

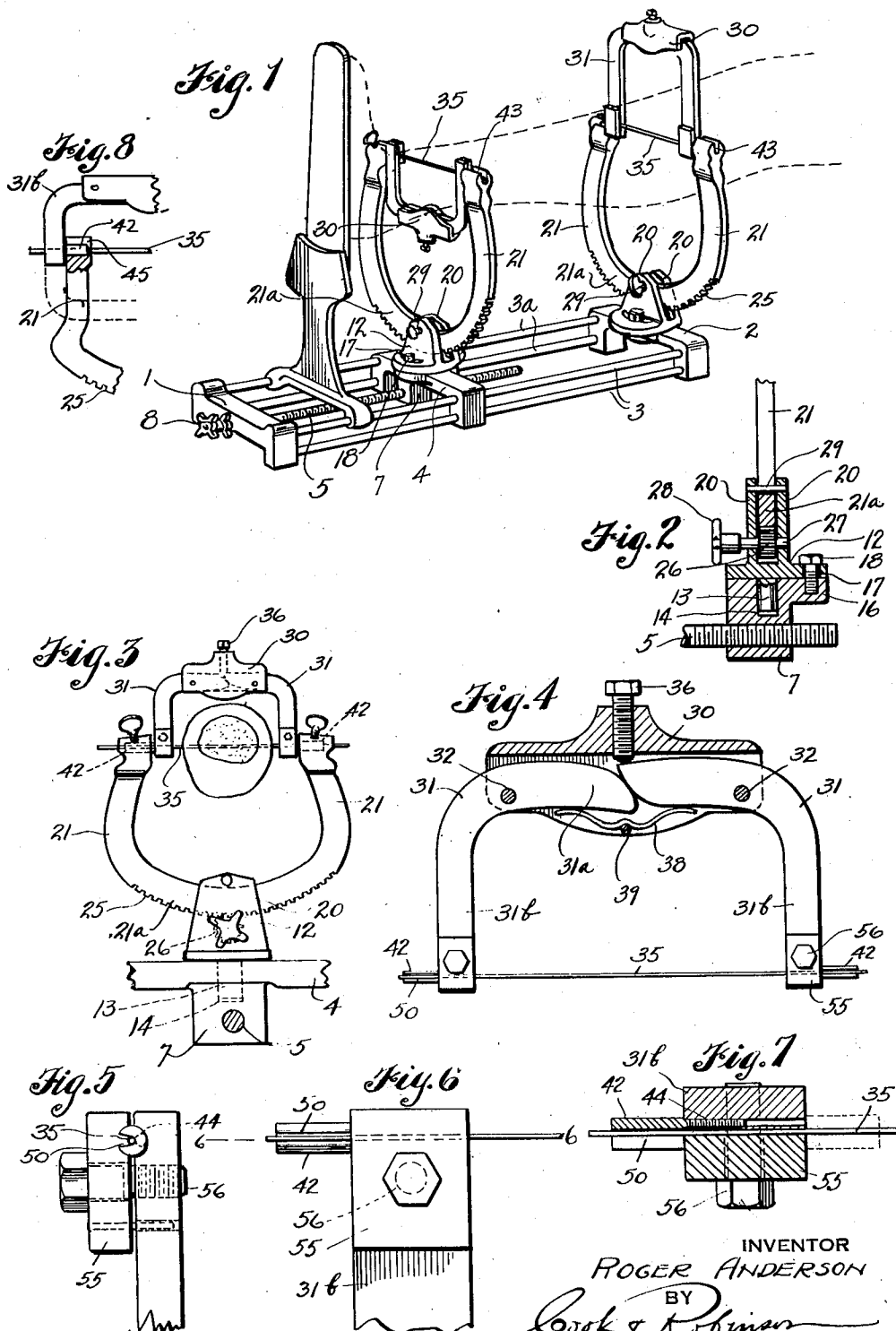
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FRACTURE SPLINT

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FRACTURE SPLINT

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This invention relates to improvements in splints designed for the reduction of fractures in the bones of the arms and legs of the human body, and it has reference more particularly to splints of that character wherein reduction is effected by a direct attachment of the splint to the fractured bone; the present invention being in the nature of an improvement on the splint described and illustrated in my co-pending application, filed on August 29, 1933 under Serial No. 687,263, wherein a frame structure mounts two traction yokes in spaced relation and in position to receive the fractured limb therein and wherein traction pins are mounted by the yokes to be extended through the bone at opposite sides of the fracture so that by a relative adjustment of the yokes, the fractured parts may be brought into proper alinement and traction may be applied to reduce the fracture and hold the bones properly for application of a cast thereto. When the cast is applied, the ends of the pins are embedded therein and then after the cast has set, the limb may be removed from the splint and by reason of the solidity and rigidity of the cast, the pins will hold the bones in proper relationship against the tension of muscles.

