United States Patent

Staib, deceased

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[54] TRACTION DEVICES FOR ORTHOPEDIC TABLES

[72] Inventor: **Armando Staib, deceased,** late of Guanabara, Brazil by Erika Esch, executrix

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June 6, 1968 Brazil.....199,660

[52] **U.S. Cl.**.....**128/71**

[51] **Int. Cl.**.....**A61f 5/00**

[58] **Field of Search**.....128/71, 84, 75, 84, 84.1, 84.2, 128/84.4; 74/425, 33

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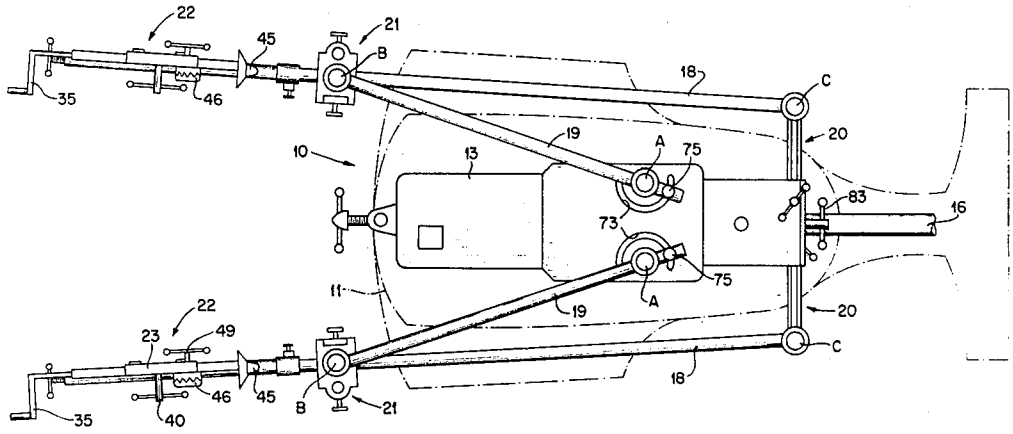
Assistant Examiner—G. F. Dunne
Attorney—Emory L. Groff and Emory L. Groff, Jr.

[57] **ABSTRACT**

An orthopedic table including traction arms for performing orthopedic traction in the upper and lower limbs of the patient includes a traction device mounted at the free end of each traction arm, said traction device includes a worm and worm gear arrangement, first manual means for operating the worm so as to produce traction displacements in a range of millimeters and a second manually operable means producing traction displacements of a greater magnitude.

