

March 31, 1936.

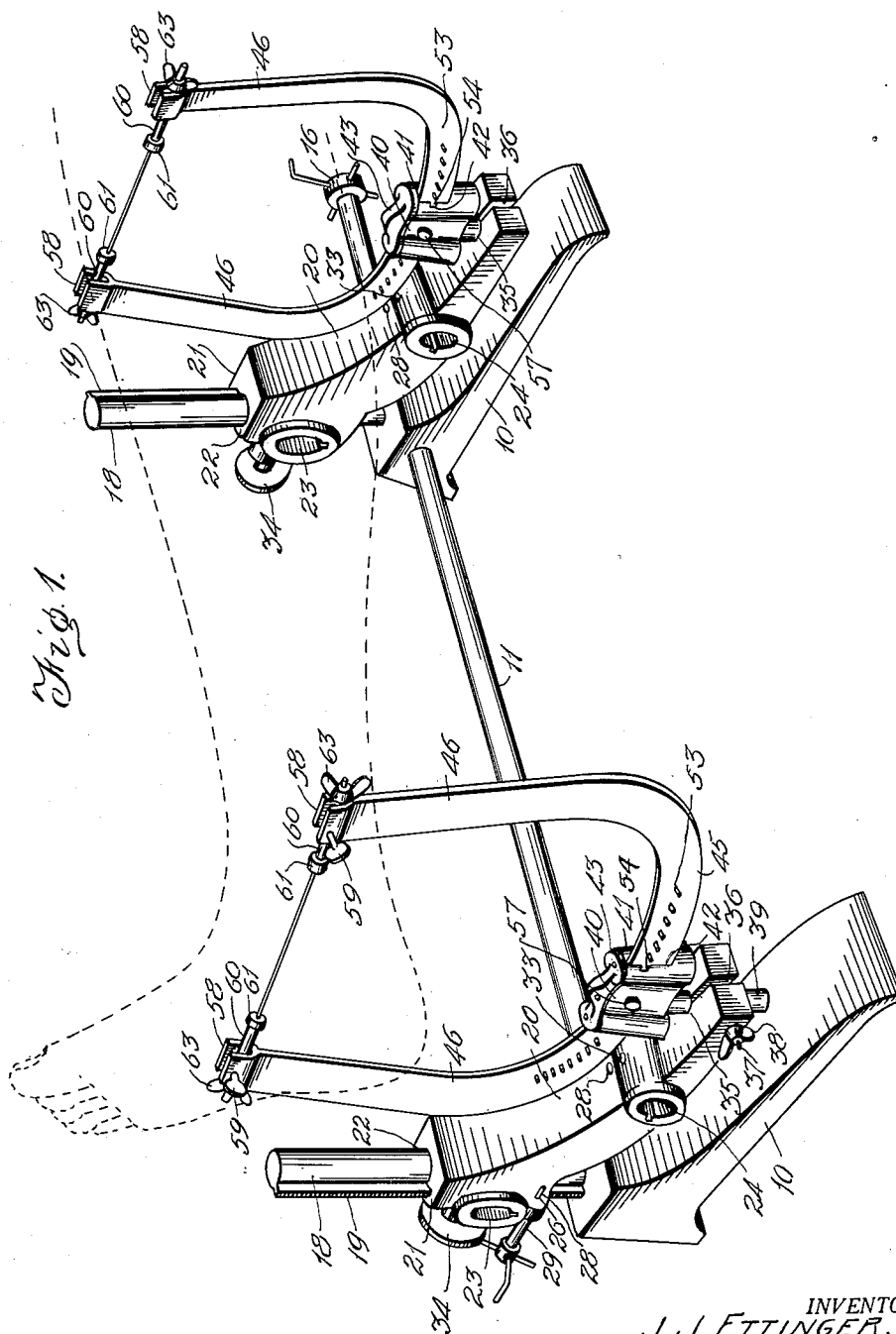
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FRACTURE REDUCTION APPARATUS

Filed May 20, 1935

4 Sheets-Sheet 1



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FRACTURE REDUCTION APPARATUS

