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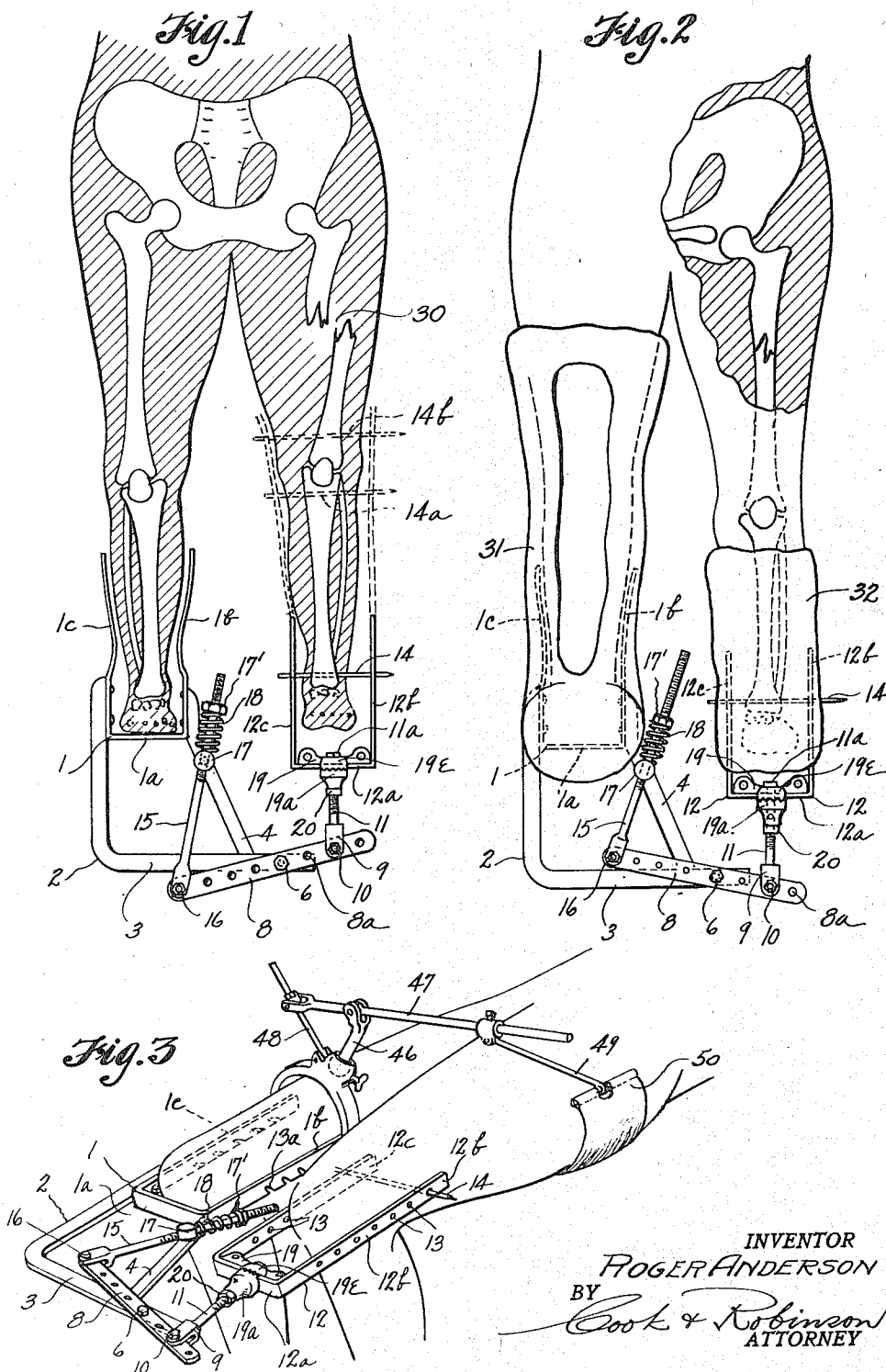
R. ANDERSON

