Dec. 16, 1947. C. J. SPEAS 2,432,695

FRACTURE APPLIANCE

Filed Aug. 26, 1943 3 Sheets-Sheet 1

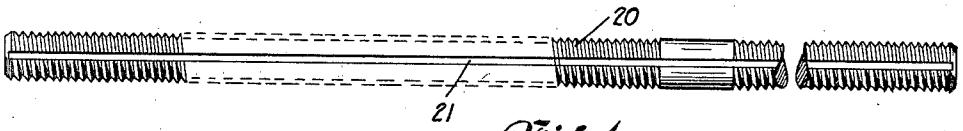



Fig. 1.

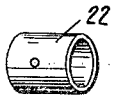



Fig. 2.

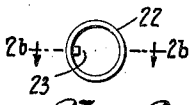



Fig. 2a.

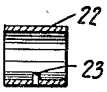



Fig. 2b.

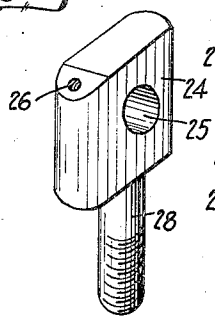



Fig. 3.

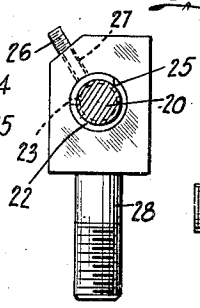



Fig. 4.

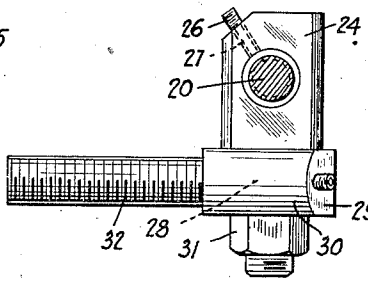



Fig. 5.

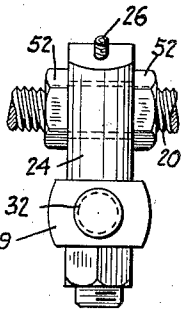



Fig. 6.

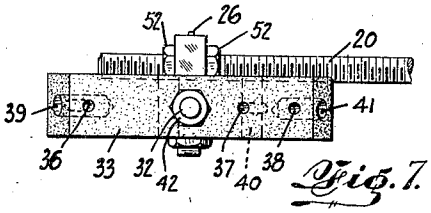



Fig. 7.

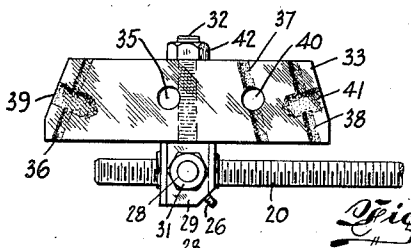



Fig. 9.

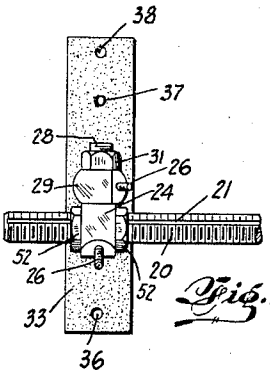



Fig. 10.

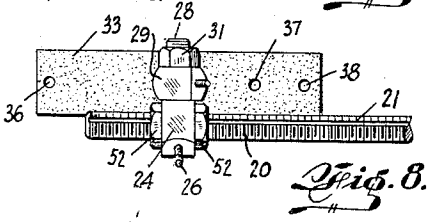



Fig. 8.

INVENTOR
CLARENCE J. SPEAS.
BY Percy Truman
ATTORNEY.

