

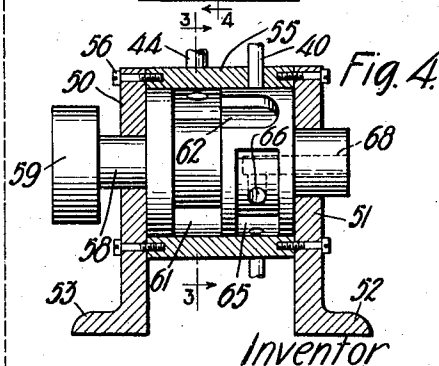
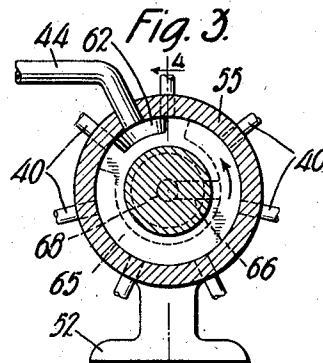
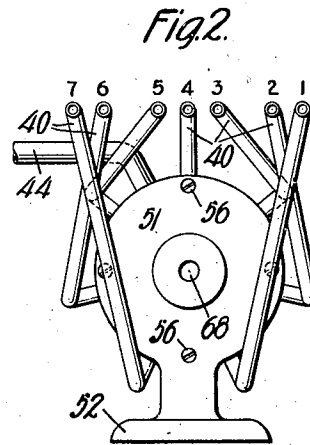
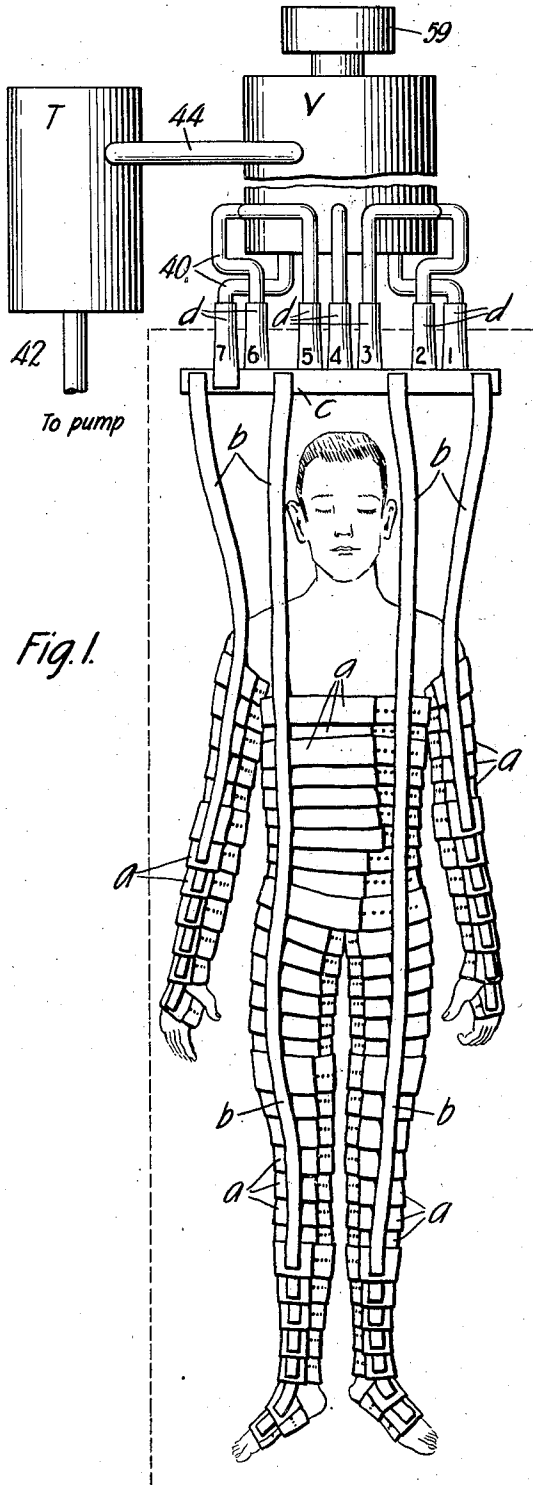
Nov. 23, 1926.

