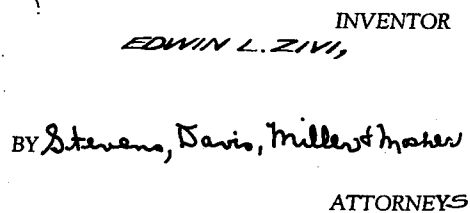


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ORTHOPEDIC TENSIONING ASSEMBLY

6 Sheets-Sheet 1



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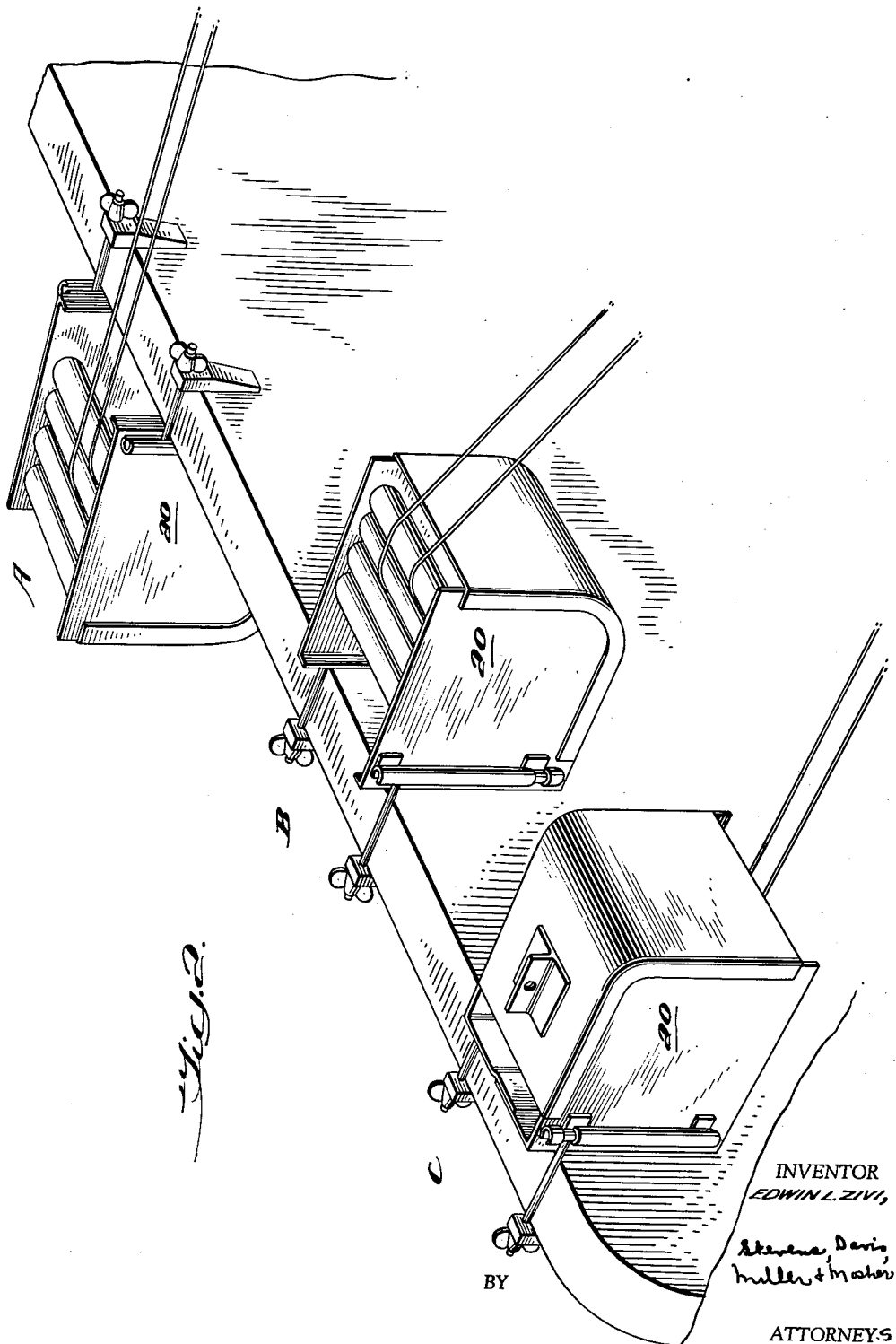
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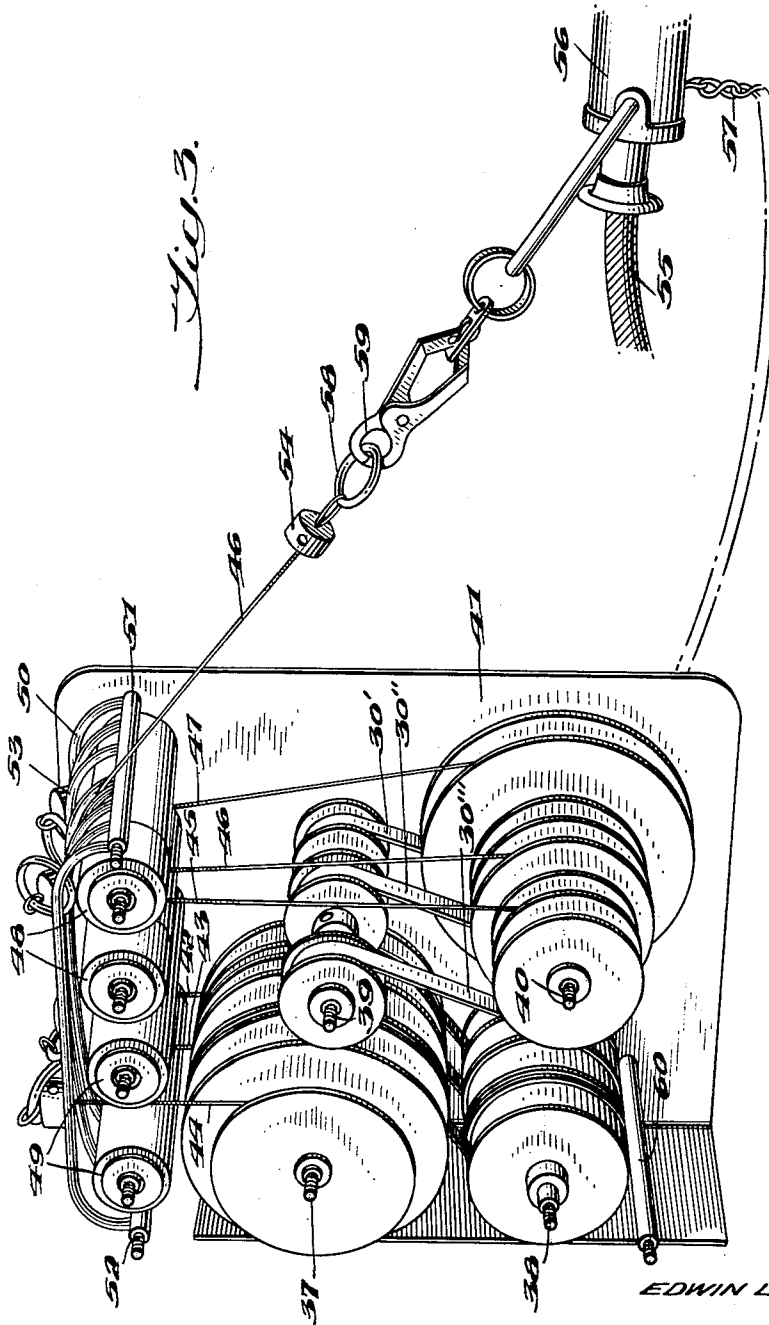
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ORTHOPEDIC TENSIONING ASSEMBLY

