May 9, 1939. S. BENSON 2,157,395

MECHANICAL MASSAGING APPARATUS

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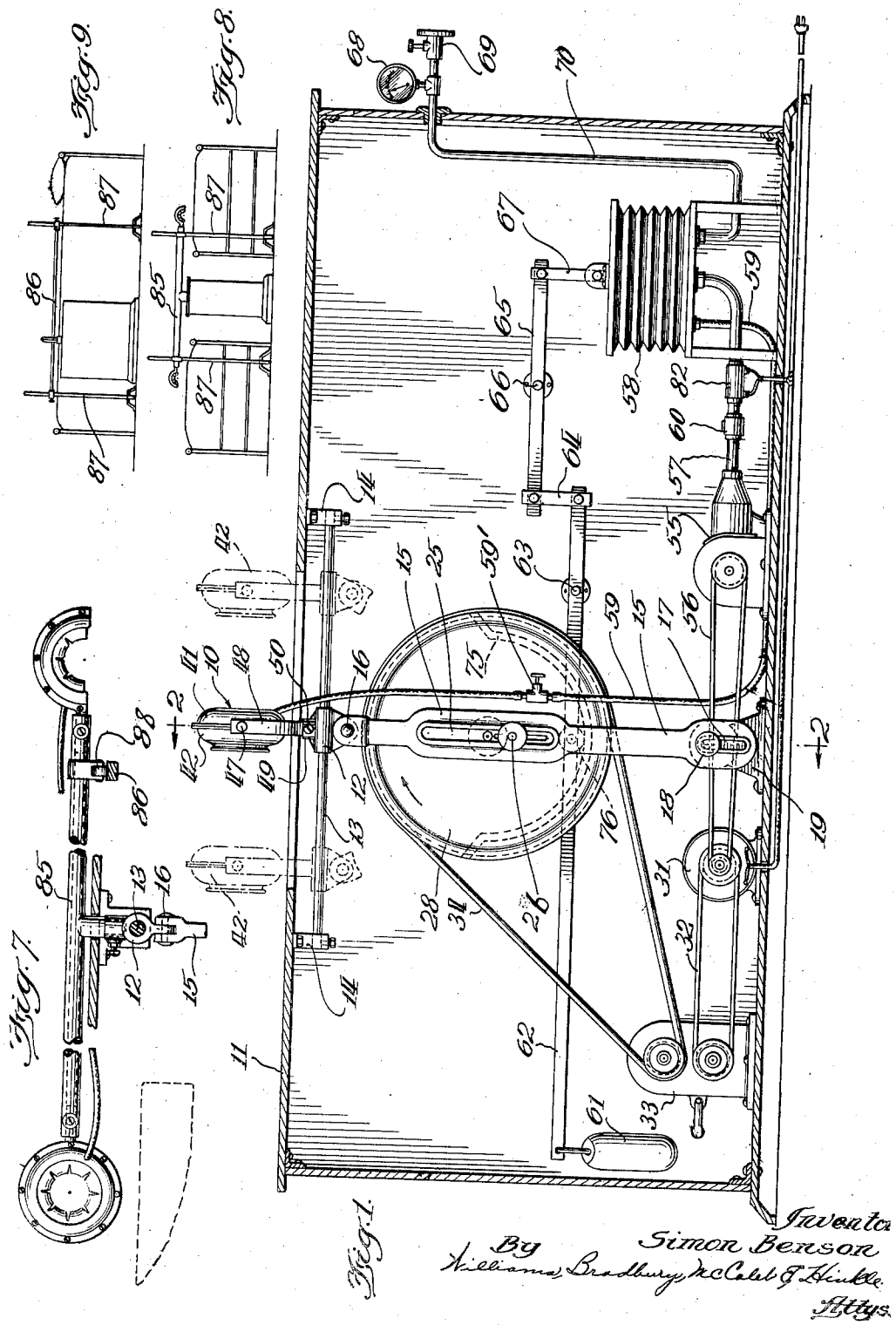


Fig. 1.