1,608,239

J. ROSETT
THERAPEUTIC DEVICE

Filed Dec. 9, 1925

4 Sheets-Sheet 1



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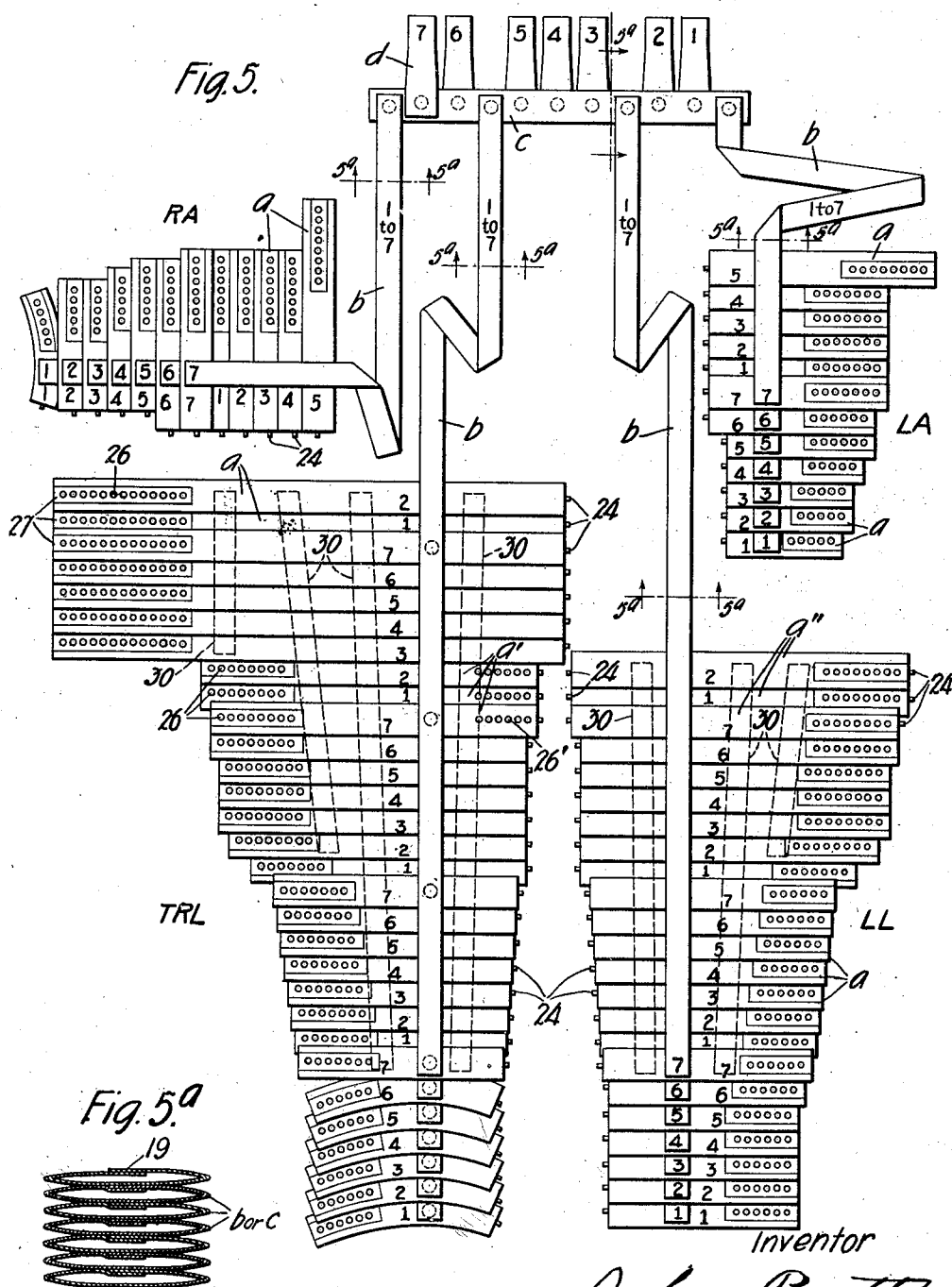
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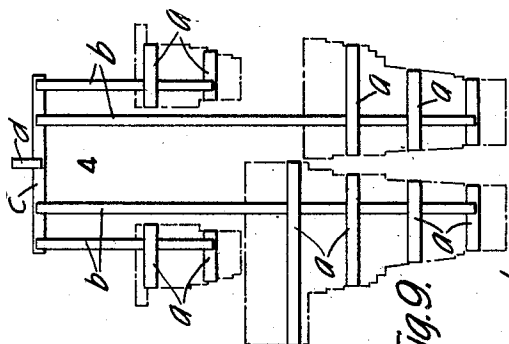


Fig. 9.

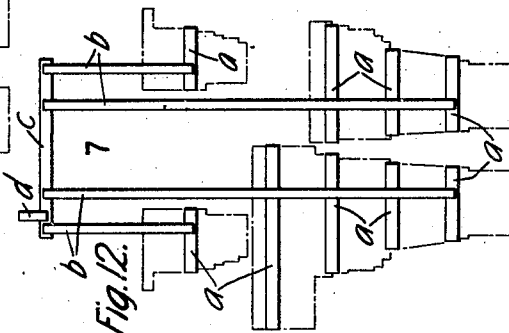


Fig. 12.

