

June 18, 1963

C. H. LOGAN ET AL  
THERAPEUTIC APPARATUS

3,094,116

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2 Sheets-Sheet 1

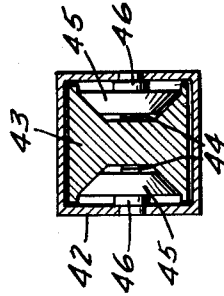
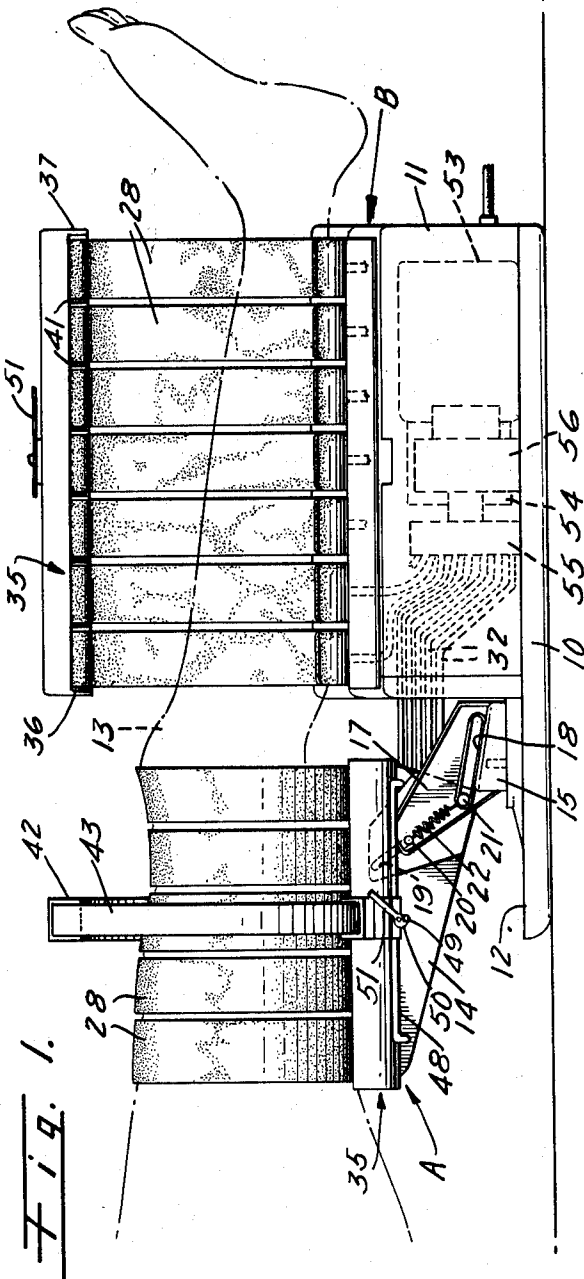


Fig. 5.

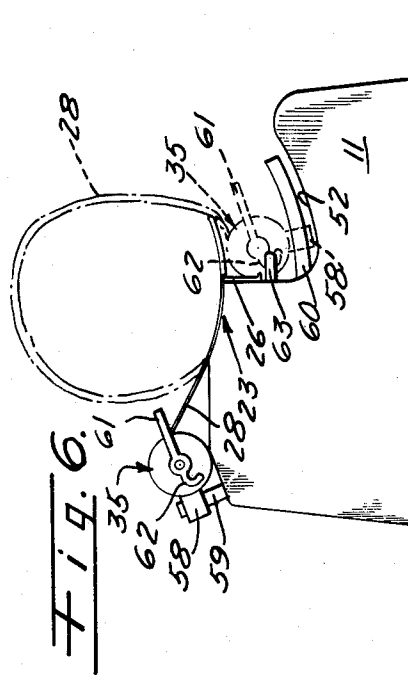


Fig. 6.

