# United States Patent

**Laerdal**

[15] **3,689,945**

[45] **Sept. 12, 1972**


[54] **STRETCHERS**


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[22] Filed: **Aug. 27, 1970**

[21] Appl. No.: **67,504**

[30] **Foreign Application Priority Data**

Sept. 3, 1969 Germany.....P 19 44 646.9

[52] **U.S. Cl.**.....**5/82,** 5/348

[51] **Int. Cl.**.....**A61g 1/00,** A61g 7/10

[58] **Field of Search** .....5/82, 91, 348; 280/201; 417/234–236 X, 313; 297/DIG. 3



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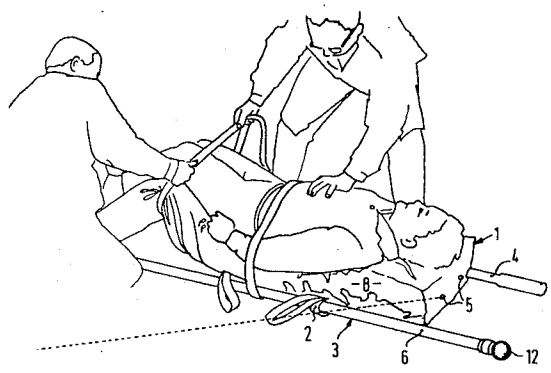
[57] **ABSTRACT**

A stretcher with a vacuum mattress and carrier poles for it, the vacuum mattress having an air impermeable cover enclosing an interior which can alternatively be filled with air or evacuated by a vacuum pump, and which contains a granular material. In order that it should always be available, independent of human factors, when the stretcher is used, and should be capable of connection to the mattress as a preparatory measure, a vacuum pump is mounted in at least one tubular region of one or both carrier poles.


**10 Claims, 2 Drawing Figures**



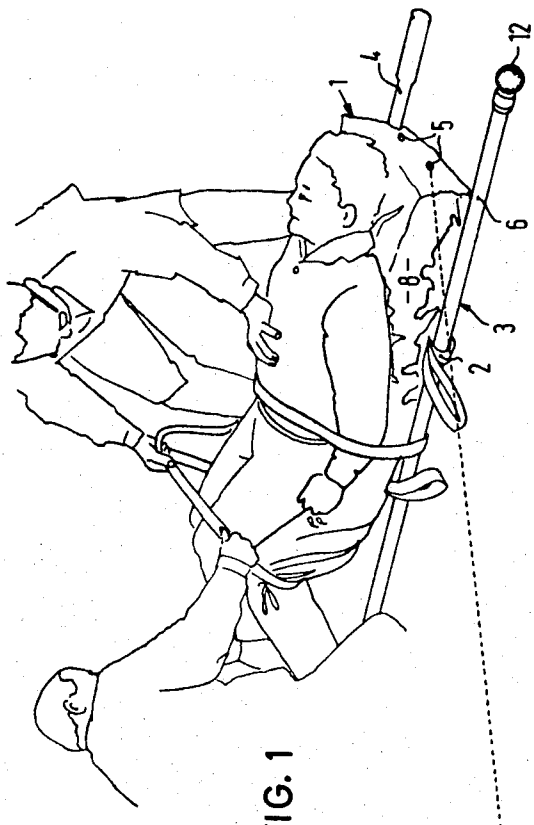



FIG. 1

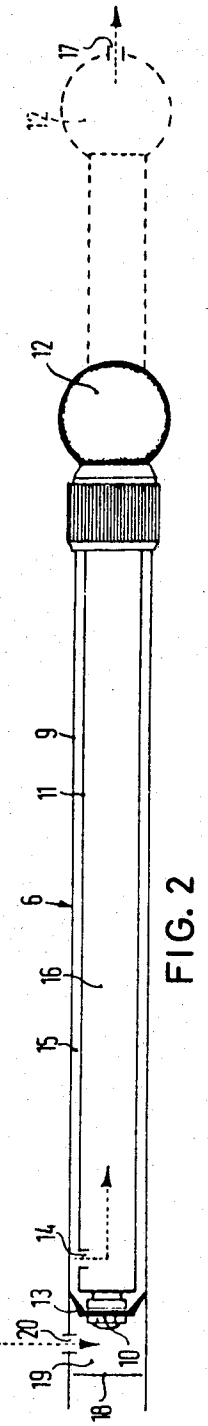



FIG. 2

# STRETCHERS

The present invention relates to stretchers.