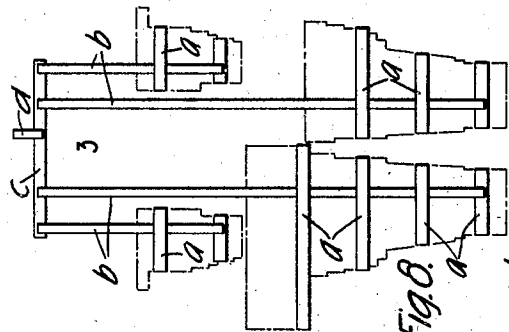


Fig. 8.

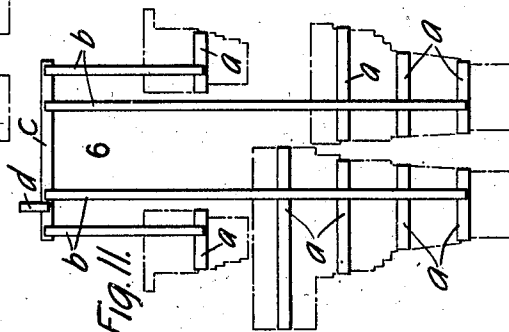


Fig. 11.

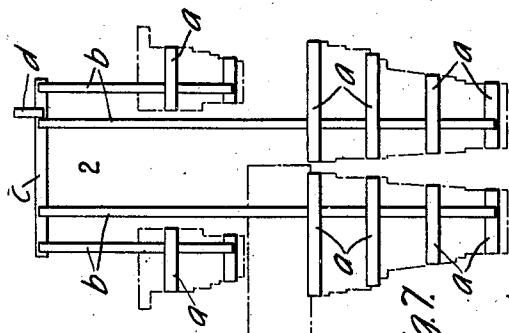


Fig. 7.

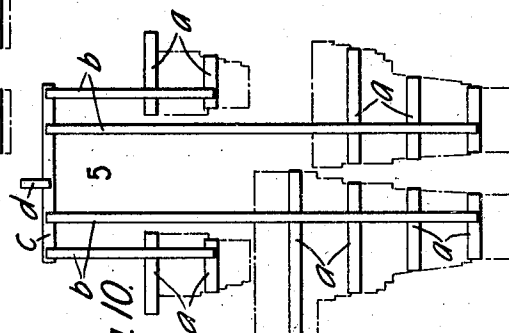


Fig. 10.

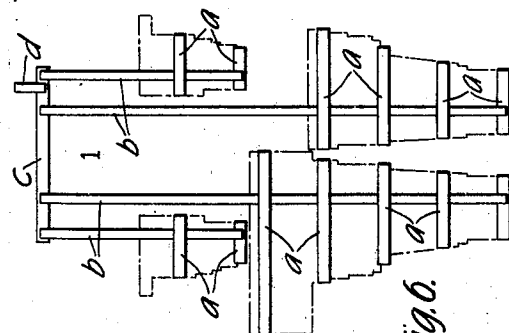


Fig. 6.