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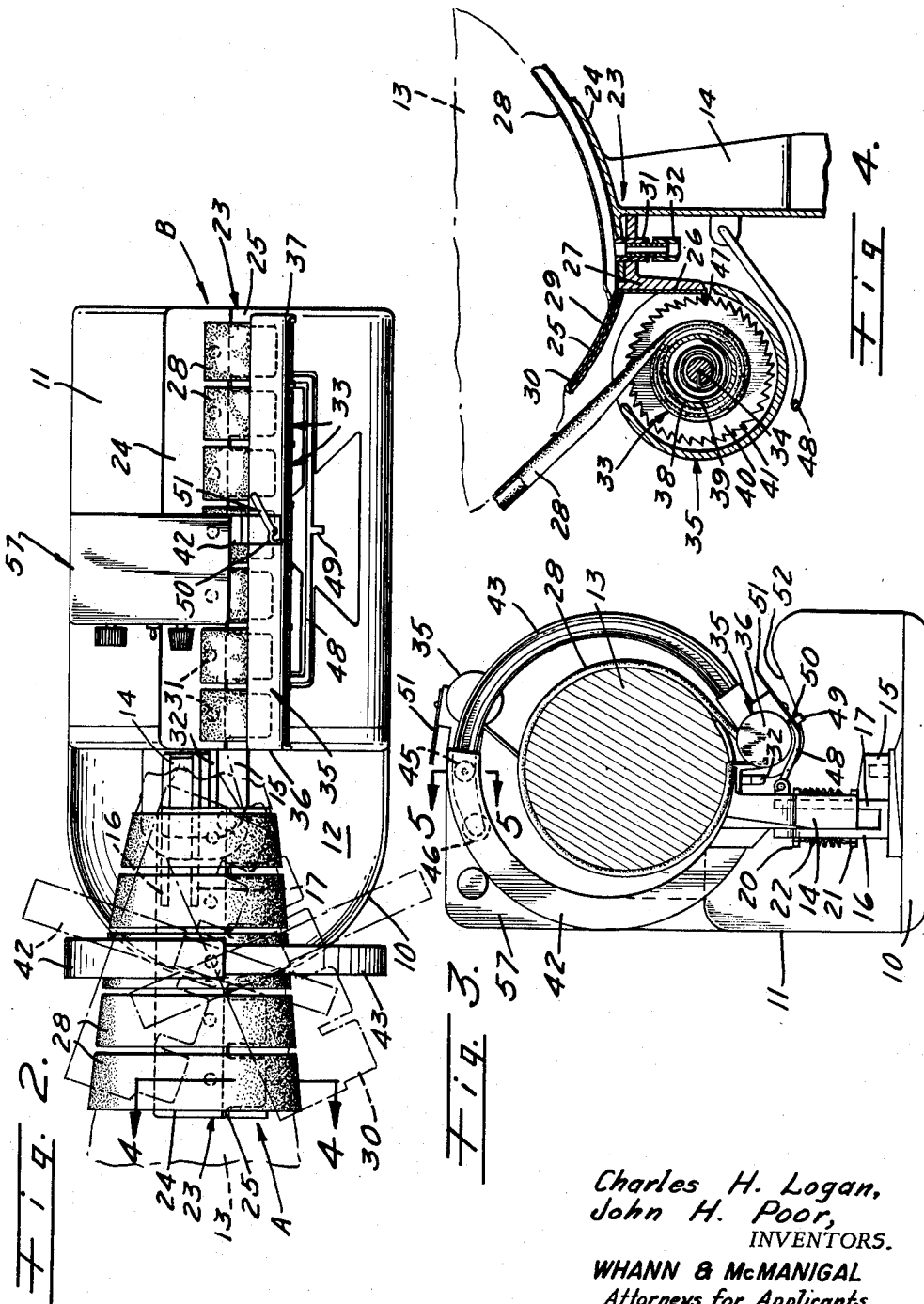
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3,094,116

## THERAPEUTIC APPARATUS

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The present invention relates generally to therapeutic apparatus, and is more particularly concerned with apparatus for the treatment of certain vascular diseases due to impaired or deficient circulation, as well as the treatment of certain muscular conditions of the human body.

In its broad concept, the present invention relates to apparatus of the character disclosed in United States Letters Patent of Henry I. Poor No. 2,533,504, entitled Therapeutic Apparatus. In the patented structure, as well as similar conventional apparatus, it has been the usual practice to provide a separate unit which housed the mechanism for providing and connecting a fluid pressure source to a plurality of inflatable bands or cuffs of a separate independent boot unit which could be applied to an extremity of the human body, such as a leg or limb to be treated.