Stretchers with vacuum mattresses are known in which the interior of an air impermeable cover, which can alternatively be filled with air or evacuated, contains a granular material, for example plastics granules. When the inner space is filled with air, the granules can be distributed as desired in accordance with external local pressure influences, whilst with the inner space evacuated it consolidates under the inward acting pressure of the flexible covering, in the particular form of distribution which it has assumed, to give a body which is rigid to an extent varying with the order of magnitude of the pressure reduction applied. If a patient is placed on the air-filled vacuum mattress, the granular material distributes itself in accordance with the contour of the body. As a result of subsequent evacuation, the granular material consolidates in the form which it has assumed and hence provides a firm hold, acting over a large area and secure against displacements, for the patient on the stretcher, and with this hold it is possible to transport the patient without hazard and without painful pressure even if the stretcher is in an inclined position.

According to the present invention there is provided a stretcher comprising two carrier poles, an air impermeable mattress cover supported by said poles and provided with a granular filling, and a vacuum pump in a tubular portion of at least one of said poles and operatively connected to the interior of said mattress cover.

With the stretcher of the present invention it is not necessary to employ a separate vacuum pump as has previously been used, and which had to be transported independently of the stretcher and had to be connected to the mattress, at the place where the patient was being collected, by means of a hose. Transporting the pump as an independent unit necessitated the use of a hand which would otherwise be free, and did not exclude the possibility of the stretcher and the pump not arriving simultaneously at the point where the patient was collected, which could result in loss of valuable time, frequently vital for saving the patient. The latter is in particular also true if the pump could, for technical reasons relating to its transportation, only be connected to the mattress at the site of the accident.

With a stretcher of the invention the vacuum pump is always available and can be connected to the mattress as a preparatory measure without the transportation of the stretcher thereby being made more involved and requiring additional hands to hold it.

In the simplest embodiment of the stretcher according to the invention, only one of the carrier poles is provided with a vacuum pump. Of course it is also possible to provide several pumps for one stretcher, for example one pump in each carrier pole or two pumps in one carrier pole which can, in view of the relative forces which arise, be operated simultaneously by two persons in opposite working cycles. The carrier poles are tubular either completely or at least in the region of the vacuum pump, so that a simple vacuum pump, operating with a reciprocable piston, can be incorporated in the inner space of the pole.

The pump can in this case fundamentally be inserted into the carrier pole as a self-contained component. In a preferred embodiment, however, the wall of the tubular region of the pole is constructed as a cylinder, the



piston being guided along its inner wall. This provides as large a stroke volume as possible for a given external diameter of the pole and a predetermined length of stroke of the pump. Furthermore the weight and the space requirement of the pump are reduced.

It is possible to operate the piston by means of an actuating handle which projects laterally from the wall of the tubular region, as a result of which the piston stroke movement would not extend beyond the length of the pole. In a particularly preferred embodiment of the invention, however, the handle is arranged so that it can be drawn out of the end face of the pole, since this simplified guiding the piston and the handle and does not weaken the carrier pole.

In the stretcher according to the invention, the carrier poles can be integrally or detachable connected to the vacuum mattress. In the former case, in particular, it is possible to connect the suction chamber of the pump directly to an orifice in the cover. In this case, a non-return valve which seals off the interior of the cover can conveniently be provided at the pump outlet. With carrier poles which are detachable from the mattress, it is advisable to provide a flexible, detachable hose connection between the suction chamber of the pump and the orifice of the cover, this hose connection being capable of following possible displacements or different connecting positions between the pole and the mattress, and facilitating connection as desired. For this reason, it is also possible to carry hoses of different lengths with the stretcher, in order to be able to do justice to different arrangements of the mattress. In particular, with the detachable connection between the suction chamber and the pump, the non-return valve is preferably provided on the orifice or orifices of the mattress, so that the mattress can be transported separately from the carrier poles, and possibly in a narrow space, whilst maintaining the evacuated condition.

Again, for technical reasons relating to transportation, it may be advantageous to use carrier poles which consist of at least two parts, displaceable relative to one another in the longitudinal direction. Thus, for example, one part of the pole can be pushed into another tubular part of the pole, at the free end of which the pump is located. By pushing one part of the pole into the other, the total length of the carrier pole can be changed so that the stretcher, with the patient strapped to it, can be more conveniently transported through narrow staircases or in small passenger lifts. In the latter case, a particular position of the body of the patient is frequently necessary, which can only be brought about if the stretcher is appropriately shortened, in order to be able to carry out requisite heart massages at short intervals.

In order that the invention will be better understood, the following description is given, merely by way of example, reference being made to the accompanying drawing, in which:

FIG. 1 is a schematic perspective view of one embodiment of the stretcher according to the invention, on which a patient is placed; and

FIG. 2 shows a schematic representation, in cross-section, of a vacuum pump of the stretcher of FIG. 1.

In the embodiment of the stretcher represented in FIG. 1, the vacuum mattress 1 is detachably supported by the carrier poles 3 and 4 by means of straps 2. The

drawing shows how the mattress 1 which has been air-filled — for example through one of the air passage orifices 5 or a shut-off valve — can easily deformably be adapted to the body shape and limb positions of the patient. If the knees are bent, the patient can thereby even be transported in a sitting position.