Dec. 16, 1947. C. J. SPEAS 2,432,695

FRACTURE APPLIANCE

Filed Aug. 26, 1943 3 Sheets-Sheet 2

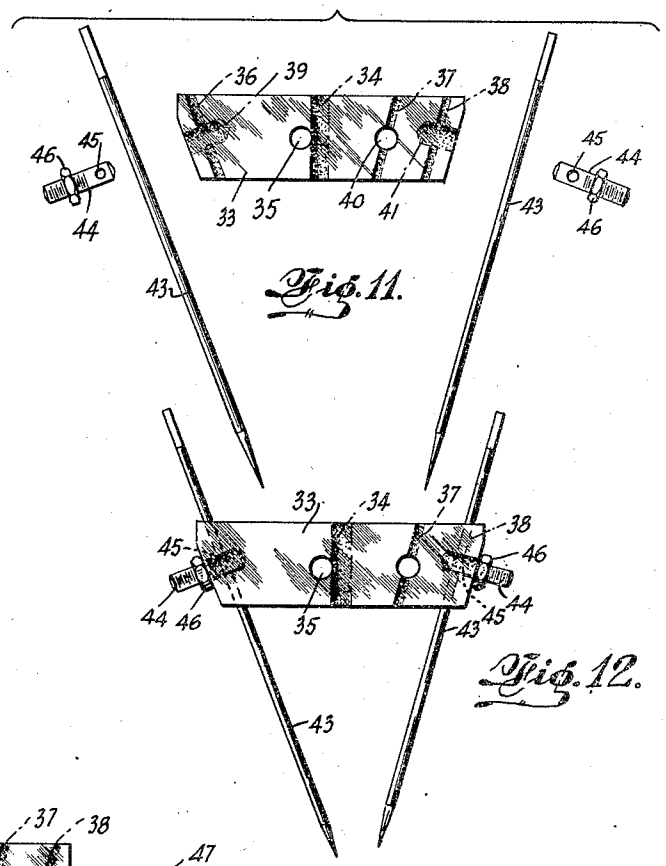



Fig. 11.

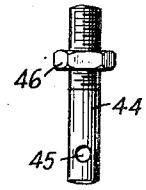



Fig. 13.




Fig. 12.

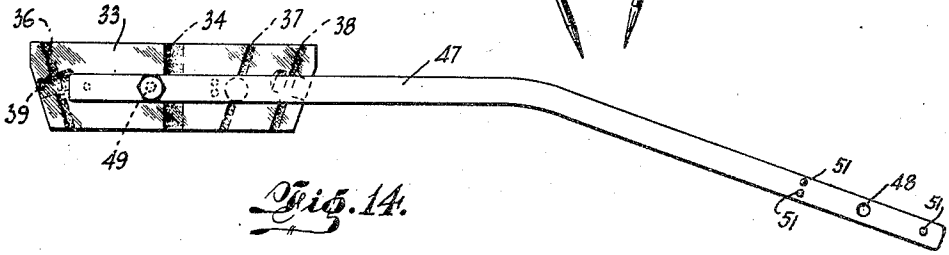



Fig. 14.

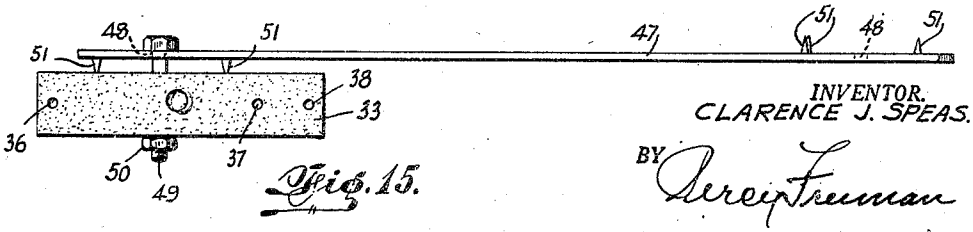



Fig. 15.

INVENTOR.
CLARENCE J. SPEAS.

BY Percy Freeman

ATTORNEY.

