July 2, 1968 N. J. GIANNESTRAS 3,390,675

LEG TENSIONING DEVICE

Filed July 26, 1965 2 Sheets-Sheet 1

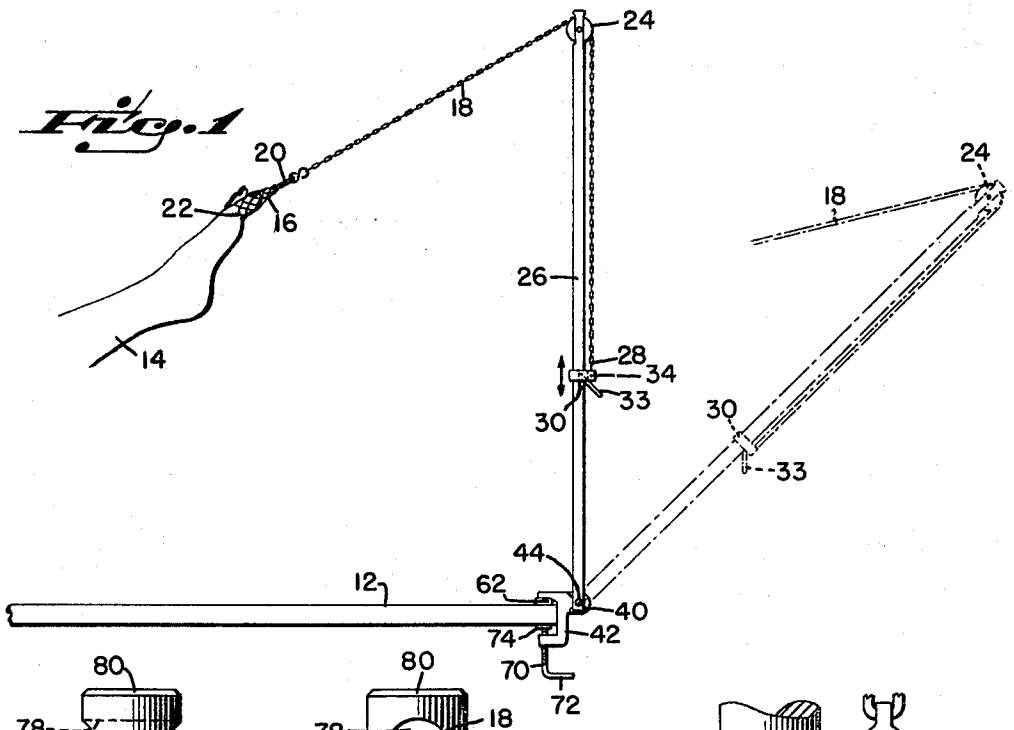



Fig. 1

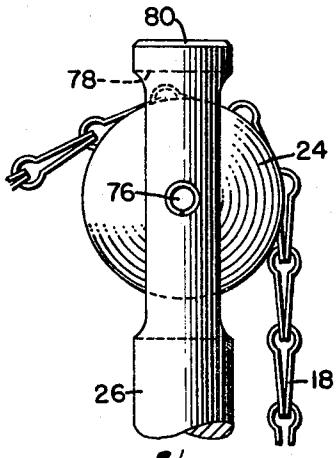



Fig. 2

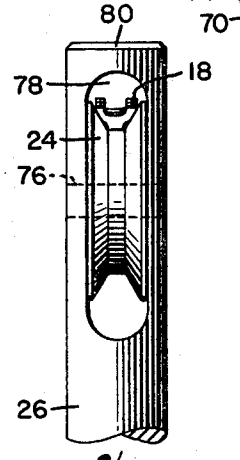



Fig. 3

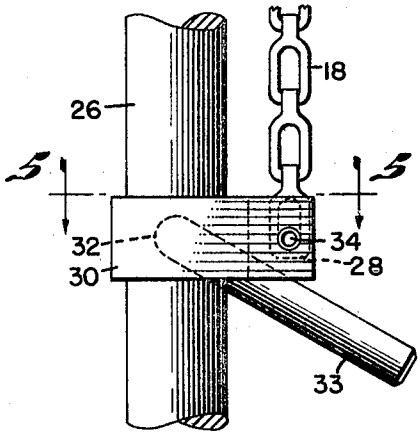



Fig. 4

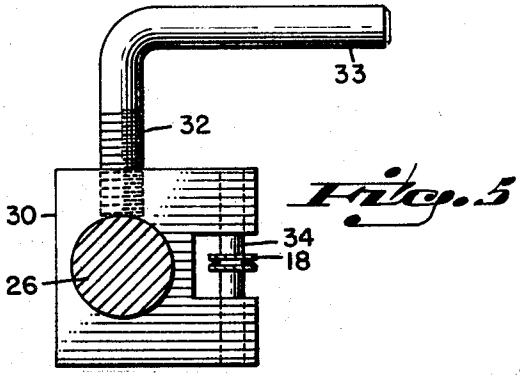



Fig. 5

INVENTOR.
NICHOLAS J. GIANNESTRAS
BY
J. Warren Kinney, Jr.
ATTORNEY

July 2, 1968 N. J. GIANNESTRAS 3,390,675

LEG TENSIONING DEVICE

Filed July 26, 1965 2 Sheets-Sheet 2

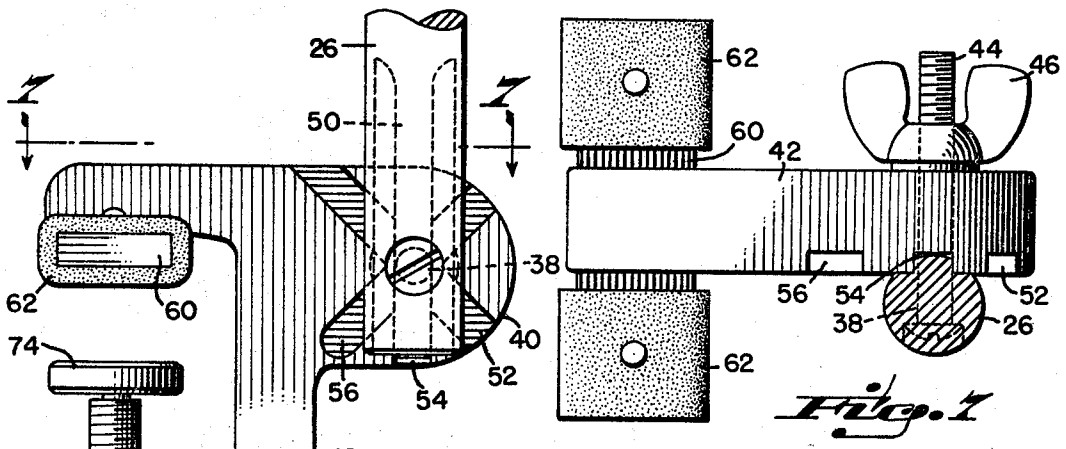



Fig. 1

Fig. 6

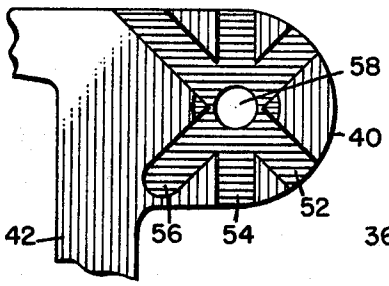



Fig. 8

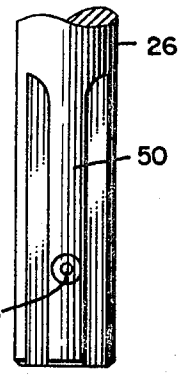



Fig. 9

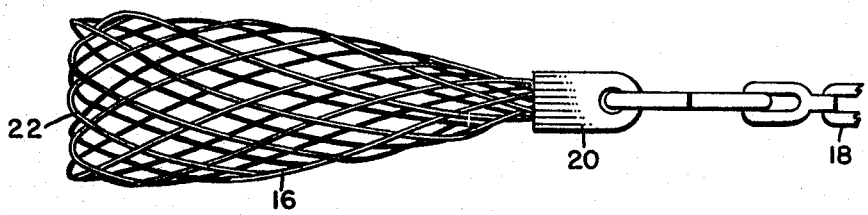



Fig. 10

INVENTOR.
NICHOLAS J. GIANNESTRAS
BY
J. Warren Kinney Jr.
ATTORNEY

United States Patent Office 3,390,675 Patented July 2, 1968



3,390,675

# LEG TENSIONING DEVICE

Nicholas J. Giannestras, 1601 E. McMillan Ave., Cincinnati, Ohio 45206

Filed July 26, 1965, Ser. No. 481,154
4 Claims. (Cl. 128—84)


## ABSTRACT OF THE DISCLOSURE

A portable, lightweight tensioning device attachable to a patient supporting structure for enabling a doctor to apply tension to the limb of a patient requiring bone setting or the like for freeing both hands of the doctor. A limb engaging trap member is attached to a tension adjuster which is slidable along a vertical mast and can be locked in selected positions of adjustment. The mast is secured to a clamp and has pivotal movement in a single plane on either side of a vertical position with cooperating locking means for selectively locking the mast in one of several angular positions.