4 Claims, 16 Drawing Figures



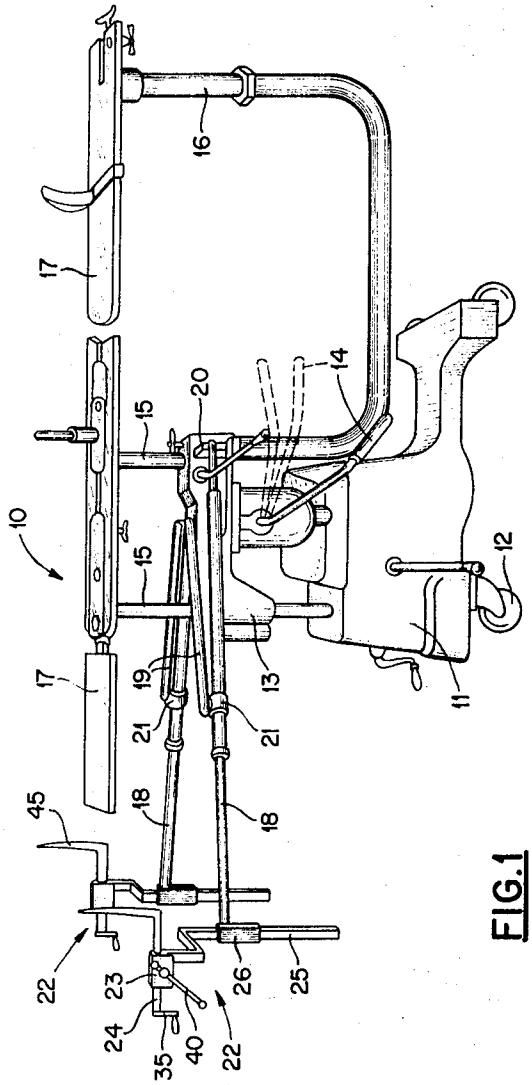

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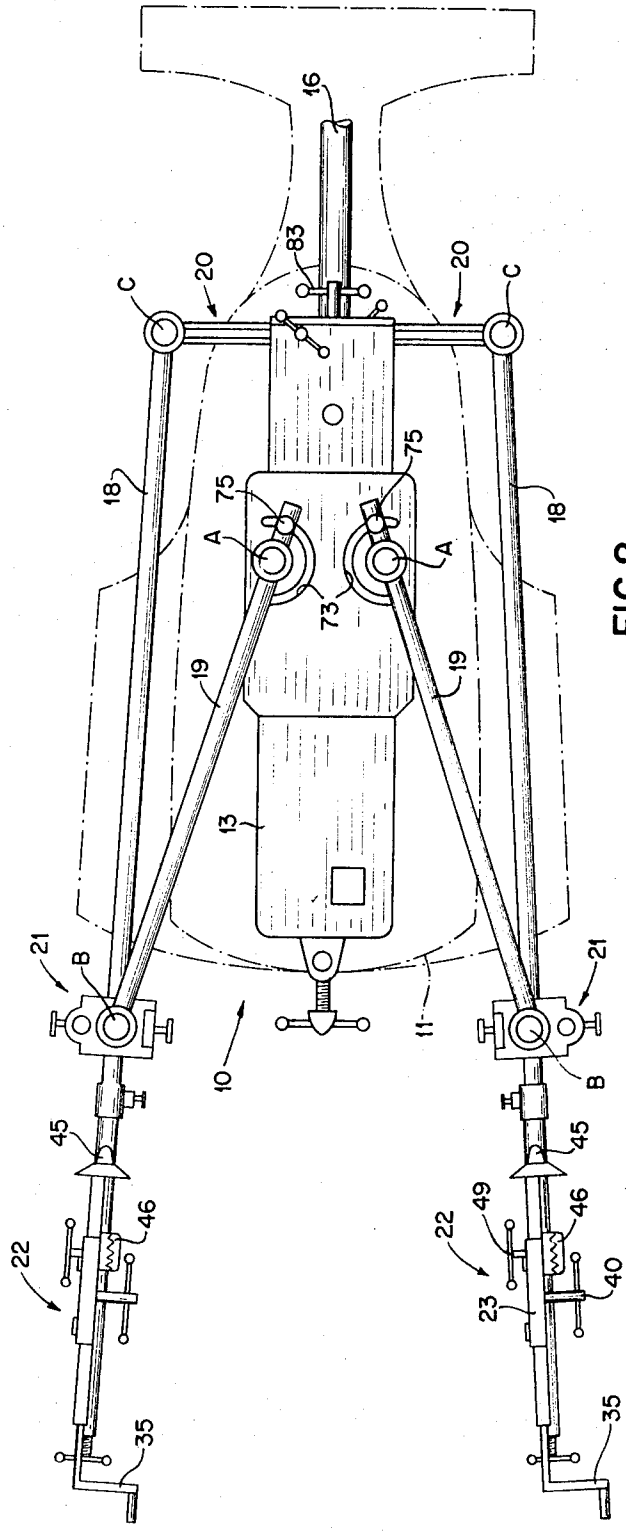
FIG.1


16
83
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C
C
18
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75
A
A
73
19
19
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FIG.2