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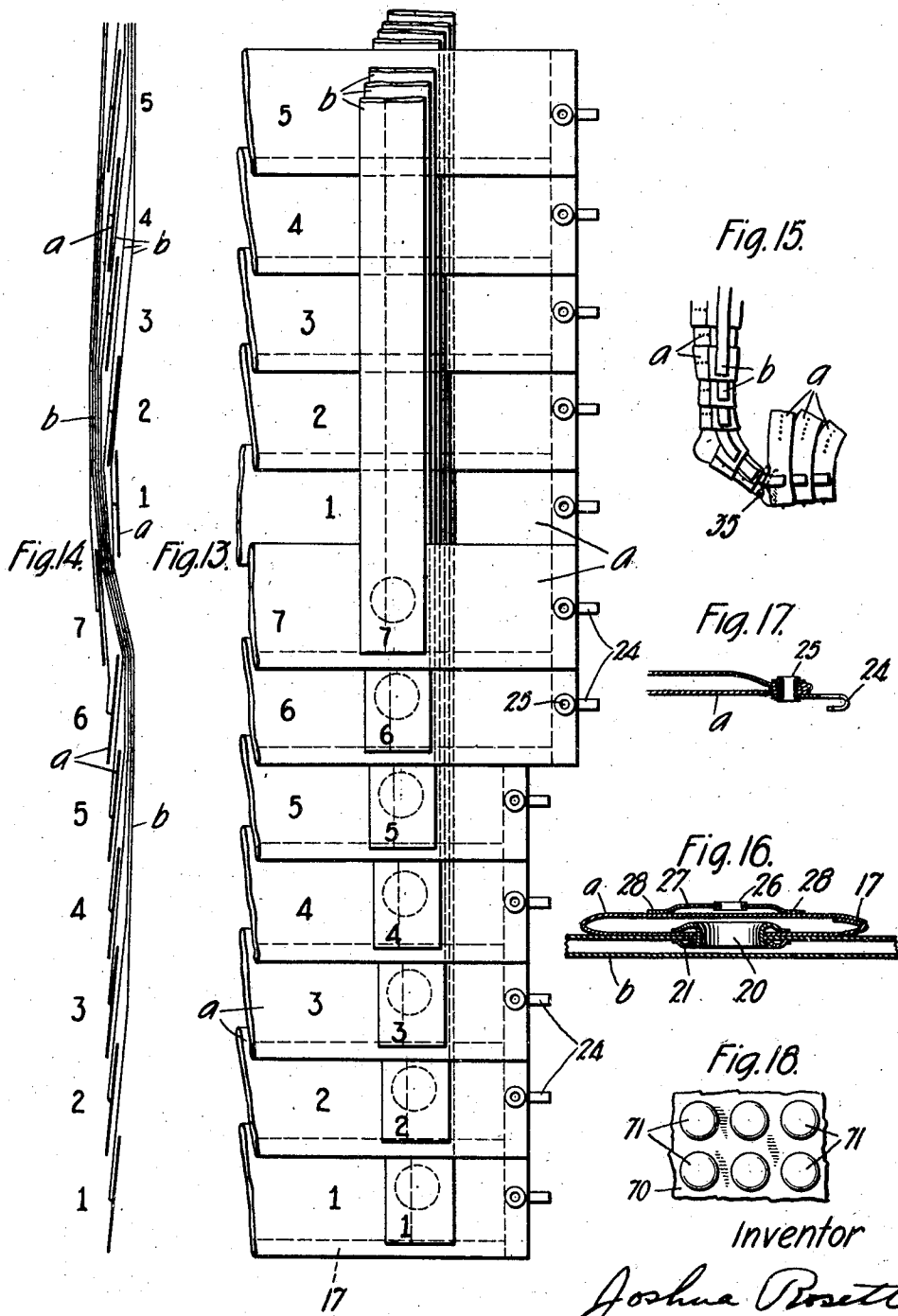
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1,608,239

J. ROSETT
THERAPEUTIC DEVICE

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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE.

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THERAPEUTIC DEVICE.

Application filed December 9, 1925. Serial No. 74,265.

This invention relates to therapeutic devices and particularly to a device for assisting in the circulation of the blood or for massaging the human body.

5 The general object of the invention is to provide means for relieving to a certain extent the work of the heart, where such relief is necessary, by propelling the venous blood of the body surface from the limbs and from
10 the trunk toward the heart; and also for increasing the general nutrition of the body, in cases where this is desirable, by a systematic kneading of the tissues and consequent enhancement of circulation of the fluids in
15 the lymphatic spaces.

Generally speaking, the device comprises what may be considered a pneumatic suit or garment adapted to be applied to the trunk and limbs of the patient. This pneumatic
20 suit comprises or has embodied in it, collapsible transverse or circumferential tubes to which air under pressure may be admitted, in such a manner as to inflate the tubes one after another in groups so as to cause the
25 garment to exert waves of pressure from the extremities of the limbs and from the lower portion of the trunk of the patient towards the region of the heart. The compressed air for operating the garment may be supplied
30 from any suitable source, through a valve mechanism which is preferably automatically operated and serves to admit the compressed air to and allow it to escape from the tubes of the garment in proper sequence
35 in all of the groups of such tubes. For convenience in handling the garment and applying it to a patient, it is preferably divided into a plurality of sections surrounding the trunk and limbs of the patient. There are
40 preferably four of such sections, two of which respectively surround the arms of the patient, one of which surrounds the trunk and one leg of the patient, and the other of which surrounds the other leg of the patient.
45 In each of these sections the transverse collapsible tubes are arranged in groups; and corresponding transverse tubes of the various groups are simultaneously inflated and deflated so as to cause said tubes to exert
50 waves of pressure as hereinbefore mentioned. The compressed air for inflating the transverse tubes is preferably supplied to them through longitudinal tubes, that is, tubes ex-

tending longitudinally of the body of the patient and projecting beyond his shoulders
55 and head. When the garment is made with four sections, as above described, four sets of such longitudinal tubes are preferably provided, and in each such set of longitudinal tubes, there is one tube extending to and
60 connected with all of the corresponding transverse tubes in each group of transverse tubes in that section. For example, if (as in the garment hereinafter described) there are
65 seven transverse tubes in each group, there will be seven longitudinal tubes leading to each section of the garment; and, if there are four sections of the garment, there will be
70 four such groups of seven longitudinal tubes. For convenience, the corresponding longitudinal tubes leading to the four sections of the garment may be connected together so
75 that they will be simultaneously supplied with compressed air; the number of tubes through which the compressed air is supplied from the source to the garment being
thus reduced to the number of transverse tubes in the groups of such tubes, that is, seven in the case of the garment hereinafter
80 described.