Fig. 7.

Fig. 8.

Fig. 9.

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Fig. 2.

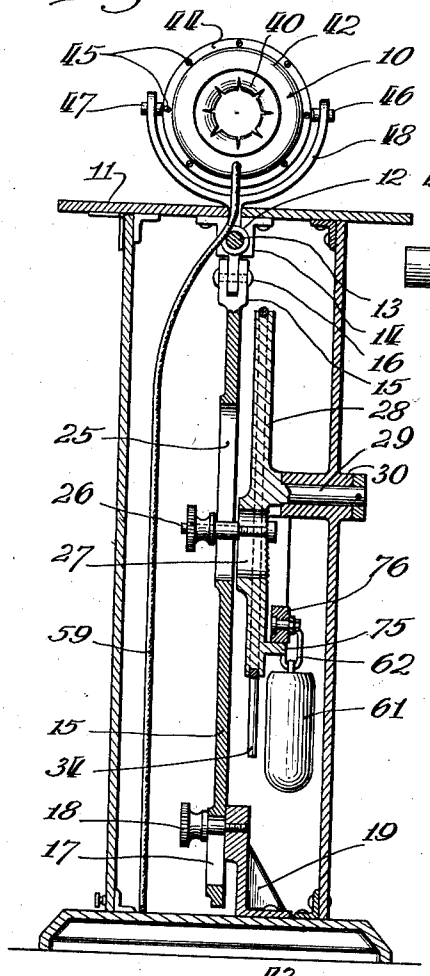


Fig. 3.

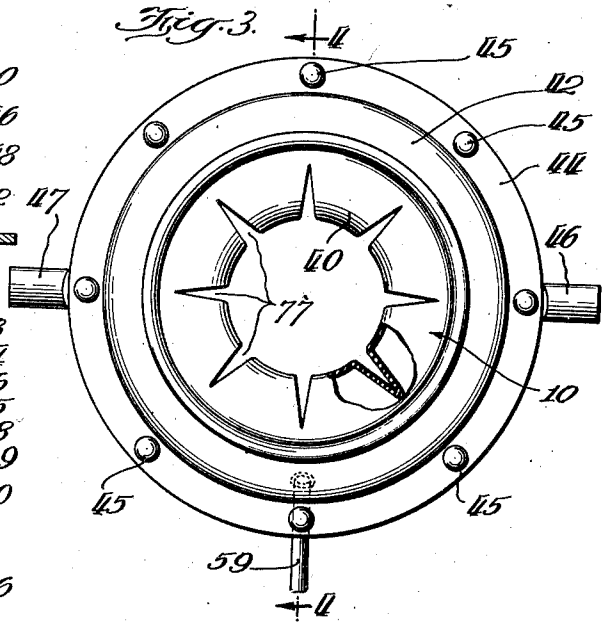
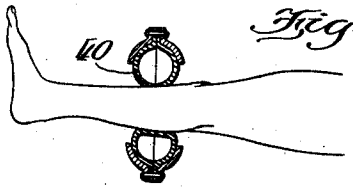


Fig. 5.



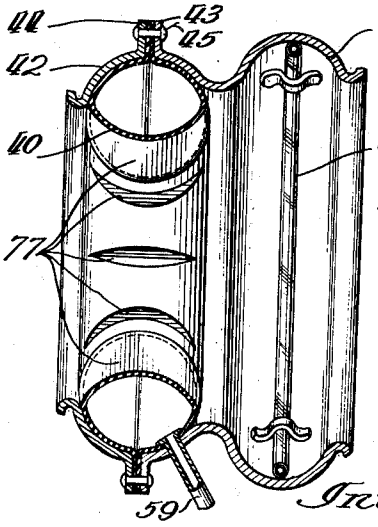


Fig. 6.