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4 Sheets-Sheet 2

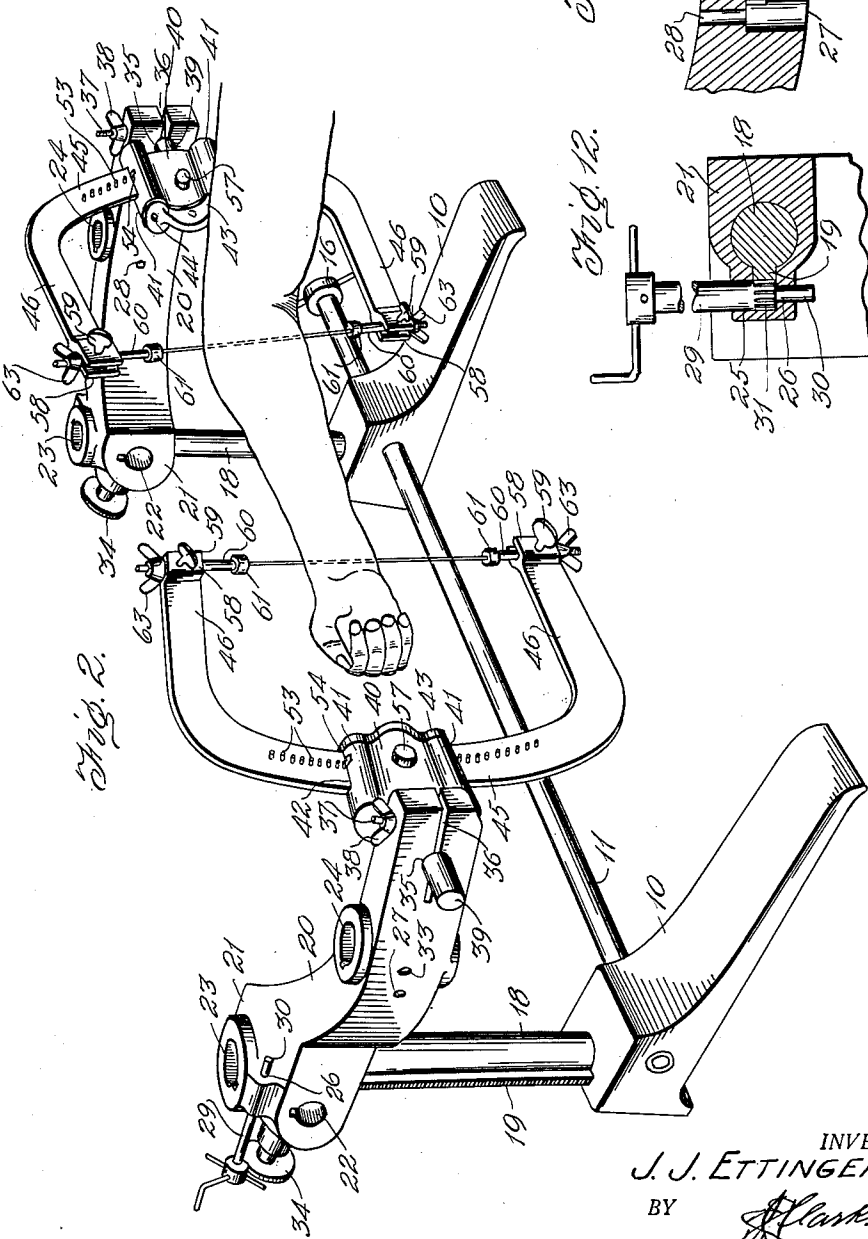


Fig. 13.

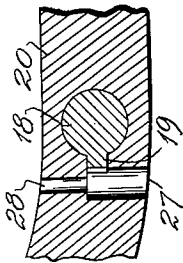
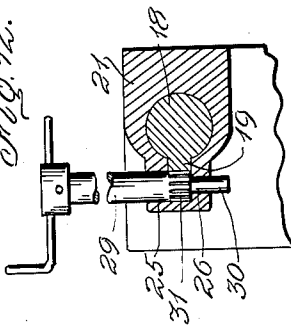


Fig. 12.



