April 10, 1956 H. I. POOR 2,741,265

FLUID CONTROL AND DISTRIBUTOR UNIT

Filed Oct. 17, 1950

Fig. 1.

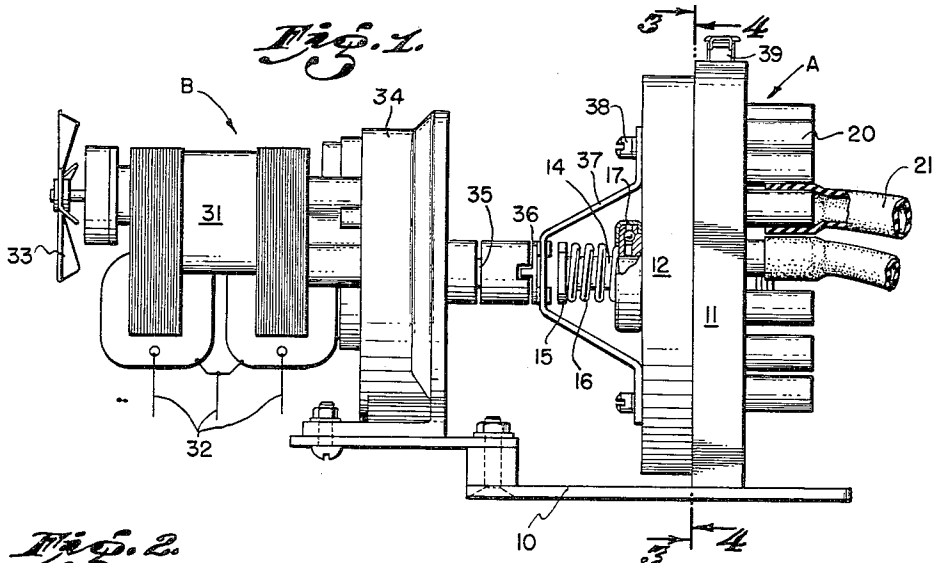


Fig. 2.

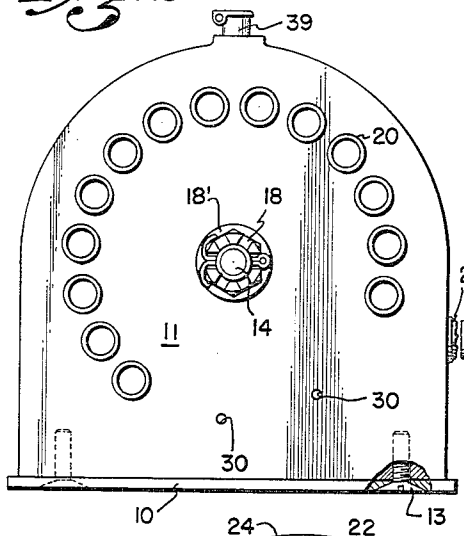


Fig. 3.

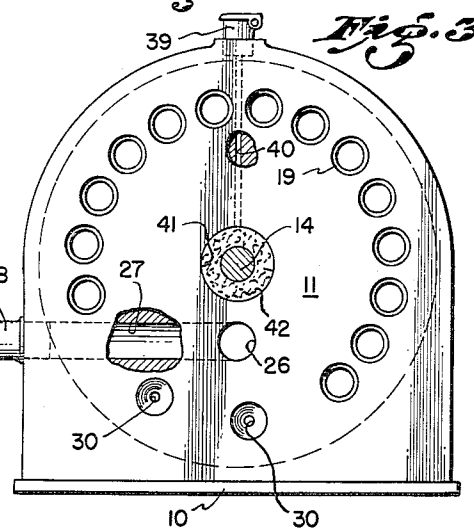
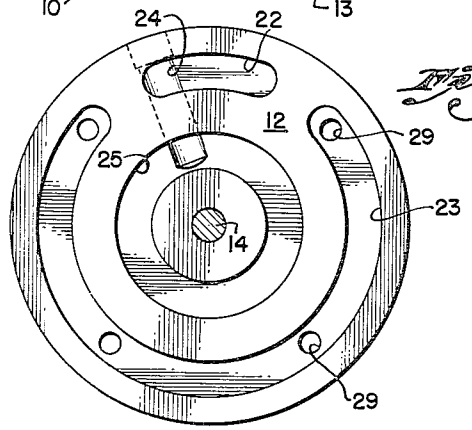


Fig. 4.



INVENTOR.
Henry I. Poor,
BY

ATTORNEY

United States Patent Office 2,741,265 Patented Apr. 10, 1956

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FLUID CONTROL AND DISTRIBUTOR UNIT

Henry I. Poor, West Lafayette, Ind.

Application October 17, 1950, Serial No. 190,469

1 Claim. (Cl. 137—625.11)

The present invention relates generally to apparatus for the selective control and distribution of a fluid; and is more particularly concerned with apparatus by means of which a sectionalized applicator unit may be inflated and exhausted according to predetermined cycles in the treatment of certain vascular diseases in which there exists deficient or impaired circulation, as in the limbs of a human body, and the case of certain muscular conditions.

An applicator of the above mentioned type is described in detail in my copending application entitled "Therapeutic Apparatus," Serial No. 21,769, filed April 19, 1948, of which the present application is a continuation-in-part, and now Patent No. 2,533,504, issued December 12, 1950.