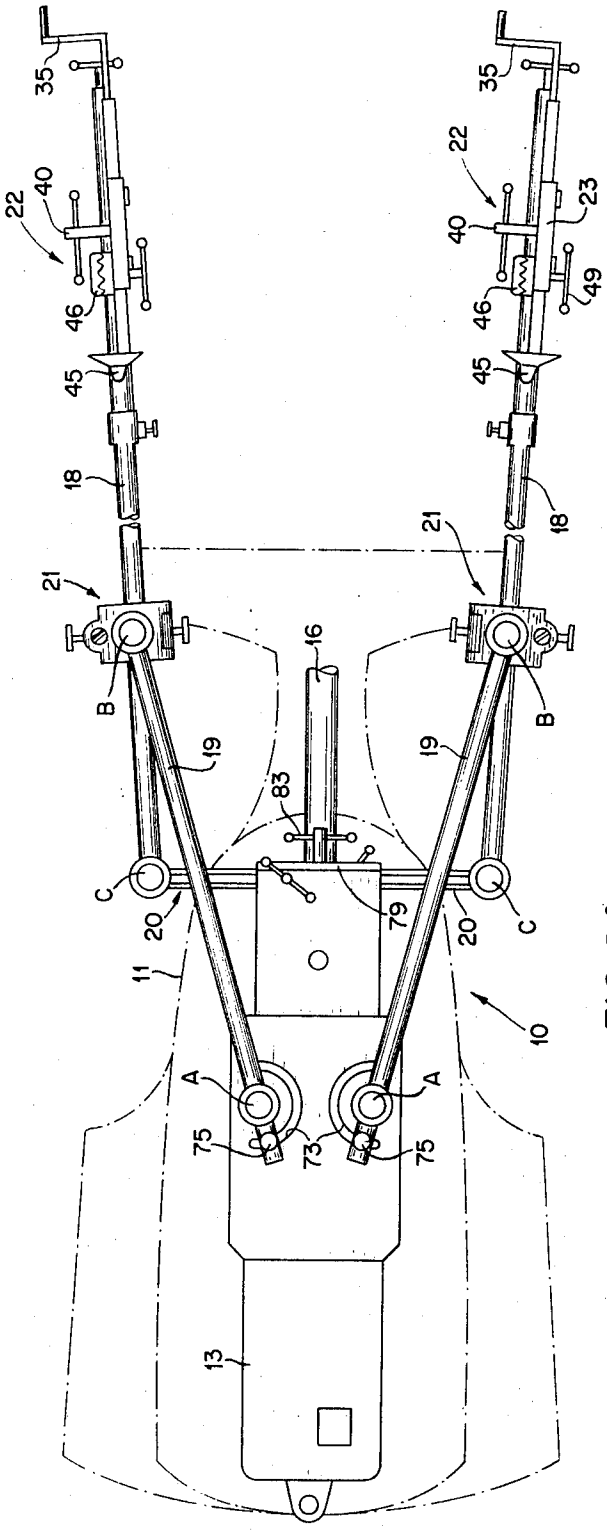


FIG.2A

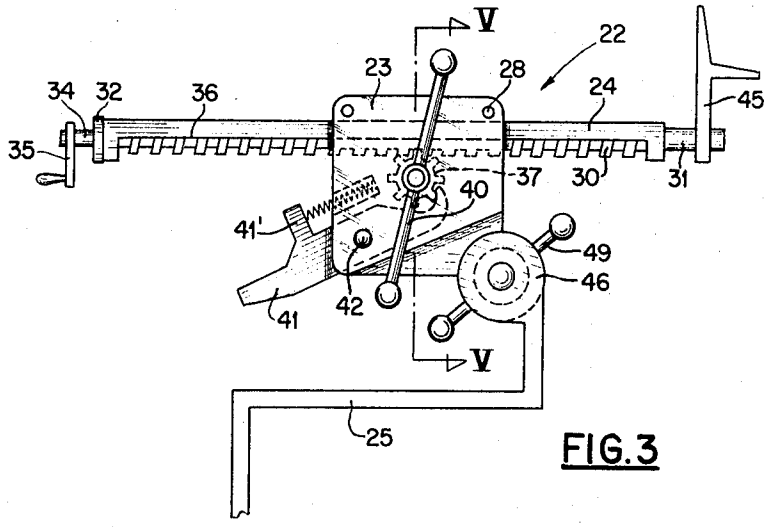
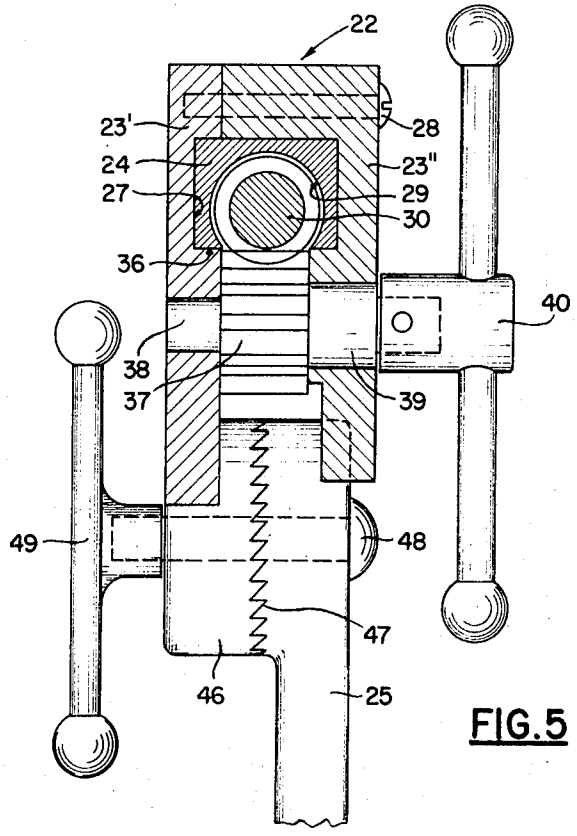