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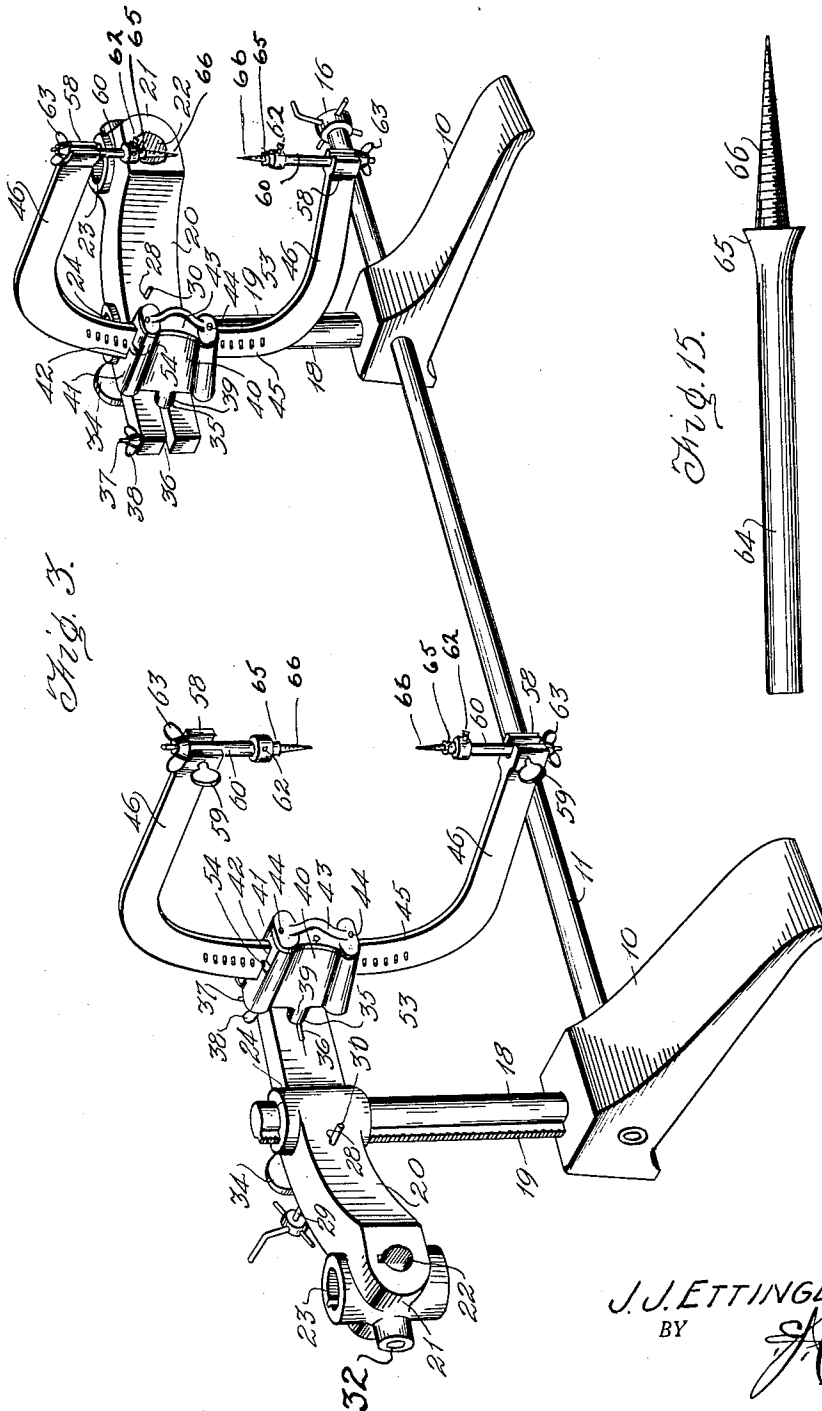
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FRACTURE REDUCTION APPARATUS