While the conventional arrangements, and particularly the arrangement of the above mentioned patent, have been extremely successful in the results obtained in the treatment of the human body, the apparatus has been more or less cumbersome to handle and set up for administering the treatment. For example, long connections were required between the pressure source unit and the boot. Also, considerable time and patience were required to properly connect and adjust the individually connectible cuffs or inflatable members of the boot.

Having the foregoing in mind, the herein described invention has for one object the provision of unitized apparatus for the purpose described, in which a housing for a fluid pressure source and distributing mechanism is utilized to support a cradle adapted to receive a body extremity thereon for treatment, this cradle being fitted with one or more cuffs or elongate inflatable members which are adapted to be tensioned over the body extremity and selectively inflated and deflated.

A further object is to provide an apparatus of the character described for treating an extremity of the human body, associated fixed and adjustable cradles to facilitate the treatment of jointed extremities.

Another object is to provide in such apparatus improved means for applying the cuffs or inflatable members to the body extremity, and in which the cuffs or inflatable members will be automatically tensioned.

It is also an object to provide therapeutic apparatus utilizing a plurality of cuffs or inflatable members which may be applied simultaneously to a body extremity having portions of different size, and wherein the cuffs or inflatable members on the different size portions will be independently accommodated and tensioned.

Further objects of the invention will be brought out in the following part of the specification, wherein detailed description is for the purpose of fully disclosing preferred embodiments of the invention without placing limitations on the scope of the invention defined in the appended claims.

Referring to the drawings, which are for illustrative purposes only:

FIG. 1 is a side elevational view of therapeutic apparatus according to the present invention, a body extremity, in this case a leg, being shown in phantom lines;

FIG. 2 is a plan view of the same, and showing the lateral adjustment of the adjustable cradle thereof;

FIG. 3 is an end elevational view, as seen when looking towards the left end of FIG. 1;

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FIG. 4 is an enlarged fragmentary sectional view taken substantially on line 4—4 of FIG. 2, and showing details of the reel structure for the inflatable members or cuffs;

FIG. 5 is an enlarged transverse section, taken substantially on line 5—5 of FIG. 3 to disclose certain constructional details; and

FIG. 6 is an end view of a modified structure.

Referring more specifically to the drawings, the therapeutic apparatus of the present invention is disclosed in FIG. 1 as comprising a unitized structure which is readily susceptible of embodiment into a portable unit, whereby the treatment of vascular diseases and muscular conditions may be more effectively and expeditiously accomplished.

For illustrative purposes, the apparatus is shown as comprising a bottom base member 10 having a hollow housing portion 11 secured to and extending above a portion of its upper surface. This housing portion does not extend the entire length of the base member but is so arranged as to leave a projecting base platform 12 at one end upon which there is supported an adjustable cradle structure as generally indicated at A, while a fixed cradle structure as generally indicated at B is provided and supported on the housing portion 11.

The provision of cooperatively associated fixed and adjustable cradle structures is of particular benefit in the treating of a body extremity having jointed sections, such as a limb or leg as shown in phantom lines and indicated by the numeral 13. Since the treatment components and their manipulation as associated with the cradle sections are substantially similar, the description in this connection will be primarily confined to the adjustable cradle and the elements associated therewith.

The adjustable cradle structure A includes a cantilever beam support 14 which tapers from its innermost end towards its outermost end. The cradle structure is supported at the innermost end of the beam 14 upon a swingably mounted bracket 15 which is pivoted on the platform 12 and provided with spaced apart upwardly inclined arms 16 and 17 (FIG. 3). These arms are respectively provided with an elongate slot 18 which is slightly outwardly and upwardly inclined with respect to the horizontal, the slots of the spaced arms being in transverse alignment. The associated end of the beam 14 is provided with an elongate slot 19 which is more acutely inclined with respect to the horizontal. A fixed guide pin 20 extends through the slot 19 and has its ends fixedly mounted at the outer ends of the arms 16 and 17, while a pin 21 is fixedly supported in the associated end of the beam 14, this pin having its ends respectively slidably mounted in the slots 18—18 of the arms 16 and 17. Tension springs 22—22 are respectively positioned outwardly of the arms 16 and 17 and interconnect the ends of the pins 20 and 21. The beam 14 is thus supported for movement in two planes, namely a vertical plane and a horizontal plane, which in effect permits a universal adjustment of the adjustable cradle structure A.

