United States Patent

Yost

[15] 3,695,259

[45] Oct. 3, 1972

[54] **BONE PLATE**

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[22] Filed: **Nov. 10, 1970**

[21] Appl. No.: **88,337**

[52] **U.S. Cl.** ..... **128/92 D**

[51] **Int. Cl.** **A61f 5/04**

[58] **Field of Search**.....128/92 D, 92 R, 92 B, 92 BA, 128/92 BB, 92 BC

[56] **References Cited**

UNITED STATES PATENTS

2,443,363	6/1948	Townsend et al.	128/92 D
3,463;148	8/1969	Treace	128/92 R

FOREIGN PATENTS OR APPLICATIONS

373,516	1/1964	Switzerland	128/92 BA

OTHER PUBLICATIONS

Fracture Appliances (Catalog) by DePuy Mfg. Co., Inc., Warsaw, Ind., 1954, page 124 A relied upon (Intramedullary Bars–Livingston Type, Cat. no. 6495)

" Fixation of Bones by Plates and Screws" by L. T. Peterson, Journal of Bone & Joint Surgery, Vol. 29, No. 2, April 1947, p. 335– 347, 128– 92B

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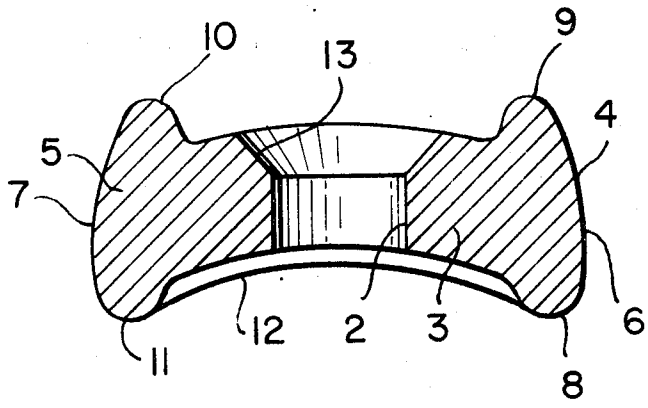
[57] **ABSTRACT**

The invention relates to a plate adapted to be secured to a bone surface in order to set broken bones, the plate having a modified I configuration in cross section for maximum strength characteristics and to enable the plate to be fitted against bones of varying surface contours, while the plate is of minimum thickness. The plate is provided with a plurality of countersunk apertures or slots to enable the plate to be secured to the bone by means of screws.