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4 Sheets-Sheet 3



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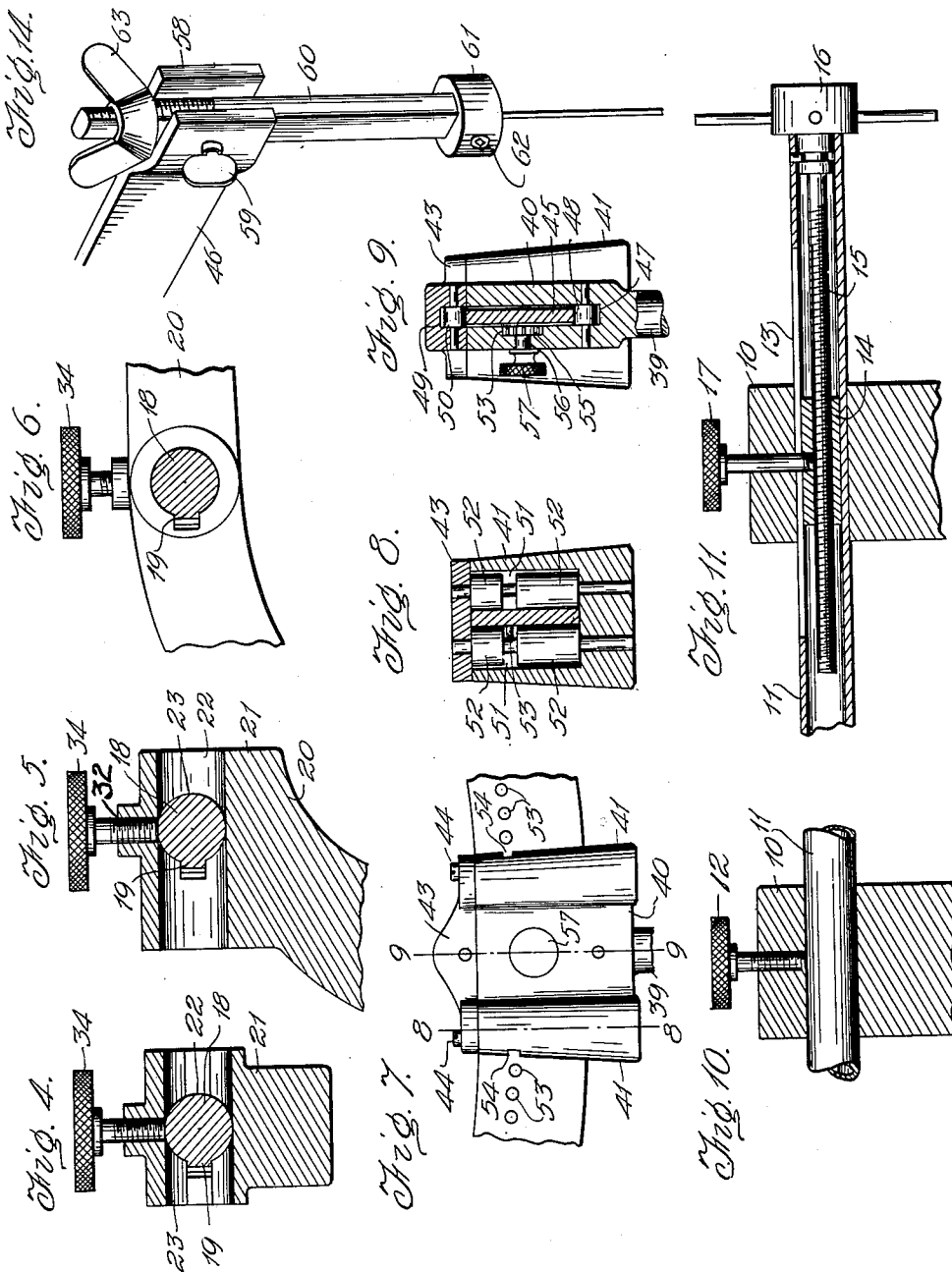
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FRACTURE REDUCTION APPARATUS

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4 Sheets-Sheet 4



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## UNITED STATES PATENT OFFICE

2,035,952

## FRACTURE REDUCTION APPARATUS

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Application May 20, 1935, Serial No. 22,480

20 Claims. (Cl. 128—84)

This invention relates to surgical apparatus and has special reference to a fracture reduction apparatus whereby skeletal traction may be obtained between the broken parts of a long bone such as a leg or arm bone.

More particularly the invention relates to a fracture fixation and traction apparatus of universal application to such long bones, the apparatus being an improvement on that shown in my prior application for patent filed January 28, 1935 and bearing the Serial Number 3,842.

One important object of this invention is to provide a novel form of apparatus of this character having yokes for holding the bone engaging pins or wires and having holders for such yokes so arranged that the holders may be supported in various positions on base standards.

A second important object of the invention is to provide a novel arrangement whereby said yoke holders or arms may be vertically adjusted on the base standards in any position of assembly of said arms on the standards.

A third important object of the invention is to provide novel means for so mounting the yokes in their supporting arms that the yokes may be adjusted in two planes relative to said arms.

A fourth important object of the invention is to provide a novel means for adjusting the yoke in one of said planes.

A fifth important object of the invention is to provide a novel arrangement of anti-friction means for supporting the yokes so that they may be easily adjusted to rotate one segment of the limb with respect to the other even after the device has been placed under adjustment to effect the desired skeletal traction.

A sixth important object of the invention is to provide a novel arrangement of a wire and pin holder with a yoke arm fork in such an apparatus.

With the above and other objects in view as will be hereinafter apparent, the invention consists in general of certain novel details of construction and combinations of parts hereinafter fully described, illustrated in the accompanying drawings and specifically claimed.

In the accompanying drawings like characters of reference indicate like parts in the several views, and:

Figure 1 is a perspective view of the apparatus as arranged for producing skeletal traction on a bone of the lower leg, the position of the leg being indicated in dotted lines.

Figure 2 is a perspective view of the apparatus assembled in a second manner particularly

adapted to produce skeletal traction on a lower arm bone, the yokes being arranged substantially in the same plane and the arm being shown in its relation to the apparatus.