The beam support 14 extends along and is connected with a cradle tray 23 of generally transversely concave configuration so as to comfortably support the limb or other extremity thereon. The tray is shown as being composed of two sections, a section 24 which may be integrally formed with the beam support 14, and a section 25 which may be formed with an attaching flange 26 which is shown as being secured to an angle frame member 27 associated with the beam 14.

For treatment of the body extremity supported on the cradle tray 23, provision is made for applying a plurality of inflatable members or cuffs 28 which are arranged in side by side relation longitudinally of the tray, and adapted to be applied and tensioned around the body extremity to be treated. Each of the cuff members comprises an elongate tube which is preferably closed at one

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end and provided with an end pocket 29 which may be slipped over one of a plurality of thin finger extensions 30 formed along one edge of the tray section 25 to anchor the cuff thereon. Adjacent the anchored end of each cuff, there is provided a tubular inlet stem 31 which

Each cuff is arranged to be sealed off at its other end by winding this end upon a winding reel, as generally indicated at 33. The respective reels for the inflatable cuff members are mounted in end-to-end alignment for independent rotation on a common shaft 34 which extends axially within a reel housing frame structure 35, this housing having closed ends 36 and 37 which respectively provide supports for the ends of the shaft 34. Each of the reels is constructed with an axially extending tubular hub 38 upon which the cuff is adapted to be wound. This hub also forms a housing for a coiled spring 39 surrounding the shaft and having one end secured to the shaft and the other end to the hub in such a manner that the reel is rotationally biased in a winding direction. One end of each reel is constructed to provide an end member 40, the periphery of which is serrated so as to form circumferentially therearound a plurality of teeth 41.

By providing a unitary housing support for the reels of the respective cuffs, means are provided whereby a plurality of cuffs may be simultaneously manipulated and applied to the body extremity to be treated, the cuffs being independently unwound from their respective reels as the reel housing is moved from one side of the cradle tray to the other. This movement serves to apply the cuffs to the body extremity, each cuff being properly tensioned and fed from the roll so as to accommodate it to the particular configuration of the body extremity to which it is being applied. After the cuffs are applied, it is only necessary to provide suitable means for securing the housing and retaining the reels against further rotational movement. The mechanism for accomplishing this purpose will be subsequently described.

In order to guide the movement of the reel housing from one side of the cradle tray to the other during the application of the cuffs to the body extremity thereon, one construction, as utilized in the apparatus shown in FIGS. 1 to 3, comprises an arcuate pedestal 42 which is secured at its lowermost end at one side of the cradle tray 23 and extends upwardly so that the uppermost end thereof is positioned substantially above the longitudinal axis of the tray. The pedestal is substantially semicircular and of tubular construction, as shown in FIG. 5 to form in effect a housing within which an arcuate substantially semicircular arm member 43 is supported for translatory movement from a retracted position in which its outermost end is adjacent the elevated end of the pedestal 42, to an extended position in which the outermost end thereon is adjacent the opposite side of the cradle tray from that on which the pedestal is positioned.

Various arrangements may be provided for supporting the arm member for movement within the arcuate pedestal. One arrangement, as shown in FIG. 5, is to provide the arm member with lateral arcuate grooves 44 having appropriately bevelled side walls, these grooves being arranged to receive therein bevelled guide rollers 45—45 supported for rotation on axle members 46 secured to the opposite side walls of the pedestal structure at the elevated end thereof, as shown in FIG. 3. The inner end of the arm 43 is also shown as being provided with an end roller 46 which is supported for rotation about a transversely extending axis so that the roller may engage either the inner or outer walls of the pedestal housing during movement of the arm between the retracted and extended positions.