V
22
23
28
34
32
36
24
45
35
37
30
31
40
41'
49
46
42
41
V
25

FIG.3


22
23'
28
24
23"
27
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46
25

FIG.5

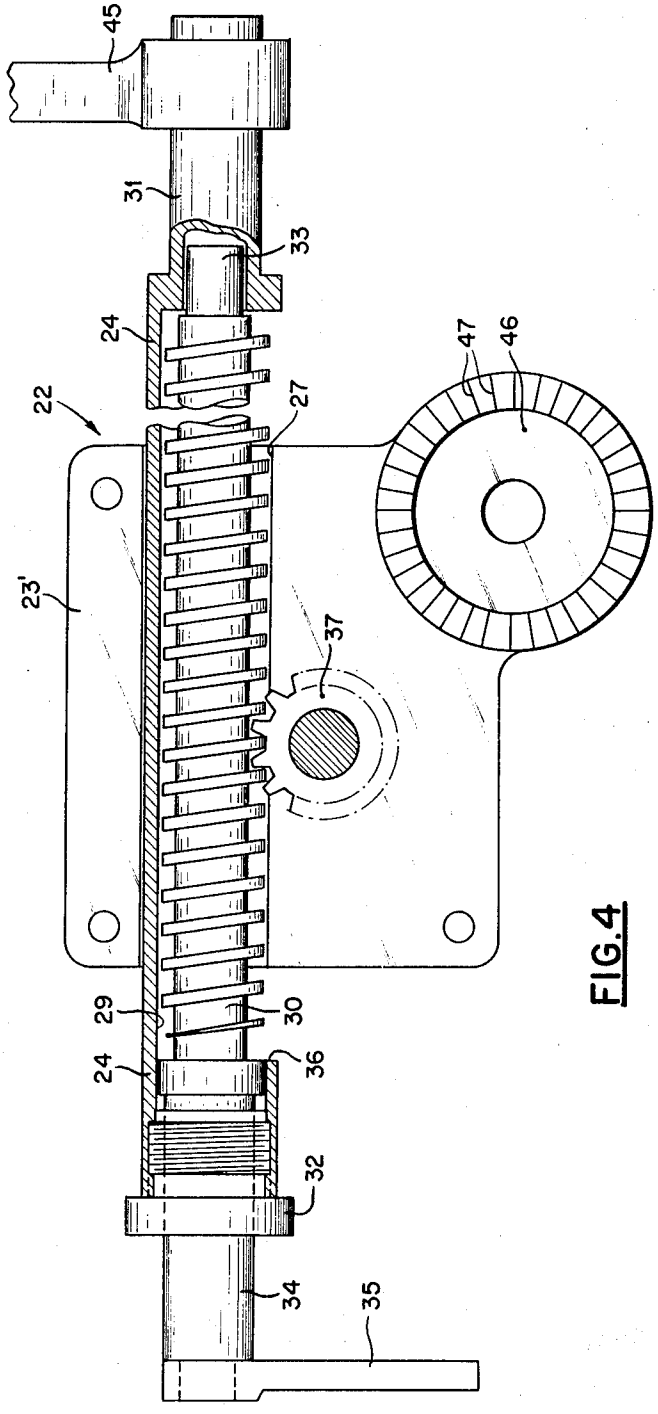


FIG.4

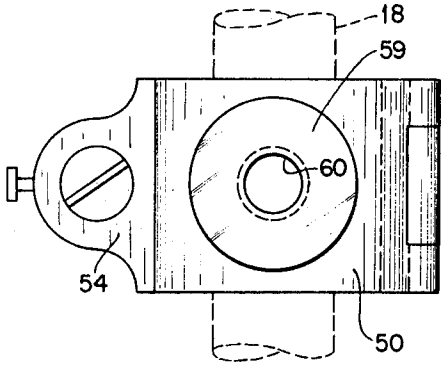


FIG.6

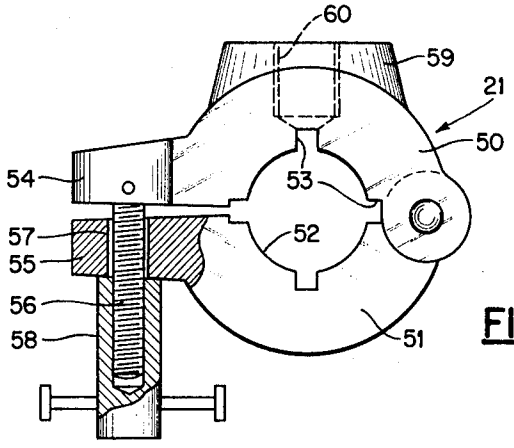


FIG.7

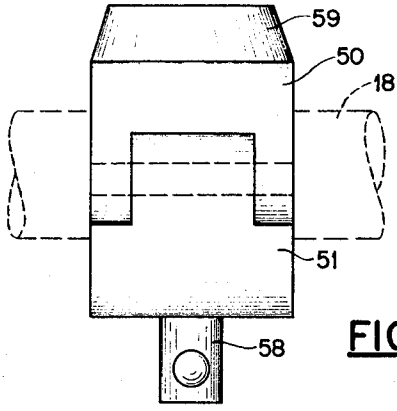
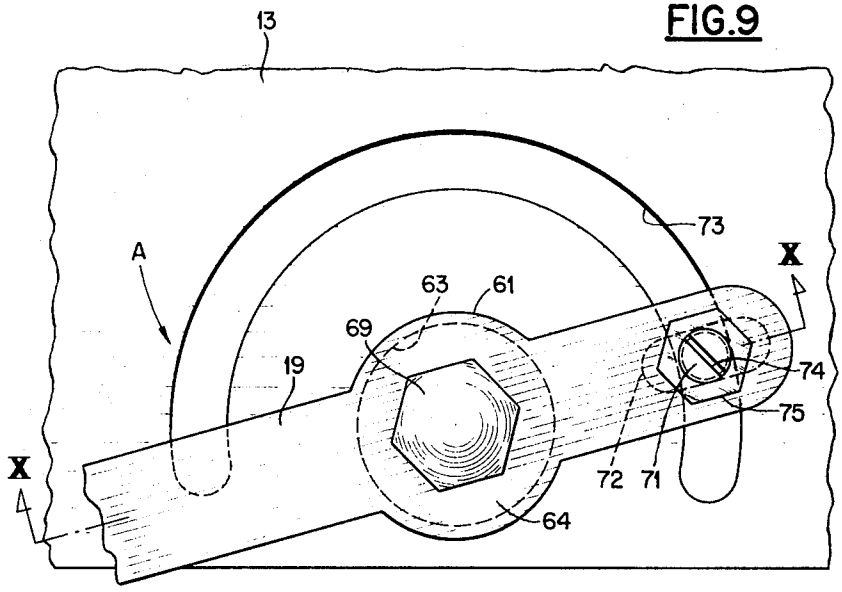


FIG.8

FIG.9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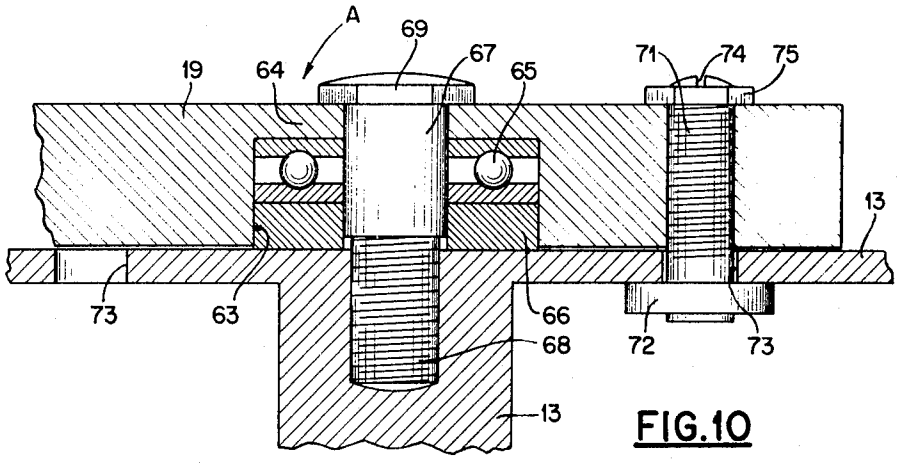
A
73
X
63
61
69
19
74
75
X
72
71
64