In many instances, however, it is more desirable to use small wires in lieu of the pins, as this lessens the danger of infection; they are more easily applied and require only relatively small holes through the bone. However, when wires are used, they must of necessity be kept absolutely taut or otherwise they will cut into the bone with serious results.

When wires are used with the yokes of that type of the device shown in the co-pending application above mentioned, the special wire tightening clamps, associated with the yokes, are employed to draw and retain the wires taut. The limb cannot with satisfaction be removed from the yokes, for the reason that no means has been provided to retain them taut. Simply the embedding of the ends of the wires in the cast will not keep them sufficiently taut to avoid cutting into the bone. Should the patient attempt perambulation with these large yokes still attached, he would experience considerable difficulty due to their size.

In view of the fact that use of wires is desirable, and in order that perambulation of the patient may be provided as soon as possible, the principal object of this invention has been to provide an improved form of splint, adapted to the use of traction wires in lieu of pins, and including wire tauteners of novel character associated with the traction yokes for mounting the traction wires and for maintaining them taut. Also, to provide means for mounting the tauteners in the traction yokes for the application of

tractive forces necessary to the reduction and setting of the fracture.

It is also an object to provide mounting trunnions for the tauteners which provide for pivotal adjustment in the yokes without change in relative position of the wires, and located coaxially of the axis of rotation of their mounting trunnions.

Other objects of the invention reside in the details of construction and in the combination of parts, as will hereinafter be described.

Fig. 1 is a perspective view of a splint embodying the improvements of the present invention; showing, in dotted lines, the application of a limb thereto.

Fig. 2 is a sectional detail of the yoke mounting and adjusting means.

Fig. 3 is an elevation of one of the traction yokes with a wire mounting tauteners applied thereto and indicating the application of the wire to a limb.

Fig. 4 is an enlarged view of the wire mounting tautener, a part being broken away for better illustration.

Fig. 5 is a view showing the wire holding clamp plate and illustrating the slotting of the wire seating trunnion of the tautener.

Fig. 6 is a front view of the same parts.

Fig. 7 is a section taken on line 6—6 in Fig. 6.

Fig. 8 is an alternative arrangement wherein the tautener is outside the traction yoke.

Referring more in detail to the drawing—

In a preferred form of construction, the present splint comprises a base frame structure having opposite end cross bars 1 and 2, rigidly joined in spaced relation by two pairs of longitudinal rods 3—3 and 3a—3a. These pairs of rods are parallel and also the rods in each pair are parallel and vertically spaced. This base frame, for practical purposes, would be made approximately two feet long and seven inches wide, but if desired, may be made in other dimensions, to suit any particular use to which it is to be put.

Supported transversely of the base frame is a cross bar 4 which, at its ends, is slidably mounted on the longitudinal rods and is adjustable along the frame by means of a threaded shaft 5. This shaft, at one end, extends revolvably through a hole in the end bar 1 and at its other end, is threaded through a depending lug 7 on the under side of the cross bar 4. At the outer end of the shaft 5 is a hand wheel 8 by means of which it may be rotated thereby to shift the cross bar 4 to different positions.

Mounted upon the cross bar 2 at one end of the frame and upon the cross bar 4, are yoke mounting bases 12. Each of these is provided on its under side, as seen in Fig. 2, with a vertical pivot 13 revolvably fitted in a socket 14 in the cross bar on which it rests. Each base 12 is also formed with a flange 15 overlying a cen-

tral, lateral extension 16 of its supporting bar and in the flange of each base is a slot 17 formed arcuately about the axis of the corresponding pivot 13. Bolts 18 extend through the slots 17 and are threaded into the parts 16 of the base bars to hold the bases at different positions of pivotal adjustment. Each base 12 also is provided with spaced vertical flanges 20—20 between which the traction yokes 21 are mounted. These flanges snugly receive the base portions of the traction yokes between them and retain the yokes rigidly in upright position, but permit of lateral rotative adjustment therein.

Each of the yokes 21 is of U-shape and its base portion 21a is curved radially about a center point located at the intersection of the extended axis of the pivot 13 and a line between the ends of the yoke arms. The under edge of the yoke base is formed with gear teeth 25 that mesh with those of an adjusting gear wheel 26 mounted between the flanges of the yoke supporting base and fixed on a rotatably mounted shaft 27 extended through the flanges and equipped at one end with a hand wheel 28. A pin 29 extended through the flanges 20 just above the yoke base, holds the yoke in place.

