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3,178,732

EVERSIBLE LIFTING DEVICE

Filed March 27, 1962

FIG. 1.

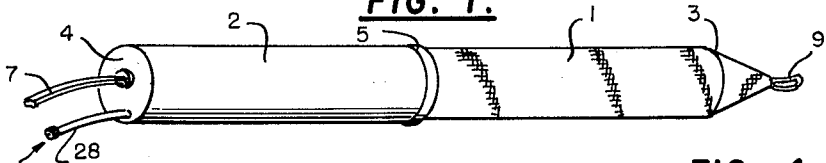


FIG. 2A.

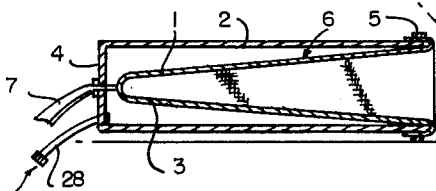


FIG. 4.

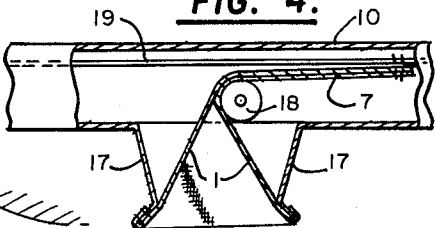


FIG. 2B.

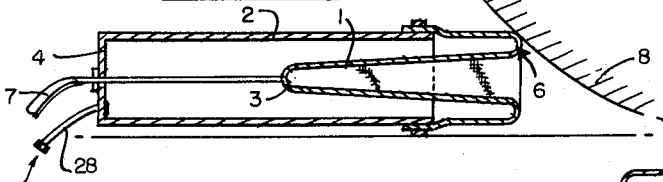


FIG. 6.

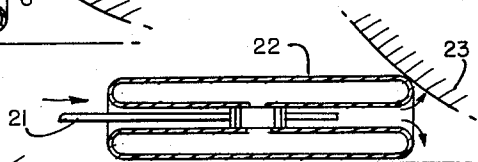


FIG. 2C.

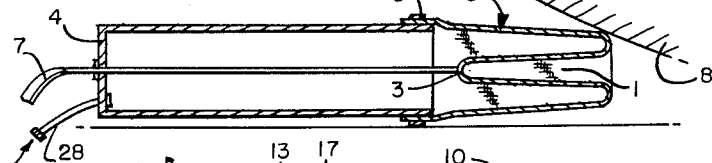


FIG. 3.

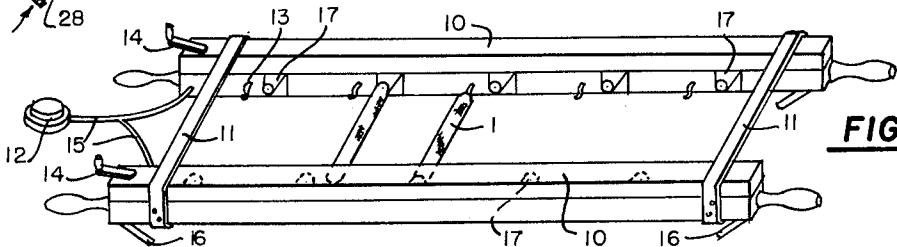
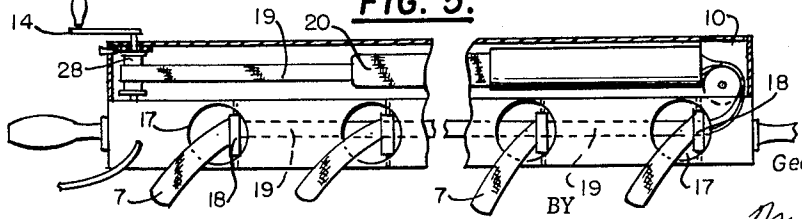


FIG. 5.