The suit or garment comprising the present invention may be made of any suitable material and may be designed in many different ways without departing from the
85 spirit of the invention. In practice, it has been found that such a garment may advantageously be made of a fine air-tight textile fabric such as rubberized silk or cotton. Such material provides tubes which are readily
90 inflated and deflated, and being substantially inelastic insures that the tubes will, when inflated, exert the desired pressure upon the surface of the body of the patient.

The invention will be understood from the following description of a preferred embodiment thereof, illustrated in the accompanying
95 drawings, in which—

Figure 1 is a plan view, more or less diagrammatic in character, showing a garment
100 embodying the invention applied to a patient, and connected with a suitable source of compressed air;

Figure 2 is an end elevation of a valve mechanism for controlling the supply of
105 compressed air to the garment and the release of such air therefrom;

Figure 3 is a sectional elevation through said valve mechanism on the line 3—3 of Figure 4;

Figure 4 is a longitudinal sectional elevation through said valve mechanism on the line 4—4 of Figure 3;

Figure 5 is a plan view, somewhat diagrammatic in character, of the outside of a garment spread out on a flat surface;

Figure 5^a is a section on an enlarged scale on the line 5^a—5^a of Figure 5;

Figures 6 to 12 are diagrammatic plan views showing how the corresponding transverse tubes in the various sections of the garment are related to their longitudinal tubes, and how such assemblages of such transverse and longitudinal tubes are related to one another in the completed garment;

Figure 13 is a fragmentary view of a portion of one of the sections of the garment, showing the relation between the transverse and longitudinal tubes;

Figure 14 is a diagrammatic sectional elevation of that portion of the garment shown in Figure 13, illustrating how the longitudinal tubes may be arranged with reference to the transverse tubes;

Figure 15 is a fragmentary side view of the lower portion of a leg and foot of a patient, showing how certain of the transverse tubes may be left unused, when the garment is applied to a patient of short stature;

Figure 16 is a transverse sectional elevation through a transverse tube, a longitudinal tube and a portion of the fastening device, illustrating the construction of the garment at these points;

Figure 17 is a fragmentary sectional elevation of one end of a transverse tube *a* illustrating a hook forming part of the fastening device; and

Figure 18 is a fragmentary view of a union suit studded with buttons for use with the garment under some conditions.

The garment embodying the invention, best illustrated as a whole in Figs. 1 and 5 of the drawings, comprises transverse tubes *a*, longitudinal tubes *b*, cross tubes *c*, and intake or coupling pipes *d*. As will be apparent from Figure 5, the transverse tubes *a* are arranged in four sections, viz, section RA intended to be secured around the right arm of the patient; section LA applicable to the left arm of the patient; section TRL applicable to the trunk and right leg of the patient; and section LL applicable to the left leg of the patient. In each of these sections, the transverse tubes are arranged in groups of seven so far as possible, and the corresponding transverse tubes *a* of the various groups are connected to a corresponding longitudinal tube *b*, of which there are seven extending to each section of the garment. These seven longitudinal tubes *b*, extending to the four sections of the gar-

ment, are connected to seven corresponding cross tubes *c*, each of which is provided with a coupling pipe *d*. In order to indicate graphically how the transverse tubes *a*, longitudinal tubes *b*, cross tubes *c* and coupling pipes *d* are related, numerals 1 to 7 are used in Figures 5, 13 and 14 of the drawings, to indicate that those tubes and pipes bearing the same numeral are connected to one another. For example, in each section of the garment, all of the transverse tubes *a* bearing the numeral 7 communicate with a longitudinal tube *b* bearing the numeral 7; and all four of such longitudinal tubes communicate with a cross tube *c* bearing the numeral 7, which communicates with a coupling pipe *d* bearing the numeral 7. Figures 6 to 12 show diagrammatically how the various sets of tubes making up the garment may be made so that when superimposed one upon another, with the cross tubes *c* and the longitudinal tubes *b* directly on top of one another, the transverse tubes *a* will be arranged in slightly overlapping relation as shown in Figure 5. That is, Figure 6 shows all of the tubes *a*, *b* and *c*, and the coupling pipe *d* bearing the numeral 1; Figure 7 shows all of the tubes *a*, *b* and *c*, and the coupling pipe *d*, bearing the numeral 2; Figure 8 shows all of the tubes *a*, *b*, and *c*, and the coupling pipe *d*, bearing the numeral 3, etc. However, of course, it is to be understood that the number of transverse tubes in a group may be fixed at some number other than seven, for example, six or eight, without departing from the principle involved.