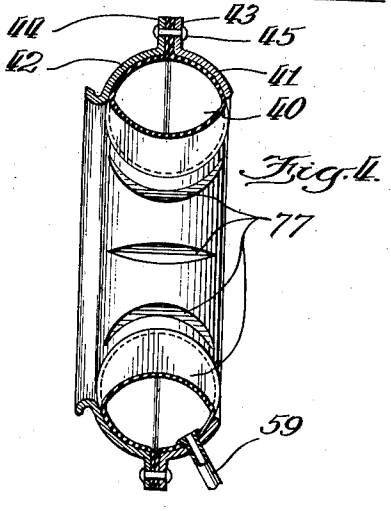


Fig. 4.

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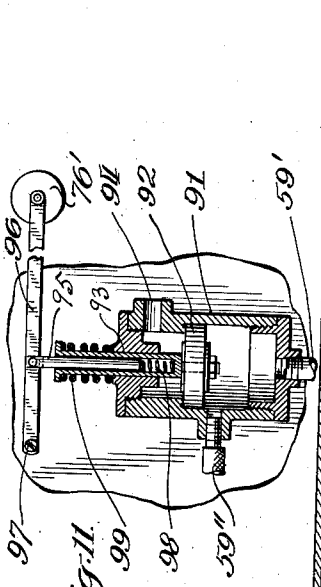


Fig. 11.

Fig. 10.

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MECHANICAL MASSAGING APPARATUS

Simon Benson, Chicago, Ill.

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12 Claims. (Cl. 128—52)

My invention relates to mechanical massaging apparatus.

One of the objects of the invention is to provide an improved motor-driven massaging apparatus.

Another object is to provide a massaging apparatus which will apply a predetermined pressure substantially uniformly, regardless of the variations in the size of the member—due to its shape—being massaged.

Another object is to provide an apparatus particularly adapted to apply the pressure periodically and in one direction only—e. g., toward the patient's body—relatively little, if any, pressure being applied upon the return stroke—e. g., away from the patient's body.

Another object is to provide an improved pressure-applicator.

Another object is to provide an apparatus particularly adapted for the massaging of arms and legs.

A further object is to provide a massaging apparatus which is effective and reliable.

Other objects and advantages will hereinafter appear.

In the accompanying drawings:

Fig. 1 is a vertical section through the enclosing cabinet, the mechanism being shown in side elevation;

Fig. 2 is a section on the line 2—2 of Fig. 1;

Fig. 3 is an enlarged front elevation of one form of the improved pressure-applicator;

Fig. 4 is a section on the line 4—4 of Fig. 3;

Fig. 5 is a small-scale cross-sectional view of a pressure-applicator as applied to a leg;

Fig. 6 is a modified type of applicator adapted to apply heat as well as pressure;

Fig. 7 is an end elevation and partial section of a modification adapted for administering massage to two patients at the same time; it also shows on the right a modified pressure-applicator;

Fig. 8 is as mall-scale showing, in end elevation, of a single apparatus arranged simultaneously to treat two patients on adjacent beds;

Fig. 9 is a side elevation of the arrangement shown in Fig. 8;

Fig. 10 is a vertical section through the enclosing cabinet of a modified construction, and

Fig. 11 is an enlarged section of a detail of this modification.

In general, the apparatus comprises an encircling pressure applicator 10, adapted to reciprocate in a substantially straight line, together with the mechanism for driving it to and fro over a set distance at a predetermined but adjustable rate, and for insuring that it applies uniformly a predetermined pressure throughout each stroke in one direction only,—relatively little or no pressure being applied during each return stroke. The operative mechanism, with the exception of the applicator, may be carried within and by a suitable cabinet 11.