Figure 3 is a perspective view of a third arrangement of the apparatus with the yokes in substantially parallel planes and their supports arranged to lie at one side of the bone under treatment.

Figure 4 is a detail section showing a portion of a standard and yoke arm as used herein with the parts arranged as in Figure 1.

Figure 5 is a view similar to Figure 4 but with the parts arranged as in Figure 2.

Figure 6 is a view similar to Figure 4 but with the parts arranged as in Figure 3.

Figure 7 is an enlarged side elevation of part of a yoke and its supporting head.

Figure 8 is a section on the line 8—8 of Figure 7.

Figure 9 is a section on the line 9—9 of Figure 7.

Figure 10 shows means for adjustably mounting a base member on a tube connecting said members.

Figure 11 is a section showing the means of tractionally adjusting one base member toward and from the other.

Figure 12 is a sectional view showing one arrangement of pinion rack for raising and lowering certain yoke arms used herewith.

Figure 13 is a section showing a second arrangement of such pinion and rack.

Figure 14 is a perspective view of a yoke end and a wire holder associated therewith.

Figure 15 is an enlarged detail side elevation showing a bone screw suitable to use with the splint.

In the embodiment of the invention as here shown there is provided a pair of base members or feet 10. In one of these members, adjacent an end thereof, is secured a tube 11 which is slidable through a base member but which is held in adjusted position by a set screw 12. Adjacent the other end of the tube there is provided a slot 13 and in the tube opposite the slot there is fitted a sleeve 14 internally threaded to receive an adjusting screw 15 which projects from the tube and carries an operating head 16 on its projecting end. A screw 17 is screwed through the second base member and passes through the slot 13 to screw into the wall of the sleeve 14. By this means the sleeve 14 acts as a nut on the screw 15 so that rotation of the screw effects movement of the base along the tube 11.

A standard 18 projects upwardly from each base 10 preferably at the end of the base receiving the

tube 11. Each standard has projecting therefrom a rib 19 having teeth cut therein to form a rack. For each of the standards there is provided a curved yoke supporting arm 20 having at one end a head 21. Extending through the head 21 in the plane of curvature of the arm 20 is a keyhole shaped bore 22 and intersecting the bore 22 at right angles is a second keyhole bore 23. A third bore 24 of like shape is formed through the arm 20 intermediate its ends. These bores are each of such size as to fit closely but slidably on the standards 18 and it will be noted that the racks 19 act as keys to prevent rotation of the arms 20 on the standards 18. Formed in the head 21 is a socket 25 terminating in a pin receiving opening 26. This socket opens at its side into the bores 22 and 23 at the rack receiving parts of said bores. Also a similar socket 27 terminating in a pin receiving opening 28 is formed in the arm 20 in like relation to the bore 24. Arranged to fit these sockets is a turnkey having a shank 29 provided with a pin end 30 to fit the openings 26 and 28. Gear teeth 31 are formed in the shank adjacent the pin 31, these gear teeth meshing with the rack 11 when inserted in the proper socket, being inserted in the socket 25 when the arm 20 is arranged as in Figure 1 or 2 and in the socket 27 when the arm is arranged as in Figure 3. Thus the one turnkey serves to adjust either arm 20 vertically on its standard in any position of such arm. Each arm 20 is also provided with a screw hole 32 opening into the junction of the bores 22 and 23 and with a screw hole 33 opening into the bore 24. A set screw 34 is interchangeable between these screw holes so that, after the arm is adjusted by the turnkey it may be secured in adjusted position. Adjacent the end of the arm 20 is an opening 35 parallel to the bore 22 and from which a slot 36 extends through the end of the bar so that this end is provided with a forked construction. A bolt 37 is held in one arm of this fork and extends through the other fork arm so that a wing nut 38 may be screwed on this bolt to force the fork arms toward each other.

Mounted in the hole 35 is a stem 39 whereon is formed a head having a relatively narrow central portion 40 and relatively wide side portions 41. By means of the wing nut 38 the stem 39 may be clamped in any desired position in the arm 20. The head has a slot 42 extending from side to side of the head, this slot being open at the face remote from the stem 39. A cap 43 is fixed on the head, as by suitable screws 44 to close the open side of the slot 42. For each head there is provided a yoke, which has an arcuate central portion 45 slidable through the slot 42. In the interior of the head adjacent the stem there is provided a pocket 47 in which is mounted a bearing roller 48 on which rests the convex edge of the yoke center 45. In the cap 43 is a similar pocket 49 in which is a bearing roller 50 on which rests the concave edge of the yoke center 45. Also in each side part 41 of the head is a pocket 51 wherein is mounted on each side of the yoke a pair of rollers 52. These rollers bear against opposite side faces of the yoke so that it may move smoothly and easily through the slot even when the apparatus is in use and traction extended tending to jam the yoke against movement. In order to move the yoke through the slot there is provided on one side face of the yoke center a series of spaced pins 53, the head being slotted by a slot 54 leading from the slot 42 to permit the pins to pass through the head.