A
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73
13

FIG.10

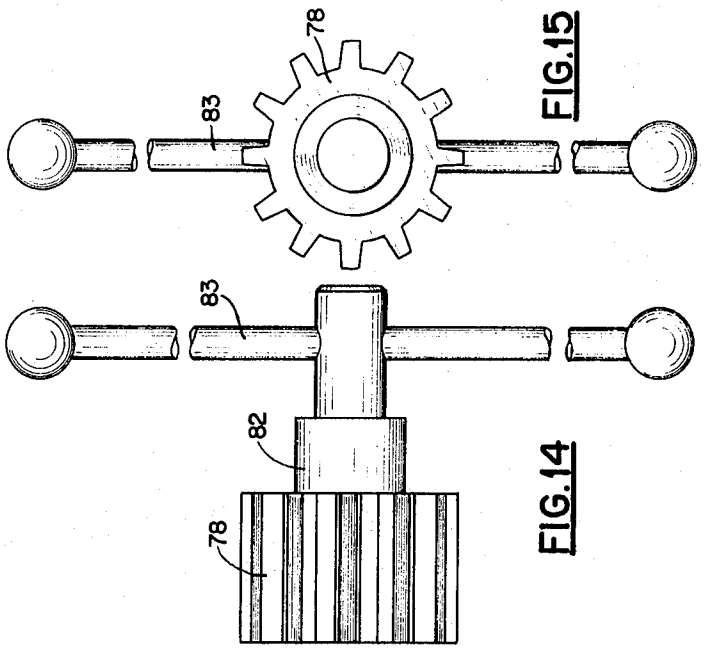

FIG.15

FIG.14

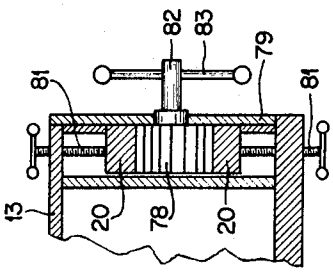

FIG.12

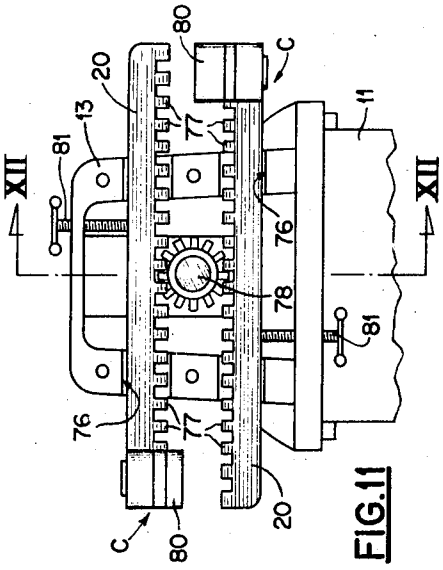

FIG.11

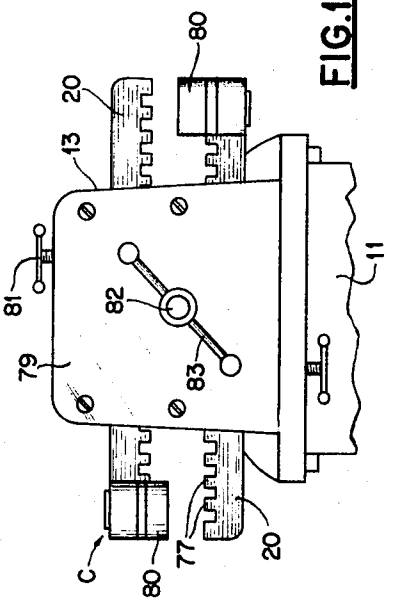

FIG.13

TRACTION DEVICES FOR ORTHOPEDIC TABLES

The present invention relates to improvements in orthopedic tables, and, more specifically, to improvements introduced in traction arms or brackets for orthopedic tables of the kind known as "Albee", providing means directed to facilitating the handling and imparting more precision and practicability for adjusting or regulating the traction devices of these tables.

Though widely used for many years in most of the hospitals, the orthopedic tables of the Albee type have always presented serious problems which render their handling too difficult, which problems are caused by structural defects whose solution, without knowing why, has never been tried, in a practical way. This orthopedic table of the Albee type generally comprises a base, in which a pair of traction arms and the table cover for receiving the patient are mounted. The traction arms, which are two horizontally disposed, elongated tubular stems, are secured at an end thereof to the rear part of the base and are supported with respect to the base by means of pivotal bars or guide rods. At the free end of the traction arms, are stirrups for securing the patient's feet and ratchet and rach devices which permit to effect the traction of the respective fractured limb. Each of the bars or rods is arranged so that it is pivotally secured to the base at an end, the other end being provided with a bracket which is designed for receiving the said traction arm and permitting the same to slide, which enables the opening or closure of said traction arms. The main problems and deficiencies observed in this type of orthopedic tables reside exactly in the pivot points of the traction arms and in the regulation or adjusting of the motion of the traction of said arms. There are four defects as viewed from these tables:

a. In the traction support of the prior art, placed at the free end of each traction arm, the traction motion is effected by means of the rack provided with a ratchet wheel. This arrangement has never been so effective in its operation, since the pitch of the rack teeth is very large (e.g., about 6.5 mm) what hinders performing small value tractions (e.g., about 1 or 2 mm), which are the most frequently required in these parts of the orthopedic table. This problem becomes even more serious whereas in this system, it is practically impossible to eliminate the traction in this zone, since the release of the system implies in releasing the whole traction.

b. The traction arms are subject to being clamped or warped within the brackets where the move, which brackets are provided at the ends of the respective support bars or rods of the traction arms.

c. The opposite ends of the bars or rods are pivotally mounted on the base disposed on the table, only by means of a bolt or a pin, which has to support the weight of the respective traction arms and the weight of the respective bar itself. With little time of use, the hinge produces a clearance and releases itself, jeopardizing the whole equilibrium of the arm, and thus rendering the work of the doctor quite difficult.

d. The rear of the traction arms are adjustably connected to the rear part of the base, in order to permit adjusting the clearance between the arms, according to the width of the patient's hips. This system comprises a pair of racks, each one pivotally secured to the end of said traction arm, these two racks being held in place together with a spur gear engaged to the teeth of the two racks. The adjustment of the arms is manually effected, by gripping the tips of the traction arms, near the rack and pulling the same until the desired position or width is obtained. This system, besides presenting the problem of eventual unbalance in the relative opening between the traction arms, requires, from the doctor, some physical effort, sometimes violent, in order to effect the desired adjustment. Besides, since it is necessary to grip directly the traction arms, near the part where the racks are situated, almost never lubricated with grease or oil, the doctor is subject to strain his hands and, sometimes, to get hurt.

The present invention aims solving these problems and deficiencies pointed out, providing an improved orthopedic table in which are provided devices which permit to effect the adjustment of the traction arms with great efficiency, practicability and precision, and with no effort at all.