Dec. 16, 1947. C. J. SPEAS 2,432,695

FRACTURE APPLIANCE

Filed Aug. 26, 1943 3 Sheets-Sheet 3

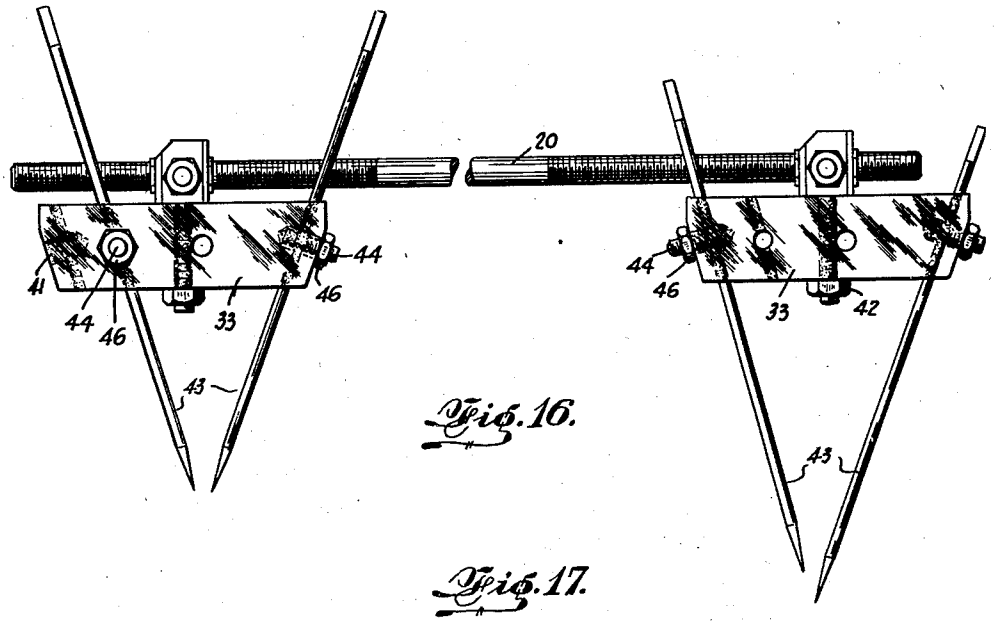
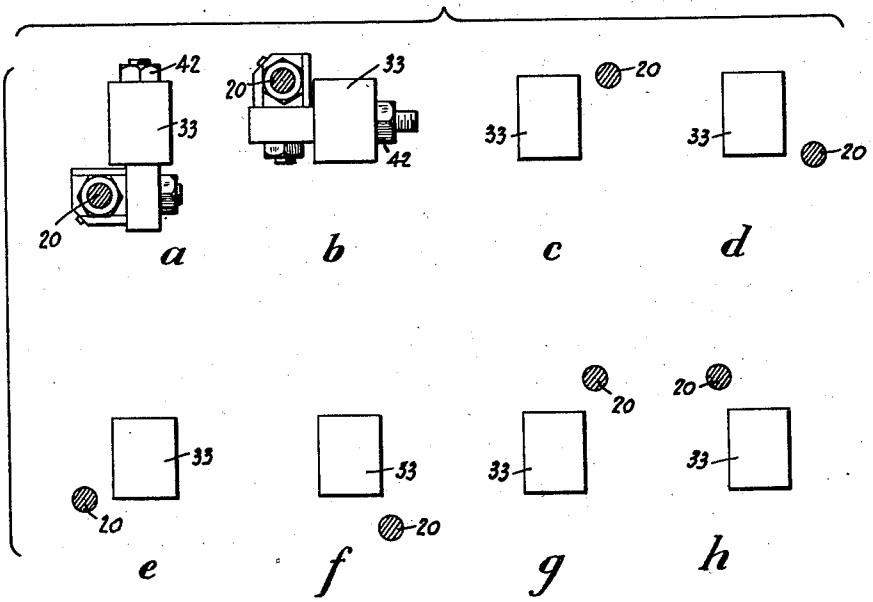



Fig. 16.

Fig. 17.




INVENTOR.
CLARENCE J. SPEAS.

BY Percy Truman

ATTORNEY

Patented Dec. 16, 1947

2,432,695

# UNITED STATES PATENT OFFICE

2,432,695

## FRACTURE APPLIANCE

Clarence J. Speas, Burlington, Vt.

Application August 26, 1943, Serial No. 500,027

3 Claims. (Cl. 128—84)

1

The present invention relates to improvements in skeletal reduction splints, and is primarily distinguished from other splints of this type, firstly, by the use of universally adjustable pin-bars and, secondly, by the use of pin-bar assemblies which are adapted to be slidably moved, independently, along the traction rod—this latter feature being in contradistinction to the practice of attaching the pin-bar assemblies to a turnbuckle-type of traction rod which has the effect, when rotated, of simultaneously advancing or retracting the pin-bar assemblies, as the case may be, depending on the direction of rotation. A serious disadvantage of this latter arrangement, however, is that when the turnbuckle rod is rotated there is a tendency for it to rotate the pin-bar assemblies also, and thus interfere with what may be the desired operation upon the bone fragments. For example, should it be desired to increase or impose impaction after initial reduction and fixation, assuming the bone fragments to be in anatomical alignment, rotating the rod in the proper direction, while having this effect, may also cause rotation of the bone fragments to alter the previously achieved anatomical alignment, or, at least, set up torsional strains or stresses. By enabling the pin-bar assemblies to be slid along the traction rod instead, separation or impaction of the bone fragments becomes an uncomplicated affair.

The advantages arising from the creation and use of universally adjustable pin-bars are dual in nature: one, it extends the range of applicability of the device, and, two, it immensely simplifies and expedites the application of the device in any given situation.

