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H. WICHMAN

2,501,978

BONE SPLINT

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FIG. 1

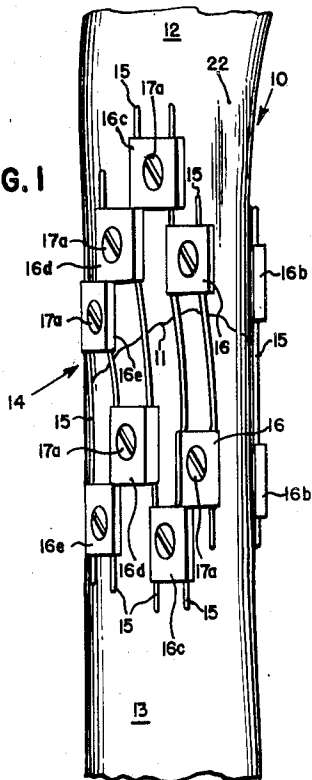


FIG. 2

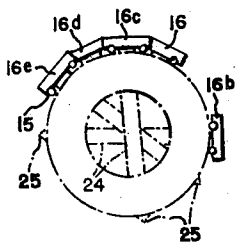


FIG. 3

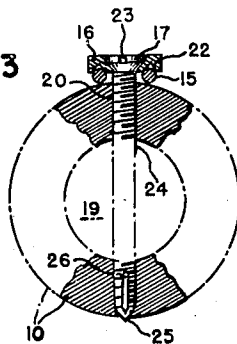


FIG. 4

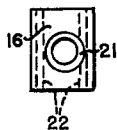


FIG. 7



FIG. 5

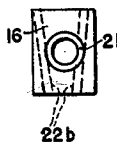


FIG. 8

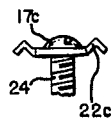
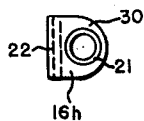


FIG. 6



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BONE SPLINT

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5 Claims. (Cl. 128—92)

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This invention relates generally to surgical appliances and has particular reference to methods of and structural means for treating bone fractures.

The primary object of this invention is the provision of an organization of the disclosed type which is capable of being applied to a fracture by methodical steps of the specified kind, each one of which advances to a greatly improved complete result.

Another object is to apply a rigidifying unit to a fracture by securely fastening elements of the unit to the bone near the fracture on opposite sides thereof, while at the same time substantially avoiding the fracture line with said elements as they pass over that line.

An important object is to provide a reliably strong, light and advantageous element of a splint which, while attached to the bone parts in the disclosed manner, passes over the fracture linearly; that is to say, in a manner having length without, or substantially without breadth.

A further object is to provide a splint having rigid elements which pass across the fracture of a bone without engaging or covering the fracture line or lines, whereby to secure advantages in the knitting functions of the bone parts.

Still another object of this invention is to provide a splint unit of the present kind, the elements of which are of a simplified nature, so that they readily may be applied to a fracture beneficially with regard to the time required for preparation of the necessary appliances, and also with regard to actual time consumed in application of said appliances to the fracture.

Yet another object is to provide a splint organization which forms a compact, easily portable and advantageous part of a surgeon's equipment.

A feature of the invention is a wire splint element which is of circular cross section, so that as said element crosses the fracture line, any actual engagement of the arcuate part of the wire with the fracture will either be nil or practically so. Since this element is merely a cut length, a number of lengths of different dimensions, longitudinally and diametrically may conveniently be provided and kept in readiness to form part of the equipment, as aforesaid. Selected lengths of this reinforcing element may also be easily cut from stock by a suitable tool.

The foregoing and other objects and advantages of the invention will be further pointed out, and will become additionally apparent in the following description and claims, taken with the accompanying drawings, which illustrate, by way of example, the principle of the invention and

the preferred mode which has been at present contemplated for applying that principle.

In said drawings:

Fig. 1 is an elevational view, showing in attachment with a fractured bone, a splint unit constructed in accordance with this invention.

Fig. 2 is an elevational view, partly diagrammatic, of the adjacent end of Fig. 1.