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6 Sheets-Sheet 3



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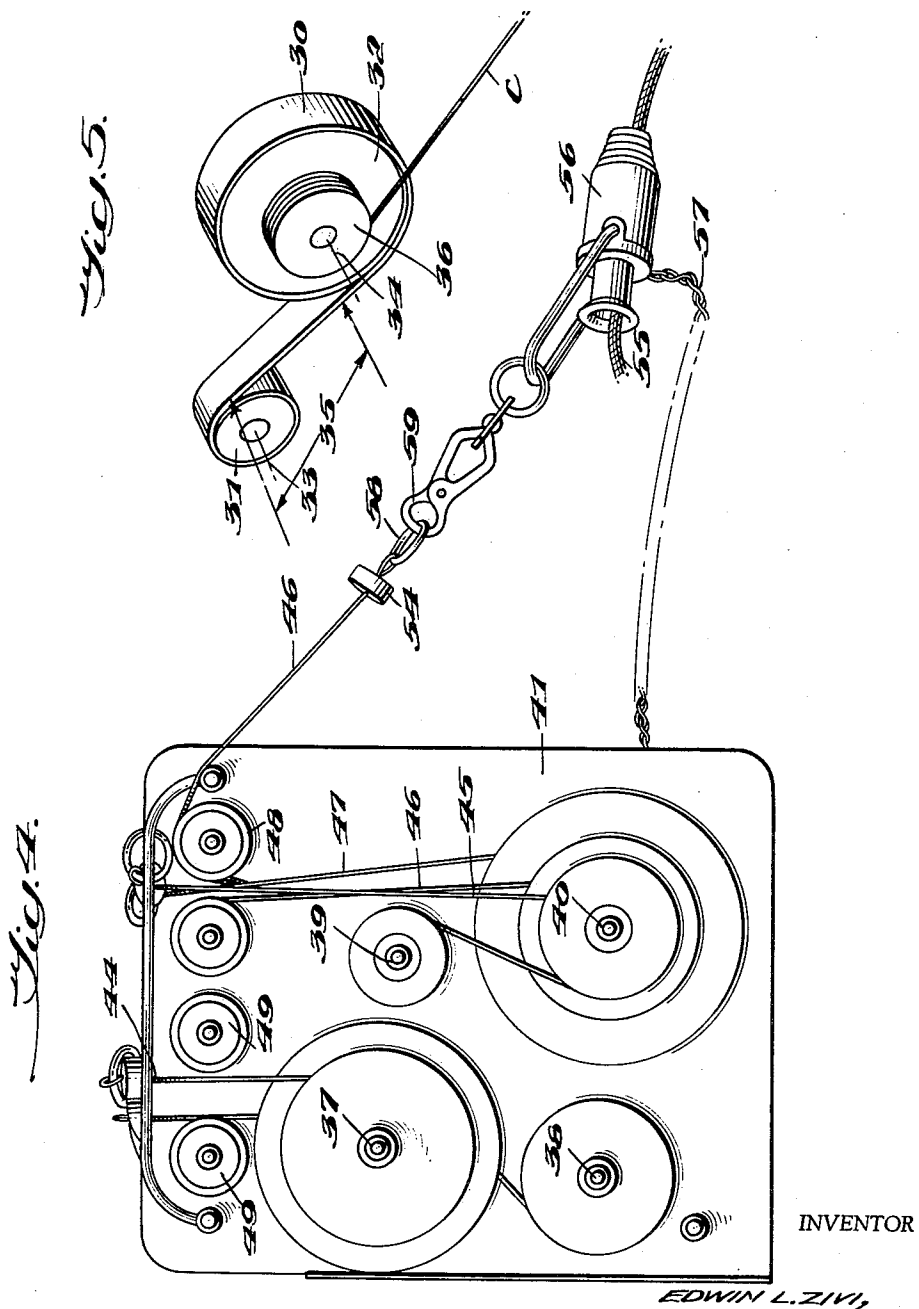
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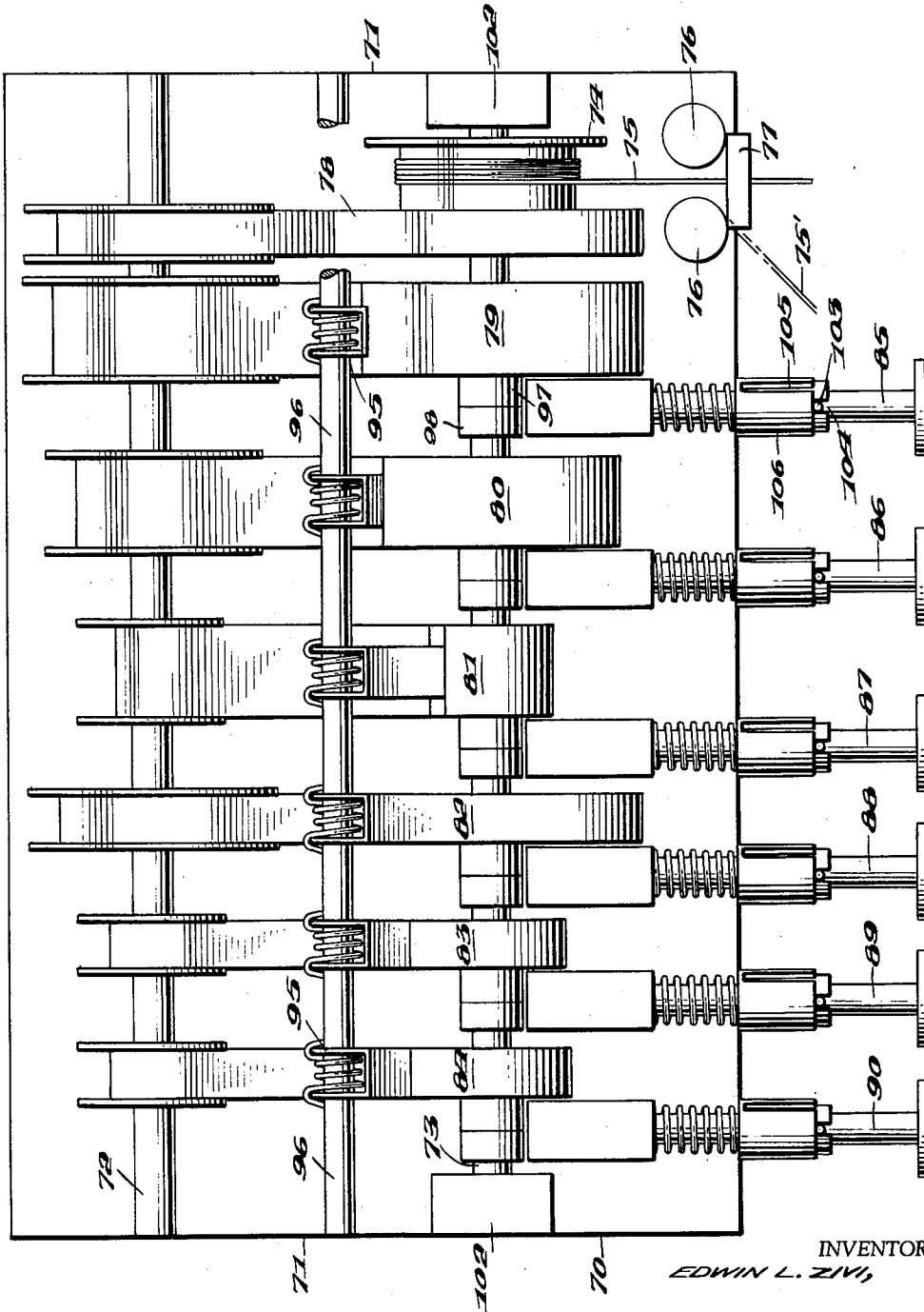