The applicator, which will be hereinafter described in detail, is carried by a head 12 mounted to slide upon a guide 13 located below the top or cover of the cabinet. Guide 13, which may be in the form of a straight cylindrical rod, is suspended from the top of the cabinet and held parallel thereto by a pair of brackets 14. An actuator arm 15 is pivotally connected to head 12 by a suitable pin 16 and has its lower end equipped with a slot 17. A pivot stud 18, which threads into a bracket 19 fixed to the bottom of the cabinet, cooperates with slot 17 to provide a fulcrum for the lower end of arm 15 which will permit the upper end of the arm to move in the straight line necessitated by its connection there to head 12.

Intermediate its ends, arm 15 is provided with a slot 25 which slidably accommodates a stroke-adjusting bolt 26. Bolt 26 also passes through a slot 27 in a driving pulley 28, which has its axle 29 journaled in a suitable fixed bearing 30 carried by the cabinet. Through the adjustment afforded by slots 25 and 27, the radial distance between bolt 26 and the axis of pulley 28 may be varied to change the length of the strokes of head 12. Pulley 28 is rotated by a motor 31 through a belt 32, suitable clutch, speed change and reduction mechanism 33 and a belt 34.

The preferred form of applicator which is shown enlarged and in detail in Figs. 3 and 4, is a flexible hollow ring 40 made of rubber or other suitable material and capable of being inflated like a pneumatic tire. The hole through the center is for receiving the member to be treated and enable the applicator to embrace the member and, when inflated, exert the desired pressure thereon.

This inflatable ring is carried within and by a rigid annular rim or frame which is shown as made of two sections 41 and 42 having flanges 43 and 44 respectively, to receive assembly bolts 45 and clamp a fold or bead of the inflatable ring therebetween, as most clearly shown in Fig. 4. One of the flanges has trunnions 46 and 47 projecting therefrom and these trunnions are journaled in the arms of a U-shaped bracket 48. Bracket 48 is attached, either permanently or

removably as desired, to head 12. In the preferred embodiment shown, head 12 is provided with an upstanding socket 49 adapted to receive a suitable lug projecting downwardly from the middle of bracket 48,—the lug of the bracket being held in the socket of the head by a set screw 50.

Applicator 40 is arranged to be inflated with air from a suitable source, such as a compressor 55 which may be driven by motor 31 through a belt 56. A suitable clutch of any appropriate type may be inserted in the drive between motor 31 and compressor 55—say at the belt pulley of the motor or of the compressor—so that the supply of air may be stopped whenever desired without stopping the motor and the reciprocation of the applicator. The outlet or supply connection of the compressor is connected by a pipe 57 to a pressure equalizer 58 and the applicator is connected to the equalizer by a suitable flexible connection, such as an air hose 59. A check valve 60 may be inserted between the compressor and equalizer to permit the ready flow of air to the equalizer but prevent its escape back through the compressor when the compressor is stopped. If desired, a suitable adjustable pressure regulator 59' may be inserted in the air line between the equalizer and the applicator to govern the air pressure—particularly maximum pressure—to which the applicator may be subjected.

Pressure equalizer 58 may be in the form of a bellows suitably biased or urged toward contracted or collapsed condition so that it will, in effect, float upon the air line between the applicator and compressor,—expanding as the pressure tends to rise and contracting as the pressure tends to fall. Thus, with the applicator applied to one part of the member to be treated—say the ankle—and inflated so as to exert the desired pressure, it will be distorted as it moves up the leg—the diameter of the leg of course increasing and varying. This distortion of the applicator will vary the bore and consequently the volume thereof and tend to vary the pressure exerted thereby upon the member. However, the equalizer expanding and contracting as the variations occur—in effect breathing—will maintain the pressure substantially constant. This biasing may be provided by a weight 61 hung—adjustably if desired—upon the end of a lever 62. Lever 62 is carried by the cabinet upon a fixed pivot 63 and is connected by a link 64 to a lever 65. Lever 65 is carried by the cabinet upon a fixed pivot 66 and is connected by a link 67 to the top movable head of bellows 58. A suitable gage 68 and adjustable safety or pressure limiting valve 69 may be connected to the air supply line by a pipe 70 and located outside of the cabinet for ready observation and manipulation.

