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FLUID PRESSURE TRACTION DEVICE

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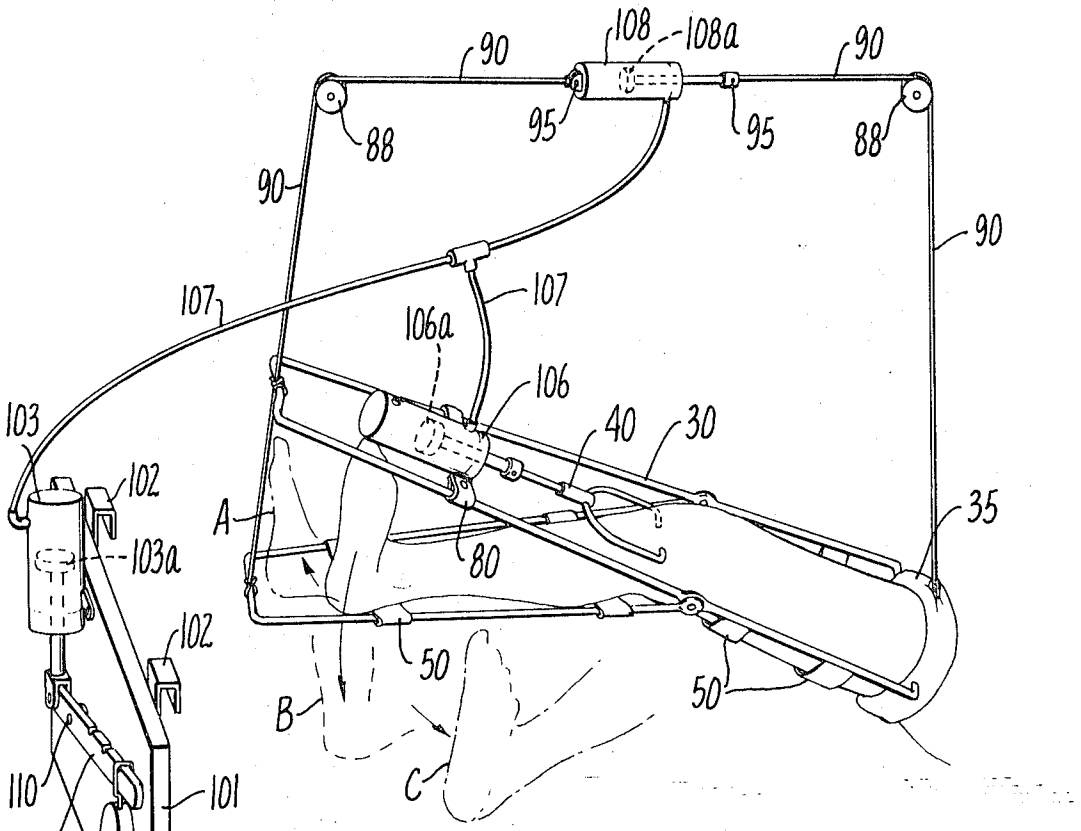


FIG. 1.