1,928,658

SPLINT

Filed Oct. 12, 1931

4 Sheets-Sheet 1



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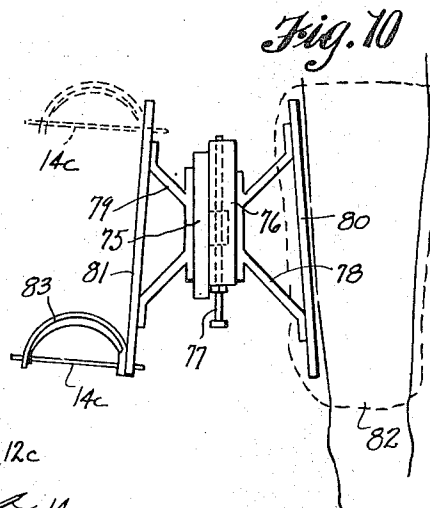
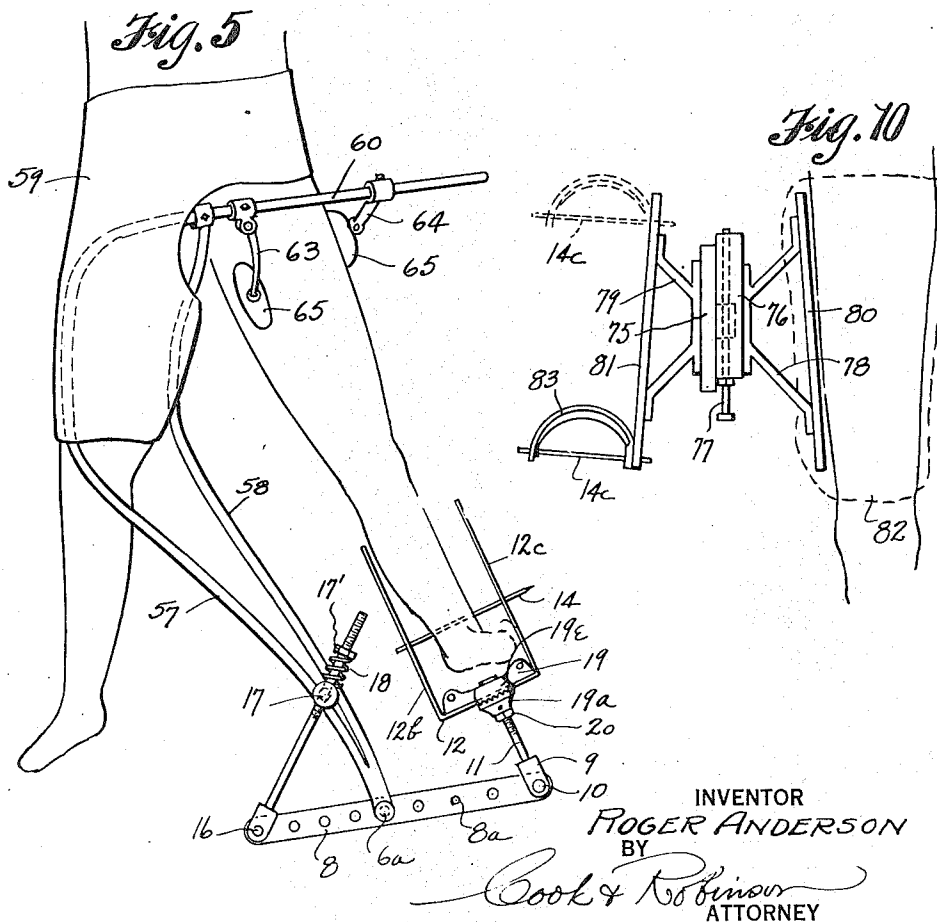
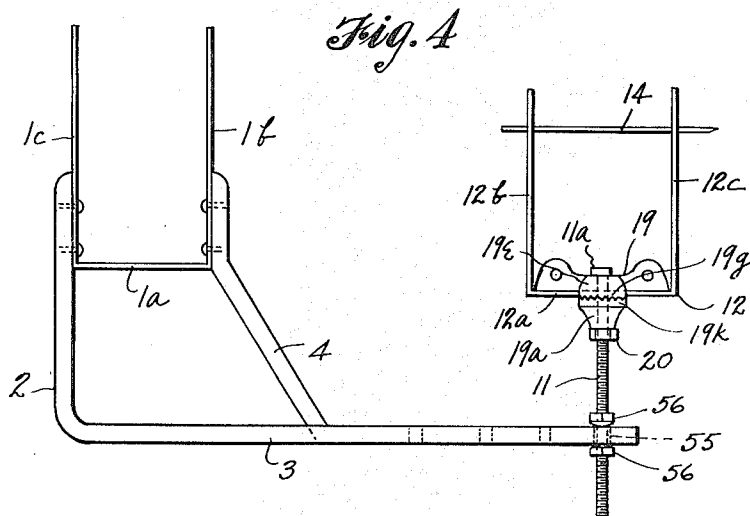