Fig. 3 is an enlarged fragmentary, sectional detail view.

Fig. 4 is a top plan view of a retaining plate.

Fig. 5 is a plan view of a modified form of plate.

Fig. 6 is a plan view of another form of retaining plate.

Fig. 7 is a plan view of an additionally modified retaining plate; and

Fig. 8 is an edge view of the plate of Fig. 7.

In the drawings, illustrating a practical embodiment of the invention, a bone 10, having therein a fracture 11, in the present instance shown as being a single break, is thereby divided into two sections 12, 13.

A splint unit 14 includes a number of wire elements 15 of stainless steel, which elements, having individual lengths suitable for matching the diameter of the bone 10, are substantially alike and held in attached positions on the sections 12, 13 by perforated retaining plates 16, through which screws pass into the bone. The numeral 16 has in some instances added thereto for distinctiveness alphabetical suffixes, and in some cases the numeral 17, representing screws, is also further distinguished by addition of the suffix *a*.

For each screw 17 a perforation 20 is made in the bone 10, the first two perforations according to one method of procedure being for screws 17a, 17a, said screws passing through the plates 16, said plates having therein countersunk seats 21 for coacting heads of the screws.

As shown in Fig. 4, each plate 16 has therein a pair of grooves 22 for holdingly receiving the end portions of the elements 15, when the screws 17a are turned home. In each of the screws is a plain kerf 23, but kerfs which include a suitable central depression, as well as coacting projecting features on a screw driver, may be used, such screw heads and screw drivers being well known in the art. With one of the screws 17a tightened on a plate 16 over two elements 15, the faces of the sections 12, 13 are properly adjusted, and then the other screw 17a is correspondingly tightened through the other plate 16, securing said sections in the correctly set location. Each of the screws, as best seen in Fig. 4, at the point portions 25 thereof, also passes holdingly, past the hollow core 19, into the opposite wall of the

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bone 10, said point portions being also additionally referred to hereinafter.

The perforations 20 for the screws 17 are made of less diameter than the threaded stems 24 of the screws, and the aforesaid point portions 25 have therein on opposite sides slots 26, providing tapped ends, so that in the reduced bores 29 the holding functions of said stems are sufficient. Otherwise stated the screw stems at the grooves 26 form their own threads in said bores.

The next set of elements to be installed may be that on the right hand side where the plates are designated 16b, and in which set the elements and procedure are the same as those described in the case of the first set, including the screws 17a. Since the equipment, as above referred to, also includes screws of different lengths, the correct screw in each instance is selected, and it is desirable that the points 25 thereof should project at least slightly beyond the outermost distant surface of the bone 10.

It being understood that perforations 20 are inserted where decided upon, next on the left to the plates 16c are plates 16d, and the splint members associated with these last mentioned plates are the same as those which cooperate with the plates 16c. The right hand grooves of the plates 16d embrace the end portions of the same wire 15 that is held by the left hand grooves of the plates 16c, and the particular screws of the plates 16d are also designated 17a.

This organization therefore includes a network of specific rigidifying members in which on one side of a fracture a wire at one of its ends is embraced by two holding plates, and at its other end, on the opposite side of the fracture, said wire is held by portions of two other plates.

Two plates 16e, 16e embrace by their grooves at the right hand sides thereof wire end portions 15, which are also engaged by left hand grooves of two plates 16d, 16d; and the left hand grooves of the plates 16e embrace at opposite sides of the fracture 11, another wire 15, which latter is the outermost at the left of the unit 14. Distribution of splint members around a bone may be made in a manner different from the particular preferred arrangement herein selected for illustration.

If for any reason it is decided at the tightening of about the last screws on the plates 16e, that the adjustment of the faces of the sections 12, 13 against each other is not exactly as desired a number of the screws in any one of said sections may be suitably loosened, so that said sections may be readjusted, whereon the screws are again finally tightened.