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3,178,732
EVERSIBLE LIFTING DEVICE
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This invention is related to the field of stretchers, or litters, which are designed for the purposes of lifting and transporting a patient, or accident victim, in a recumbent position.

Heretofore it has been necessary to transfer a patient or accident victim, from wherever he may be, to a stretcher by various means, (some improvised), and including lifting by man power which always involves two, and preferably more adults. The same means, including lifting by man power, are required to transfer the patient, or accident victim, from the stretcher to the new location.

Additionally, in hospitals, or other facilities for bed patients, there are always some patients who are incapable of moving themselves in order to have bedding changed, or have some kind of specified treatment, and it becomes necessary for the patient to be lifted by man power.

The disadvantages are several in all the known methods of lifting patients, such as are practiced by hospitals or ambulance attendants, or which are recommended for those who are trained in first aid. These disadvantages include the fact that in many instances it is acutely painful for the patient or accident victim to be lifted to a stretcher by the known methods; and in addition, the lifting operation by these methods may aggravate his injuries due to the stresses which are created. There is the further disadvantage that few adults can be lifted easily and comfortably by fewer than three strong, well-trained adults.

With these disadvantages in mind it is an object of my invention to provide means to simplify the lifting and transportation of a patient, or accident victim, and at the same time, do so in a manner that will be both comfortable and safe for the patient or victim. I propose to avoid subjecting the patient or accident victim to unnecessary disturbance or mechanical stresses; and to prevent any possibility of his body being twisted or bent.

It is an object of my invention to provide supporting means of flexible material to be inserted under the patient, or accident victim, in a frictionless manner; i.e. with no sliding force on the patient.

It is another object of my invention to provide means for retracting the said supporting members in a frictionless manner.

It is a further object of my invention to provide frictionless insertion by means comprising an everting sleeve of flexible material, and means for causing eversion and inversion. (I say that the sleeve of my invention is capable of eversion since it turns outward from within itself.)

Still other objects of my invention are to provide an improved device of the character described which is sturdy in construction, economical to produce, and highly efficient in operation.

Additionally, in contrast to the known methods of lifting a patient, or accident victim to and from a stretcher, I propose to put the stretcher around and under the person, or to take it from under the person, and lift it off.

While I recognize the necessity and utility of the comfortable wheeled stretchers such as are conventional in hospitals, it is certain that my invention would have many applications, such as I have described, in hospitals, as well as at the sites of accidents. It is an improvement over the conventional litter of canvas with wooden or metal poles, and should be useful to the Armed Services,

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police and fire departments, ambulance units, or any group routinely charged with the transportation of the ill or injured.

The stretcher which can be constructed in accordance with my invention may have a hollow rectangular frame. The frame can be placed on the ground, bed, or any horizontal surface where the patient may be lying, in such manner as to surround him. Supporting bands will then be forced under the patient, (by compressed air from an associated foot pump), in a frictionless manner from their staggered positions in both sides of the frame. The bands, when they are fully extended, are then to be fastened to hooks opposite, which are also in staggered positions on the sides of the frame. Then, and only then, need the patient, fully supported, be lifted for transportation, for bed-making or treatment, and this lifting can be accomplished, under ordinary circumstances, by two people. Since the loading of a patient or victim on the stretcher of my invention could be accomplished by one person, if it were ever desired to put wheels on the stretcher, both loading and transportation could be accomplished by one person.

The manner in which my invention may be practiced will be described in greater detail hereinafter, with reference to the figures which are as follows:

FIG. 1 shows a cylindrical sleeve such as I employ as a lifting and supporting member, and the tube from which said sleeve may be everted or into which it may be inverted.

FIG. 2 is a cutaway view of the sleeve of FIG. 1, in successive conditions during eversion.

FIG. 3 shows the embodiment of my invention in a stretcher adapted to pick up patients, or accident victims from the ground, bed, or other surface, and to lay said person in another location.