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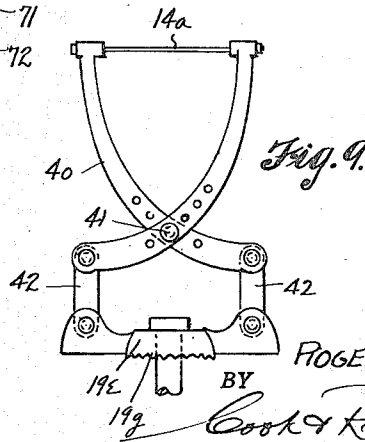
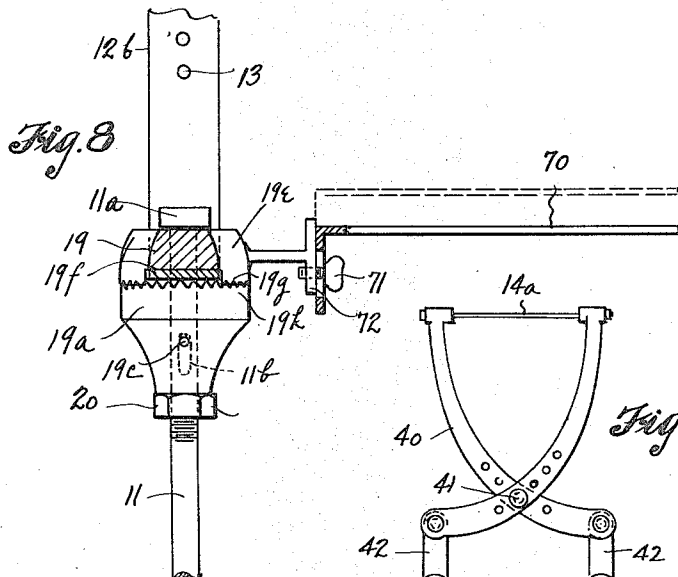
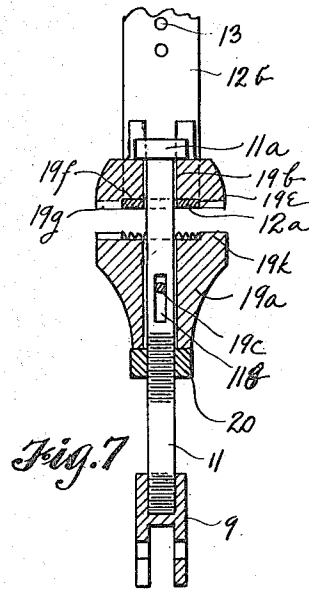
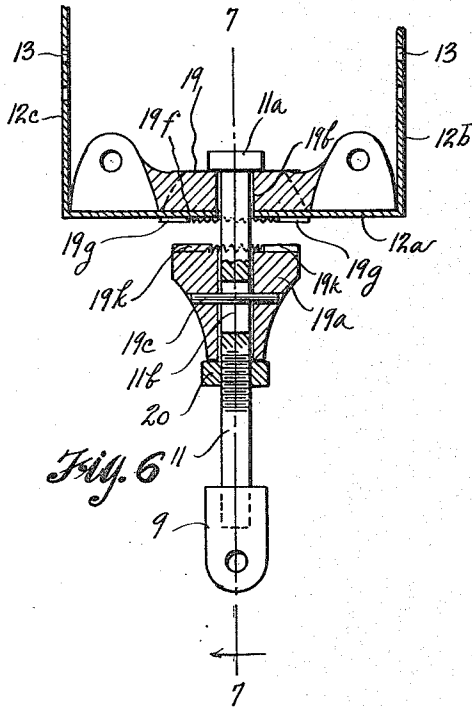
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4 Sheets-Sheet 4