In order that the desired massaging pressure may be applied during only one stroke of each reciprocation of the applicator, a cam 75 is provided upon pulley 28. This cam, which extends over a sufficient arc of the pulley to insure pressure release during return strokes of the applicator, is adapted to engage a cam roller 76 carried by lever 62. Thus, assuming that pulley 28 is rotated in the direction of the arrow, cam 75 is in contact with roller 76 during that part of a revolution in which the applicator is traveling its return stroke (e. g., away from the patient's body), so that the left end of the lever 62 is elevated irrespective of the action of weight 61 and its right end is depressed. The depression of the right end of lever 62 raises the right end of lever 65, expanding the equalizer bellows and thereby reducing the pressure within the applicator. In this manner the massaging-pressure reduction on the return stroke of the applicator may be relatively as little as desired, reduced, if required, practically to zero. However, during the rest of the revolution of pulley 28, during which the applicator is traveling its active stroke (e. g., toward the patient's body) cam roller 76 is free from cam 75 and weight 61 is able to influence bellows 58 to afford the pressure equalization heretofore mentioned.

In order that the pressure exerted by the applicator may be quite independent of the elasticity of the material of which it is composed and, consequently, more accurately controlled and equalized, the applicator may be molded or otherwise formed in somewhat pie-shaped sectors by wedge-shaped slots 77 which extend outwardly from its bore, as most clearly shown in Figs. 3 and 4. Such formation or shape may be secured and ordinarily inherently follows if the applicator is constructed of a straight piece of tubing bent into ring shape. When so formed, the distortions of the applicator are accommodated in large measure by relative movements of the sectors among themselves and less by the mere contraction and stretching of the elastic material of which it is composed. The friction between the applicator and the member or part being treated and any objectionable pull may be suitably reduced by greasing the contacting surface of the applicator with a suitable lubricant, such as petroleum jelly.

An air-inflated, pressure-equalized flexible applicator of the type described is easy to apply and adjust and readily accommodates itself to variations in the size and shape of the members being treated so that relatively equal pressure is exerted throughout the circumference of any member and maintained substantially constant throughout each active stroke.

Fig. 6 shows how the apparatus may be provided with a heater for applying heat as well as pressure. For example, one of the applicator-attaching rim sections may be formed into a reflector 80 and a suitable electrical heater 81, such as a coil of resistance wire, mounted therein. With such an arrangement heat may be applied to the member simultaneously with the pressure. The air supplied to inflate the applicator may be pre-heated, if desired, in any suitable manner, such, for example, as an electrical resistor heater 82 surrounding the pipe 57.

Figs. 7, 8 and 9 illustrate how the apparatus may be constructed to treat patients who cannot readily be moved from the bed or cot on which they lie and how more than one applicator may be operated by a single actuating mechanism. Thus, the crosshead 85 may be substituted for the single U-shaped bracket heretofore described and an applicator may be carried by each end thereof, thereby making accommodation for the treatment of two patients at the same time if desired. The applicator shown at the left of Fig. 7 is of the complete ring type heretofore described. Sometimes, however, it may be inconvenient or impossible to use a complete ring—for example, it may be impossible to elevate the patient's arm or leg even the short distance required to insert it into the bore of the ring. Under such conditions it may be advisable to use only a partial ring applicator such as shown at the right. When such a partial ring applicator is used, it may be necessary to hold the extension arm of the

crosshead especially rigid against the pressure applied largely in one direction. This rigidity can be assured by providing a track 86 supported upon adjustable standards 87 and extending along the bed or treatment table. Each extension arm may be equipped with a roller 88 adapted to bear and ride upon the supporting track.