Pairs of wires 15, such as those held by the plates 16 and 16b respectively, need not be in parallelism, this independent setting being to suit the bone formation, and a pair of wires held by two plates need not be in parallel relation. In this latter case a plate with a pair of grooves a certain distance apart may be used at one end of such pair, for example, and a plate may be used at the opposite end of such pair in which the grooves are a different distance apart.

In Fig. 5 is shown a pair of grooves 22b which are splayed, so as to engage and hold wire elements that are similarly placed; and in Fig. 6 is shown a plate 16h having only one groove therein, said plate having an arcuate end 30, and other features thereof being like those already described above.

Fig. 7 shows an additional form of retaining plate, which is suitable for being struck out of or otherwise formed from plate stock, this plate hav-

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ing a screw hole 21c and angularly turned flanges 22c, forming in effect grooves for wires 15. This plate 16j is held in place by a screw having a rounded head 17c, and is otherwise like the screw 17.

Between the lowermost part of the countersunk opening 21 of a plate and the stem of a screw 17, at its head, some play is provided for, so that, in order to avoid any two screws at their stems coming into contact, particularly apertures 29 may be arranged to receive stems which, at final tightening, may not be exactly at right angles to the plane of the face of a retaining plate.

For similar reasons, the perforations for the screws 17, as well as being staggered, are disposed at different distances from a transverse plane of the bone 10. The plates 16 are oblong, with the holding groove features running along the longer dimension, so as to give a beneficial holding result, and the stainless steel used in the members of the present splint is of a special variety, suitable as is well known for surgical purposes.

It is another advantage of the wires 15 that they may be formed or bent to suit curvatures or local formations of a bone, said wires being capable of being provided with depressions or projections, or both, to meet requirements.

After application of the splint as herein described, the injury is treated by the surgeon in the usual manner, and on completion of the time concerned, as required for the knitting to take place, the splint is removed.

In Fig. 1 is indicated a ridged portion 32 of the bone 10, at which the splint parts are disposed in outwardly inclined relation, it being seen that the wires 15 are appropriately bent thereat, while said wires are at the same time, close to the bone.

As the construction hereinbefore described admits of being considerably modified by those skilled in the art, the particular arrangements shown should be taken as illustrative, and not in a limiting sense; therefore the scope of the protection contemplated should be taken from the appended claims, interpreted as broadly as is consistent with the state of the prior art.

Having thus described my invention, I claim:

1. A surgical splint having a pair of wires for crossing a fracture between two bone sections, two retaining plates for the ends of said pair of wires on said sections, each plate having therein one perforation for receiving an attaching screw, said plates having grooves therein for fitting onto said ends.

2. A splint comprising in combination three substantially straight wire elements having plain ends, said elements including a medial wire having right and left hand lateral wires therewith; retaining plates each including a pair of grooves for fitting onto said ends, said plates including a first member at each end having a right hand groove for the medial element and a groove for the left hand element, and a second member having a left hand groove for the medial element and a groove for the right hand element.

3. A splint comprising in combination a set of three substantially straight wires having plain opposite ends, said wires including a middle element and right and left lateral elements; and two retaining plates for said set at its opposite ends, each plate having therein a screw hole and a pair of lateral grooves, the latter being to fit onto said ends, one plate at each end having a right hand groove for the middle element and a

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groove for the left hand element, another of the plates at each end having a left hand groove for the middle element, and a screw for the hole of each plate.

4. A splint of the class described having plural elements of linear type adapted to be placed over a bone fracture with the end portions of the elements engaging bone parts near the fracture, said elements being individually bendable before the emplacement to conform with the contour of the bone surface, retaining members for said end portions, each of said members having therein a perforation and being so formed at its lateral sides as to fit limitedly onto pairs of said end portions, and means for holding said plates in the fitting position in such manner that the inner faces of said plates are still spaced from the bone, said holding means adapted to pass through the perforations.

5. In a surgical instrument, in combination, a wire member having its ends adapted to engage a bone surface on opposite sides of a fracture, and

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a retaining plate for each of said ends, each plate having therein a hole and an adjacent groove, the latter adapted to fit onto one of said ends, said hole in each case adapted to receive a fastening screw.

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