In other extraskeletal splints, over which mine is an improvement, while the pin-bar assemblies as a whole may be rotated 360 degrees, the pin-bar itself has only limited movement both with respect to the other elements of the assembly and about its own axis of rotation. The swing of the pin-bar with respect to the other elements of the assembly is actually hardly more than 30 degrees, and the swing on its own axis is actually about 30 degrees. In my case, all the elements of the assembly are capable of 360 degree rotation, each (of which there are three) in a plane or about an axis at right angles to each other, thus constituting a true universal joint or unit. In my case, too, all the elements are freely accessible and unobstructed.

In my preferred embodiment, I employ a screw-threaded traction rod having a longitudinal keyway. Two collars are provided, each of a diameter substantially equal to the thickness or diameter of the rod and having key portions extending from the inner walls thereof. The collars are slid onto the traction rod with the key portions disposed in the longitudinal keyway of the rod. Thus, while the collars are capable of movement along the length of the rod, they are incapable of being rotated thereabout. However, mounted on said collars are members capable of rotation around said collars, which members are also capable of being moved, together with the collars, along the traction rod. Each of said members has a post extending from the main body upon which is adapted to be mounted a similar member capable of rotation about said post a full 360 degrees but in a plane at right angles to the axis of rotation of the first-named member. Mounted on posts of the second set of members are the pin-bars proper, which are capable of rotation a full 360 degrees but in a plane at right angles to the other two planes or axes of rotation. Independent means are provided for locking the said members and pin-bars in adjusted position. Nuts are provided for locking the first-named members against movement along the traction rod, while set-screws may be provided for locking said members against the collars and thus prevent rotation of said members on the traction rod. Similarly, means are provided for locking the second-named members against the first-named members, and the pin-bars against the latter, all as hereinafter more particularly illustrated and described.

2

In order to avoid galvanic action, the pin-bars may be made of non-conducting material; my experience has been with plexiglass, an acrylic polymerization product, which I have found satisfactory.

Additional features of my invention are the provision of a tool for making adjustments of the apparatus after the latter has been set, and a novel and efficient means for locking the bone pins to the pin-bars or vice versa.

In the accompanying drawings:

Fig. 1 is a plan view of the traction rod;

Fig. 2 is a perspective view of the collar above referred to;

Fig. 2*a* is an end view thereof;

Fig. 2*b* is a longitudinal sectional view thereof;

Fig. 3 is a perspective view of one of the members of the universal assembly;

Fig. 4 is an elevation, partly in section, showing the disposition of the collar on the traction rod and the aforesaid member on the collar;

Fig. 5 is a view similar to Fig. 4, with the ad-

dition of the second member of the universal assembly;

Fig. 6 shows the appearance of the assembly of Fig. 5 rotated 90 degrees to the right;

Fig. 7 is a view similar to Fig. 6 with the addition of a pin-bar;

Fig. 8 is a plan or top view of the apparatus minus the bone pins, the pin-bars being arranged in alignment with each other and parallel to the traction rod;

Fig. 9 is an elevational view designed mainly to show the detailed construction of my preferred form of pin-bar, particularly where it is to be applied to the long bones of the body;

Fig. 10 is a plan or top view showing the pin-bar adjusted at right angles to the traction rod;

Fig. 11 shows the pin-bar, pins and pin-locking bolts, disassembled;

Fig. 12 shows the aforesaid elements assembled;

Fig. 13 is an enlarged elevation of the pin-locking bolt;

Figs. 14 and 15 are plan and elevational views, respectively, of an adjusting tool as operatively applied to the pin-block;

Fig. 16 is a plan view of an entire unit in assembled condition;

Fig. 17 is a group of end views, most of them diagrammatic and showing each of eight positions in which the pin-bars may be adjusted relative to the traction rod.