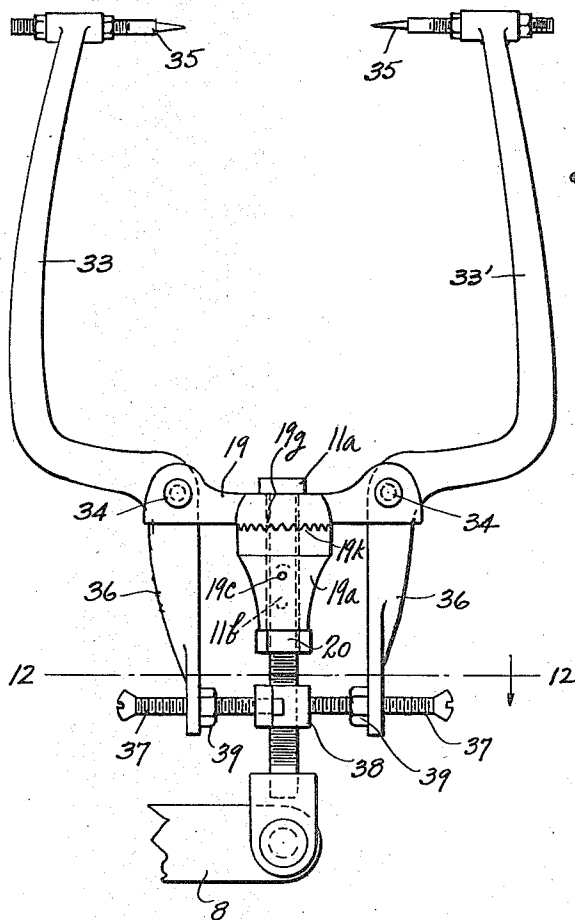


*Fig. 11*

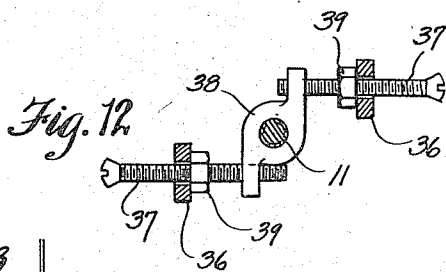
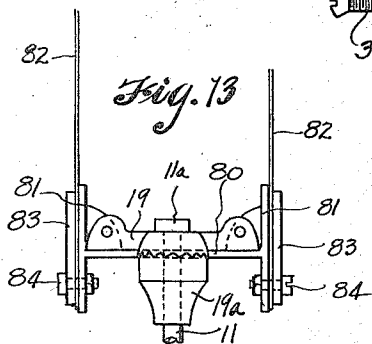


Fig. 12



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## UNITED STATES PATENT OFFICE

1,928,658

SPLINT

Roger Anderson, Seattle, Wash.

Application October 12, 1931. Serial No. 568,321

8 Claims. (Cl. 128—83)

This invention relates to surgical splints, and it refers particularly to splints used for the reduction of fractures occurring in the bones of the pelvis or legs of the human body, and which in their application use the sound leg as an anchor for sustaining the pull or traction which is applied by means of the splint to the injured leg in the reduction of the fracture; it being the principal object of the present invention to provide a novel form of splint of the above character that is intended, primarily, in its various applications, to employ skeletal traction, although adhesive skin traction is possible if this should be necessary or desired.

It is also an object of the invention to provide a splint which, by reason of its novel construction, permits of a varied amount of traction and a wide range of adjustability after it has been applied.

Another object of the invention is to provide a splint that is easy to apply, simple to adjust, relatively inexpensive, more comfortable to the patient than the ordinary splint and which reduces the time of hospitalization.

More specifically stated, the invention resides in the provision of a splint of the above character that is especially useful for the reduction of intracapsular, extracapsular, intertrochanteric and pelvic fractures, as well as for fractures of the femur and bones of the lower leg; also a splint adapted to treatment or correction of dislocations, open reductions, malunion, nonunion, and congenital dislocations.

The device, in a preferred form of construction, employs an anchor stirrup or brace adapted to be applied and securely affixed to the sound leg of the injured person in such manner that the pressure exerted therethrough is applied to the sole of the foot and is sustained by the bones of the sound leg naturally as in the support of the body. It also employs a traction stirrup or yoke adapted to be pinned to a bone of the injured leg or otherwise attached to the leg, and to be connected to the anchor stirrup through adjustable leverage by means of which an adjusted pull or traction may be placed on the fractured member to draw and retain it properly in place for reduction.

Still further objects of the invention are to provide novel means for permitting extended abduction and adduction also means for permitting internal or external rotation of the traction yoke after it has been applied.

The invention resides in the details of construction of the various parts in their combina-

tion and mode of operation as will hereinafter be described.

In accomplishing these objects, I have provided the improved details of construction, the preferred forms of which are illustrated in the accompanying drawings, wherein—

Figure 1 is a diagrammatic view illustrating one mode of application of the splint for the reduction of a fracture of the femur; the casts being omitted in this view.

Figure 2 is a view showing the splint as held by the casts and adjusted for applying traction to the fractured limb.

Figure 3 is a diagrammatic view illustrating the device in another application, with attachments applied thereto, the casts being omitted for better illustration.