These pins 53 form a species of gear segment and are engaged by a pinion 55 mounted in the head on a short shaft 56 which projects through the head. A thumb nut 57 is fixed on the projecting end of the shaft and, by rotation of this nut 57 the yoke is moved through the slot 42.

Each arm 46 is provided on its end with a fork 58 and through one arm of each fork extends a set screw 59. This screw may be used to hold a Steinman pin (not shown) or a wire holder may be used in each fork. Such a wire holder may have a threaded tubular shank 60 having oppositely disposed flat sides so that the shank may fit in the fork against rotation. On the inner end of the shank is a tubular head 61 carrying a set screw 62 so that when a tractor wire is inserted in the head and its shank it may be securely clamped by this set screw. On the outer end of each shank is fitted a wing nut 63 so that the traction wire may be tensioned by rotation of this wing nut.

As will be seen from Figures 1, 2, and 3 this apparatus does not require separate fittings for different traction arrangements, the arm 20 being engageable on its standard for different positions by selectively fitting a bore on said standard. Further, when so positioned the arm may be bodily raised and lowered on the standard. Obviously, by transposing the arms and inverting them from the position shown in Figure 1, the yokes may be positioned above the limb under treatment. Thus the device may be applied below or above the limb, at either side thereof or in alignment therewith. Also, in either of the aforesaid positions the universal mounting of the yokes, by means of the rotatable stems 39 and the sliding of the yokes through the heads, permits the establishment of any desired relation between the Steinman pins, tractor wires or other traction devices such as ice tong pins or bone screws held by the yokes.

In place of a wire or a pin, a bone screw may be used in connection with the splint and in Figure 15 is shown a bone screw having a shank 64 having an enlarged end 65 from which projects a screw threaded and tapered point 66, the enlarged end 65 forming an abrupt shoulder at the base of the threaded portion. The manner of using such bone screws is illustrated in Fig. 3 wherein it will be seen that the traction wires of Figs. 1 and 2 and their tension nuts 63 have been removed and bone screws as shown in Fig. 15 substituted therefor. Otherwise the device is the same.

There has thus been provided a simple and efficient device of the kind described and for the purpose specified.

It is obvious that minor changes may be made in the form and construction of the invention without departing from the material spirit thereof. It is not, therefore, desired to confine the invention to the exact form herein shown and described, but it is desired to include all such as properly come within the scope claimed.

Having thus described the invention, what is claimed as new is:

1. In an apparatus of the kind described including a pair of like traction devices and means to force said devices apart, each of said traction devices including a base, a standard carried by said base, a yoke supporting arm having a series of bores therein selectively engageable on said standard, and means for adjustably raising and lowering the arm in any position of engagement of the arm on the standard.

2. In an apparatus of the kind described including a pair of like traction devices and means to force said devices apart, each of said traction devices including a base, a standard carried by said base, a yoke supporting arm having a series of bores therein selectively engageable on said standard, means for adjustably raising and lowering the arm in any position of engagement of the arm on the standard, and other means for clamping said arm to the standard in adjusted position on the standard.

3. In an apparatus of the kind described including a pair of like traction devices and means to force said devices apart, each of said traction devices including a base, a standard carried by said base, a yoke supporting arm having a series of bores therein selectively engageable on said standard, said arm being curved and having at least one bore at right angles to another bore, and means for adjustably raising and lowering the arm in any position of engagement of the arm on the standard.

4. In an apparatus of the kind described including a pair of like traction devices and means to force said devices apart, each of said traction devices including a base, a standard carried by said base, a yoke supporting arm having a series of bores therein selectively engageable on said standard, said arm being curved and having at least one bore at right angles to another bore, means for adjustably raising and lowering the arm in any position of engagement of the arm on the standard, and other means for clamping said arm to the standard in adjusted position on the standard.