As illustrated in the accompanying drawings, the splint of my invention comprises a traction rod 20 screw-threaded at both ends and provided with a longitudinal keyway 21. Adapted to be mounted on said rod are collars 22 having keyed portions or pins 23 adapted to fit into the keyway 21. When one of said collars is mounted on said rod with its key portion or pin in the keyway, it will be obvious that the collar can be slid along the length of the rod but incapable of turning with respect to it. Adapted to be rotatably mounted on said collar is a block 24 having a hole 25 therein substantially of the same diameter as the external diameter of the collar. When the said block is mounted on said collar, and the latter is mounted on the rod 20, the relation of the parts is as illustrated in Fig. 4; namely, the block 24 is movable along the length of the rod and is capable of rotation relative to the collar and the rod. Should it be desired to lock said block 24 against rotation use may be made of a set-screw 26 which passes through the threaded bore 27 communicating with the hole 25. Extending from the body of block 24 is a post 28 threaded at least at its outer end to receive a nut 31. The post 28 is arranged to and does receive a block 29 to all intents and purposes identical in form and character with block 24. The said block 29 has a hole 30 the diameter of which is substantially the same as the diameter of post 28, and block 29 is capable of rotational movement around post 28, except when nut 31 is tight up against it. Extending from the body of block 29 is a post 32, at least the outer end of which is screw-threaded. Post 32, it will be observed, is at right angles to post 28, while post 28 is at right angles to the traction rod 20. It will be apparent that any member mounted on post 32 for rotational movement may rotate in a plane or about an axis different from that of post 28 or rod 20. In short, there will be three planes or axes of rotation, each at right angles to the others, and thus constituting in fact a universal joint or assembly.



In actual practice, I mount a pin-bar 33 upon said post 32, which pin bar is, preferably, of non-metallic character, to avoid galvanic action, and may be any of the various acrylic resin plastics, or other suitable material. In actual practice, I use a pin-bar made of acrylic resin, the preferred construction of which is best shown in Fig. 9.

The said pin-bar is provided with vertical and transverse bores 34 and 35 respectively, either one of which may receive the post 32 of block 29, as the exigencies of the case may demand. The bores 34 and 35, drilled in the usual way, are at right angles to each other, and are located substantially mediate the ends of the bar. In addition, the pin-bar is provided with inclined bores 36, 37 and 38 adapted to receive bone-pins, to be later identified. Said inclined bores have preferably a pronounced "toe-in," but only two of them are ordinarily employed. The pin-bar is provided with additional bores 39, 40 and 41 respectively transsecting inclined bores 36, 37 and 38. Said bores 39, 37 and 38 are adapted to receive pin-locking bolts, as and for the purpose to be described later.

Reverting now to Fig. 7, it will be seen that it corresponds to Fig. 6, with the addition of the pin-bar 33 shown mounted on post 32 and secured thereon by nut 42.

As already adverted to, the foregoing assembly makes it possible to adjust the position, plane or angle of the pin-bar to any one desired with reference to the traction rod.

Through the pin-bores 36, 37 and 38 are adapted to be passed bone-pins 43, the latter preferably being flattened at their upper ends so that they can be engaged in the chuck of a drill, said drill being used to advance the bone-pins through the pin-bores into the bone proper. Instead of set-screws being employed in the bores 39, 40 and 41, we prefer to use pin-locking bolts 44 such as illustrated in Figs. 11, 12 and 13. The bolt 44 has a transverse hole 45 near one end, while the upper part of the bolt is screw-threaded, so as to enable it to receive a locking nut 46.

The procedure followed in applying the pin-bars and bone-pins is as follows: after it has been determined where the pins are to be inserted, the pin-bar is placed in contact with the skin, the pin-locking bolts 44 are placed in their respective bores and one or both pins passed into the selected pin bores and through the hole 45 of bolt 44, as illustrated in Fig. 12. In order to keep the pins from slipping out of the pin-block, should there by any looseness between the parts, nuts 46 may be turned down on the bolts 44, which will have the effect of drawing the bolts out, and thus more firmly engage the pins against the walls of the pin-bores. This turning down of the nuts 46 should only be sufficient at this point to assure the pins from inadvertently slipping out, but insufficient to interfere with the progress of the pin through the bar and into the bone. Where the possibility of losing the pin because of loose fit does not exist, it is not necessary, of course, to turn down the nuts 46. After the pins have been inserted into the bone, the nuts 46 are turned down tightly. I have found that the use of set-screws to lock the pins in acrylic resin pin-bars frequently causes chipping and sometimes even cracking of the bar. This danger is avoided by the use of our pin-locking bolt 44 and the nut 46.

Frequently, it is found advisable, after the apparatus has been set, to make adjustments.

Where these are relatively minor, these adjustments can be made without loosening the various locking nuts—that is, it is possible to make a forced further adjustment or readjustment. We have found that this is possible and feasible through the use of a special tool which preferably comprises an elongated angular bar 47 (Figs. 14 and 15), the ends of which have holes 48, 48, through which is adapted to be passed a bolt 49, one end of which is headed and the other threaded to receive a locking nut 50. In addition, extending from the faces of the bar are sharply pointed prongs 51, capable of biting into the pin-bar. The prongs are so disposed that at one end they extend from one face, while at the other end they extend from the other face. The purpose of this angularity and particular disposition of the prongs is to assure that whichever end becomes the power end of the lever will be offset from the limb.