6 Claims, 4 Drawing Figures



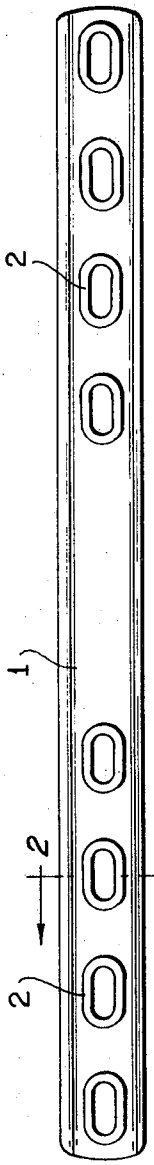


FIG. 1

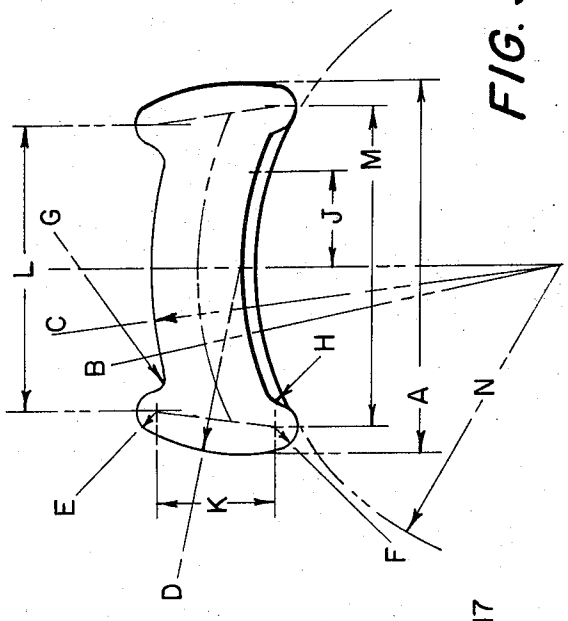


FIG. 3

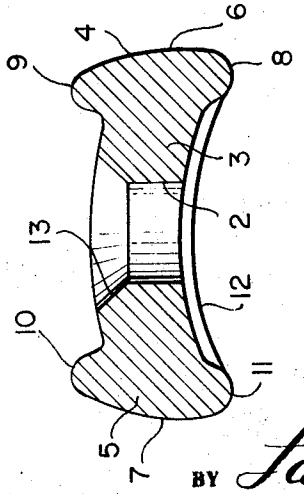


FIG. 2

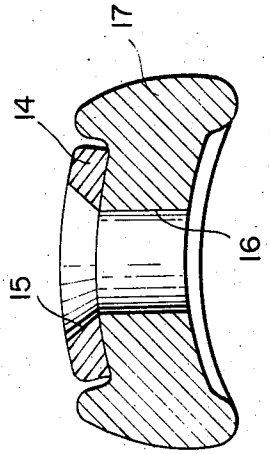


FIG. 4

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BONE PLATE

The present invention relates to a bone plate and more particularly to a bone plate having a modified I shape in cross section with the plate being of minimum thickness and providing maximum rigidity.

Heretofore bone plates have been generally flat with apertures therein so that bone screws may be passed through the plate into the bone. In order to give these plates the necessary strength and rigidity they are generally formed of uniformly relatively thick stock. Alternatively these plates have been made of thinner stock but with reinforcement at the apertures. Difficulty has been encountered in that the plates could not fit snugly against bones of varying configuration.

According to the present invention there is provided a bone plate having a modified I beam cross section such that the plate provides maximum strength with minimum thickness. Furthermore, the plate is of such a configuration that it is adapted to fit against bones having varying curvatures. The plate is provided with counter sunk apertures which may be in the form of slots so that the plate can be adjusted or replaced after being screwed into position on the bone. The plate according to the present invention may be made from rolled formed stock.

A primary object of the present invention is to provide a bone plate which is of minimum thickness and yet which provides maximum strength characteristics.

A further object of the present invention is to provide a bone plate which may be replaced or adjusted after fixation to a bone.

Still other objects and many of the attendant advantages of the present invention will become more readily apparent upon consideration of the following detailed description in connection with the accompanying drawings wherein:

FIG. 1 is a plan view of a bone plate according to the present invention,

FIG. 2 is a sectional view along the line 2—2 of FIG. 1,

FIG. 3 is a sectional view showing the dimensional relationships of various portions of the plate and

FIG. 4 is a sectional view of a modified embodiment of the bone plate.

Referring now more specifically to the drawings wherein like numerals indicate like parts throughout the several views there is shown at 1 in FIG. 1 a bone plate which is preferably formed of low carbon vacuum melt stainless steel. Adjacent each end of the plate are a series of apertures 2 which may be in the form of slots. These slots are adapted to receive bone screws for securing the plate to the surface of a bone. By providing slots in the bone plate it is possible to adjust the position of the plate with respect to the bone screws should it be necessary to relocate the bone plate or replace the plate due to absorption of the bone or the necessity for resetting the bone fixation.

As clearly shown in FIG. 2 the bone plate is shaped in a modified I cross section. The central portion 3 is provided with flanged side portions 4 and 5. The elongated rounded shape of these flanged side portions may conveniently be referred to as being of generally oval cross section. The outer peripheral surface of the flanged side portions 4 and 5 are convexly curved as shown at 6 and 7 respectively, the curvature extending inwardly

towards the upper surface of the bone plate. The peripheral edges of the flanged portions 4 and 5 are rounded as shown at 8, 9, 10 and 11 so as to present no sharp edges and to provide a surface which will permit the snug engagement of the bone plate with bones having varying contours as shown, for example, by the engagement of the rounded flanged portions 8 and 11 with the curved bone shown diagrammatically at 12. The slotted aperture 2 has a chamfered surface 13 adjacent the upper surface of the bone plate. This permits the bone screws to be received within the bone plate without any portions of the screws projecting beyond the peripheral edges of the plate.