Fig. 6.

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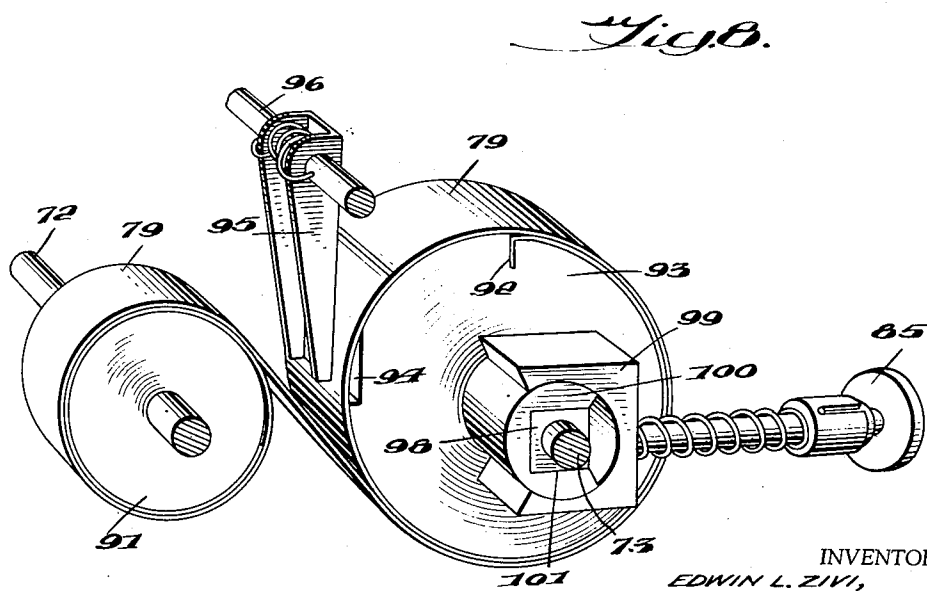
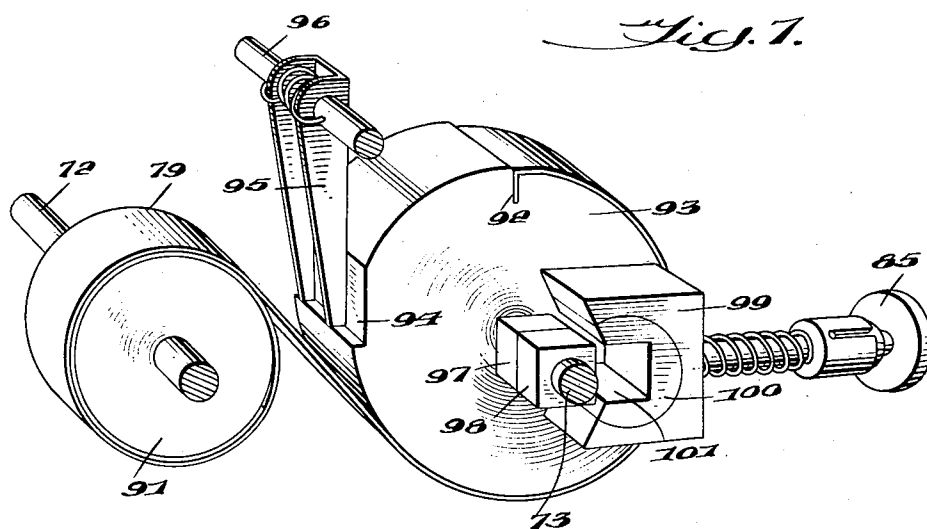
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6 Sheets-Sheet 6



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ORTHOPEDIC TENSIONING ASSEMBLY

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10 Claims. (Cl. 128—75)

This invention relates to a traction device, more particularly to a traction unit for use in orthopedic work.

