally located on the other. Some clips may be installed in inverted disposition, although the end portion **24** may still be considered the upper end portion. With the clips thus mounted the calvarium section S' is replaced. As it engages all the clips, each is bent inwardly against its own resilience, the upper portion of each serving as a positioner to guide the section into place as illustrated in FIGURE 11. The spurs **25** stand out far enough in front of plate **20** to automatically engage and embed themselves into the inside tissue and against the bone surface as depicted in FIGURE 12. The clips cooperate with one another not only in guiding the section S' into place, but also in resiliently

bearing outwardly in collectively opposite directions, thereby holding the section from slippage in any direction.

While a clip according to this invention may be constructed from many different suitable materials, such as a high-impact, yet resilient plastic, it is preferably constructed of a metal alloy having resilient, form-retentive qualities and containing a corrosion resistant element such as cadmium, or it may be coated with a noncorrosive paint, or the like. The illustrated embodiment is specially designed to be initially stamped from a sheet of metal **50**, as illustrated in FIGURE 9, with minimum waste of material. Construction is therefore essentially a two or three step process consisting first of stamping a multiplicity of the clips in flat plate form from a large sheet, including making the necessary cuts for the spurs **25**, the spacer element **26** and point **28**, and stamping in the serrations **22***a* and **24***a*. The second step is to bend and fold the various parts into shape as previously described, and thirdly the spurs may be sharpened and teeth or serrations T on the point **28** created. Thus the further advantages of simplicity and low construction cost inhere in the invention. These and other advantages will be apparent to those skilled in the art.

I claim as my invention:

1. A calvarium clip comprising a body strip formed with upper and lower end portions lying generally in one continuous curve from end to end, and a median portion therebetween, the strip being formed of resilient material, an integral point offset from the convex side of said clip at its median portion and extending in the direction of and generally parallel to the strip's length towards its lower end portion, and spur means outstanding from the convex side of the upper end portion, and also directed towards the lower end portion, the point of said spur means being located wholly above the median portion.

2. A calvarium clip as in claim **1** including two spurs outstanding from the convex side of the strip, at respectively opposite sides of its longitudinal centerline, and directed towards the lower end portion thereof, the point being located substantially along the longitudinal center line.

3. A calvarium clip comprising a body strip of resilient material formed with upper and lower portions lying generally in one continuous curve from end to end, and a spacer element outstanding from the convex side of the strip, intermediate the two end portions, in a plane transverse to the strip's longitudinal centerline, a point projecting from said spacer element in the direction of the strip's length towards its lower end portion, and spur means outstanding from the convex side of the upper end portion and directed towards the lower end portion, the point of said spur means being located wholly above said spacer element.

4. A calvarium clip as in claim **3**, wherein the spacer element is in the form of a semicircular rim, and the point is supported at substantially the midpoint thereof, and within said rim.

5. A calvarium clip as in claim **4**, wherein the point is flat and lies in a plane perpendicular to the general plane of the clip.

6. A calvarium clip as in claim **1**, wherein the point is flat, lies in a plane perpendicular to the general plane of the clip, and is serrated for retention, along at least one edge.

7. An elongated calvarium clip of resilient sheet material formed with upper and lower portions joined at a median portion, each end portion having opposite side edges converging towards its tip from the median portion, the upper and lower end portions lying wholly in one continuous curve substantially from tip to tip, an anchoring point integral with and outstanding from the convex side of the median portion, and directed generally parallel to said lower portion and towards its lower end tip, a pair of spurs integral with the upper end portion, and each formed with a tip outstanding at the convex side of said upper end portion and directed generally towards the lower end portion, the spurs each having a lower edge directed inwardly and diagonally upwardly from its tip.

8. A calvarium clip as in claim **7**, wherein the diagonally directed edges of the spurs are sharp, for engagement by their resilience with a calvarium surface.

9. A calvarium clip as in claim **7**, including a spacer element integral with the median portion and disposed in a plane perpendicular to the clip's longitudinal centerline, and to the general plane of the clip, the anchoring point being integral with said spacer element.

10. An elongated calvarium clip of sheet material formed with upper and lower end portions, and a median portion therebetween, said clip having a general end-to-end curvature, spur means outstanding from its upper end portion at its convex side, a spacer element integral with the median portion and disposed in a plane perpendicular to the clip's longitudinal centerline, and to the general plane of the clip, and an anchoring point integral with the spacer element, and outstanding from the clip's lower end portion, directed generally towards the tip thereof.

11. A calvarium clip as in claim **10**, wherein the spacer element is formed as a generally semicircular rim, and the point is formed of a plurality of folded layers of material originally within said rim.

12. A calvarium clip as in claim **11**, wherein the point includes a generally triangular portion joined along one edge to the midpoint of the rim, a web portion of generally trapezium shape joined along one of its edges to another edge of said triangular portion and folded back towards the same, and a generally triangular reinforcing portion joined along one of its edges to another edge of the trapezium-shaped web portion and doubled back against the same.

13. A calvarium clip comprising a body strip formed of resilient material with upper and lower end portions lying generally in one continuous curve from end to end, and a median portion therebetween, an integral point offset from the convex side of said clip at its median portion and extending in the direction of the strip's length towards its lower end portion, spur means outstanding from the convex side of the upper end portion, and also directed towards the lower end portion, the point of said spur means being located wholly above the median portion, and transverse serrations outstanding from the convex side of the clip, adjacent the tips of the upper and lower end portions.

14. An elongated calvarium clip of one-piece construction, comprising an elongated strip of resilient sheet metal formed with upper end and lower end portions and an intervening median portion, and having a general end-to-end curvature, an integral spacer element struck from the lower end portion and lying in a plane, at the median portion, that is generally perpendicular to the general plane of the strip, at its convex side, and that is perpendicular to the longitudinal centerline thereof, a point integral with and struck from the spacer element, and directed towards the tip of the lower end portion, offset from the convex side thereof, and spur means also integral with and struck from the upper end portion of the strip, at its convex side, directed towards the median portion.

References Cited by the Examiner

UNITED STATES PATENTS

2,065,659	12/1936	Cullen	27—21
2,212,339	8/1940	Cullen	1—47
2,576,649	11/1951	Slind	27—21
3,020,602	2/1962	Siering	85—13 X

RICHARD A. GAUDET, *Primary Examiner.*