In the device of the application previously mentioned, the ends of the yoke arms were equipped to mount the opposite ends of the traction pins or wires. In the present instance, wires are employed but they are mounted in frames known in trade as "tauteners" which in turn are removably mounted in the traction yokes. One of the tauteners is well illustrated in Fig. 4 wherein 30 designates a longitudinally channeled base bar in which a pair of lever arms 31—31 are pivotally mounted respectively at opposite ends of the bar by pivots 32—32. These levers have inner end portions 31a extended into overlapped relation at a location medially of the bar and they have outer end portions 31b extended in substantially parallel relation for mounting therebetween the traction wire 35.

As will be observed in Fig. 4, the inner end portion 31a of one of the lever arms underlies the other and these ends have rounded interengaging portions. Also there is an adjusting bolt 36 threaded through the base of the bar 30 and engaging with the end of the underlying arm 31a. A leaf spring 38 is mounted at the opposite side of the two arms by a pin 39 extended through the bar and this spring has its opposite end portions bearing inwardly against the arms, 31a—31a.

Assuming that the ends of a wire 35 are mounted and fixed in the outer ends of the lever arms, it is apparent that it may be put under tension and held taut by adjusting the bolt 36 inwardly, thereby to rock the lever arms on their pivots in a manner to spread their outer ends. When the bolt is outwardly adjusted, the spring 38 causes the arms to move toward each other to release their tension on the wire.

For mounting the frames or tauteners, the arms 31b—31b are provided at their ends with pivots or trunnions 42—42, located in axial alignment with each other and adapted to seat revolvably within upwardly opening transverse channels 43 in the upper ends of the opposite arms of a yoke 21. The construction provides that the tauteners may swing pivotally about the supporting trunnions to different positions as is indicated in Fig. 1.

It will be observed, by reference to Fig. 7, that

the trunnion 42 is mounted in the arm 31b by a threaded shank 44 of considerably lesser diameter. It is also observed that the trunnion has a longitudinal slot 50 for seating the end of the traction wire therein, and this slot is extended into the trunnion to a depth which provides that the wire, when seated, will be coaxial of the trunnion and will rest flatly against a face of the arm 31b. This arrangement provides that when the tautener is mounted in the arms of a yoke, as shown in Fig. 1, they may be rotatably adjusted, and will not cause any change in relative positions of the wire which they mount; it being understood that if the axis of a wire was eccentric of the axial line of the trunnions of a tautener it would change position with rotation of the tautener and this, although very little, might throw the fractured bones out of proper setting.

When the ends of a wire are applied to the trunnion slots, as in Fig. 5, they seat flatly against the arms 31b. They are then clamped and held by clamp plates 55 arranged to be tightened against them by bolts 56, as seen in Fig. 5.

As shown in Fig. 3, the tautener is generally located inside the arms of the traction yoke 21, but it is understood that it might be made so that its arms are outside the yoke arms, as shown in Fig. 8; this necessitating locating the trunnions at the inside of the arms 31b.

Assuming the device to be so constructed, it is used as follows: First, the bone is prepared at opposite sides of the fracture to receive the traction wires 35 therethrough. After the wires have been extended through the bone the opposite ends of each is applied to the opposite arms of a tautener and are clamped beneath the clamp plates, as shown in Figs. 5, 6 and 7. Then the bolt 36 of the tautener is adjusted inwardly to place the wire under the proper and required tension. The trunnions of the tauteners are then seated within the sockets at the ends of the arms of traction yokes 21, as shown in Fig. 3, and the yokes are then adjusted by manipulation of the hand wheel 28 and by pivotal movement about the pivots 13 and by application of traction by adjusting screw 5 to bring the end portions of the fractured bone into proper relationship. Then a plaster cast is applied about the limb and the tautening yokes are embedded in the cast. After the cast has set, the limb may then be lifted from the traction yokes and perambulation of the patient is thereby provided for.

If at any later time it would be desired to remove the cast from the limb for treatment of the latter, the limb is again applied to the splint, the trunnions of the tauteners are replaced within the sockets of the traction yokes and the latter are set against movement. Then the cast may be removed from the limb without any danger of the bones shifting or changing their relationship. After a new cast has been applied and has set solidly about the tauteners, the latter may again be removed from the traction yokes to permit perambulation.

In this form of device, the tautening yokes are so reduced in size and weight that they do not interfere with perambulation of the patient. They retain the traction wires taut at all times so that cutting of the bone thereby cannot occur. The particular advantage of this type of device resides in the fact that the tautening yokes are relatively small; they may be easily and quickly

applied to the traction yokes; they provide a satisfactory and effective means of holding the wires under tension and also afford a means of solidly anchoring the wires in the cast. Another advantage in the construction is that the wires are located coaxial of the trunnions, thereby permitting rotative adjustment of the tauteners in the traction yokes without effecting any change in relationship of the traction wires.