Figure 4 is a view of a splint of an alternative form of construction.

Figure 5 is a view illustrating the use of still another alternative form.

Figure 6 is an enlarged sectional view illustrating the mounting means for the traction yoke, showing the locking means released.

Figure 7 is a cross section on the line 7—7 in Figure 6.

Figure 8 is a detailed view showing the use of a foot rest in connection with the yoke mounting.

Figure 9 illustrates a form of a traction device adapted to be applied to the mounting means.

Figure 10 is an illustration of still another device applicable for skeletal traction.

Figure 11 is a view showing the use of traction tongs of a novel form of construction.

Figure 12 is a cross section on the line 12—12 in Figure 11.

Figure 13 is an alternative device for adhesive traction.

Referring more in detail to the drawings—

It will first be explained that the present splint is intended for use especially where one side of the body is sound and well or in a suitable condition for sustaining the counter traction that will be applied to it by reason of traction exerted directly through the splint to the injured side. It will be mentioned also that applicant is quite familiar with splints heretofore employed which are anchored to the sound side or limb for the reduction of certain fractures in the injured limb, but the present device differs from these heretofore known to him in that where formerly the traction was obtained by pressure applied to soft parts or by skin traction, both in attachment to the injured and to the uninjured limb, the present device is intended and is designed primarily for skeletal traction.

etal traction on the injured limb and an abutting anchorage of the device to the uninjured limb for counter traction but avoiding the objectionable pressure on soft parts or adhesive skin traction at either point of attachment.

The present device also differs materially from those formerly used especially in those details of its construction which makes possible a wide range of adduction and abduction, also internal or external rotation of the injured member.

First describing the construction of the device of Figures 1 and 2, 1 designates the counter traction stirrup or brace of U-shaped form, adapted to receive a part of the sound limb therein, in a manner presently described, and which comprises a transverse base portion 1a and inner and outer side or leg portions 1b and 1c of a bendable metal so that they may be made to conform to the shape of the limb to which they are applied. To the outside leg portion of this stirrup an angular bar 2 is rigidly attached and extended downwardly therefrom, and at its lower end is turned inwardly forming an arm that extends somewhat beyond the line of the inner leg portion of the stirrup where it joins with the lower end portion of a brace bar 4 fixed to the inner leg of the stirrup and extended downwardly therefrom in an inwardly inclined direction. Pivotaly mounted by a bolt 6 extended through the joined ends of the bars 3 and 4, is a lever 8, which, at its outer end, has a clevis 9 pivotaly attached thereto by a pivot bolt 10, and a threaded rod 11 is fixed at one end in the clevis, and at its outer end mounts the traction yoke 12.

The yoke 12 consists of a transverse base or cross bar 12a and upwardly extending parallel opposite side legs 12b and 12c. These legs have openings 13 therealong for receiving a traction pin 14 that may be extended between the legs of the yoke and through the openings therein. It will be mentioned here that the yoke 1 may be secured to bars 2 and 4 by screws, and that the yoke may be keyhole slotted to receive the screws and to permit easy detachment of the yoke if such is desired.

A rod 15 is pivotaly connected by a bolt 16 to the inner end of the lever 8. This rod extends slidably through an opening in a lug 17 that is pivotaly fixed on the brace bar 4 and a nut 17' is threaded onto the outer end of the rod to be adjusted against a coiled spring 18, that is interposed between the nut and the lug, thereby to yieldingly adjust the position of the lever 8 for the purpose of applying traction by means of yoke 12 to the injured leg after the splint has been applied.

The traction yoke 12 is internally or externally rotatably adjustable relative to the splint and it may be locked at its different positions of adjustment. In its connection with rod 11, the base bar 12a is clamped between a cross bar 19 and a locking head 19a mounted by the rod 11. As shown in Figures 6 and 7 the cross bar 19 has a central hole 19b through which the rod 11 extends and a head 11a on the end of the rod prevents displacement of the cross bar. The locking head 19a is slidable longitudinally on the rod but is locked against rotation thereon by a pin 19c which extends through it and through a slot 11b lengthwise of the rod. The cross bar 19 is provided centrally with a nut 19e having an underside slot or seat 19f for receiving the base 12a of the yoke, and this also is knurled at opposite sides of the seat, as at 19g to engage a knurled surface 19h of the locking head 11a to prevent relative rotative movement. A lock nut

20 is threaded on rod 11 to clamp against the head to hold it against the knurled nut of the cross bar. To permit rotative adjustment of the yoke, it is only necessary to run the nut 20 down, so that the locking head is free from the cross bar, then to rotate the yoke and cross bar to the place or angle desired. This adjustment is held by using the nut 20 to clamp the head against the bar.