These and other objects, features and advantages of the invention will be more easily understood from the following description, and in connection with the accompanying drawings, wherein:

FIG. **1** is a schematic perspective view of an orthopedic table, which the improvements of the present invention are applied to.

FIG. **2** is an top plan view of the table shown in FIG. **1**, but with the cover part removed therefrom for facilitating the location of the improved devices of the present invention.

FIG. **2A** is a view similar to FIG. **2**, with the traction arms facing the opposite direction, after a turn of about 180°.

FIG. **3** is an inner side view of the device for the traction of the limbs.

FIG. **4** is an enlarged sectional view of the bar and worm assembly which belongs to the device shown in the preceding figure.

FIG. **5** is a sectional view taken along the line V—V of FIG. **3**.

FIGS. **6**, **7** and **8** are, respectively, an upper view, a side and a front view of the pivotal bracket which allows the traction arms to slide on the support extremity of the respective guide bar.

FIGS. **9** and **10** are, respectively, an enlarged view of the pivotal assembly of the guide bars on the support block of the table, according to the present invention, FIG. **9** being an upper view and FIG. **10** being a sectional view in the direction of the arrows X—X of the FIG. **9**.

FIG. **11** is a rear view of the upper part of the support block, illustrating the assembly for the extreme parts of the traction arms, but with its cover removed therefrom.

FIG. **12** is a sectional view taken along the section line XII—XII of FIG. **11**.

FIG. **13** is a view similar to FIG. **10**, but with the cover in place.

FIGS. **14** and **15** are, respectively, side and rear views of the spur gear with crank used for performing the gradual motion between the tracks which provide opening and closing, in a controlled way, of the traction arms in the region of the hips.

As shown in the drawings, an orthopedic table of the type referred to, designed by reference numeral **10**, comprises a base **11** which is mounted on rotatable wheels **12** for facilitating the motion of the table **10** on the floor. On the base **11** is disposed a support block **13**, arranged so that it can be lifted or lowered with respect to the base **11** by means of a conventional hydraulic system, driven by the manual lever **14**. In addition to the traction arms and other devices described hereinafter, on the support block **13** there are provided two vertical rods **15** and a support member **16**, the latter being of tubular design and substantially U-shaped, which provide the means for securing the table cover **17** designed to receive the body of the patient on the table **10**.

On the support block **13** there are mounted two traction arms **18** preferably of tubular design, supported by means of guide bars **19** and racks **20** adapted to be transversally displaced in the rear part of said support block **13**, as best shown in FIGS. **11–15**, in order to allow regulating the opening of the arms **18** in this region of the table. Each of the guide bars **19** is pivotally mounted with an end on the block **13** and presents, at the opposite end thereof, a pivotal bracket **21** as best shown in FIGS. **6–8**, whereby the traction arm is supported and slidably guided along the respective guide bar. At the free end of each of the traction arms **18**, a traction device is provided, which device includes the stirrup for tensioning the limbs, this device being designed generally by reference number **22**.

Referring to FIGS. **1**, **2**, **2A**, **3**, **4**, and **5**, this device for tensioning the limbs **22** comprises a support body **23** wherein is disposed an elongated bar **24** arranged such that it slides along said body. The support body **23** is adjustably mounted on an

angularly folded bar **25** which is, in turn, engaged to a housing **26** located at the free end of the respective traction arm **18**.

As shown, in detail, in FIGS. **3** to **5**, the elongated bar **24** has an inner section which is square at its ends and rectangular along most of its length and is located in a suitable hole **27** intermediate the two body parts **23'** and **23''**, these latter being joined by means of screws **28**. The elongated bar **24** is perforated from one end to another by a longitudinal cylindrical bore **29**, in order to accommodate a worm **30**. At an end, the bar **24** presents a cylindrical extension **31** and at the opposite end thereof, it receives a threaded bushing **32**. The cylindrical extension or shank and the bushing **32** are longitudinally perforated and are concentric with the cylindrical bore **29** in order to receive, respectively, the tips **33** and **34** of the worm **30**, the worm tip **34** being elongated in order to exceed the outer face of the bushing **32** and to receive an operating crank **35**. At the lower part thereof, elongated bar **24** presents a longitudinal flange **36** which intersects the cylindrical bore **29** in order to allow a part of the periphery of the worm **30**, slightly more than the depth of the thread, to exceed the flanged face **36**. This part of the worm exceeds the flanged face of the bar to engage a gear with helical teeth **37**, disposed under the elongated bar **24**, said gear being mounted on the support body **23** by means of two shaft ends **38** and **39** which engage corresponding holes provided in said parts **23'** and **23''** that constitute the support body. As shown in FIG. **5**, the shaft end **39** projects beyond the outer face of part **23''** for receiving, adjusted by counterpin or other suitable means, a handle **40** designed to allow the direct rotation of said screw gear **37**. A ratchet member **41**, pivotally connected by a pin **42** to the lower part of the support body **23**, permits the gear **37** to rotate counter-clockwise, as viewed from the FIGS. **3** and **4**, but prevents the same from rotating in the opposite direction, unless it is desired. The ratchet member is resiliently held in the position represented in FIG. **3** by means of a helical spring **43**, which has one of its ends anchored to a boss **41'** provided in the ratchet member, the other end being located within a cavity **44** formed at the part **23''** of the support body. Whenever releasing or freeing the gear **37** is required, in order to permit the same to rotate in a direction opposing the one normally allowed by the ratchet member, rotation of the ratchet member against the action of spring **43** until the gear teeth are released will be sufficient.