In operation, the apparatus is properly located relative to the patient and the member to be treated is inserted through the bore of the applicator. Ordinarily this can best be done before the applicator is inflated. With the clutch of the reduction gearing disconnected, the motor and compressor may be started and the applicator inflated until the gage indicates the desired pressure. The compressor may now be disconnected and the reciprocation started. The rotation of the driving pulley 28 causes the applicator to be reciprocated with a length of stroke for which adjustment was made by the position of the bolt through the slot of the actuating arm. As the applicator passes along the member in the direction of the body, pressure is applied—the pressure being maintained substantially constant irrespective of the changes in the size of the member by the equalizer, as heretofore described. Should the equalizer fail to operate properly or for any other reason should the pressure tend to become excessive, the pressure regulator or relief valve will permit sufficient air to escape to bring the maximum down to the desired level. When the applicator has reached the end of its active stroke and starts to return, the pressure control cam on the driving pulley acts upon the equalizer to extend it beyond its normal expansion and thereby relieve the pressure within the applicator until the active stroke is again started.

Figs. 10 and 11 show a modification of the means for insuring pressure reduction on the return strokes of the applicator. In this construction the equalizer is biased toward contracted position by a suitable spring 90, which may be made adjustable in various approved ways, in order to change the sensitiveness and range of equalization after the manner of the adjustable weight in the construction previously described. The air line from equalizer to applicator is in two sections, 59′ and 59″, connected by a relief valve 91, a form of which is shown in detail in Fig. 11. The action of this relief valve is controlled by the cam 75′ on driving pulley 28′. The valve has a closure disc 92, mounted upon a hollow valve stem 93, and a venting port 94. Stem 93 slidably carries a push rod 95 which is pivotally attached to a lever 96. Lever 96 has a fixed pivot 97 at one end and carries a cam roller 76′ at its other end,—which cam roller is in the path of cam 75′ on pulley 28′. A cushioning spring 98 is interposed between the inner end of rod 95 and the bottom of the socket in the stem 93 to cushion the impact of the valve disc when it is pushed down and strikes the lower seat in the valve casing. A biasing spring 99 normally holds stem 93 in its outward or upward position, with the valve disc in the location shown in Fig. 11. In this condition the air line is complete or open from the equalizer to the applicator. This is the condition when the cam is out of engagement with the cam roller. When, however, the rotation of pulley 28′ brings cam 75′ into contact with cam roller 76′, then the outer end of lever 96 is depressed and valve disc 92 is pushed downwardly or inwardly until it seats, thereby interrupting or closing the air line from the equalizer and venting the applicator through vent port 94.

In operation, the rotation of the driving pulley 28′ reciprocates the applicator back and forth in the manner previously described. During the active strokes of the applicator the air line thereto from the equalizer is open and the applicator is inflated to the predetermined pressure desired. And this pressure, because of the action of the equalizer, is substantially maintained regardless of variations in the distortion and compression of the inflated applicator. On the return strokes cam 75′ engages cam roller 76′, causing the air line to be interrupted and the applicator to be vented,—thereby releasing the pressure in the applicator so that the applicator, during its return strokes, does not exert the same pressure upon the member being treated as during the active strokes. In order to replenish the air lost by the venting of the applicator during the return or inactive strokes, the compressor should, preferably, be operated and connected to the equalizer continuously during a treatment.

Although the applicators have been described and possibly their greatest utility will be attained in the treatment of arms and legs, it will be readily understood that, by suitably enlarging them, they may be made applicable to the body of a patient.

Having thus illustrated and described the nature and preferred embodiments of my invention, what I claim and desire to secure by United States Letters Patent is as follows:

1. A massaging apparatus comprising a pneumatic pressure-applicator, driving mechanism for reciprocating the applicator, means for applying air pressure to the applicator, and means for automatically decreasing the air pressure upon the applicator during one stroke only of each reciprocation thereof.

2. A massaging apparatus comprising an inflatable pressure-applicator, driving mechanism for reciprocating the applicator, a source of air pressure connected to the applicator to inflate the same, an equalizer for maintaining the air pressure substantially constant irrespective of variations in the distortion of the applicator, and means for automatically decreasing the air pressure upon the applicator during one stroke of each reciprocation thereof.