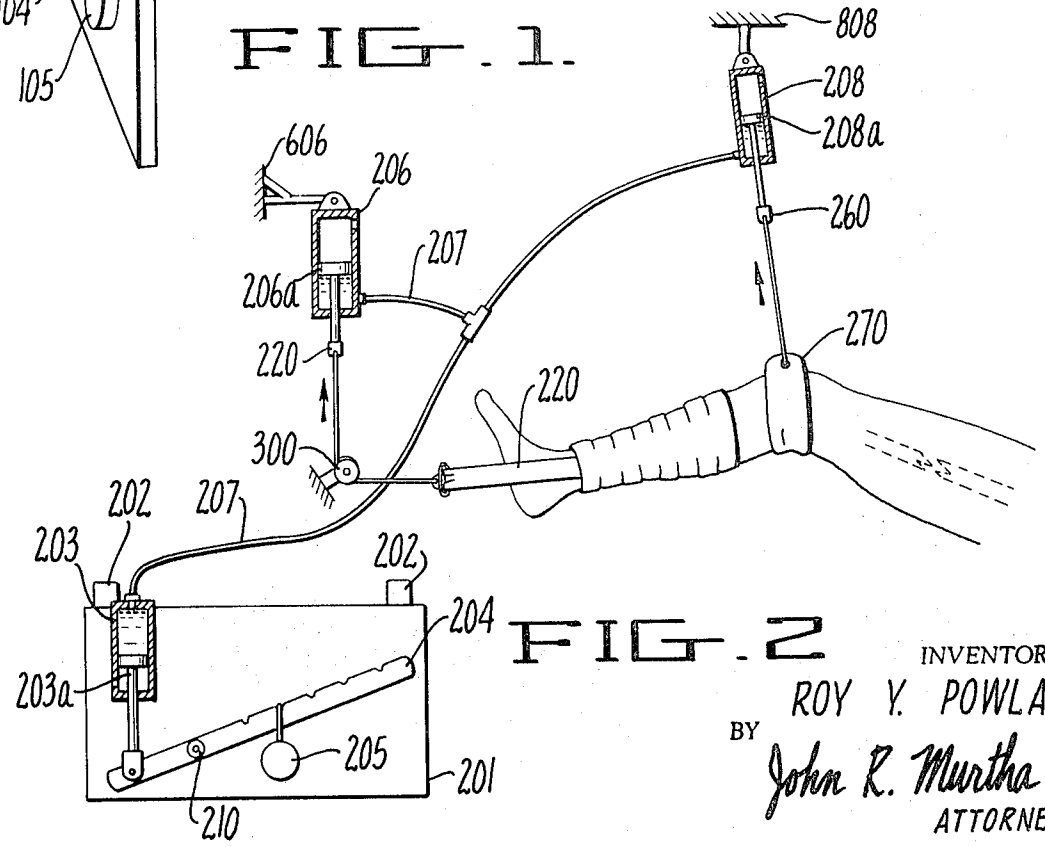


FIG. 2.

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FLUID PRESSURE TRACTION DEVICE

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ABSTRACT OF THE DISCLOSURE

A fluid pressure device for applying traction to orthopedic patients utilizes hydraulic cylinders connected together in a closed fluid system and actuated by applying torque through a calibrated counterweight, resulting in the application of a constant regulated tension on a patient in traction.

This invention relates to a self-contained fluid pressure device and more particularly to a portable self-contained traction device operating as a closed hydraulic system.

The particular device disclosed in this application has been designed for use in the orthopedic treatment of broken limbs, strained muscles, torn ligaments and other surgical and medical procedures requiring constant controlled and sustained tension on the portion of the anatomy affected. The usual traction devices previously used consist of a series of pulleys which employ counterweights in the desired mass to provide the required tension.

The prior art pulley and counterweight technique generally consists of a system of opposite and opposing forces which place the patient so treated in fixed position where tension in the desired amount can be exercised against the affected member. This system of opposite and opposing forces is created by the utilization of suitable weight-supporting members connected to the ends of the flexible members attached to the patient's body. The weight-supporting members receive various weights suitable to develop the desired tension for traction and are of varying amounts which can be added or removed from the weight-supporting member to control the level of applied traction.

As can readily be appreciated, the prior art devices in current vogue suffer from a number of deficiencies.

Firstly, they require a plurality of pulleys and ropes which must be secured by the appropriate framework to the bed upon which the patient is lying.

Secondly, weights of various denomination must be secured to apply the necessary tension. These weights are of various amounts and require manual placement at the end of the pulley. This necessitates a supply of weights which must be brought from a storage area and added by hand as the need arises.

Thirdly, the weights are frequently in an awkward position in the hospital room resulting in accidental bumping by pedestrians traversing the area, with the attendant discomfort and pain to the patient and/or the displacement of some of the weights onto the floor, creating the likelihood of further damage and/or pain to the patient so involved.