At the end of said cylindrical projection **31** of the bar **24** is mounted a conventional orthopedic stirrup, which is only diagrammatically shown in the Figures and designed by reference numeral **45**. The support body **23** is mounted at the end of the angularly folded bar **25** by means of a cogged coupling **46** as best seen from FIG. **5**, the cooperating parts of which are provided with radial teeth **47** engaged one another. The coupling parts **46** are traversed by a headed bolt **48** which has a threaded end for receiving a handle **49**. This arrangement permits the regulation of the angular position of the stirrup **45** and, thus, of the assembly formed by the support body **23**, the elongated bar **24**, relative to the traction arm **18**, in a conventional way. In practice, when the crank **35** is rotated, the worm **30** is also rotated, causing the gear **37**, in turn, to rotate. When rotating, the gear causes the motion of the elongated bar **24**, permitting, thus, said orthopedic table stirrup **45** to be advanced or moved backwards in a controlled and millimetrical way. However, when these delicate motions of the bar are not necessary, directly driving the handle **40** will be sufficient, in order to cause the gear **37** to rotate, and, thus, displacing the bar **24** and said orthopedic stirrup **45**, obtaining, therefore, more rapid tractions.

From the foregoing, it will be apparent that this device, besides providing two different movements for tensioning the limbs, by means of the conventional adjustment and a more delicate and more accurate adjustment which could not be obtained with conventional tables, permits the traction to be released in a controllable way, without being necessary to release the traction immediately, as is customary in those former ones. The fastening device of the invention is also applied to any other table of the type referred to.

Normally, the traction arms **18** should have a rotation capacity of almost 180°, in order to permit the traction of the patient's legs and arms to be carried out. These two extreme positions of the arms are shown in FIGS. **2** and **2A**. For this purpose, each of the traction arms has to be arranged so that it can slide relative to the respective guide bar **19**, whereby a bracket **21** is provided, pivotally mounted at the outer end of the guide bar. As seen from FIGS. **6**, **7** and **8**, the bracket **21** is formed by two half-round members **50** and **51**, which are connected to each other as a hinge, in order to provide, when joined, a cylindrical bore **52** where radial grooves **53** are formed, disposed 90° from each other. At the side opposing the pivotal side, the half-round members are provided with radial flanges **54** and **55**, respectively, the first one including a threaded shank or bolt **56**, disposed in order to be able to be inserted in a hole **57** correspondingly formed in the radial flange **55** and to receive a manual clasp nut **58**. At the upper part of the upper half-round member **50** is provided a boss **59** provided with a threaded central bore **60**, by means of which the bracket **21** is pivotally mounted on the end of the respective guide bar **19**, forming the pivot point designed by B in FIGS. **2** and **2A**. The other end of the guide bar, as can be seen from said FIGS. **2** and **2A**, is pivotally secured to the support block **13**, as hereinafter described in detail. With this construction, the bracket **21** fully encircles the periphery of the traction arm **18**, the engagement or submission of the same being obtained by adjusting the nut **58**. In addition to the firmness obtained, this bracket permits, with the screw released, to guide smoothly the traction arm as it slides, during adjusting, without being bound to stall, as is customary in conventional construction devices. Since the desired position is obtained, it is enough to adjust the nut **58** so that the arm **18** is secured in the selected position. Another advantage of the improved bracket according to the invention is to facilitate the disassembly of the traction arms **18**, which is attained, relative to the guide bar, by simply unscrewing and removing the nut **58**.

With reference again to the FIG. **2**, it is shown that the guide bars **19** are pivotally mounted on the support block **13**, in order to permit the traction arms **18** to effect said 180° turn. As previously mentioned, in the conventional orthopedic tables, this pivotal assembly of the bar **19** is carried out by means of a single bolt or fulcrum point. Therefore, with little usage, due to the weight of the traction arm and the guide bar **19** itself, the pivotal connection of the latter in the block **13** is loose, whereby the bar and the traction arm function floppily, and present little firmness after the clasp nut **58** is adjusted. The present invention solves this problem by providing an arrangement, in which the weight of the bar and the traction arm is distributed into two pivot points thus increasing the bearing surface and eliminating the possibility of existing clearances. This arrangement is illustrated in detail in FIGS. **9** and **10**.

With reference to FIGS. **9** and **10**, it will be apparent that each of the guide bars **19** is pivotally mounted on the block **13** by means of a central point A, where the pivotal axis of the bar **19** is situated, and a second point, situated at the end of the bar and which moves along a slot provided in said block **13**.

More specifically, the guide bar **19** presents, near the end thereof, a circular enlargement **61** in which there is a central bore **63**, perforated through the lower side of the bar, in order to form a wall **64** at the upper part thereof. In the central bore **63** are disposed an axial bearing **65** and a bushing **66**. The guide bar is secured against the block **13** by means of a bolt **67**, which includes a cylindrical part and a part of threaded shank **68** arranged to be screwed to a threaded bore provided in the block **13**. The cylindrical part of the bolt **67** passes through a bore opened in the wall **64** concentrically with the central bore, through the central bore of the bearing and the bushing and has its hexagonal head **69** accessible through the upper side of the guide bar **19**. At the end of the guide bar, after the enlargement **61**, there is provided a threaded bore **70** designed to receive a bolt **71** screwed thereto, which presents at the lower end a flaring head **72**. The bolt **71** passes through a semi-circular slot **73** at the upper wall of the block **13** and is provided with a notch **74** at the upper end. The head **72** of the

bolt has a little smaller width than the width of said semi-circular slot **73** and a suitable length to be retained behind the slot, when in the position crossed over represented in FIGS. **9** and **10**. The crossed over position of the head **72** of the bolt **71** is assured by means of a hexagonal nut **75**, screwed at the projection tip of the bolt and adjusted against the upper face of the guide bar, as shown in FIG. **10**. The semi-circular slot **73** is concentrically opened relative to the pivotal axis of the guide bar and has a suitable extension for permitting the bar **19** to have a little lower stroke than 180°.