FIG. 4 is a section showing means for everting or inverting the supporting means of my invention.

FIG. 5 illustrates the retracting mechanism I propose for the preferred embodiment of my invention.

FIG. 6 illustrates another embodiment of the everting principle of my invention.

Referring now to FIG. 1, which shows a single sleeve illustrative of the principle of my invention I show sleeve 1 which is constructed of flexible inelastic, airtight material in a form that is approximately cylindrical. Tube 2 may be rigid or flexible, but is of a larger size than is sleeve 1, to permit said sleeve to fold inside the tube. Conical sleeve end 3 is closed and made airtight, and sleeve 1 and tube 2 are joined tightly at point 5. End 4 of tube 2 is pierced to admit retracting cord 7 to pass therethrough. Air or other fluid is admitted to the interior of tube 2 through tubing 28. Eye 9 is a loop of material, the use of which will be explained in relation to FIG. 3.

The operation of the eversible sleeve of FIGURE 1 will be explained by reference to FIGURE 2, wherein parts corresponding with those of FIGURE 1 are similarly numbered.

FIGURE 2a shows in section the sleeve 1 inverted or drawn back by retracting cord 7, so that the end 3 of the sleeve is within tube 2. FIGURE 2a shows the tube 2, with the inverted sleeve 1, placed in its proper location with respect to a body 8, shown in section, prior to eversion.

Air pressure is forced by means not shown here, through tubing 28 to the interior of cylinder 2. The air pressure, acting on the surface of flexible sleeve 1, causes the sleeve to evert as seen in FIGURE 2b. The entry of further air through end 4 into tube 2 causes sleeve 1 to evert further under body 8, effecting a lifting action on said body, as in FIGURE 2c.

It will be clear that the direction of the force exerted on sleeve 1 by the contained air is such as to cause that portion of the sleeve which, at any instant, is reverted to collapse, and to cause that portion of the sleeve which has everted to extend and become cylindrical.

The fact that the eversible sleeve of my invention exerts no tangential or frictional force on the body under which it everts may be seen by following the motion of a reference particle 6, on the sleeve, during eversion in FIGURE 2.

The sleeve 1 of FIGURES 1 and 2 may be removed from under body 8, also without sliding friction between the body 8 and sleeve 1. A force exerted on retracting cord 7 inverts sleeve 1, and forces air out of the interior of tube 2 through tubing 28, retracing in reverse order the events pictured in FIGURE 2.

It should be noted that the device of FIGURES 1 and 2 is simplified for illustration of the principle of my invention and that in a practical embodiment of my invention means must be provided for forcing air or other fluid into tube 2. Furthermore, sleeve 1 of FIGURE 2 would in practice be made long enough to pass completely under body 8, and to carry loop 9 (FIGURE 1) beyond the body so as to make it accessible for attachment to a carrying bar. Such a practical embodiment of my invention is disclosed in FIGURE 3, and certain pertinent details of said embodiment are shown in FIGURES 4 and 5.

FIGURES 3, 4 and 5 disclose in diagrammatic form a practical litter or stretcher employing my invention as described in the foregoing paragraphs and in FIGURES 1 and 2. The said stretcher is constructed for the purpose of picking up the victim of an accident, for example, when said victim is lying on the ground. The general view, FIGURE 3, shows the said stretcher, comprising hollow carrying bars 10, 10, each fitted with a multiplicity of eversible sleeves 1—1, a foot pump of conventional kind, 12, for providing air under pressure to actuate said sleeves, and other elements to be described herein. Each sleeve 1 is joined to the rim of housing 17, which, together with an adjacent portion of hollow bar 10, serves as the outer sleeve, corresponding to sleeve 2, as will be explained below, and as is shown in FIG. 4.