Assuming the device above described to be so constructed it would be used as follows: For the reduction of a fracture of the femur, for instance, as shown at 30 in Figure 1, or for other injuries or fractures of the femur tibia, or in the pelvis, first a cast as at 31 in Figure 2 is applied to the lower portion of the uninjured leg. This for most uses should extend from the foot to mid-thigh. It will be mentioned here that I anticipate also the use of a standardized plaster or metal cast which can be easily and quickly applied. After the cast has been applied, the counter traction stirrup 1 is placed in position against the bottom of the foot with the side portions thereof extending along opposite sides of the lower leg portion and bent to conveniently conform thereto. The stirrup is then securely fixed in the cast by plaster bandages or other suitable bindings. Then the skeletal traction stirrup 12 is applied to the injured limb usually by first applying the pin 14 through the lower extremity of the tibia as shown, then applying a cast about that portion and then springing the yoke to receive and mount the pin ends. In some instances it is more desirable to extend the pin through the bone at another point. Also, before applying the traction stirrup the pin may first be incorporated in a cast as at 32, and then the stirrup fastened to the cast by plaster bandages. After the stirrup and yoke portions have thus been attached to the limbs, they are connected through the lever 8 which is adjusted on its connection through bolt 6 to give a desired abduction or adduction. With the lock nut 20 loosened, and the locking head 19a free of the knurled surface of the cross bar 19, the yoke 12 is rotated to the desired position and is locked there by clamping the head 19a against the bar; this being done by lock nut 20. The desired traction is then applied by adjusting the nut 17' on the rod 15. The lever 8, as shown, is provided along its length with openings 8a, or with notches, to receive the pivot bolt 6 and also for the bolts 10 and 16, thereby to obtain any desired abduction or adduction and suitable leverage.

In some instances it may be more practical or desirable to anchor the traction yoke 12 to the upper portion of the tibia as at 14a or through the lower end portion of the femur as at 14b, see Fig. 1, and in such cases the plaster or the legs 12b and 12c of the stirrup 12 could be extended to the mid-thigh as indicated in dotted lines in Figure 1, and the pin 14 then projected through the bone at the place desired. For some treatment skeletal attachment is made through the crest of the tibia or crest of the ilium or obliquely through the greater trochanter.

If it should be found impractical to apply the splint to the lower limbs in the manner illustrated in Figures 1 and 2, or more desirable for any reason to apply it to the upper leg extremities, this may be done in the manner illustrated in Figure 3, by flexing the knees downwardly, then applying the anchor stirrup 1 to the thigh portion of the sound limb so that the cross bar 1a will rest against the knee joint and the legs 1b

and 1c will extend along the leg above the knee. Likewise, the traction stirrup 12 may be applied to the injured leg and anchored for exerting traction by extending the pin 14 through the femur at a suitable point. The yokes of the splint in this instance also would be held by properly applied cast or casts. In some instances it may be desirable to remove the cross piece 1a of the counter traction yoke so that the leg to which it is applied may be held practically straight. This condition has been anticipated and in such event, the skeletal attachment of the counter traction yoke could be made by extending a pin through the tibia of the well leg and its ends seated in inclined notches 13a such as have been shown in the side members 1a and 1b in Fig. 3. Thus I have anticipated use of skeletal attachment for both traction and counter traction.

It will be mentioned here that various traction means may be employed in place of the yoke 12 and pin 14 without changing the mode of application. For example, the yoke 12 might be removed from the cross bar 19 and replaced by tongs of that character shown in Figure 11, consisting of a pair of levers 33—33' mounted pivotally by bolts 34 in the opposite ends of the cross bar 19. These levers are provided at their outer ends with opposed pins 35 for pivotally piercing the bone to which the device is to be attached. At their lower ends the levers have lever arms 36 extended below their mounting pivots 34 with bolts 37 extended slidably therethrough. These bolts are fixedly mounted in a collar 38 applied to rod 11 as in Fig. 12 and nuts 39 are threaded on the bolts for adjustment against the lever arms to hold the tongs at set positions of adjustment. Rotatable adjustment of the tongs is made as in the case of the yoke.

I have also provided for use of the apparatus of Figure 9 consisting of a pair of Piersons crossed levers 40 joined by pivot bolt 41 and connected at their ends by short links 42—42 with the ends of the cross bar 19. At their outer ends they mount a cross pin 14.