Thus, when guide bar **19** is rotated, by the displacement of the respective traction arm **18**, the head **72** of the bolt **71** rides within the semi-circular slot **73**. Therefore, besides containing on larger surfaces for fulcrum at its end, the guide bar can be easily adjusted in order to eliminate any clearance that might be eventually observed after a long time usage. This clearance is compensated by adjusting the bolt **71** which rides within said semi-circular slot **73**. In order to effect the adjustment, it is necessary to release the nut **75** and to turn the bolt **71** until the eventual clearance is completely eliminated; readjustment is assured by screwing the nut **75**.

As shown in FIGS. **2** and **2A**, the traction arms **18** are pivotally mounted on the support block **13** by means of racks **20**, which are arranged so that they provide for adjustment of the traction arms relative to said block; i.e., permitting the arms **18** to come closer to or to separate from each other, so that the clearance between the arms can be regulated, according to the position and width of the patient's hips on the table **10**.

According to the present invention, this device, which is shown in FIGS. **11–15**, comprises two racks **20**, one for each traction arm **18**. Each of the racks is horizontally mounted on a transverse slot **76** provided at the rear part of the block **13**. The two racks **20** have their teeth **77** facing each other, so that they can engage a central spur gear **78**. The racks **20** and the central spur gear **78** are held in place by means of a cover **79**, secured on the block **13** by means of screws, the traction arms **18** being pivotally mounted at the outer ends of the racks, as designed by **80**, by means of an arrangement of axial bearing, bushing and bolt similar to the one described for the pivot points A and B. This pivot point, between the outer ends of the racks and the ends of the traction arms is designed by reference letter C in FIGS. **2** and **2A**.

Each of the racks, after their position is regulated, can be fixed in place by means of a screw **81**, provided with a stem or handle designed to facilitate the manual seizing or releasing of the respective rack. The spur gear **78** is provided with an axial extension **82**, which has a suitable length for projecting beyond the cover **79** in order to receive, at the end thereof, a handle **83**. With this arrangement, the gear **78** can be manually rotated, after the clamps **81** of the racks are released. When turning, from left to right, the gear **78** causes the simultaneous and uniform transversal displacement of the two racks. Considering the illustration of FIG. **11**, if the gear **78** is turned to the left, the two racks **20** are transversally displaced relative to the block in opposing directions; namely, the upper rack to the left and the lower rack to the right, providing, thus, the mutual separation of the traction arms **18**. When turning the gear **78** to the right, the racks **20** move in opposite direction with respect to the one above described, providing, thus, the closure or the mutual approach between said traction arms **18**. Since adjustment is obtained, the clamps **81** are adjusted in order to secure the racks **20** and, thus, the arms **18** in the desired position.

From the foregoing, it is thus apparent that the present invention provides various improvements that eliminate in a practical and effective way, the problems pointed out in the orthopedic tables of the "Albee" type, of conventional design. Such improvements facilitate the work of the doctor and permit maintaining the table in perfect operating conditions during an unlimited period of time. Besides, by means of an arrangement of endless screw the traction device provided at the end of each of the traction arms **18** permits millimetrical adjustments to be made, and, thus, more delicate tractions to be carried out, what was impossible in orthopedic tables known heretofore.

The present invention can be embodied according to other specific designs, without deviating from the spirit and the essential characteristics thereof. Thus the embodiment presented herein should be held, under any circumstances, as illustrative and not restrictive, the scope of the invention being better defined by the following claims than by the disclosure presented hereinabove and, therefore, all of the modifications about the meaning and equivalencey of the claims must be considered as within the same.

I claim:

1. An orthopedic table comprising a base, a pair of traction arms pivotally supported by said base and displaceable to perform orthopedic traction in both lower and upper limbs of a patient, a traction device supported at the free end of each traction arm, each device including a supporting body adjustably mounted with respect to the associated traction arm, said body having a bore formed therethrough, a bar movably mounted in said bore for axial movement in said bore relative to said supporting body and having a recess opening along one face thereof, said bar defining a pair of spaced stop portions for engaging the supporting body to limit axial movement of the bar, a traction member connected to one end of said bar, an elongated worm disposed within said recess and having the opposite ends thereof rotatably supported by said bar, a worm gear supported by said body for rotation with respect thereto and having teeth engaging said worm, the axis of rotation of said worm gear extending transverse to the axis of said worm, first manually operable means connected to said worm for operating the worm to produce traction displacement of said bar in a range of millimeters, and second manually operable means connected to said worm gear to turn said worm gear and to produce traction displacements of said worm and the associated bar of greater magnitude.

2. An orthopedic table as defined in claim **1** including ratchet means engageable with said worm gear so as to permit free rotation of the worm gear only in the direction of movement thereof so as to produce traction displacement of said bar, release of the traction force being obtained gradually by rotating said worm by means of said first manually operable means.

3. Apparatus as defined in claim **1** wherein each of said traction arms is pivotally mounted on rack means supported by said base, a guide bar interconnected with each of said traction arms, each guide bar being pivotally interconnected with said base, each guide bar being pivotally supported by a fixed fulcrum point spaced from the adjacent end of the associated guide bar, each guide bar also including a second movable fulcrum point comprising a threaded leg provided with a head, means on said base defining an arcuate guide slot the center of which is located at the axis of said fixed fulcrum point, said leg extending through said guide slot and a nut threaded on said leg whereby the nut and threaded leg enable adjustment to compensate for any clearances occurring during use of the apparatus.

4. Apparatus as defined in claim **3** wherein said rack means includes a pair of racks the teeth of which are disposed in facing relationship to one another, an intermediate pinion in engagement with each of said racks, a drive handle operatively connected to said pinion and extending laterally therefrom to enable rotation of the pinion to cause displacement of said racks and thereby adjust the space between the pivotally supported ends of the traction arms.

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