The frame structure 35 is secured intermediate its ends to the outer end of the arm member 43, and as shown in

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FIGS. 3 and 4, movement of the arm 43 to extended position will carry the frame structure 35 to a position below the tray section 25 where it is latchingly anchored with the peripheral teeth 41 of the respective reel members engaged by an edge flange 47 formed on the attaching flange 26. The reels are thus held against further rotation. Various means may be provided for anchoring the reel housing in this position. One arrangement is to provide a bail member 48 which is pivotally supported on an adjacent frame portion for swinging movement to a position extending below the associated reel housing, the bail member having a projecting lug 49 intermediate its ends, which is adapted to be engaged by hook 50 of a pivotally mounted latching member 51 carried by the connection between the arm 43 and the frame structure 35.

As previously mentioned, the fixed cradle structure B is supported on the top of the housing portion 11, and in order that the frame structure 35 may pass below the associated tray section 25, the upper surface of the housing is suitably deformed to provide a longitudinally extending depression as indicated by the numeral 52.

The apparatus disclosed herein is unitized into a portable device in which the housing portion 11 contains the instrumentalities for producing and distributing the pressurized fluid to the inflatable cuff members 28 associated with the adjustable cradle structure A and the fixed cradle structure B. Briefly these instrumentalities are similar to those described in the above mentioned U.S. Letters Patent No. 2,533,504 and comprise a motor 53 which drives a suitable air compressor 54 to provide the pressurized fluid for use in the apparatus. Pressurized fluid is distributed through supply conduits 32 respectively to the inflatable cuff members 28 by means of a distributor 55 which is shown as being of the rotary type and driven by a separate motor 56. This distributor is arranged to cyclically control the inflation and deflation of the cuff members. For convenient access, the control instrumentalities for the compressing and distributing units are disclosed as being provided in a control box 57 mounted on the arcuate pedestal 42 which is associated with the fixed cradle structure B.

Referring now to FIG. 6, there is disclosed a simplified embodiment wherein the frame structure 35 is manually manipulated from one side of the cradle tray to the other in order to associate and disassociate the inflatable members 28 with the body extremity to be treated. In other words, in this embodiment the mechanical guiding members comprising the pedestal 42 and arm member 43 have been eliminated.

In this arrangement, the frame structure 35 is provided with a projecting lug 58 which is arranged to receive therein an upstanding projecting pin 59 which normally retains the frame structure 35 in the full line position as shown on one side of the cradle tray, when the apparatus is not being used. When applying the inflatable members or cuffs 28 to a body member for purposes of treatment, the reel housing is manually moved by the practitioner so as to apply the inflatable members around the body extremity and in so doing unwind the members from their associated reels. The reel housing is moved to the position shown in dotted lines, in which position the lug 58 may be guided over an arcuate projecting guide member 60 which guides the reel housing to a position under the adjacent edge of the cradle tray. Various means may be utilized to anchor the reel housing in this position. In the illustrated embodiment, this is accomplished by providing a U-shaped bail 61 having ends which are pivotally mounted at the axis of the reel housing and fitted with projecting hooks 62 for engagement in each case with a suitable anchor member 63 fixedly secured to the adjacent surface of the housing 11.

Various modifications may suggest themselves to those skilled in the art without departing from the spirit of our invention, and hence, we do not wish to be restricted to

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the specific form shown or uses mentioned, except to the extent indicated in the appended claims.

We claim:

1. Therapeutic apparatus, comprising: a base structure having a cradle portion adapted to receive and support a body extremity thereon for treatment; a plurality of elongate inflatable cuffs each having a portion attached to said cradle; means for wrapping free portions of said cuffs around said body extremity; and means for cyclically inflating and deflating said cuffs while applied to the body extremity.

2. Therapeutic apparatus, comprising: a base structure having a fixed cradle portion and an adjacent adjustable cradle portion, said cradle portions being adapted to receive and support thereon different parts of a body extremity for treatment; a plurality of elongate flexible inflatable tubular members, certain of said members being attached at one end to the fixed cradle portion, and others each being attached at one end to the adjustable cradle portion; means for selectively applying the free portions of the members associated with each cradle portion around the associated body extremity portion thereon; and means for inflating and deflating said members.

3. Therapeutic apparatus, comprising a base structure having a cradle portion adapted to receive and support a body extremity thereon for treatment; a plurality of elongate flexible inflatable cuffs extending transversely of said cradle portion in side-by-side relation, each of said cuffs being anchored on said base structure; and means for simultaneously applying and tensioning said cuffs over the periphery of said body extremity.