5. In an apparatus of the kind described including a pair of like traction devices and means to force said devices apart, each of said traction devices including a base, a standard carried by said base, a yoke supporting arm having a series of bores therein selectively engageable on said standard, said arm including a head and a curved part, two of said bores extending through the head, and intersecting at right angles and a third of said bores extending through the curved part perpendicular to the plane of curvature, and means for adjustably raising and lowering the arm in any position of engagement of the arm on the standard.

6. In an apparatus of the kind described including a pair of like traction devices and means to force said devices apart, each of said traction devices including a base, a standard carried by said base, a yoke supporting arm having a series of bores therein selectively engageable on said standard, said arm including a head and a curved part, two of said bores extending through the head, and intersecting at right angles and a third of said bores extending through the curved part perpendicular to the plane of curvature, means for adjustably raising and lowering the arm in any position of engagement of the arm on the standard, and other means for clamping said arm to the standard in adjusted position on the standard.

7. In an apparatus of the kind described including a pair of like traction devices and means to force said devices apart, each of said traction devices including a base, a standard carried by said base, a yoke supporting arm having a series of bores therein selectively engageable on said standard, said standard having a rib extending therealong and provided with rack teeth, each of said bores having a slotted portion receiving said rib whereby the rib forms a key to prevent

rotation of the arm on the standards, gear means journaled in the arm and engaging said rack, and means to operate the gear means to move the arm along the standard.

8. In an apparatus of the kind described including a pair of like traction devices and means to force said devices apart, each of said traction devices including a base, a standard carried by said base, a yoke supporting arm having a series of bores therein selectively engageable on said standard, said standard having a rib extending therealong and provided with rack teeth, each of said bores having a slotted portion receiving said rib whereby the rib forms a key to prevent rotation of the arm on the standard, gear means journaled in the arm and engaging said rack, means to operate the gear means to move the arm along the standard, and other means for clamping said arm to the standard in adjusted position on the standard.

9. In an apparatus of the kind described including a pair of like traction devices and means to force said devices apart, each of said traction devices including a base, a standard carried by said base, a yoke supporting arm having a series of bores therein selectively engageable on said standard, said standard having a rib extending therealong and provided with rack teeth, each of said bores having a slotted portion receiving said rib whereby the rib forms a key to prevent rotation of the arm on the standard, said arm being curved and having at least one bore at right angles to another bore, gear means journaled in the arm and engaging said rack, and means to operate the gear means to move the arm along the standard.

10. In an apparatus of the kind described including a pair of like traction devices and means to force said devices apart, each of said traction devices including a base, a standard carried by said base, a yoke supporting arm having a series of bores therein selectively engageable on said standard, said standard having a rib extending therealong and provided with rack teeth, each of said bores having a slotted portion receiving said rib whereby the rib forms a key to prevent rotation of the arm on the standard, said arm including a head and a curved part, two of said bores extending through the head, and intersecting at right angles and a third of said bores extending through the curved part perpendicular to the plane of curvature, gear means journaled in the arm and engaging said rack, and means to operate the gear means to move the arm along the standard.

11. In an apparatus of the kind described including a pair of like traction devices and means to force said devices apart, each of said traction devices including a base, a standard carried by said base, a yoke supporting arm having a series of bores therein selectively engageable on said standard, means for adjustably raising and lowering the arm in any position of engagement of the arm on the standard, a stem rotatably mounted in the free end of said arm, means to secure the stem in rotatably adjusted position, a head on said stem, a yoke having a curved central portion passing through the stem, said yoke having arms arranged to carry a traction element, anti-friction means carried by the stem head for supporting the yoke for free movement through said stem head and gear means for moving the yoke in the head.

12. In an apparatus of the kind described including a pair of like traction devices and means

to force said devices apart, each of said traction devices including a base, a standard carried by said base, a yoke supporting arm having a series of bores therein selectively engageable on said standard, said arm being curved and having at least one bore at right angles to another bore, means for adjustably raising and lowering the arm in any position of engagement of the arm on the standard, a stem rotatably mounted in the free end of said arm, means to secure the stem in rotatably adjusted position, a head on said stem, a yoke having a curved central portion passing through the stem, said yoke having arms arranged to carry a traction element, anti-friction means carried by the stem head for supporting the yoke for free movement through said stem head and gear means for moving the yoke in the head.

13. In an apparatus of the kind described including a pair of like traction devices and means to force said devices apart, each of said traction devices including a base, a standard carried by said base, a yoke supporting arm having a series of bores therein selectively engageable on said standard, said arm including a head and a curved part, two of said bores extending through the head, and intersecting at right angles and a third of said bores extending through the curved part perpendicular to the plane of curvature, means for adjustably raising and lowering the arm in any position of engagement of the arm on the standard, a stem rotatably mounted in the free end of said arm, means to secure the stem in rotatably adjusted position, a head on said stem, a yoke having a curved central portion passing through the stem, said yoke having arms arranged to carry a traction element, anti-friction means carried by the stem head for supporting the yoke for free movement through said stem head and gear means for moving the yoke in the head.