Having thus explained the theory upon which a garment embodying the invention may be constructed, the detailed construction of the particular garment illustrated in the accompanying drawings will now be explained. As hereinbefore stated, the various tubes may conveniently be made of rubberized silk or cotton. As best shown in Figure 16, the transverse tubes *a* of such material may be made by folding a strip thereof longitudinally and then folding over and cementing one free edge thereof upon the other, as shown at 17 in that figure. The ends of said tubes may also be closed in a similar manner. The tubes *b* and *c* may be constructed in the same way, or as illustrated in Figure 5^a, which shows the edges of the fabric overlapped and cemented along one side as indicated at 19, instead of along the edge of such tubes.

Communication between the transverse tubes *a* and the longitudinal tubes *b*, and between the longitudinal tubes *b* and the cross tubes *c*, and between the cross tubes *c* and the coupling pipes *d* may be readily effected by means of metal eyelets as shown in Figure 16. In this figure, the flange end sleeve portion of the eyelet is shown at 20

and the ring portion thereof at 21, these parts being crimped together in a well-known manner with the fabric of the adjacent walls of the tubes *a* and *b* between them. The fabric of the tubes is pierced for the reception of the eyelets, and the eyelets are inserted and crimped, before the edges of the fabric are cemented together at 17 or 19 (Figures 16 and 5^a) to form the tubes. Other methods, however, of providing communication between tubes *a* and *b*, *b* and *c*, and *c* and *d* may be used, the particular one just described being merely illustrative of a construction that has been found satisfactory.

In order to provide for the securing of the transverse tubes *a* around the trunk and limbs of the patient, adjustable means must be provided for securing the ends of these tubes together. Obviously, various forms of such securing means may be employed. In the garment illustrated in the drawings, this means comprises a hook 24 secured by an eyelet 25, or in any other suitable manner, to one end of each tube *a*; and a series of eyelets 26, which may be inserted in a fabric strip 27 secured by cement at its edges 28 to the outside of the transverse tube *a*, as best shown in Figures 5, 16 and 17.

In making up the garment, it will be found convenient to assemble the corresponding transverse tubes *a*, longitudinal tubes *b*, cross tubes *c* and coupling tubes *d* as illustrated in Figures 6 to 12. After the corresponding transverse tubes *a* have been thus secured to their longitudinal tubes *b* at proper distances from the cross tubes *c*, the sets of tubes shown in Figures 6 to 12 may be assembled, to form the garment shown in Figure 3, by superimposing the cross tubes *d* and the longitudinal tubes *b*. The manner of superimposing these sets of tubes is best shown in Figures 13 and 14, which may be considered as representing one of arm sections RA of the garment. It will be noted from Figures 13 and 14 that the transverse tubes *a* are in overlapping relation. It will also be apparent from Figure 14, how the longitudinal tubes *b* are arranged with reference to the transverse tubes *a*. In order to maintain the proper relation between the various sets of tubes shown in Figures 6 to 12, after they are assembled into the garment, the overlapping edges of the transverse tubes *a* are preferably cemented together for some distance each side of the longitudinal tubes *a*; and the longitudinal tubes *b* are also cemented to one another at various points about midway of their width. In order to further assist in holding the transverse tubes *a* in proper relation to one another, strips 30 of fabric may be cemented to the tubes, on the outer side thereof, as shown in Figure 5.

In this way, the four sections, RA, LA,

TRL and LL of the garment are given sufficient stability to permit their being handled with ease. Inasmuch as not more than two of the cross tubes *c* and not more than two longitudinal tubes *b* in each section are inflated at any one time, as hereinafter explained, no difficulty arises from the fact that these tubes are cemented to one another. In order to facilitate application of the transverse tubes *a* to the feet and hands of the patient, the last few of such tubes at the end of each section of the garment, are left free and uncemented to one another along their edges, as shown in Figure 5 at the ends of sections RA and TRL.