Fourthly, many hospital beds are not designed for the mounting of such pulleys and the supporting members necessary to secure the pulley and counterweight system at the ends of the bed. When the bed has a high headboard, the mounting of the pulleys thereon results in the patient's members being placed at an awkward and frequently uncomfortable position, requiring other therapeutic measures to prevent any restriction of circulation in the affected member or other patient-care problems.

Finally, when a patient inadvertently slides forward in the bed, a danger exists that the weight-supporting member will rest on the floor, effectively reducing the traction force applied.

In addition, when certain orthopedic supporting devices such as a Thomas splint are involved, the patient, while not permitted to rotate the affected member about the axis of the main bones of the body, still may medically move the affected limb across the surface of the bed parallel to the end of the bed. However, when used in conjunction with the counterweight devices now known to the art, the injured limb must remain fixed within a narrow arc circumscribed by the location of the pulley and weights. This adversely affects the patient's rate of recovery.

Ultimately, because of the complex nature of the pulley and weight systems utilized, a great deal of time must be spent in setting up and tearing down the systems as the combination of weights, angle of pull, mounting, etc., vary with each case and each patient involved. This results in a considerable loss of time and cost to the hospital in the care and treatment of the patients and the use of hospital personnel.

It is also obvious that under certain emergency field conditions such as battlefield or remote wilderness areas, the use of any complicated system of pulleys and counterweights is impossible. Inasmuch as the present invention requires none of the usual supportive apparatus, it can readily be seen that this device is readily adaptable for such field and emergency uses. This has the additional advantage of preventing further damage to the injured member and reduction of shock and other trauma to the patient.

Other prior art devices utilizing hydraulic traction systems which employ the usual hydraulic pumps and complex valving, are cumbersome and unwieldly and generally fail to provide any method for compensating for any bodily movement of the patient while in traction.

It is, therefore, an object of the present invention to eliminate the need for a system of pulleys and weights for applying traction.

Another object of this invention is to provide a rapid means for changing traction pressure without the necessity of adding or removing extra weights.

A still further object of this invention is to provide a self-contained portable fluid traction unit for applying traction under emergency conditions.

Another object of this invention is to provide a self-contained portable fluid traction unit for applying traction that can be rapidly moved from bed to bed without any special frame arrangement.

A still further object of this invention is to provide for a central traction device which can be used to control a number of traction units from a single master cylinder.

A further object of the invention is to provide an improved traction-applying, fluid pressure device which eliminates the need for any power source necessary when using any conventional prior art hydraulic system.

Further objects of this invention will become obvious and will appear as the description proceeds and as taken in conjunction with the accompanying drawings.

In the drawings:

FIG. 1 is an isometric view of the system showing a patient's leg in a Thomas splint indicating the uses of said device;

FIG. 2 is an isometric view showing a patient's leg in "split" or Russell traction with tension applied at the lower extremity of the leg by means of skin traction utilizing adhesive plaster on the lower leg region.

Referring now to the drawings wherein there is shown preferred embodiments of the invention. As utilized, the ratio of the diameter of the fluid means depicted in the drawings is adjusted to predetermine the precise vector resultant of the forces applied by the counterweight.

In FIG. 1 the fluid pressure traction apparatus consists of a backing means indicated by the reference numeral