In use, the stretcher of FIGURE 3 is laid on the ground, with one of the carrying bars, 10, 10 on each side of the victim, and with straps 11, 11, above the head and below the feet respectively. Pump 12 is next operated, forcing air through flexible hose 15 to the interior of hollow carrying bars 10, 10, and thence to sleeves 1—1, causing said sleeves to evert and to be inserted under the body of the victim, raising the body slightly at the same time.

When fully everted, each sleeve 1—1 passes under the body of the victim, and extends beyond said body, carrying with it a loop, similar to 9 of FIGURE 1. Said loops are then slipped over hooks 13—13, to attach the ends of all sleeves to the carrying bars, thus providing support for lifting and carrying the victim.

I provide folding legs 16—16, which may be unfolded to hold the device with the victim in place at a suitable distance above ground, so that blankets may be wrapped entirely around the victim, if desired.

On reaching the hospital or other destination, the stretcher of my invention with the victim on it, may be placed on a table or bed, and the sleeves removed without frictional force, by rotating retracting cranks 14, 14, as will now be described.

The retraction mechanism will be understood by reference to FIGURES 4 and 5. FIGURE 5 shows one of the carrying bars, 10, but with the eversible sleeves removed. In this figure, the retracting cords, 7—7, adapted for attachment to the respective sleeves, are shown. One end of each cord, 7, is attached to a common retracting strap, 19, which strap passes over rollers at the right-hand end of bar 10, FIGURE 5, and thence to retracting drum 28, to which retracting crank 14 is affixed.

Whereas, in the illustrative embodiment of FIGURES 1 and 2, tube 2 is shown as straight, and sleeve 1 is inverted straightly into said tube, 2, I have chosen in the device of FIGURE 3 to cause sleeve 1 to pass over a guide-roller, 18, seen in FIGURE 4, and to retract within the hollow carrying bar 10. Stub tubes, 17—17, perform the functions of supporting one end of sleeve 1—1, and of conveying air to said sleeves (FIGURE 4).

Rotation of retracting crank 14, thus withdraws strap 19, which is joined to bar 10 in an airtight manner by flexible sleeve 20, FIGURE 5, and draws inwardly all cords 7 attached to sleeves 1—1, causing the latter to retract in the manner described in connection with FIGURES 1 and 2.

It will be clear to one skilled in the art that a retractile spring or an everting sleeve under controlled air pressure, or other means may be substituted for the retracting crank and drum of FIGURES 3 and 5, to perform the retraction of strap 19, without departing from the spirit of my invention.

It will be clear to one skilled in the art that while I show in FIG. 3 means for five supporting members on each side, this is for illustrative purposes only, and that for practical construction and use there may be more, if required. Also, in actual manufacture, tubes 17 might be padded for additional comfort to the patient, and two or more straps and buckles might be affixed to bars 10, 10. Said straps would be available to fasten over the patient or victim to retain him in a stable, fixed position. Additionally, wheels might be attached to the feet 16 if desired.

The model of the stretcher I have constructed, (for illustrative purposes only), and demonstrated successfully, I made with two sheet metal hollow ducts 29, about 6' long, 2" wide and 1" deep. (See FIGS. 1 through 5 for ducts 29, as well as for other corresponding numbers I shall use in this description). To these ducts 29 I affixed five tubes 17 on each, said tubes about 3" long and about 2" in diameter. These tubes flare slightly in order to hold sleeves 1 snugly against the traction of incoming and outgoing air.

Inside the ducts 29, and adjacent to each tube 17, I fixed a guide 18 for guiding each sleeve 1 as it inverts by action of its retracting cord 7. At one end of each bar 10 is a retracting steel drum 28, approximately 1" in diameter and 2" long. I have joined this drum to a shaft that is attached to crank 14.

Also, I made a retracting strap 19 which runs the full length of each duct over a set of conventional rollers and back through an airtight sleeve 20, to the retracting drum attached to crank 14. This retracting strap is attached to each retracting cord 7.