Of course, it is desirable that the garment be capable of use with patients of different stature. Persons of different statures, of course, have different lengths of trunk and arms and legs, which means that tall patients require the use of more transverse tubes *a* than short patients. For general use, the garment must have sufficient transverse tubes *a* to be capable of use with a tall person, that is, someone somewhat over 6 ft. in height. The adjustment of such a garment to a short person is easily made, as far as arms and legs are concerned, by closing off with a clamp 35, as shown in Figure 15, those transverse tubes *a* which are located beyond the end of the arms and legs, thereby leaving these transverse tubes inactive. Adjustments for different lengths of trunk are also easily made by designing the trunk portion of the garment, that is, the upper portion of the section TRL, so as to fit a short person, say one about 5 ft. 3 in. tall, and by using for the lower part of the trunk of a tall person, one or more of the transverse tubes *a* which form the upper parts of the thigh sections of the garment when it is applied to a short person. The manner in which the trunk portion of the garment is thus lengthened for tall persons will be apparent from Figure 5, in which the upper three transverse tubes *a'* in the section TRL are provided with eyelets 26' which may be engaged by the hooks 24 on the ends of the three upper transverse tubes *a''* in the section LL, thereby in effect combining the three upper tubes in each leg section of the garment into three tubes capable of surrounding the trunk of the patient. The three upper transverse tubes in the section LL are provided with auxiliary hooks 24', which are adapted to engage the eyelets 26 on the tubes *a'* of the section TRL, when these tubes are used around the trunk of the patient instead of around his thighs. Thus, with tall patients as many of the upper thigh tubes *a'* and *a''* as may be necessary are converted into tubes capable of surrounding the trunk of the patient.

With the aid of Figures 1 to 4, one means for supplying compressed air to the gar-

ment for the proper use thereof will now be described. This means may take many forms and the one hereinafter described is to be considered as merely illustrative. As has been hereinbefore mentioned, compressed air at suitable pressure must be supplied to and relieved from the coupling pipes *d* one after another, so as to inflate and deflate the seven transverse tubes one after another in the various sections of the garment. It is desirable that the expansion of each transverse tube *a* shall take place before the preceding transverse tube *a* has begun to collapse, and as soon as the expansion of a tube has been accomplished the air in the preceding adjacent transverse tube should be promptly released. This method of inflating and deflating the transverse tubes *a*, is accomplished by the apparatus which will now be explained.

Referring to Figure 1, the patient is shown as lying upon a table or bed with the garment properly applied. When so arranged, the cross tubes *c* are beyond the head of the patient, and the coupling tubes *d* are in position to be attached to pipes or tubes 40 leading to a distributing valve V which will be hereinafter described. A supply of compressed air may be obtained from any suitable pump (not shown), from which it may pass through a pipe 42 to a storage tank T, from which it may pass through a pipe 44 to the distributing valve V. The construction of this distributing valve V is shown in Figures 2, 3 and 4. As shown in those figures, said valve comprises a casing composed of ends 50 and 51, substantially circular in shape but provided with feet 52 and 53, said ends being bolted to a cylindrical shell 55 by means of bolts 56. These seven pipes 40, communicate with openings in the shell 5 spaced at equal angular distances around the circumference of said shell as best shown in Figure 3. The pipe 44 leading to the air storage tank T also communicates with an opening in the shell 55 but at a point longitudinally at some distance from the openings with which the pipes 40 communicate. Within the casing formed by the end members 50 and 51 and the shell 55, is a rotating valve member, the shaft 58 of which is journaled in the end members 50 and 51. Said shaft 58 carries a pulley 59 by which it may be rotated by hand or any suitable source of power not shown. As best shown in Figure 4, the rotating member of the valve is grooved as indicated at 61 opposite the point where the pipe 44 communicates with the casing. Communicating with this groove 61, is a longitudinally extending cavity 62 in the cylindrical face of that portion of the rotating valve member which is opposite the points at which the pipes 40 communicate with the valve casing. This portion of the rotating valve member is also

provided with a circumferentially extending cavity 65, from which extends an exhaust passage formed by the radial hold 66, and the axial hold 68 in the rotating valve member. The length of the cavities 62 and 65 on the circumference of the rotating valve member will be apparent from Figure 3. From this figure it will be evident that the cavity 62 is capable of spanning the distance between the two adjacent pipes 40, thereby insuring that compressed air from the pipe 44 will be admitted to a pipe 40 before said supply of compressed air is cut off from the previous pipe 40. It will also be apparent from Figure 3, that the cavity 65 is of sufficient length so that it will permit air to exhaust from each pipe 40 soon after compressed air has been admitted to the succeeding pipe 40. Assuming that the rotating portion of the valve revolves in the direction indicated by the arrow in Figure 3, it will be apparent that compressed air will be admitted by this valve mechanism successively to the pipes 40 and will be allowed to exhaust therefrom, so as to cause the desired inflation and deflation of the transverse tubes *a* which are in communication with said pipes 40 through the longitudinal tubes *b*, cross tubes *c* and coupling pipes *d*. In the operation of the device, the rotating member of the valve mechanism V may be driven at any desired speed depending upon the rate at which it is desired to apply waves of pressure to the surface of the body of the patient. For example, the rotating member of the valve may be driven at a rate of from 15 to 20 revolutions per minute.