101 with mounting brackets 102, 102 for mounting said apparatus on the desired frame such as a bed, litter, guerney or other patient handling device. This backing has mounted thereon a first fluid pressure means or hydraulic cylinder 103. The first fluid pressure means consists of an outer cylinder and having within it a displaceable connection or piston 103*a*. This first fluid pressure means is connected by a single coupling means to a calibrated notched fulcrum means or arm 104 rotatably mounted to backing 101 about pivot 110. Mounted on said fulcrum arm 104 is movable counterweight 105. By positioning said counterweight 105 on the fulcrum arm 104, torque is applied about pivot 110 causing the displaceable connection or piston 103*a* to exert pressure on the fluid in the first fluid pressure means 103. Fluid displaced by the movement of piston 103*a* travels through fluid conduit means 107 to second fluid pressure means or hydraulic cylinder 106 and simultaneously to counterbalance fluid pressure means 108. As the fluid traverses conduit means 107 into the cylinder of the second fluid pressure means, force is exerted on the second fluid pressure means displaceable connection or piston 106*a*. The displaceable fluid pressure means 106*a* will move inwardly in direct proportion to the force applied by counterweight 105. When the displaceable fluid pressure means 106*a* moves, it exerts tension on a leg attachment 40 which is depicted in FIG. 1 as tongs coupled to a Steinmann pin inserted into the bone of the patient's leg. Said second fluid pressure means 106 is mounted by securing clamp 80 to a splint apparatus depicted herein as a Thomas splint brace collar 35 and support straps 50, 50.

Simultaneously, when pressure is applied along conduit means 107, pressure is varied against displaceable connection 108*a* in counterbalance fluid pressure means 108 which, as in the base of the second fluid pressure means 106, has been adjusted with respect to diameter ratio to give the desired vector resultant of applied force. This fluid pressure results in force being applied along pulley lines 90, 90 traversing over pulleys 88, 88 attached to the bed frame (not shown) and thereupon to Thomas splint collar 35 and Thomas splint 30 for the purpose of reducing the pressure exerted against the patient's groin when the apparatus is in use.

Also depicted in FIG. 1 are three alternate positions marked A, B and C which indicate that the patient's leg in traction may be moved parallel to the surface of the bed, guerney or litter within the radius of the arc described by the patient's groin and the end of his leg.

When a patient under traction moves the fractured limb either forwards or backwards, the fluid means mounted on the splint apparatus responds accordingly. If the patient slides forward in bed, the displaceable fluid means or piston will also move forward. Forward movement of the displaceable fluid means allows fluid to flow up through the conduit lines from the first fluid pressure means and causes the fulcrum arm and counterweight to move downward. As this is a closed system, the traction so applied remains constant.

If the patient moves towards the head of the bed and away from the Thomas splint, the displaceable fluid means will move accordingly and will force fluid out along the fluid conduit means again maintaining the constant fluid balance and applied traction of the system. Even if the patient moves his foot at various angles and heights as depicted by A, B and C in FIG. 1, no change in the traction or the pressure applied throughout the closed system will be transmitted ot the injured limb.

FIG. 2 is merely another embodiment of the same invention. Depicted therein is backing means 201 with mounting brackets 202 for attachment to the bed, litter or guerney. This backing has mounted thereon a calibrated notched fulcrum means or arm 204 with displaceable counterweight 205. The fulcrum is rotatably mounted about pivot point 210 and is connected to first fluid displaceable pressure means 203*a* mounted inside first fluid pressure means 203, which is linked by fluid conduit means 207 to the second fluid pressure means 206 having displaceable means 206*a*. Mounting of the second fluid pressure means 206 to a bed or traction frame (not shown) is accomplished by bracket 606. Also linked into the closed system by fluid conduit means 207 is counterbalance pressure means 208 having displaceable means 208*a* mounted to a bed or traction frame (not shown) by bracket 808.

When counterweight 205 is positioned, fulcrum arm 204 rotatably moves about 210 causing fluid pressure displaceable means 203*a* to apply pressure via conduit means 207 on fluid contained in first pressure means 203. In response to this pressure, second fluid displaceable means 206*a* moves upward creating traction on adhesive plaster attachment 220. At the same time this also forces counterbalancing fluid displaceable means 208*a* to move upward, forcing support sling 270 to rise.