4. Therapeutic apparatus, comprising: a base structure having a cradle portion adapted to receive and support a body extremity thereon for treatment; a plurality of elongate flexible inflatable cuffs attached adjacent one set of their ends to said base portion; a plurality of spring biased reels having free portions of said cuffs respectively wound thereon; and means for moving said reels for unwinding said cuffs and applying them around said body extremity in side-by-side relation.

5. Therapeutic apparatus, comprising: a base structure having a cradle portion adapted to receive and support a body extremity thereon for treatment; a plurality of elongate flexible inflatable cuffs anchored adjacent one set of their ends to said base portion; a plurality of spring biased reels having free portions of said cuffs respectively wound thereon; means for moving said reels to unwind said cuffs and apply unwound portions thereof around said body extremity in side-by-side relation; and means for releasably securing said reels to said base structure in the unwound position of said cuffs to retain them around the body extremity.

6. Therapeutic apparatus, comprising: a base structure; a cradle adapted to receive and support a body extremity thereon for treatment; and means connecting said cradle to said base structure for adjusting movements including a swivelly mounted bracket having a pair of spaced apart elongate arms respectively formed with an elongate slot, the slots of said arms being in transverse alignment; a bottom rib member of said cradle extending between said arms and having an elongate slot extending at an angle to the slots in said arms; a fixed pin extending between said arms and through the rib slots; a pin carried by said rib having its opposite ends respectively slidable in the slots of said arms; and a tension spring interconnecting said pins and acting to normally resiliently retain said cradle in an elevated position.

7. Therapeutic apparatus, comprising: a base structure; a cradle adapted to receive and support a body extremity thereon for treatment; a plurality of elongate inflatable members carried by said cradle for applying to a body extremity on said cradle; and means for adjustably supporting said cradle on said base member for independent horizontal and vertical movements relative to said base structure.

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8. Therapeutic apparatus, comprising: a base structure including a cradle adapted to receive and support a body extremity thereon for treatment; an arcuate member supported on said base structure for movement about an axis of rotation to an extended position overlying said cradle and a retracted position enabling the body extremity to be placed on and removed from the cradle; an elongate inflatable member having one end connected with said base structure and its other end carried by and guided by said arcuate member, whereby movement of said arcuate member to extended position carries said inflatable member into a binding position on a body extremity on said cradle; and spring biased feeding means for varying the effective length of said inflatable member as the arcuate member is extended, and decreasing the effective length as the arcuate member is retracted.

9. Therapeutic apparatus, comprising: a base structure including a cradle adapted to receive and support a body extremity thereon for treatment; an elongate inflatable member having one end connected with said base structure; manipulating means connected with the other end of said inflatable member, whereby the inflatable member may be actuated from a retracted to extended position in binding relation to a body extremity on said cradle, and vice versa; means for anchoring the manipulating means in the extended position of said inflatable member; and means for feeding said inflatable member to increase its effective length as the manipulating means are moved to a position corresponding to the extended position of the inflatable member, and decrease the effective length thereof as the manipulating means are moved to a position corresponding with the retracted position of said inflatable member.

10. Therapeutic apparatus, comprising: a base structure including a cradle adapted to receive and support a body extremity thereon for treatment; an elongate inflatable member having one end connected with said base structure; a reel having a free portion of said inflatable member wound thereon; spring means normally biasing said reel in a winding direction with respect to said inflatable member; and manipulating means connected with said inflatable member, said manipulating means being movable from one side of said cradle to the other to unwind the inflatable member from said reel and forcibly bind a body extremity on said cradle and place the inflatable member in a position for treating the body extremity thereon.

11. Therapeutic apparatus, comprising: a base structure including a cradle adapted to receive and support a body extremity thereon for treatment; an elongate inflatable member having one end connected with said base structure; manipulating means including a reel having the other end portion of said inflatable member wound thereon; and spring means normally biasing said reel in a winding direction with respect to said elongate inflatable member, said manipulating means being movable to carry the inflatable member into a treating position across and into binding relation with a body extremity on said cradle, and said spring means acting to tension said inflatable member in the treating position.

