Nov. 13, 1962 C. JOBST 3,063,444

MEANS FOR STIMULATING THE FLOW OF FLUIDS IN ANIMAL BODIES

Filed Feb. 13, 1956 2 Sheets-Sheet 1

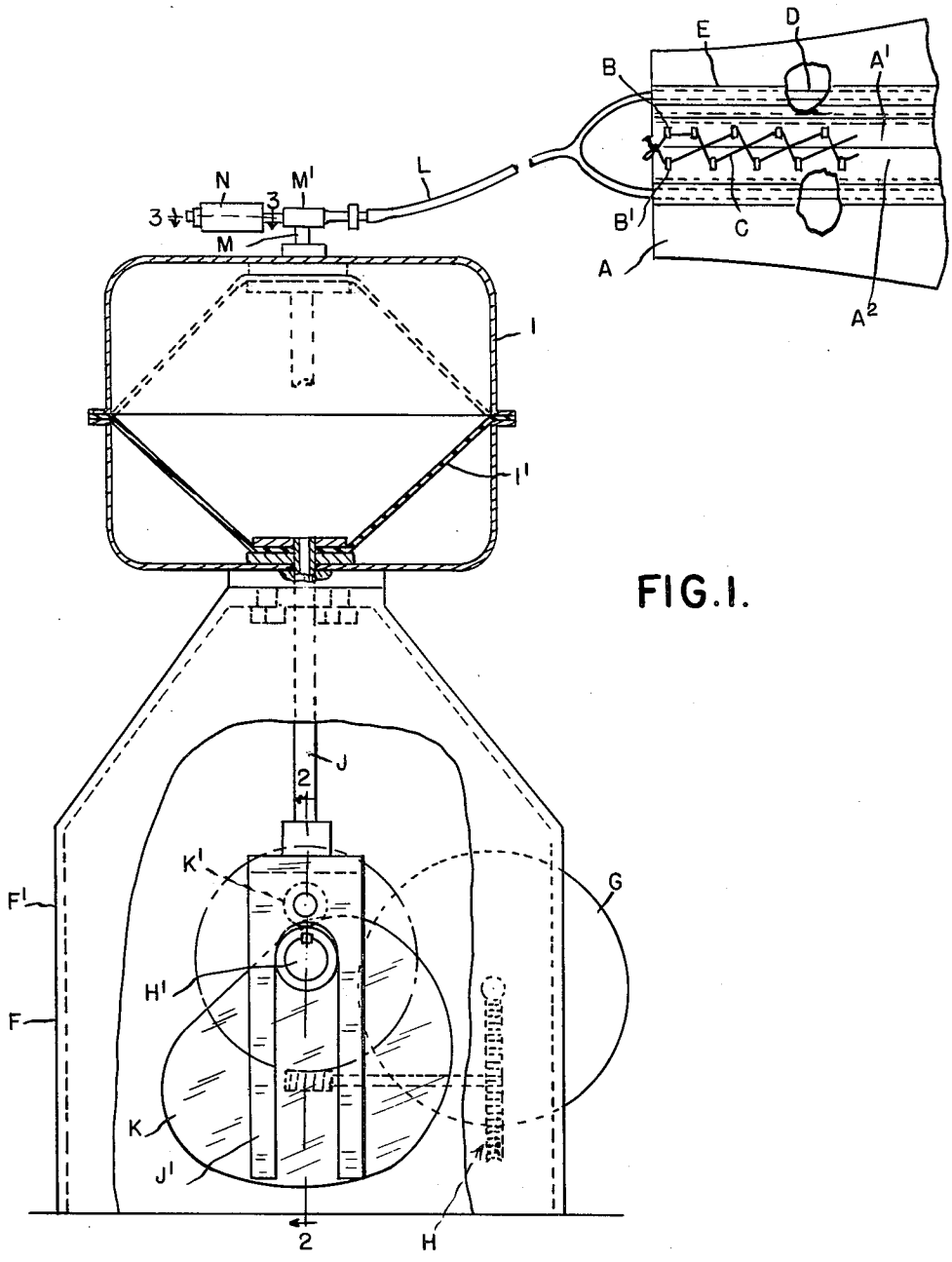

FIG. I.