The manner in which the garment is applied to a patient will be obvious. After being spread out upon a table or bed, with the side opposite to that shown in Figure 3 uppermost, the patient is placed thereon and the various transverse tubes *a* are fastened around his trunk, legs and arms, by means of the hooks 24 and eyelets 26. Adjustment to make the garment fit the particular patient being treated may be made in the manner hereinbefore described; and any transverse tubes *a* at the ends of the various sections of the garment which are not in use, may be rendered inoperative by means of clamps 35, as shown in Figure 15. Compressed air may then be supplied to the garment under the control of the valve V, and the treatment of the patient may be continued as long as it is thought desirable. When used for the kneading of the tissues of the body, the effect of the garment is preferably enhanced by clothing the patient with a union suit 70 studded on the inside with padded buttons 71, as shown in Figure 18, the garment being then applied over this suit.

It will be noted that the comfort of the patient during treatment is prompted by the fact that, although he is almost com-

pletely encased in the garment, he is nevertheless free to move his arms and legs and even his body to a considerable extent, because the longitudinal tubes through which the compressed air is supplied and exhausted extend upwardly over the chest and shoulders of the patient, and being flexible do not prevent his movement.

It is, of course, to be understood that the embodiment of the invention herein described is merely illustrative and that it may be modified in many respects without departing from the spirit of the invention as defined in the claims hereto appended.

What is claimed is:

1. In a therapeutic device adapted to be applied to the body of a patient, a garment containing transverse collapsible inelastic tubes adapted to surround the body, and means for repeatedly inflating and deflating said tubes one after another so as to cause them to exert waves of pressure upon the surface of the body from the extremities toward the upper part of the chest.

2. In a therapeutic device adapted to be applied to the body of a patient, a garment containing groups of transverse collapsible inelastic tubes adapted to surround the body, and means for successively inflating and deflating the tubes in each group one after another so as to cause them to exert waves of pressure upon the surface of the body from the extremities toward the upper part of the chest.

3. In a therapeutic device adapted to be applied to the body of a patient, a garment containing a plurality of collapsible inelastic tubes, means for securing each tube around the body of the patient, longitudinal tubes connected to said transverse tubes, and means for temporarily inflating said transverse tubes one after another through a medium under pressure supplied through said longitudinal tubes.

4. In a therapeutic device adapted to be applied to the body of a patient, a garment containing transverse collapsible inelastic tubes adapted to surround the body and arranged in a plurality of sections which surround various parts of the body, and means for repeatedly inflating and deflating said tubes one after another in each of said sections.

5. In a therapeutic device adapted to be applied to the body of a patient, transverse collapsible inelastic tubes adapted to sur-

round the body and arranged in a plurality of sections surrounding the trunk and limbs of the patient, the tubes in each section being arranged in groups, and means for inflating and deflating the corresponding tubes of the various groups one after another so as to cause said tubes to exert waves of pressure upon the surfaces of the trunk and limbs of the patient from the extremities toward the upper part of the chest.

6. In a therapeutic device adapted to be applied to the body of a patient, transverse collapsible tubes arranged in groups and adapted to surround the trunk and limbs of the patient, longitudinal tubes connected to corresponding transverse tubes in said groups, and means for temporarily furnishing compressed air through said longitudinal tubes to said transverse tubes, whereby the latter are inflated and deflated one after another in the several groups.

7. In a therapeutic device adapted to be applied to the body of a patient, transverse collapsible tubes arranged in a plurality of sections surrounding various parts of the body, the transverse tubes in each section being arranged in groups, longitudinal tubes connected to corresponding transverse tubes in the groups of each section, and means for temporarily furnishing compressed air through said longitudinal tubes to said transverse tubes one after another, whereby the tubes of each group are inflated and deflated one after another so as to cause them to exert waves of pressure upon the surface of the body.

8. In a therapeutic device adapted to be applied to the body of a patient, a garment containing transverse collapsible tubes, certain of which are adapted to surround the arms of the patient, certain of which are adapted to surround the trunk of the patient, certain of which are adapted to surround the legs of the patient, and certain of which may be united so as to surround the trunk and may be used separately so as to surround the legs of the patient; and means for inflating and deflating said tubes one after another in groups so as to cause them to exert waves of pressure upon the surface of the body in a direction from the extremities towards the upper part of the chest of the patient.

In testimony whereof, I have affixed my signature to this specification.

JOSHUA ROSETT.