The present invention relates to a leg tensioning device, or apparatus for stretching the leg of a patient requiring treatment for a leg injury, bone fracture, or malformation.

It is usual, in cases of leg bone fractures and for other surgical procedures, to apply traction or tension to the leg incident to preparing the leg for operation, and this has been accomplished with the use of various types of contrivances, none of which have been entirely acceptable for the purpose. The most common objections to the known devices for leg tensioning, are their complexity, excessive bulk and weight, and a tendency to interfere with the work of the surgeon and his attendants in preparing for and treating the injury.

An object of the present invention is to provide a leg tensioning device of simplified and economical construction, which effectively and securely applies tension to the leg of a patient requiring bone-setting or other treatment, without unduly discomforting the patient.

Another object of the invention is to provide a device of the character stated, which is applicable to the patient's limb with ease and despatch, and which furnishes no interference with the work of the physician and his attendants in treating the patient, and preparing the leg, knee or thigh for operation.

Another object is to provide a device of the character stated, which incorporates a minimum of simple, durable components that are easily kept in clean and sanitary condition, and which effectively resist bending, distortion and other malfunctioning that might endanger the welfare and recovery of the patient.

A further object is to provide a leg tensioning device which is constructed for quick and easy application with dependable security to any available support, whether it be a hospital bed, office desk, or any other available structure upon which or near which the patient may repose while receiving the necessary treatment or manipulation.

Another object of the invention is to provide a device for the purposes stated, which requires no maintenance or replacement of parts, so that the device is always in proper condition for regular or emergency usage.

The foregoing and other objects are attained by the means described herein and illustrated upon the accompanying drawings, in which:

FIG. 1 is a side elevational view showing the device of the invention applying tension to the lower limb of a patient.

FIG. 2 is an enlarged detail view showing in side elevation the upper pulley end of a mast forming an element of the device.



FIG. 3 is a view of the upper pulley end of the mast, looking from left to right upon FIG. 2.

FIG. 4 is a fragmentary side elevation of a tension adjuster upon the mast.

FIG. 5 is a cross-sectional view taken on line 5—5 of FIG. 4.

FIG. 6 is a side elevational view of an adjustable mounting clamp for supporting the mast.

FIG. 7 is a cross-sectional view taken on line 7—7 of FIG. 6.

FIG. 8 is a fragmentary plan view of a clamp ear including means for adjusting the inclination of the mast.

FIG. 9 is a fragmentary side elevation of the lower or base end of the mast.

FIG. 10 is a side elevational view of a chinese finger trap comprising an element of the leg tensioning device.

With reference to FIG. 1, the reference numeral **12** indicates a table, bed, or other support upon which a patient may be placed, with his leg extended as at **14**. The leg is placed under tension by applying to the big toe a gripper **16** pulled taut by a flexible cord or chain **18** which serves also to incline the leg above support **12**. The gripper employed is a device commonly known as a chinese finger trap, which consists of a hollow conical net so constructed as to contract about and securely grip any inserted object whenever an attempt is made to withdraw the object therefrom.

The chinese finger trap usually is constructed of soft flexible cords, reeds, or thin wires formed into loops having their terminal ends anchored in a ferrule **20**, the loops being intertwined to form a hollow conical network. The open end **22** of the conical network is readily receptive of an object, such as a finger or toe, but upon an attempt to withdraw it, the object in frictional contact with the loops tends to elongate the conical network, resulting in an ever-increasing contractive force about the inserted object. Removal of the object is effected by slackening the pull at ferrule **20**, and gently withdrawing the object as the loops are manipulated to break frictional engagement thereof with the inserted object.

The device above described is noteably superior to other forms of grippers, in that it holds the toe with great tenacity, and will not chafe the skin if the patient moves or twists his limb while under restraint. The device produces no appreciable interference with blood circulation in the toe or limb, and offers a minimum of discomfort to the patient, all of which is beneficial to the patient and to the success and facility of the surgeon's work.

For applying tension to the finger trap and the inserted big toe of the patient, the cord or chain **18** may be trained over a pulley **24** at the free upper end of a mast or post **26**, and that end **28** of the cord or chain which is remote from the finger trap, is secured to the mast or post at a location selected to apply the desired tension. The tension adjuster may be in the form of a collar or sleeve **30** slidably supported upon the mast, and provided with a clamping device such as a thumb screw **32**, for fixing the collar or sleeve at selected locations along the length of the mast. An anchor pin **34** or its equivalent, may be employed for attaching to the collar or sleeve **30**, the end **28** of cord or chain **18**.