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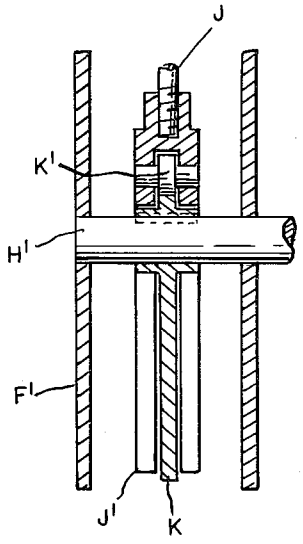

FIG.2.

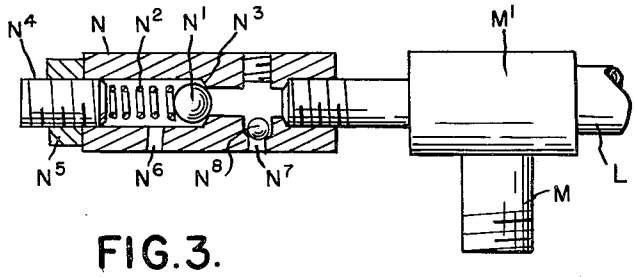

FIG.3.

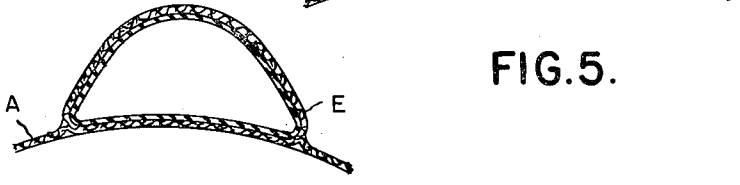

FIG.5.

FIG.4.

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3,063,444

MEANS FOR STIMULATING THE FLOW OF FLUIDS IN ANIMAL BODIES

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1 Claim. (Cl. 128—39)

The invention relates to means for stimulating the flow of fluids in animal bodies and more particularly in the venous and lymphatic systems. It is the object of the invention to obtain means which may be used by patients that are either bedridden or for some reason are not able to live a life of muscular activity. It is a fact known to the medical profession that venous flow is induced by alternate contraction and release of the muscles of the body. The direction of flow is controlled by valves in the veins which in a state of health will limit it to one direction. In certain conditions of health these valves may fail to function which requires other means for directing the flow. What has been said about the venous circulation is equally true of the lymphatic fluid which requires a degree of muscular activity to insure proper functioning. In a former invention forming the subject matter of patent application Serial No. 430,770, now Patent No. 2,747,570 filed May 19, 1954, and allowed October 19, 1955, fluid flow is stimulated by periodic contraction of a non-elastic garment surrounding some portion of the body. In particular the garment fitted for skin contact with the body but with negligible pressure thereon is provided with one or more tubes extending longitudinally thereof which when deflated will produce no pressure but when inflated will circumferentially contract the garment. The means for inflation of these tubes is not specifically described and may be anything suitable for the purpose. However, I have discovered that the timing of this periodic inflation is of importance and that in each cycle there should be a period where the contraction is negligible. It is also important to establish a maximum limit of pressure during the cycle and to gradually increase and decrease the pressure from the zero point and return. To this end I have devised an automatic mechanism which will operate in the desired cycle periodically contracting the garment to produce the radially inward pressure on the body and releasing it from any pressure during a part of the cycle.

In the accompanying drawings:

FIG. 1 is a vertical central section through the operating unit which periodically produces the fluid pressure and releases the same in a predetermined cycle; it also includes a diagrammatic representation of the garment connected to said unit to be operated by the fluid thereof.

FIG. 2 is a section on line 2—2, FIG. 1.

FIG. 3 is a section on line 3—3, FIG. 1, with the tube thereof deflated.

FIG. 4 is a view of a portion of FIG. 3 showing the tube inflated to circumferentially contract the garment.

FIG. 5 is a view similar to FIG. 4 showing the tube in collapsed position.

The garment or envelop of non-elastic material A is adapted to be wrapped about the portion of the body, such as a leg, in which fluid circulation is to be stimulated. As specifically shown, FIG. 1, the opposite edge portions A', A^2 are overlapped and spaced series of hooks B, B' are attached thereto which may be drawn towards each other by a lacing C. Thus, the envelop may be fitted to contact the body with negligible pressure thereon. At one or more points, preferably two, adjacent to said overlapping portions tubes D are placed in pockets E within the envelop being normally in flattened deflated

condition. If, however, the tube is inflated its transverse expansion will cause a circumferential contraction of the envelop and a corresponding radially inwardly directed pressure against the body.