Having thus described my invention, what I claim as new therein and desire to secure by Letters Patent is—

1. In a fracture reducing splint, a traction yoke, a traction wire for transfixing a limb, a wire tautener frame for embracing the transfixed limb, and including means for gripping opposite end portions of the wire, and an adjusting means for spreading the frame to tension the wire, pivot means mounting the frame in the yoke for application of traction to the limb and permitting rotation of the frame about the axial line of the taut wire.

2. In a splint having a traction frame a traction wire, a wire mounting tautener adapted to embrace a limb and including means for gripping opposite end portions of the wire after it has been projected through a limb, and for holding the wire under tension, and trunnions coaxial of the wire for mounting the tautener frame in the traction frame for rotative movement about the axial line of the trunnions and wire.

3. In a splint, in combination, two relatively adjustable traction applying supports adapted to receive a limb for treatment, traction wires corresponding to the supports, a wire tautener frame associated with each support for embracing the limb, and comprising means for gripping opposite end portions of its corresponding traction wire after the latter has been projected through the limb and adjustable to place and hold the wire under tension, and means on each tautener for removably mounting it in its corresponding support and whereby it may be rotated about the axial line of the wire.

4. A fracture splint comprising a base, a pair of traction applying yokes mounted thereon for receiving a limb to be treated, means for effecting a change in spacing and a relative rotative adjustment of the yokes about the anatomical axis of the limb, a frame associated with each yoke and adapted to embrace the limb, a wire mounted by each frame and held under tension thereby; said wires being adapted to transfix the limb at opposite sides of a fracture, and trunnions on said frames whereby they are rotatably mounted in the yokes.

5. A device as in claim 4 wherein said trunnions of each frame are in axial alinement with the wire mounted by said frame.

6. In a splint of the character described, a wire tautener comprising a base member, a pair of bell cranks pivotally mounted thereon with corresponding arms extended in spaced relation and their other arms extended into interengaged relation whereby tautening movement of one causes a like movement of the other, a wire fixed at its ends to the first mentioned arms and an adjustment member adjustably mounted in the base and operatively engaging one of the interengaged arms, and trunnion supports for the tautener extended from the first mentioned arms coaxial of the wire.

7. In a splint of the character described, a traction applying means, a wire mounting frame comprising a base bar, a pair of bell cranks pivotally mounted thereon having corresponding arms extended from the bar in spaced relation, and their other arms interengaged for effecting adjustment in spacing of the first mentioned arms, an adjustment means in the bar for actuating the interengaged arms to effect an adjustment in spacing of the first mentioned arms, means on the extended arms for mounting a traction wire between them, a traction wire mounted by said means, and supports on the said frame coaxial of the wire adapted to mount the frame rotatably in the traction applying means.

8. A device as recited in claim 7 wherein said frame supports are in the form of trunnions removably applied to said traction applying means and, providing for rotative mounting of the frame in the traction applying means.

9. A device as in claim 7 wherein the said frame supports are in the form of trunnions that extend from the first mentioned arms of the bell cranks coaxial of the traction wire extended between them, and are longitudinally slotted to receive the wire coaxially therein.

10. In a splint, in combination, a traction element having spaced arms with end slots, a wire mounting frame for embracing a limb, a traction wire, means on said frame for gripping opposite ends of the traction wire after it has transfixed the limb embraced by the frame, means for adjusting the frame to effect the tensioning of the gripped wire, trunnions on the frame axially aligned with the taut wire and pivotally seated in the end slots of said spaced arms for application of traction to the limb; said pivots being adapted to be unseated from the arms without loss of tension on the wire.

11. In a splint of the character described, a support, a yoke mounting base having a mounting pivot applied to the support, a traction yoke of U-shape, adjustably mounted in said yoke mounting base in the axial plane of the said mounting pivot and rotatably adjustable about a center in the extended axial line of the said mounting pivot, a wire tautener frame comprising spaced arms provided with trunnions supported by the arms of the traction yoke and a wire mounted under tension by said frame and extending between the spaced arms and passing through said center.

12. The combination with a traction applying means for embracing a limb, of a wire mounting frame adapted to be mounted removably within said traction means and having spaced arms for securing the opposite ends of a wire for transfixing the limb, and means in the frame for adjusting the relationship of said arms to regulate the tension of the wire.

13. In a fracture splint, a traction applying yoke, means supporting said yoke for rotation about the anatomical axis of a limb applied thereto, a wire mounting frame supported by the yoke, between the arms thereof, and a wire mounted under tension by said frame, for transfixing the limb through its anatomical axis; said wire mounting frame being mounted by said yoke for rotation about the axial line of the wire.

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