Means may be provided for varying the angle at which the cord or chain **18** lifts the leg of the patient relative to the level of surface **12**. Such means may involve varying the inclination of mast **26** (see FIG. 1), and fixing the mast at the desired inclination. For this purpose, the lower end of the mast may be provided with a transverse bore **36** adapted to receive a screw **38** for securing the mast end to an extending ear **40** of a clamp **42**. Ear

40 may be drilled transversely to receive the threaded end 44 of the screw. A wing nut 46 or its equivalent may be accommodated by the threaded end of the screw, for fixing the mast to the ear of clamp 42. The head 48 of screw 38 may be countersunk into the bore 36 of the mast, as shown.

If desired, the mast and the ear 40 of clamp 42, may carry cooperative means to establish several predetermined inclinations of the mast upon tightening of nut 46. Such means may comprise a longitudinal spline or rib 50 formed on the lower end portion of the mast, to engage any one of several channels 52, 54, 56, cut into one face of clamp ear 40, the channels crossing one another and radiating from the bore 58 of ear 40. Upon loosening the thumb nut 46, the rib 50 of the mast may be registered with any one of the differently inclined channels 52, 54, 56, for definitely establishing the inclination of the mast. When nut 46 is re-tightened, the mast may not be shifted, inadvertently or by deliberation, from the inclination chosen by the surgeon.

Although the accompanying drawings show only three channels 52, 54, 56, by way of example, it should be understood that the number of channels provided in ear 40 may be increased or decreased, as may be desired. One of the channels, for example channel 54, preferably is of vertical disposition. The remaining channels may be inclined at various angles from the vertical.

Clamp 42 may be a casting or a forging of generally C-shape, having a head constituted of a transverse fixed bar 69, having at its opposite ends the pads 62 of soft rubber, vinyl, or other suitable friction material. The pads are adapted to frictionally contact the upper face of a support or table such as 12.

Beneath the bar 60 is located an arm 64 carrying a boss 66, which boss is bored at right angles to bar 60 and provided with internal screw threads for engagement with the complementary external threads 68 of a clamping screw 70. Screw 70 carries a suitable handle 72 whereby the screw may be rotated in opposite directions, to advance and retract a pressure disc 74 relative to the plane of bar 60. Disc 74 may be rotational upon the upper end of screw 70, to abut the underface of a table or support such as 12 when the clamp is applied thereto.

Constructed as explained, the clamp may be securely fixed to a table or other support, for firmly positioning the mast 26 without injury to the finish of the table or support. The clamp effectively resists accidental displacement from its point of fixation, thereby ensuring at all times a proper disposition of the leg tensioning device with relation to the patient's body.

With reference to FIGS. 2 and 3, it is noted that the mean plane of pulley 24 includes the longitudinal axis of mast 26, to produce a balanced structure for accurately guiding the chain or cord 18. The pulley rotates upon a transverse shaft 76 which spans a vertical slot 78 milled or otherwise formed in the mast near its upper end. The upper end 80 of the mast closes the upper end of slot 78, thereby preventing disassociation of the chain or cord from the pulley at all times.

To use the leg tensioning device, the clamp 42 may be mounted upon a table or other support 12 which preferably, though not necessarily, is the same table or support that carries the patient. The clamp screw 44 extends transversely of the direction of extension of the patient's leg, so that mast 26 may be swung toward or from the end of the big toe. Depending upon the judgment of the surgeon, the mast may be adjusted as to inclination, and secured by means of thumb nut 46, to incline the patient's leg at a desired angle about support 12.

After loosening clamp screw 32 by means of handle 33 to free the adjusting collar 30, the collar may be slid upwardly upon mast 26 a distance sufficient to enable the surgeon to apply the chinese finger trap 16 to the patient's big toe. Then the collar 30 may be lowered upon the mast to tension the chain or cord 18, and cause the finger trap



to contract about the toe of the patient. By tightening screw 32 at handle 33, the proper amount of tension needed for stretching the leg of the patient is effectively maintained, as in FIG. 1.

Should the surgeon prefer to hold the leg at a lesser elevation than shown in FIG. 1, he may loosen the clamps at 33 and 44 to permit changing the inclination of the mast and the position of collar 30 thereon. After securing the mast at the desired inclination, the surgeon may lock the collar 30 to the mast at a position which will apply the necessary tension to the chain and the big toe of the patient.

When the leg tensioning device is in use, no part thereof is in a position to interefere with the work of the surgeon or his attendants. Moreover, none of the parts can chafe the skin of the patient's body, or otherwise cause added discomfort. Other advantages and features of merit have been set forth previously herein, and still others may readily become manifest to persons conversant with the subject matter of the present disclosure.