Traction apparatus, as presently used in hospitals to apply a tension force to a limb or any part of the body which requires a pulling action, involves a complicated framework arrangement that must be erected over the hospital bed and involves quite a number of pulleys to conduct the rope from the point of contact with the patient to a point where a weight may be hung vertically and free of the bed. When not in use, the framework, a minimum of eight pieces, must be taken apart and stored. The pulleys, hooks, cords and weights are also disassembled and stored. It should be obvious, therefore, that the apparatus presently employed has many disadvantages, it takes considerable time to assemble, the time of the doctor is valuable, and also the time involved may be critical. There are numerous parts to be accounted for and inevitable when the assembly is in the process of being set up, pulleys or other parts will be missing, lost or mislaid. The apparatus requires considerable mechanical and professional skill in selecting the parts for a particular assembly. Moreover, whenever the patient's bed is jarred or moved, the hanging weight may swing, thus placing extra inertia loads on the patient where not intended.

By the traction unit of this invention, the present system of pulleys and weights may be completely replaced by a single unit which provides for increments of pounds of pull from the unit, without the use of pendulous weights, and there are no small parts to be assembled and stored.

It is an object of this invention to provide a traction unit for orthopedic work which will provide an array of tension forces from a single unit.

It is another object of this invention to provide a tension unit which is integral and except for mounting on a frame which is attached to the bed of the patient, requires no assembling or attaching of parts.

It is a further object of this invention to provide multiple tension loads from one or more cables of a traction unit which has self-contained provisions for being mounted in a variety of positions and places at the bed of the patient.

Further and other objects will become apparent from the description of the accompanying drawings, in which like numerals refer to like parts.

In the drawings:

FIGURE 1 is a pictorial representation of the traction unit to obtain various angles of pull from the horizontal to the vertical.

FIGURE 2 is a perspective view showing the use of the unit in various low level positions on the foot of the bed. The same positions apply to the head of the bed.

FIGURE 3 is a perspective view of the unit with a side removed, showing the internal arrangement.

FIGURE 4 is a side elevation with a side removed, showing the internal arrangement of the unit.

FIGURE 5 is a perspective view of the spring-actuated power or motor unit.

FIGURE 6 is a plan view of a modified form of the unit for a single cable application of load.

FIGURES 7 and 8 are perspective views showing operations of the clutch arrangement whereby multiple loading of a single cable may be effected.

FIGURE 1 shows the several ways in which the traction unit can be mounted on the head or foot of the bed of the patient to provide high-level forward or rearward

2

traction, as well as overhead traction, from the same unit.

The unit will be described in greater detail later in this specification. The head or the foot of the bed shown at 1 is a conventional hospital bed. Vertical support 2 consists of two spaced channel members 3 having spacers 4 top and bottom, welded or bolted in place. A clamp member 5, consisting of three plates, 6, 7 and 8, bolt 9 and wing nut 10 affords an effective clamp on the top and bottom of the head or foot of the conventional bed. A bracket 11 is adapted to be mounted by a lock pin 12 on either side to vertical support 2 to support horizontally extending frame member 13, consisting of tubes 14 and end plate 15, which affords a lightweight, stable, horizontal support, extending over the patient's bed. Pin 16 and holes 17 permit the location of the horizontal support in several radial locations from vertical support 2 over the patient's bed. Slide 18 and lock pin 19 suspended traction unit 20 by bracket 21 in practically any position over one half of the patient's bed. Cable 22 can then be arranged to provide a traction pull generally upwardly of the bed. The traction unit 20 and slide 18 may be moved along tube 14 to obtain proper angle of pull.

Another mounting is shown wherein traction unit 20' is mounted on the vertical support alone, in which case, the horizontal support may be removed. This mounting consists of a clamping arrangement comprising tubes 23 having slots 24, extending along the base of the unit, facing the support, bolts 25, mounted in the tube 23 and clamps 26 and wing nuts 27. Such clamping devices on each side of number 20' are quite adequate to hold the traction unit in any position along the vertically extending support member 2. When not in use, as shown in connection with traction unit 20, bolts 25, clamps 26 and wing nuts 27 are slipped to the upper ends of the slotted tubes and rotated 180° until they lie flat against the sides of the housing of the traction unit 20. This clamping arrangement provides a universal attachment which is a permanent part of the traction unit.

Traction unit 20' shows a mounting to achieve high level forward to the rearward pull with a single vertical support. The mounting of traction unit 20' shows the manner in which the traction unit can be mounted to have the least interference with the area over the bed.