In FIG. 2 the second fluid pressure means is shown at right angles to the direction of traction. This merely depicts use of this apparatus when the space between the splint or adhesive attachment and the end of the bed is insufficient to permit the fluid displaceable means adequate space to traverse the length of the piston stroke.

Although both drawings disclose the use of a counterbalance fluid means, it is apparent that the use of this means is primarily for patient comfort and is not required for the medical treatment of the fractured limb. Clearly, it could be readily eliminated from the apparatus when used under emergency or field conditions where speed and ease of handling are the primary considerations.

It is obvious to one skilled in the art that drawings and descriptions as shown here are only a few possible embodiments of the invention disclosed.

For example, it is possible by the use of the invention to place a single first fluid means and counterweight apparatus in any room in the hospital and control any number of response means from a distance. It is also possible to place it in areas well out of the traffic flow, thus avoiding congestion and possible injury to the patient.

It is also obvious that by utilizing conventional electrical timing devices in conjunction with the apparatus disclosed herein, traction can be varied or even totally discontinued on a regular schedule without requiring any changing of the counterweight means by the hospital staff.

The fluid pressure means described herein can be made of any conventional materials including polyethylene, glass, metal, plastic or other material that can be made to form a tight-seal hydraulic system.

The fluid conduit means utilized can be of any material including, but not by way of limitation, nylon, neoprene, Geon, high pressure neoprene, woven stainless steel, etc., although flexible tubing is obviously a preferred embodiment.

It is also obvious to one skilled in the art that while the drawings and the accompanying description included herein deal with traction on the lower extremities of the body, this apparatus is equally and as efficiently applicable to traction desired on any member of the body and the same benefits as disclosed are available under all circumstances.

I claim:

1. A device for applying traction to fractured bones and other orthopedic purposes, said device comprising:

(a) a splint apparatus adapted to be attached to the patient on one side of the fracture,

(b) an attachment adapted to be secured to the patient on the opposite side of the fracture,

(c) a first hydraulic cylinder having a piston, and means to fixedly mount the cylinder at a remote location,

(d) a second hydraulic cylinder having a piston mounted on said splint apparatus,

(e) means to adjustably apply a constant force to the piston of said first hydraulic cylinder to place

the fluid therein under desired constant pressure, said force applying means having a movable arm associated with the piston of said first hydraulic cylinder and means to adjustably apply a force to said arm, said arm moving with said piston without altering the force applied thereto, and

(f) conduit means to transmit the pressure produced in said first hydraulic cylinder to said second hydraulic cylinder to apply a force to the piston thereof.

2. A device for applying traction to fractured bones as set forth in claim **1** wherein said splint apparatus comprises a rigid apparatus longitudinally extending beyond the fractured ends of the bone.

3. A device for applying traction to fractured bones as set forth in claim **1** wherein said splint apparatus comprises an adhesive plaster means.

4. A device for applying traction to fractured bones as set forth in claim **1** wherein said first hydraulic cylinder and piston are located at a point remote from said splint apparatus.

5. A device for applying traction to fractured bones as set forth in claim **1** wherein said hydraulic cylinders and pistons are opposed to each other so that displacement of one piston relative to its cylinder results in an equal but opposite displacement of the other piston relative to its cylinder.

6. A device for applying traction to fractured bones as set forth in claim **5** wherein said force applying means comprises a pivoted arm and a weight attached thereto,

said arm being attached at one point to the piston of said first hydraulic cylinder.

7. A device for applying traction to fractured bones as set forth in claim **6** wherein said force applying means is provided with attachment means for attaching said force applying means to an object remote from said splint apparatus.

8. A device for applying traction to fractured bones as set forth in claim **1** in which the pressure transmitted to said second hydraulic cylinder is employed to force the piston thereof into said cylinder.

9. A device for applying traction to fractured bones as set forth in claim **1** in which a third hydraulic cylinder having a piston is connected to said attachment and said conduit means transmits the pressure produced in said first hydraulic cylinder to said third hydraulic cylinder to apply a force to the piston thereof.

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