It is to be understood that various modifications and changes may be made in the structural details of the device, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed is:

1. A surgical leg tensioning device for placing in traction the leg of a patient, said device comprising in combination: a mast having upper and lower ends each bored transversely in a common plane; a pin in the upper bore, and a pulley rotationally mounted upon said pin; a threaded screw in the lower bore and having a nut threaded thereon; a clamp of generally C-shape, said clamp having an extending ear transversely apertured to receive the screw aforesaid; the ear of the clamp having a plurality of intersecting channels formed therein radially of the ear aperture; a longitudinal spline on the mast near the lower end thereof, said spline being registerable selectively with any one of the intersecting channels upon loosening of the nut on the screw aforesaid, said nut when tighthened serving to hold the spline securely within a channel registered therewith; a collar surrounding the mast for shifting movement longitudinally thereon between the ends of the mast; means for securing the collar at selected locations of shiftability upon the mast; a chinese finger trap to engage a toe of a patient; and an elongate flexible member having opposite ends fixed to the collar and to the finger trap, said flexible member intermediate the ends thereof being trained over the pulley aforesaid.

2. A surgical leg tensioning device for placing in traction the leg of a patient, said device comprising in combination: a mast having upper and lower ends, and means for securing the mast to a support with the upper end thereof elevated above the support; coacting means on said lower end and on said securing means for holding said mast upright on one of several selected like angular positions in a common plane on either side of a substantially vertical position, a pulley on the mast near the upper end thereof; an elongate flexible member trained over the pulley and having opposite ends; a finger trap attached to one end of the flexible member for application to a toe of the patient; a tension adjuster movable along the mast lengthwise thereof and including means for clamping the adjuster to the mast at selected locations, said tension adjuster having attached thereto the remaining end of the elongated flexible member.

3. A surgical leg tensioning device for placing in traction the leg of a patient, said device comprising in combination: a mast having upper and lower ends; a clamp on the lower end of the mast for securing the mast upon a support, with the upper end thereof elevated above the support, coacting means on said lower end and on said clamp securing said mast in one of several selected angular positions in a common plane on either side of a substantially vertical position, said upper end being slotted

lengthwise of the mast with the slot including the major axis of the mast; a pulley rotationally supported in the slot, the diameter of the pulley exceeding the diameter of the mast; an elongate flexible member trained over the pulley and having opposite ends; a chinese finger trap attached to one end of the flexible member for application to a toe of the patient; a tension adjuster consisting of a collar surrounding the mast and slidable lengthwise thereon between the pulley and the adjustable clamp aforesaid, said collar having connection with the remaining end of the elongate flexible member, whereby movements of the collar along the mast are coordinated with movements of the finger trap toward and from the pulley as the flexible member passes over the pulley; means associated with the collar for clamping of the mast; and means at the upper end of the mast for confining that portion of the flexible member which is trained over the pulley, to preclude disassociation of the flexible member from the mast.

4. A surgical leg tensioning device for placing in traction the leg of a patient, said device comprising in combination: a mast having upper and lower ends each bored transversely in a common plane; a pin in the upper bore and a pulley rotationally mounted upon said pin; a threaded screw in the lower bore and having a nut threaded thereon; a clamp of generally C-shape, said clamp having an extending ear transversely apertured to receive the screw aforesaid; coacting means on said ear of said clamp and the end of said mast for selectively



positioning said mast in a substantially vertical position or in angular position on either side of said vertical position in a common plane and said nut when tightened serving to hold said mast fixedly in said selected position, a collar surrounding the mast for shifting movement longitudinally thereon between the ends of the mast; means for securing the collar at selected locations of shiftability upon the mast; a chinese finger trap to engage a toe of a patient; and an elongate flexible member having opposite ends fixed to the collar and to the finger trap, said flexible member intermediate the ends thereof being trained over the pulley aforesaid.

**References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 1,380,297 | 5/1921 | Hughes | 128—84 |
| 2,584,203 | 2/1952 | Hart | 128—84 |
| 2,750,939 | 6/1956 | Bolger | 128—84 |
| 3,068,859 | 12/1962 | Treutelaar | 128—75 |
| 3,145,709 | 8/1964 | Pinegar | 128—84 |

FOREIGN PATENTS

| | | |
|---|---|---|
| 214,281 | 10/1909 | Germany. |

RICHARD A. GAUDET, *Primary Examiner.*

R. L. FRINKS, *Examiner.*

J. W. HINEY, *Assistant Examiner.*