FIGURE 2 shows the traction unit shown in FIGURE 1 and illustrates the mounting directly on the bed in three possible positions, positions A and B affording a low level installation for traction longitudinally of the bed. Position A shows one for the least interference with the useful area of the bed. Position C shows how the unit may be inverted to get even a lower level traction pull. The same clamp used to attach the unit 20 to the vertical support 2 is used to attach the unit to the head or base board of the bed.

FIGURES 3, 4 and 5 shows the internal arrangement of parts in the traction unit whereby the pull of the cable is accomplished.

Before describing in detail FIGURES 3 and 4, it might be best to describe the construction and operation of the motor unit shown in FIGURE 5 since there are several of these units in each traction unit.

The power for the traction or pull on the cable is obtained from a special in part, reversely coiled prestressed steel band 30. Spool 31 is a take-up spool and spool 32 is the output spool. The two spools are mounted on two separate axes 33 and 34, displaced from each other. Spool 31 is mounted for free rotation about its axis. Strip 30 is a prestressed steel coil and is mounted on spool 31 and tends to coil up thereon when relaxed but is not normally fastened thereto. The outer end of the strip or spring is extended and anchored to spool 32. When spool 32 is rotated, the strip coil is progressively transferred from spool 31 to spool 32.

As the transfer of the coiled strip spring takes place from spool 31 to spool 32, the strip is stressed in a reverse direction to its normal relaxed condition as it is pulled through zone 35 and then bent backward around spool 32 with the result that a return driving power is provided that causes it to naturally tend to reel itself back onto spool 31. During the subsequent angular rotation of spool 32, all of the strip already transferred to spool 32 does not change the stress value in the strip and all of the strip remaining on spool 31 is at virtually zero stress. Only the strip passing through zone 35 is subject to a change in stress. Thus, the entire length of material during the winding or unwinding is stressed incrementally in truly non-cumulative fashion. The torque produced by the above-described arrangement of the coiled strip spring and spools is substantially constant from the start to the completion of the driving cycle.

Secured to spool 32 or formed as a part of it, is a drum 36 to which is fastened a cable C wrapped around the drum, as shown in FIGURE 5. The spring motor arrangement described above causes a constant force to act on the cable as it is pulled out, thus transferring the spring strip from spool 31 to spool 32. The cable is retrieved as the prestressed strip tends to recoil on spool 31. During this retrieving action the same constant force acts on the cable. Therefore, the force on the cable is constant for any extended or retracted position of the cable.

The diameter of the two spools 31 and 32 and the thickness and width of the steel strip spring determines the torque applied to the output spool 32. The radius of a cable drum determines the pull in the cable which is constant. By choosing the spool and drum radii and the spring size, a specific cable load may be obtained.

In using traction, various tensions are required, as determined by the doctor. To obtain the various tensions, a plurality of units as described above in FIGURE 5 are mounted in one device, called the traction unit. For example, there may be six units each, designed for specific pulls, such as a quarter pound, half pound, one pound, two pound, four pound and five pound. By combining the pulls of the one or more of these six cables, a total pull may be obtained of, from one quarter pound to twelve and three quarter pounds, in one quarter pound increments. It should be obvious that depending upon the need, more or less units of different loads may be designed into a device to give a different load range.

The arrangement described above is shown in FIGURES 3 and 4. In FIGURE 3, four axes or shafts 37, 38, 39 and 40, are shown extending between side cover members 41, the outer one of which has been removed in this figure. Cover members 41 afford the mounting and positioning means for shafts 37 to 40. On shafts 37 to 40, taken in pairs 37-38 and 39-40, a plurality of juxtaposed units, such as described in connection with FIGURE 5, are mounted so that the spools on preferably stationary shafts 38 and 39, which correspond to spool 31 of FIGURE 5, are free to rotate. The spools and drums on shafts 37 and 40, which correspond to spool 32 and drum 36 of FIGURE 5, are also mounted free to rotate on the shaft. Cables 42, 43, 44, 45, 46 and 47 extend from cable-drums upwardly between pairs of rollers 48 or 49. A guard 50 consists of rods 51 and 52 mounted between side members 41, having a plurality of curved spaced rods or bars 53 extending between bolts or threaded rods 51 and 52. It will be seen from the extended cable 46, that stop 54 is wider than the space between bars 53, which prevents the cable from being retracted within guard member 50. As a cable such as 46 is pulled out, it passes between rollers 48 and a pair of bars 53 of guards 50. Cable 46 then may be bent in any direction; if it contacts either of the pair of rollers 48, it will move quite freely and bars 53 prevent adjacent cables from becoming tangled. The cable may be pulled out in an arc in excess of 180° over the rollers 48, 49