3. A massaging apparatus comprising an inflatable pressure applicator adapted when inflated to embrace and exert pressure upon a member to be treated, driving mechanism for reciprocating the applicator at a predetermined rate, a source of air pressure connected to the applicator to inflate the same, an equalizer for maintaining the air pressure within the applicator substantially constant during one stroke of each reciprocation thereof irrespective of variations in the distortion of the applicator, and means controlled by the driving mechanism for automatically causing the equalizer to decrease the air pressure within the applicator during the other stroke of each reciprocation.

4. A massaging apparatus comprising an air inflated applicator for applying pressure to a patient, means for reciprocating the applicator, to and fro over a part of the anatomy of the patient, and means for automatically maintaining a substantially constant air pressure within the applicator during increases and decreases in the volumetric capacity thereof caused by distortion due to variations in the size of the part of the patient encountered during the to and fro movements thereof.

5. A massaging apparatus comprising an in-

flatable pressure-applicator, driving mechanism for reciprocating the applicator, means for varying the lengths of the strokes of the applicator, a source of air pressure, an air line between the source of air pressure and the applicator, a pressure equalizer located in the air line to maintain a substantially constant air pressure in the applicator regardless of distortion of the applicator, and a pressure release acting automatically to reduce the pressure in the applicator during one stroke of each reciprocation thereof.

6. A massaging apparatus comprising an inflatable pressure-applicator, driving mechanism for reciprocating the applicator in a substantially straight path, a source of air pressure, an air line between the source of pressure and the applicator, and a pressure equalizer located in the air line and acting automatically to maintain a substantially constant air pressure in the applicator regardless of distortions thereof due to variations in the size of the member being treated.

7. A massaging apparatus comprising an inflatable pressure applicator, driving mechanism for reciprocating the applicator, a source of air pressure, an air line between the source of air pressure and the applicator, a pressure equalizer interposed in the air line between the source and the applicator, and means acting upon the equalizer to cause it to reduce the pressure in the applicator during one stroke of each reciprocation thereof.

8. A massaging apparatus comprising an inflatable pressure applicator, driving mechanism for reciprocating the applicator, a source of air pressure, an air line between the source of air pressure and the applicator, a pressure equalizer interposed in the air line between the source and the applicator, and means for automatically venting the applicator during one stroke of each reciprocation thereof.

9. An applicator for a massaging apparatus comprising an inflatable body shaped in the form of at least a partial ring and composed of flexible rubber-like material, said body being sub-divided into segment-shaped sectors and for at least partially encircling a part of a patient's body and exerting inwardly directed pressure by application of the inner surface of the ring against the patient.

10. A massaging apparatus comprising a ring-shaped hollow inflatable applicator composed of flexible material which, when the applicator is inflated, will directly and intimately contact a portion of a patient's anatomy and exert an inwardly directed pressure thereon by the action of the flexible material thereagainst, means for inflating the applicator to cause the flexible material thereof to exert the desired pressure upon the patient, and means for causing the applicator to reciprocate between predetermined regions of a patient's anatomy.

11. An applicator for at least partially encircling a part of a patient and for use with a massaging apparatus, comprising a ring-shaped support which axially is unobstructed indefinitely in both directions, and a hollow inflatable member carried by and lying within the curve of the support, said member being composed of flexible rubber-like material in the shape of an annulus, the inflation of said member causing the material thereof directly and intimately to contact the patient and exert thereon a distributed pressure inwardly toward the center.

12. An applicator for a machine for massaging a part of a patient's anatomy, comprising a support in the form of at least a partial ring which axially is unobstructed indefinitely in both directions, and a hollow inflatable body carried by and lying within the curve of the support, said body being composed of flexible material in the shape of at least a partial ring, the inflation of said body causing the material of which it is composed directly and intimately to contact the patient and exert thereon a distributed inwardly directed pressure.

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