In FIG. 4 there is shown a modified design of a bone plate wherein there is provided a washer 14 which has a chamfered aperture 15 therein adapted to be aligned with the bone screw aperture 16 in plate 17. It can be seen that the washer 14 is of such dimensions that it does not project beyond the peripheral edges of the bone plate 17.

The dimensional configurations of the bone plate constructed in accordance with the present invention are critical. It is desirable to provide a bone plate with maximum strength characteristics and yet with minimum dimensions in order to reduce trauma in the patient. It has been found that with the modified I beam design great strength can be achieved using a minimum of metal. The I beam design also permits the bone plate to fit against bones of varying configuration as shown in FIG. 2. The most commonly used sizes for bone plates are ⅜, ½, ⅝ and ¾ inch. In FIG. 3 there is shown diagrammatically a cross section of the modified I beam design bone plate with the dimensional relationships shown by letter designation. These critical dimensional relationships are as follows:

N	A	B	C	D	E
0.319 ⅜	0.375	0.338	0.431	0.290	0.019
0.425 ½	0.500	0.450	0.575	0.387	0.025
0.531 ⅝	0.625	0.563	0.719	0.484	0.031
0.637 ¾	0.750	0.677	0.863	0.581	0.037
	F	G	H	J	K
	0.026	0.019	0.019	0.103	0.122
	0.034	0.025	0.025	0.138	0.162
	0.043	0.031	0.031	0.172	0.203
	0.052	0.037	0.037	0.206	0.244
	K	M			
	0.298	0.323			
	0.397	0.431			
	0.496	0.539			
	0.595	0.647			

The plate shown and described herein not only posesses marked strength characteristics but is economical to manufacture. The plate may be used to replace any bone plates currently available, particularly where the slotted configuration with washer as shown in FIG. 4 is utilized. The bone screw and washer can be slid along the slot to line up with the previous hole in the bone to prevent drilling of another hole in the bone.

Obviously many modifications and variations of the present invention are possible in light of the foregoing teachings. What is claimed as new and is desired to be securred by Letters Patent is:

I claim:

1. A bone plate adapted to be secured to the exterior surface of a bone comprising:

an elongated plate of modified I shape having a pair of generally parallel side flanges, each of generally

oval cross-section with one of the longer sides of the generally oval cross-section of each side flange facing the other side flange, the ends of said generally oval cross-sections being rounded on at least one side of the elongated plate to conform to bone surfaces of varying contours,

and a central portion integral with said side flanges and extending between them, intersecting the side flanges at an intermediate point along the said facing long sides of their generally oval cross-sections, said central portion being of the same thickness across its width, from its intersection with one of said side flanges to its intersection with the other side flange, said thickness being less than the dimension of the side flanges taken in the longer direction of the said generally oval cross-section and apertures in said central portion to receive screws for securing to the bone.

2. A bone plate according to claim 1, wherein said apertures are countersunk on one surface of the central portion and the outer side faces of the side flanges are curved inwardly in a direction towards the countersunk apertured surface.

3. A bone plate according to claim 2, wherein said apertures comprise slots extending longitudinally in said central portion.

4. A bone plate according to claim 1, the surfaces of said central portion being curved in a direction transverse to the longitudinal direction of the plate, both surfaces being curved in the same direction as each other so as to extend substantially parallel and in space relation with respect to the surface of the bone to which the plate is adapted to be secured.

5. A bone plate according to claim 4, wherein said apertures comprise slots extending along the longitudinal axis of said central portion and including washers having countersunk apertures therein, said washers being located on one side of said central portion and having a thickness substantially equal to the distance which said flanged sides extend perpendicularly away from said one surface of the central portion.

6. A bone plate according to claim 1, having a total width from the outside of one side flange to the outside of the other flange within the range of 0.375 to 0.750 inches, said central portion having a thickness within the range of 0.093 to 0.186 inches, and the side flanges having a thickness within the range of 0.167 to 0.333 inches.

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