and between bars 53. Any type of traction member or fitting may be employed to detachably connect cable 46 from rope or cable 55. In the embodiment shown, traction device 56 illustrates a unit which is a well-known rope clamp, employing three balls in the housing that will permit the rope to feed through the small end of the housing but will resist the pull of the rope through the conical end of the housing. Any one of a number of devices can be used as a rope clamp as long as they are capable of being connected to the cable 46 by a detachable clamp. The rope or cable clamp 56 has a chain 57 of a suitable length so that it will not impair the operation of the device; however, the other end of the chain is secured to member 41 so the clamp cannot be lost or misplaced. It should be noted that chain 57 is also of a length that will preclude the complete unwinding of the prestressed coiled steel strip 30.

As additional traction is required over and above that supplied by one cable 46, any other cable such as 47 may be pulled out of the unit and secured by ring 58 to clamp coupling unit 59.

Bolts 51 and 52, in addition to the function of supporting bars 53, combine with bolt 60 to hold the structure assembled between cover plates 41.

It can be seen, therefore, that the traction unit described and illustrated in connection with FIGURES 3, 4 and 5 consists of a plurality of cable and spring arrangements, described in detail in connection with FIGURE 5, which may be used separately or together at clamp 59, and rope or cable clamp 56, to afford a wide range of tensions for traction purposes in orthopedic work.

In some instances, it may be desirable to use a traction unit having a single cable. Such a traction unit would be generally of the same design and configuration and be used in the same manner as the multiple-cable-traction unit as described above. FIGURE 6 shows a plan view of such a single-cable unit. The housing 70 is generally the same as housing 20 inasmuch as the mechanism is mounted between end plates 71 on shaft 72 which is fixed, and shaft 73, which is free to rotate in bearings 102. A drum 74 has single cable 75 passed between a pair of rollers 76 which guide cable 75 in and out as it is unreel or retrieved. Strip 78 is on a spool secured to drum 74 and is of some nominal amount so that there will always be a small amount of tension on the cable to retrieve it.

Mounted on shafts 72 and 73 are a plurality of juxtaposed strips 79 through 84 paralleling coil spring strip 78. The heads on the control buttons 85 to 90 can show the amount of tension that a particular spring is capable of adding to the cable, and combinations of buttons can be operated to get a wide range of total load in the cable 75. The control buttons 85-90, which are clearly shown extend exteriorly of the housing are spring loaded to engage portion 100 of latch 99 with collars 97 and 98. When the button is depressed, this indicates that the load noted on the particular button is in action. To remove the load the button is pulled outwardly and pin 103 of the button slides in slot 104 and 105 of two relatively rotatable telescoped collars disposed exteriorly of the housing 70. The collar 106 is then rotated as shown in FIGURE 6. Thereby the control button is held in a disengaged position.

A spring assembly such as 79 is shown in detail in FIGURES 7 and 8. One end of precoiled spring 79 is wrapped around spool 91 which is free to rotate on shaft 72. The outer end of spring 79 is secured as at 92 to spool 93 which is normally free to rotate on shaft 73. A notch or stop 94 is cut in the periphery of spool 93. A spring-loaded latch 95 is mounted on shaft 96. Latch 95 is spring-loaded so that it presses against the outside of strip 79 as it is coiled on spool 93, but when the action of the spring is such as to retrieve the cable, latch 95 drops into notch 94 on the last revolution of spool

5

93 to prevent strip 79 from becoming disconnected from spool 93.

On shaft 73 there are two square collars 97 and 98. Collar 97 is secured to drum 93 and collar 98 is secured to shaft 73. A latching mechanism consists of block 99 formed with an internal cylindrical portion 100 of a length sufficient to span block collars 97 and 98. The square opening 101 in cylindrical portion 100 will slide over and engage collars 97 and 98 to hold them in alignment. Another function of notch 94 and latch 95 is to stop drum 93 in such a position that collar 97 will be aligned with hole 101 in cylindrical portion 100 of the block 99. The location of the stop 77 on the cable determines the angular position of the shaft 73, and, therefore, the angular position of collar 98 so that it will be aligned with hole 101. Thus, it will be seen that when it is desired to transmit the spring tension of spring 79 to drum 74 through shaft 73, it is merely necessary to rotate collar 106 which will cause latch member 99—100 to slide over collars 97 and 98. Thereafter, as the cable is pulled from drum 74, lock collars 97 and 98 will turn as shown in FIGURE 8, as cylindrical portion 100 turns in latch 99. The tension of spring 79 will thereby be transmitted to the cable 75 as it is pulled from drum 74. When the cable is retrieved, the strip spring 79 moves from drum 93 to drum 91 until latch 95 drops into latch 94. The latching mechanism will then be so aligned that button 85 may be pulled outwardly until the tension of that particular spring assembly is needed again.