I made the sleeves 1 of rubberized cloth, in roughly cylindrical form, approximately 18" long, and 2" in diameter. I sewed rug binding (retractor cord 7) into the closed ends, each with two ends free, one to act as the retractor cord, and the other (about 4" long) to be made into an eye 9, to be fixed over hook 13.

I use a conventional foot pump 12, well known in the art, and have found 10 lbs. per square inch to be adequate to operate my demonstration model.

Because the sheet metal ducts would not be capable of bearing the weight of say, a 300-lb. patient, for this demonstration model I joined the ducts to wooden poles, the ends of which I turned into smooth carrying handles. To these poles I affixed steel hooks 13, on which to fasten eyes 9 of the sleeves 1, when said sleeves are fully everted.

In actual production, I envision that some light but strong metal, such as aluminum tubing of adequate size, would be used in place of my present combination of sheet metal air ducts and wooden carrying poles. Also, that one or more of the many plastics available would be used for the sleeves, which plastics should be capable of being airtight against pressure, and capable of withstanding any weather conditions.

Refer now to FIG. 6 in which I show another embodi-

ment of the eversion principle of my invention in a supporting and lifting means.

I propose to fill inverted sleeve 22 with actuating fluid and to seal said sleeve. Attached to the sleeve will be a rigid propelling means 21. It will be seen that as this inverted sleeve 22, filled with actuating fluid, is propelled along a horizontal surface under body 23, the actuating fluid will cause the sleeve to evert. As the device comes in contact with body 23, the contact is essentially vertical, and will remain so as the supporting member is propelled under body 23; hence no rubbing will occur.

This embodiment, associated with standard component parts, is a lifting means embodying the principle of my invention.

Although the stretcher, which is the preferred embodiment of my invention, has been described in considerable detail, such description and application are intended to be illustrative rather than limitng. It will be clear to those skilled in the art that my invention may be variously embodied and applied, with some alterations of structural details but without departing from the spirit and scope of my invention, the extent of which is to be determined by the appended claims.

I claim:

1. Insertable supporting means adapted for insertion into constricted space beneath a recumbent body and for lifting said body, comprising an eversible sleeve fabricated of flexible, impervious, inelastic material, and fluid-moving means adapted to force fluid into said sleeve, thereby causing said sleeve to evert under said body to raise the body by pressure of the side of the sleeve thereon as the sleeve everts under the body.

2. Insertable means adapted for insertion into an elongated constricted space, comprising first and second eversible sleeves constructed of fluid-impervious material, said sleeves being interconnected for flow of fluid from one into the other, means for causing the first of said sleeves to invert and force fluid into the second of said sleeves, thereby causing the second of said sleeves to evert.

3. Insertable means for insertion beneath a recumbent body and for elevating said body, comprising an eversible sleeve constructed of flexible fluid-impervious material, fluid-conducting tubing connected to said sleeve, a fluid pump connected to said tubing and adapted to force fluid through said tubing and into said sleeve under pressure sufficient to cause said sleeve to evert under said body and to elevate said body to raise the body by pressure of the side of the sleeve thereon as the sleeve everts under the body.

4. In a litter adapted to raise and carry a recumbent body, said litter having two carrying bars, at least one of which is hollow, the combination of at least one eversible sleeve attached to said hollow bar, a fluid pump, fluid-conductive tubing adapted to conduct fluid from said pump to said eversible sleeve through said hollow bar, said fluid pump being constructed to force fluid through said tubing and hollow bar into said sleeve thereby causing said sleeve to evert under and to raise said recumbent body, and supporting means constructed to be attached to the other carrying bar of said litter and to support said body for carrying.

5. A litter for raising and carrying a body recumbent on a supporting surface, comprising carrying bars, at least one eversible sleeve affixed thereto and adapted to be inserted by eversion between said body and said supporting surface, a source of fluid under pressure, and fluid-conducting channels adapted to conduct fluid from said source to said sleeve thereby causing said sleeve to evert.

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