In Figure 3 I have also illustrated use of an attachment device for the splint which may be employed for the purpose of lifting and rotating the limb to support the broken parts in proper relationship. This attachment consists of the bracket 46 rigidly or adjustably attached to stirrup 1 and a lever rod 47 pivoted in the bracket and having one end connected thereto by an adjoining rod 48 in a manner whereby the opposite end of the rod may be raised or lowered. A short adjustable rod or cable connection 49 may be made with adhesive tape 50 applied to the thigh so that by adjustment of the rod connection 48 any desired listing and rotating action may be effected on the limb corresponding to the well known Maxwell-Ruth method of treatment.

In a modification shown in Figure 4 the lever 8 has been omitted and the rod 11 arranged to be extended directly through any one of a series of openings 55 in an extended end portion of the brace bar 3. Nuts 56—56 are threaded onto the lower end of rod 11 and may be adjusted to secure the desired traction on the injured limb. The rod 11, in this instance would be keyed in a suitable manner to prevent rotation in the opening through which it is extended.

In Fig. 5 is another modified form of device especially for fractures of the pelvis and hips or for dislocations, and which is desirable when the lower leg to which counter traction is applied, is injured below the knee. The stirrup 12, lever 8

and tension adjusting and applying means are substantially as in the device in Figure 1, but the stirrup 1 has been replaced by a brace comprising a pair of rods 57—58 which extend along the thigh, then cross inwardly and extend to a position providing for extreme abduction; the lever 8 being pivotally attached to the ends of the rods by a bolt 6a. In the use of this device, a cast, as at 59, for holding the rods should be applied about the body and thigh of the uninjured limb as indicated.

In Figure 10 I have illustrated the use of skeletal traction by use of a brace including complementary slidably connected parts 75 and 76 arranged to be adjusted lengthwise of each other by manipulation of a hand screw 77. Frames 78 and 79 are fixed to the parts 75 and 76 and these are intended to carry the leg plates 80 and 81. Plate 80 is here shown attached by a cast 82 to the leg and plate 81 carries yokes 83 which mount pins 14c which are extended through the bone of the other leg to exert the desired skeletal traction which is obtained by relative adjustment of the parts 75 and 76.

It is to be understood that devices of this general character may be applied in various ways other than shown, and their form of construction might be altered to meet any special condition without departing from the spirit of the invention. Therefore it is not desired that the claims be limited only to the details of construction herein illustrated, but that they shall be given an interpretation commensurate with the scope of the invention disclosed, the novelty of which resides in the provision of means for applying skeletal traction to the injured limb either by the pin, tongs, rod or wire attachment and for sustaining this traction by counter traction applied to the uninjured limb which does not cause pressure on the soft parts or employ adhesive skin traction to either limb. Also a device which permits of extreme abduction and internal or external rotative movement of the traction stirrup, and adjustment at any time without disturbing the traction.

The device also lends itself to the use of pressure pads for exerting pressure on one or both fragments. Such an arrangement has been illustrated as applied to the device of Figure 5, but it should be understood that it likewise might be applied to the device of Figures 1 and 3. In the embodiment shown in Figure 5 it consists of a transverse bar 60 fixed pivotally or solidly to bars 57 and 58 to extend across the injured limb. On the bar 60 are brackets 63 and 64 which mount pressure pads 65. Adjustment of the brackets makes possible the application of pressure at places and in amounts desired.

In Figure 8 attachment of a foot rest to prevent foot drop is shown. This is merely a foot plate 70 designed to support the foot of the injured limb and secured, adjustably, by bolts 71 to a flange 72 integral with the cross bar 19. Adjustment is made by loosening the set screws.

Figure 13 illustrates a modification of the device for permitting adhesive traction if this should be found desirable for any special treatment. In such a case the traction yoke 12 is removed from the clamp members and a cross piece 80 is applied between the members 19 and 19a. This cross piece has upright plates 81—81 at its ends. The adhesive strips 82 for attachment to the injured limb extend downwardly beyond the foot of the patient and is drawn across the plates 81—81 and is clamped securely thereto by over-

lying plates 83 attached by bolts, or the like, 84. This device is merely to illustrate that this device is not primarily intended for adhesive skin traction but it may be used in that manner if for any reason it should be found desirable or necessary.