14. In an apparatus of the kind described including a pair of like traction devices and means to force said devices apart, each of said traction devices including a base, a standard carried by said base, a yoke supporting arm having a series of bores therein selectively engageable on said standard, said standard having a rib extending therealong and provided with rack teeth, each of said bores having a slotted portion receiving said rib whereby the rib forms a key to prevent rotation of the arm on the standard, gear means journaled in the arm and engaging said rack, means to operate the gear means to move the arm along the standard, a stem rotatably mounted in the free end of said arm, means to secure the stem in rotatably adjusted position, a head on said stem, a yoke having a curved central portion passing through the stem, said yoke having arms arranged to carry a traction element, anti-friction means carried by the stem head for supporting the yoke for free movement through said stem head, and gear means for moving the yoke in the head.

15. In an apparatus of the kind described including a pair of like traction devices and means to force said devices apart, each of said traction devices including a base, a standard carried by said base, a yoke supporting arm having a series of bores therein selectively engageable on said standard, said standard having a rib extending therealong and provided with rack teeth, each of said bores having a slotted portion receiving said rib whereby the rib forms a key to prevent rotation of the arm on the standard, said arm

being curved and having at least one bore at right angles to another bore, gear means journaled in the arm and engaging said rack, means to operate the gear means to move the arm along the standard, a stem rotatably mounted in the free end of said arm, means to secure the stem in rotatably adjusted position, a head on said stem, a yoke having a curved central portion passing through the stem, said yoke having arms arranged to carry a traction element, anti-friction means carried by the stem head for supporting the yoke for free movement through said stem head, and gear means for moving the yoke in the head.

16. In apparatus of the kind described, a traction yoke having an arcuate central portion of bar form, a yoke supporting member including a head having a slot therein receiving the central portion of the yoke, a cap removably covering said slot, anti-friction bearings in the cap and in the bottom of the slot to support the yoke at its edges, and other anti-friction bearings at the sides of the slot to support the yoke at its sides.

17. In apparatus of the kind described, a traction yoke having an arcuate central portion of bar form, a yoke supporting member including a head in which the central portion of the yoke is mounted for sliding movement therethrough, anti-friction means mounted in said head and engaging both edges and both sides of the yoke, the anti-friction means at one side of the yoke being provided with a gap, gear teeth projecting from a side of the yoke positioned to pass through the gap upon movement of the yoke through the head, and a gear carried by the head in mesh with said gear teeth and operable from the exterior of the head.

18. In apparatus of the kind described, a traction yoke having an arcuate central portion of bar form, a yoke supporting member including a head having a slot therein receiving the central portion of the yoke, a cap removably covering said slot, anti-friction bearings in the cap and in the bottom of the slot to support the yoke at its edges, other anti-friction bearings at the sides of the slot to support the yoke at its sides, the anti-friction means at one side of the yoke being provided with a gap, gear teeth projecting from a side of the yoke positioned to pass through the gap upon movement of the yoke through the head, and a gear carried by the head in mesh with said gear teeth and operable from the exterior of the head.

19. In an apparatus of the kind described, a traction yoke having an arcuate central portion of bar form, a yoke supporting member including a head in which the central portion of the yoke is mounted for sliding movement therethrough, a row of pins projecting from one side of the yoke and spaced along a line concentric to the curvature of the yoke, a pinion in said head meshing with said pins, a shaft carrying the pinion and journaled in one side of the head, means on the shaft exterior of the head for rotating said shaft, and anti-friction means in said head and supporting said yoke, said anti-friction means engaging both edges and both sides of the yoke, the anti-friction means on the pin provided side of the yoke engaging said side on both sides of the line of pins.

20. In an apparatus of the kind described including a pair of like traction devices and means to force said devices apart, each of said traction devices including a base, a standard carried by

5 said base, a yoke supporting arm having a series of bores therein selectively engageable on said standard, a yoke supported at its middle portion by said arm, means for adjustably raising and lowering the arm in any position of engagement of the arm on the standard, and bone screws held in the arms of said yoke and each compris-

ing a cylindrical shank provided at one end with an enlarged portion, said enlarged end having a threaded end tapered point, the said enlarged end forming an abrupt shoulder at the base of said point to limit insertion of the screw into skeletal structure. 5

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