A pair of nuts 52, 52, are provided on each side of block 24 which are adapted both to lock said block against longitudinal movement along the traction rod and as means for either advancing or retracting it. Thus, taking the set-up illustrated in Fig. 8, for example, should it be desired to move the lefthand pin-bar assembly to the left, the lefthand nut 52 is turned in a direction to separate it from the block 24 and the righthand nut with the help of a suitable wrench may be so rotated as to move said block to the left. In the event it is desired to move said pin-bar assembly to the right, then the righthand nut is rotated in such a direction as will cause it to move away from the block 24, and then the lefthand nut may be turned in the proper direction to push said block to the right. When the desired position has been arrived at, the nut which has been moved away from the block 24 is brought back into engagement with the side of said block and tightened.

In connection with the blocks 24 and 29, in addition to the nut 31 for locking member 29 against member 24, the block 29 may be provided with a bore 53 communicating with the hole therein through which post 28 passes, into which bore a set-screw 54 is adapted to be placed, said set-screw being employed as additional means for locking block 29 against rotation about the post 28.

My splints may be applied to fractures of the long bones of the body as well as to fractures of the maxillo-facial bones, such as the mandible. Obviously the size of the splint applied to fractures of the mandible will generally be considerably smaller than splints intended for use on the long bones, such as the humerus, ulna, femur or tibia.

The flexibility of use of the appliance may be appreciated by a glance at the diagrammatic end views, *a, b, c, d, e, f, g,* and *h* of Fig. 17, wherein are depicted eight different positions in which the pin-bars 33 may be adjusted relative to the traction rod 20 so that the splint may be placed in any position relative to the injured part. It will also be appreciated that if after the bones have been reduced, it should be necessary to move the traction rod relative to the injured body



member or relative to the pin-bars, another traction rod may be attached to the pin-bars by utilizing the unused transverse bores, 34 or 35, as the case may be, and then after securing said traction rod in place to maintain the pin-bars in position, the first traction rod may be removed entirely or replaced in another position without disturbing the setting of the bones.

It is to be understood that the invention is not to be restricted to the specific forms shown in the drawings, since it may take other mechanical forms within the comprehension of the appended claims.

Having thus described my invention, what I claim is:

1. A skeletal reduction splint including a traction rod having a longitudinal keyway and a pair of pin-bar assemblies, each assembly comprising a collar mounted for slidable but non-rotational movement along said rod and having a key disposed in said keyway, a first block mounted for controlled rotational movement on said collar, said block having a post extending therefrom upon which is rotatably mounted a second similar block, the axis of rotation of said second named block being at right angles to the axis of rotation of the first-named block a post extending from said second block, and a pin-bar rotatably mounted on said last-mentioned post, the axis of rotation of said pin-bar being at right angles to the aforementioned axes of rotation, means for locking the first block to its collar, and means for locking the assemblies against movement along said rod.

2. In combination, a pin-bar having a pin-bore and a bore transsecting said pin-bore, a member disposed in the second-named bore having a hole alignable with the pin-bore, and having its outer end screw-threaded, a nut engaging said threaded portion, and a bone-pin passing through the pin-bore and the hole in said member.

3. The combination with skeletal reduction splint pin-bars having intersecting holes therein, of a pin-locking bolt partially disposed in one of said intersecting holes, said bolt having a transverse hole therein for alignment with the other of said intersecting holes in the pin-bar, a bone-pin extending through the aligned holes in the pin-bar and locking bolt, the extending portion of said locking bolt being threaded, and a nut on said threaded portion positionable against the outer surface of the pin-bar.

CLARENCE J. SPEAS.

## REFERENCES CITED

The following references are of record in the file of this patent:


UNITED STATES PATENTS

| Number | Name | Date |
|---|---|---|
| 1,190,445 | Mitchell | July 11, 1916 |
| 1,379,371 | Toscas | May 24, 1921 |
| 2,181,746 | Siebrandt | Nov. 28, 1939 |
| 2,214,490 | Thomas | Sept. 10, 1940 |
| 2,250,417 | Ettinger | July 22, 1941 |
| 2,251,209 | Stader | July 29, 1941 |
| 2,300,840 | Huxel | Nov. 3, 1942 |