For producing the inflation pressure in a predeterminately timed cycle I have provided an operating unit F. This includes a small power rotary electric motor G, such as a synchronous motor with a speed of rotation of 1800 r.p.m., which motor is mounted on a casing F' containing a step-down transmission H. The driven shaft H' of the transmission extends transversely across the casing F' and rotates at the desired speed, such as 1 r. per forty-five seconds. Above the casing F' is a cylindrical casing I forming an air pump preferably with the flexible diaphragm I'. This diaphragm has centrally connected thereto a rod J which extends downward in the casing F' and has a bifurcated portion J' embracing the shaft H'. The portion J' is also slotted in a plane transverse to the axis of the shaft H' to receive a cam K mounted on said shaft. A cam follower roller K' is also secured to the portion J' within said slot so that the rotation of said cam will raise and lower the flexible diaphragm I'. The upward movement of the diaphragm will compress the air in the cylinder I which is conducted through a flexible tube L to the tube or tubes D in the pockets of the envelop A. The cam K is so fashioned as to raise the rod J and diaphragm I' in a predetermined portion of its cycle to retain it in raised position for another interval, to then lower the diaphragm to its original position, and to maintain it lowered during another portion of the cycle. A particular cycle which I have found desirable is one in which the diaphragm is raised during a period of eight seconds, is held in such raised position for six second, is gradually lowered through another six seconds, which leaves a period of twenty-five seconds of the forty-five seconds cycle. The advantage of this cycle is that for more than one-half the time the pressure is atmospheric, producing no inflation of the tubes D or contraction of the envelop and avoiding interference with other natural functions of the body, such as that of arterial circulation within the body produced by heart action. Nevertheless in the active portion of the cycle the contraction of the garment will force flow of fluid in the venous or lymphatic systems. The operation may be controlled by merely turning on or off an electric switch so that the patient without the service of an attendant may treat himself. The radial pressure on the body is varied, being highest in the portion farthest from the heart as fully described in my Patent No. 2,747,570, Serial No. 430,770.

A patient may have a single envelop surrounding a small portion of the body, such as a leg, or this may be extended to cover a greater portion or separate envelops may be simultaneously applied to arms and legs. It is, therefore, necessary that the volume of air compressed should be sufficient for the greatest extent of coverage and without objectionably altering the cycle where the extent of coverage is varied. This is accomplished by forming the cylinder I of sufficient dimensions for the maximum capacity and by providing a pressure relief valve for the surplus compressed air not required. As specifically shown in FIG. 3, the air from the cylinder I passes upward through a conduit M to a T-fitting M' which is connected at one end of the head of the T to the flexible conduit L. The opposite end of the T-head is connected to a valve casing N which contains a ball check valve N' biased by a spring N^2 to engage a seat N^3 closing the valve. The spring is loaded to a predetermined pressure by an abutment N^4 threadedly engaging the casing and a lock nut N^5 holds said abutment in adjusted position. An exhaust port N^6 in the portion

of the casing beyond the valve permits the escape of surplus air. There is also an air inlet port N^7 on the opposite side of the valve N' which is normally closed by the ball check valve N^8. In operation the air displaced by the diaphragm I' in its upward movement will rise in pressure but not higher than that determined by the pressure relief valve N'. At the same time air passing through the flexible tube L will inflat the tube or tubes D or one or more of the envelops depending upon the number used, causing contraction of the same with the resulting radial inward pressure against the body. This occurs during the first fourteen seconds of the cycle, the pressure being gradually released during the next six seconds and dropping to atmospheric pressure for the remaining portion of the forty-five seconds cycle. During the downward movement of the diaphragm air which has escaped through the pressure relief valve N' will be replaced by air entering the port N^7 and lifting the check valve N^8.

What I claim as my invention is:

Means for stimulating fluid flow in animal bodies comprising an envelop adapted to fit about and in contact with a portion of the body, means for circumferentially contracting said envelop and alternately releasing in successive uniformly timed cycles, means for timing within said cycles periods of contraction at one predetermined rate and periods of release at a second independent predetermined rate, in which said means for contraction and release includes a cam operable against a flexible diaphragm to urge said diaphragm to predetermined positions corresponding to the cam surface, the pressures in said envelop being variable corresponding to the position of said diaphragm.

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