With the aid of the vacuum pump 7 carried in a hollow end region 6 of the carrier pole 3, air can be pumped out of the flexible covering 8 after having fastened the patient to the appropriately deformed mattress 1. The connection between the pump and one of the orifices 5, provided with non-return valves, in the covering 8 is not shown. As already described, the granular material contained in the covering and distributed in accordance with the contact surfaces of the mattress with the body of the patient, is more or less firmly compressed, through the action of the covering which is compressed by atmospheric pressure, depending on the order of magnitude of the vacuum achieved in the covering, so as to maintain its distribution and retain the shape. The stretcher is now ready for transporting the patient. By virtue of the detachable connection between the mattress and the carrier poles and the non-return valve in the orifice 5, the mattress 1 can at any time be separated from the carrier poles 3 and 4 and hence also from the vacuum pump 7, without air entering and the shape retention of the mattress thereby being lost.

The vacuum pump 7, formed in the end region 6 of the carrier pole 3, is shown in schematic cross-section in FIG. 2. The wall 9 of the tubular region 6 of the carrier pole 3 at the same time serves as the cylinder for the piston 10 of the pump, carried therein, which is connected through its piston rod 11 with an operating handle 12 projecting from the end face of the end region 6 of the pole 3. The piston 10 carries a lip seal 13, which opens or closes depending on the pressure difference on the two sides of the piston and hence forms, in addition to the non-return valve in the air passage orifice 5 of the covering 8, the second valve required for operation of the pump. The piston rod 11 is hollow and is connected at its piston end, via an orifice 14, with the annular space 15 between the cylinder and the piston rod. The cavity 16 of the piston rod 11 is in turn connected to the atmosphere via an outlet 17. The piston rod 11 is particularly resistant to bending because of its hollow form and hence contributes to a reduction in weight, without the output space of the pump being impaired.

The suction space 19 of the pump, formed in front of the piston 10 and shut off at 18, is connected via a connecting orifice 20 and a pipeline shown in broken lines, with the orifice 5 of the covering 8. One or more hoses, which can also be of different length, for adaptation to different mattresses or their intended shape, can be stored in the cavity 16 of the piston rod 11, which is for example accessible by undoing the actuating handle 12, which can be in the form of a detachable end cap.

The broken arrows at 20, 14 and 17 show the flow of air during the suction stroke, which results from pulling the handle 12 away from the end region of the pole 3, in its longitudinal direction. When the piston is returned, the non-return valve in the orifice 5 of the covering 8 closes, so that a pressure is built up in the suction chamber 19 and the lip seal 20 opens in the direction of the output space 15, 16 of the pump and allows the accumulated air to pass through. When the handle 12 is again pulled, a reduced pressure relative to the pressure in the output space 15, 16 results in the suction chamber 19, so that the lip seal rests against the cylinder inner wall to form a seal, as a result of which the flow of air indicated by the broken arrows again results.

I claim:

1. A stretcher comprising:
   a. two carrier poles, at least one of said poles having a tubular portion;
   b. an air impermeable mattress cover supported by said poles and having an interior zone;
   c. a granular material in said interior zone of said mattress cover; and
   d. a vacuum pump means in said tubular portion of said pole in gaseous communication with said interior zone of said mattress cover for reducing the pressure therein thereby permitting compression of said granular material within said mattress.

2. A stretcher as claimed in claim 1, wherein said pump includes a piston, axially reciprocable within said tubular portion.

3. A stretcher as claimed in claim 2, and further comprising an operating handle connected to said piston and projecting axially from the associated carrier pole.

4. A stretcher as claimed in claim 2, wherein said piston cooperates with the interior of the tubular portion, whereby said tubular portion itself acts as a cylinder.

5. A stretcher according to claim 4, and further comprising a lip seal carried by said piston and engaging said tubular portion effective to act as a valve.

6. A stretcher according to claim 2 and further comprising a hollow piston rod connected to said piston and defining, with said tubular portion, an annular space therebetween, and means defining an aperture in said piston rod communicating the hollow interior thereof with said annular space.

7. A stretcher according to claim 6, and further comprising a removable end cap to said hollow piston rod, whereby the hollow interior thereof may be used as a storage space.

8. A stretcher according to claim 1, wherein said mattress cover further comprises at least one non-return valve.

9. A stretcher according to claim 1, wherein said vacuum pump is operatively connected to said mattress cover by means of a hose.

10. A stretcher according to claim 1, wherein the carrier poles are each formed as at least two parts which are selectively mutually longitudinally displaceable, said vacuum pump being in an end one of said parts.

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