Needless to say the operation of springs 79 to 84 and associated buttons in the latch mechanism 85 to 90 are similar and by pushing a selection of buttons 85 to 90, a wide range of combinations of tension may be achieved at cable 75.

From the foregoing description, it will be apparent that the invention described above achieves the objects of this invention. However, it is to be understood that certain changes, alterations, modifications, or substitutions can be made without departing from the spirit and scope of the depending claims.

I claim:

1. A constant tension orthopedic traction device comprising in combination, a housing, constant stress reversely coiled spring motor means including a plurality of constant stress, motor units in axial alignment and having common shaft mounting means in said housing, traction means operatively associated with said traction device, means including means exterior of said housing for selectively connecting said constant stress motor units to said traction means to transmit and maintain a predetermined total constant tension from said constant stress motor units to said traction means, said selective connecting means including cable means.

2. A constant tension orthopedic traction device as defined in claim 1, wherein roller guide means for said cable means are mounted adjacent one side of said housing, one of said housing and cable means having guard means mounted thereon to prevent the retraction of the end of said cable means within said housing.

3. A constant tension orthopedic traction device comprising in combination, a housing, constant stress motor units in juxtaposed axial alignment and having common shaft mounting means in said housing, a traction member operatively associated with said traction device, means for selectively connecting said constant stress motor units to said traction member to transmit and maintain a predetermined total constant tension from said constant stress motor units to said traction member, said selective connecting means including cable means, clamping means to engage said traction member, said clamping means having cable coupling means, said cable means having terminals to engage said coupling means.

4. An orthopedic traction unit for maintaining a constant predetermined tension on a traction member, com-

6

prising a housing, a plurality of constant stress motor means mounted in said housing in axial alignment and having common shaft mounting means, cable means, means including means exterior of said housing for selectively connecting said motor means to said cable means to transmit and maintain a predetermined amount of constant tension from said selectively connected constant stress motor means to said member, said last named means comprising clutch means mounted on said housing adjacent each said motor means and operable externally thereof for selectively clutching said plurality of motor means to said cable means.

5. An orthopedic traction unit for maintaining a predetermined constant tension on a member, comprising a housing, a plurality of constant stress motor means mounted in said housing juxtaposed in axial alignment and having common shaft mounting means, cable means, one of said motor means permanently biasing said cable means, the remainder of said motor means having clutch means for selectively connecting said motor means to said cable means to transmit a predetermined total constant tension from a selected group of said motor means to said member, said clutch means including control means extending exteriorly of said housing.

6. An orthopedic traction unit for maintaining a constant preselected tension on the cable of a traction member for all positions of the cable, comprising a housing, a plurality of constant stress motor means in said housing in axial alignment and having common shaft mounting means, each of said constant stress motor means having a rotary power output member, shaft means including a rotatable shaft, said rotary power output members being mounted to rotate freely on said rotatable shaft, which is positioned to rotate within said housing, a cable drum mounted fixedly on said shaft, a cable attached to and coiled on said cable drum to extend from said housing, means including means extending exteriorly of said housing to selectively engage each of said power output members with said shaft to tension said cable by the total amount of said power output members in engagement with said shaft.

7. An orthopedic traction unit as set forth in claim 6, in which one of said output members is permanently engaged with said shaft to bias said cable by an initial predetermined amount.

8. Orthopedic traction apparatus comprising, a plurality of constant stress, reversely coiled, spool-mounted, pre-set spring motor means disposed in juxtaposed relationship to each other on common axes, cable means connected to and extending from said reversely coiled, pre-set spring motor means and arranged for coupling to a traction member, means to selectively couple said spring motor means to said cable means whereby said cable means is selectively maintained under a predetermined constant load corresponding to the manner in which said spring motor means are coupled for connection to the traction member.

9. An orthopedic traction unit as set forth in claim 6 wherein the rotary power output member of each constant stress motor means comprises a spool, a reversely coiled spring having a portion wound on and anchored to said spool, said spool having a stop notch in its outer periphery normally covered by said coiled portion of said spring, a spring-actuated latch means pivotally mounted in said housing and biased so as to engage in said stop notch when exposed by the rotation of the spool and uncoiling of said spring thereon by the tension of the traction member to thereby prevent further rotation of the spool and disconnection of the spring from said spool.

10. An orthopedic traction unit as set forth in claim 6 in which one of said output members is permanently engaged with said shaft to bias said cable by an initial predetermined amount, roller guide means for and ad-

jacent the said cable means and mounted in said housing adjacent the side from which said cable means extends, stop means mounted on said cable means and engageable with said roller guide means to limit retraction of said cable means by said constant stress motor means to thereby determine an initial angular position of said rotatable shaft.

5

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