12. Therapeutic apparatus, comprising: a base structure including a cradle adapted to receive and support a body extremity thereon for treatment; a plurality of elongate inflatable members in side-by-side relation lengthwise of said cradle, each of said members having one end connected with said base structure; manipulating means including a plurality of axially aligned reels respectively having the other end portions of said inflatable members wound thereon; and spring means normally biasing each of said reels in a winding direction with respect to said elongate inflatable member, said manipulating means being movable to carry the inflatable members into a treating position across and into binding relation with a body extremity on said cradle, and said spring means

acting to tension said inflatable members in the treating position.

13. Therapeutic apparatus, comprising: a base structure including a cradle adapted to receive and support a body extremity thereon for treatment; a pedestal extending upwardly from said base structure at one side of said cradle; an arcuate member supported on said pedestal for endwise movements about an axis of rotation parallel to the longitudinal axis of said cradle into extended and retracted positions, said member in its retracted position enabling the placing of a body extremity on said cradle and in its extended position projecting over the body extremity on said cradle; an elongate frame structure carried by the outer end of said member extending at right angles thereto; a plurality of axially aligned reels rotatably mounted on said frame structure; a plurality of elongate inflatable members respectively wound on said reels and having their free ends anchored on the pedestal side of said cradle; spring means respectively acting to bias each of said reels in a winding direction and tension said inflatable members into binding engagement with the body extremity on said cradle, when the arcuate member is moved to extended position; and means for latching said arcuate member in extended position and retaining said reels against further rotation.

14. Therapeutic apparatus, comprising: a base structure including a cradle adapted to receive and support a body extremity thereon for treatment; a pedestal extending upwardly from said base structure at one side of said cradle; an arcuate member supported on said pedestal for endwise movements about an axis of rotation parallel to the longitudinal axis of said cradle into extended and retracted positions, said member in its retracted position enabling the placing of a body extremity on said cradle and in its extended position projecting over the body extremity on said cradle; an elongate frame structure carried by the outer end of said member extending at right angles thereto; a plurality of axially aligned reels rotatably mounted on said frame structure, each of said reels having a peripherally toothed end member; a plurality of elongate inflatable members respectively wound on said reels and having their free ends anchored on the pedestal side of said cradle; spring means respectively acting to bias each of said reels in a winding direction and tension said inflatable members into binding engagement with the body extremity on said cradle, when the arcuate member is moved to extended position; means for latching said arcuate member in extended position; and means operative in

the latched extended position of said arcuate member for engaging the teeth of the end members of said reels for opposing further movements of the reels.

15. Therapeutic apparatus, comprising: a base structure including a cradle adapted to receive and support a body extremity thereon for treatment; a pedestal extending upwardly from said base structure at one side of said cradle; an arcuate member supported on said pedestal for endwise movements about an axis of rotation parallel to the longitudinal axis of said cradle into extended and retracted positions, said member in its retracted position enabling the placing of a body extremity on said cradle and in its extended position projecting over the body extremity on said cradle; an elongate frame structure carried by the outer end of said member extending at right angles thereto; a plurality of axially aligned reels rotatably mounted on said frame structure, each of said reels having a peripherally toothed end member; a plurality of elongate inflatable members respectively wound on said reels and having their free ends anchored on the pedestal side of said cradle; spring means respectively acting to bias each of said reels in a winding direction and tension said inflatable members into binding engagement with the body extremity on said cradle, when the arcuate member is moved to extended position; means for latching said arcuate member in extended position; and a latching member on the opposite side of said cradle for engaging the teeth of the end members of said reels in the latched extended position of said arcuate member for opposing further movements of the reels.

16. Therapeutic apparatus, comprising: a base structure having an upwardly extending hollow housing portion; a cradle supported by said housing portion, said cradle being adapted to receive and support a body extremity thereon for treatment; a plurality of elongate inflatable members in side-by-side relation carried by said cradle and each being arranged to be wrapped substantially around the body extremity on said cradle; a source of fluid pressure within said housing portion; fluid connections respectively with said inflatable members; and means for selectively connecting and disconnecting said fluid connections in a predetermined cyclic order with respect to said fluid source.

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