In cases of malunion and nonunion of the leg and in hip and other reconstruction operations, this type of splint can be more profitably employed than the fracture table. Immobilization without general anæsthetic, is done before the operation—preferably one or two days before—whereas with the fracture table, it is necessary to apply spica cast or traction under continued anæsthetic, following the operation. Cases of non-union are generally accompanied with shock, and to continue the anæsthetic and to keep the patient exposed while applying a spica cast only augments the shock. Moreover, hours spent in a cold, wet cast is an invitation for further complications.

Since this traction and immobilization means is not attached to the operating table, being an entity with the body, the patient may be turned on the side or placed in the most accessible position for operation. The danger of reduction or graft slipping after the operation, while removing the patient to bed, could not occur with a method where means of constant traction and reduction are applied before the operation. Therefore, this relatively inexpensive apparatus is a desirable substitute for the expensive fracture table, even in the well equipped hospital.

Summarizing, it may be mentioned that the special advantages of this device in its preferred and modified forms are—

1st. It is simple in design and has all the advantages of direct skeletal traction.

2nd. Application may be effected in the hospital ward, if necessary, under local anæsthesia.

3rd. No orthopedic table is required.

4th. Skeletal traction avoids pressure over the skin and constriction of the soft parts.

5th. The patient may sit erect thus facilitating his general care.

6th. The traction is adjustable yet constant.

7th. The plaster cast may be cut out for physiotherapy or dressings.

8th. Adhesive traction may be employed if this is desired for any special occasion.

9th. This requires no cast on injured leg.

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

1. A splint of the character described comprising an anchor member designed for cast attachment to one leg of the human body, a lever pivotally mounted thereby, a traction yoke attached to one end of the lever; said yoke being designed to embrace a part of the other leg of the body, and including means for effecting a holding connection with a skeletal part of that leg, an adjusting rod fixed pivotally to the other end of the lever, a lug on the anchor member through which the rod is slidable and a nut threaded on the rod to adjust it within the lug to vary the tractive force applied through said yoke.

2. A device as in claim 1 wherein a coiled spring is disposed between the lug and adjusting nut to provide a yielding adjustment.

3. A splint of the character described comprising an anchor stirrup adapted for connection

with a sound limb of the body, a traction member adapted for skeletal attachment to an injured limb of the body, means interconnecting the said members whereby tractive force, sustained by the anchor member, may be applied to the traction member; said traction member having an adjustable mounting permitting rotative movement of the injured limb relative to the well limb while the splint is applied, and means for locking it at different positions of adjustment.

4. A splint of the character described, comprising a stirrup adapted for application to a limb of the body for cast attachment thereto, a bracket fixed to said stirrup and extended laterally thereof, a lever pivotally mounted on the bracket with one end extending to the side thereof, a lug on the bracket, a rod pivotally fixed to the lever and extended slidably through the lug, an adjusting nut threaded onto the rod to co-act with the lug to adjust the position of the lever relative to the stirrup, a traction yoke attached to the outer end of the lever and comprising side members with perforations and a pin extended there-through for skeletal attachment to a part of the body.

5. A device as in claim 4 wherein the point of connection of the traction yoke with the lever is adjustable to vary the distance between the stirrup and yoke, and wherein the yoke is rotatably adjustable and adapted to be fixed at different positions of adjustment.

6. In a device of the character described, the combination with a traction applying lever, of a traction member comprising a cross bar adapted for connection with a traction means and having a central opening, a bolt attached to the traction lever and extended through said cross bar opening and having a bar retaining head at its end, a locking head slidably keyed on the bolt for adjustment against the bar and a nut threaded on the bolt to adjust the head into holding contact with the cross bar.

7. In a device of the character described, the combination with a traction applying lever, of a traction member comprising a yoke having opposite sides and a base member, a cross bar disposed upon the base member, a bolt extended slidably through the bar and base member of the yoke and connected pivotally with the lever, and having a head at its outer end to retain the bar, said bar having a seat on its under surface to receive the base of the yoke, and having a knurled surface, a locking head slidably keyed on the bolt for adjustment into and from holding contact with the knurled surface of the bar, and a holding nut threaded onto the rod and adjustable against the head.

8. A device of the character described comprising an anchor member adapted for fixed mounting on one limb of the body to sustain counter traction, a traction member adapted to be attached to a skeletal part of the body to exert a tractive force, a lever mounted by one of said members and having connection with the other to apply the tractive force, means for adjusting the position of the lever to vary the force applied; said traction member comprising a pair of pivotally mounted tongs and means for adjusting and holding their ends in holding contact with the skeletal part.

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