In brief, my applicator, as described in the above mentioned application, comprises a casing which may be secured around the limb or part of the body to be treated; the casing being made up of a plurality of separate tubular bands having independent connections by which the bands may be inflated and exhausted.

It is an object of the present invention, therefore, to provide improved apparatus for controlling the operation of the respective bands in such a manner that a peripherally extending band of constrictive pressure will be applied to the portion of the limb to be treated, and wherein this band of pressure will be translated along the limb by advancing the zone of pressure application, while maintaining and at no time releasing the constrictive pressure during such translation until the end of the treated portion of the limb is reached. At such time, all pressure may be released and, immediately or after a lapse of a predetermined time interval, another band of constrictive pressure may be applied and translated along the limb portion to repeat the cycle of treatment.

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.

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

Fig. 1 is a side elevational view of a fluid pressure control and distribution unit embodying the features of the present invention;

Fig. 2 is an end elevational view of the unit;

Fig. 3 is a transverse sectional view, taken substantially on line 3—3 of Fig. 1; and

Fig. 4 is a transverse sectional view, taken substantially on line 4—4 of Fig. 1.

Referring now particularly to the drawings, a unit according to the present invention is generally illustrated in Fig. 1. In practice, it is contemplated that this unit will be supported upon a portable standard (not shown), or in a cabinet along with associated control devices, and that fluid pressure of air or other suitable fluid will be conducted to the control and distribution unit from a suitable supply source.

In the disclosed construction, the unit is supported upon a suitable base structure 10 which is arranged to support

the various parts of the unit in operative connected relationship. Basically, the unit comprises a distributor A and a power device as generally indicated at B.

The distributor generally comprises a pair of cooperatively associated plate members 11 and 12 which are supported in cooperative relationship for relative rotative movement with their confronting faces in intimate contact. In the present instance, the plate member 11 is disclosed as being stationary, this member being secured to the base structure 10 as by screws 13.

The plate member 12 is rotatably supported upon a shaft 14 which extends through appropriate apertures in the plate members. One end of the shaft 14 is provided with a head 15 which bears against a coil spring 16 having its other end in engagement with the outer race of an antifriction bearing 17. The inner race of this bearing engages against the adjacent wall of plate member 12. The opposite end of shaft 14 is threaded to receive a nut 18 which bears against a washer 18' which is interposed between the nut and the adjacent wall of member 11. By adjusting the nut 18, it will be apparent that the pressure between the contacting faces of the plate members 11 and 12 may be adjusted and that the spring 16 normally acts to bias the rotatable plate member 12 in an axial direction toward plate member 11.

As shown in Fig. 3, the plate member 11 is provided with a plurality of passages 19 opening into its confronting face, these passages being in communication with connection nipples 20 in each case, which project from the opposite side of the plate and provide connecting means for flexible tubular connectors 21, respectively, for individually connecting the several bands of the applicator device with the control unit described herein.

Although in the present disclosure, the passages 19 are shown as being circumferentially spaced about the shaft 14 as an axis, and with a considerable gap between the two endmost of the passages 19, it is contemplated that in some arrangements it may be desirable to have the passages 19 arranged with a uniform spacing around the shaft axis.

As shown in Fig. 4, the plate member 12 has its confronting face provided with a plurality of arcuate slots in end-to-end relation, one of these slots, 22, being of relatively short length, and the other slot 23, being of relatively greater length. It will be noted that the slot 22 is connected through a radially extending passage 24 with an annular groove or slot 25 which is in concentric relation surrounding the shaft axis and so positioned as to be in continuous communication with a port opening 26 in the confronting face of plate member 11. The opening 26 connects with a passage 27 which externally connects with a nipple 28 at one side of the plate 11, this nipple providing connecting means for connecting the device with a suitable source of fluid pressure supply.

The slot 23 communicates with a plurality of port openings 29 which extend through the plate member 12 and connect the slot 23 with atmosphere.

With the foregoing arrangement, rotation of plate member 12 will successively move the slots 22 and 23 over the passages 19, fluid pressure being supplied to the passages 19 which are in connection or communication with slot 22, and those passages 19 which are in communication with slot 23 being vented to atmosphere.

It will be observed that the length of slot 23 is such as to be capable of simultaneous communication with a plurality of passages 19, and in the arrangement illustrated the slot 23 is of sufficient length to extend over all of the passages 19 at the same time. The slot 22, on the other hand is of such length as to extend over several of the passages 19 at the same time, and has been shown in the present instance as being of sufficient length to simultaneously encompass three of the passages 19.

Assuming the during the operation of the device, the slot **22** is positioned in the large interval between the endmost passages **19**, it will be apparent that as the slot **22** is moved from this interval, the first three passages **19** will be successively connected to the fluid pressure, all three being simultaneously connected to the fluid pressure supply. Consequently, the first three sections of the applicator will under these conditions be supplied and inflated by fluid pressure.

As relative rotation is continued between the plate members **11** and **12**, passages **19** will be successively connected with slot **22** in the direction of rotation and successively disconnected in the opposite direction, but at least one passage **19** will remain connected so as to maintain one of the applicator sections connected to the group of passages **19** which are in connection with slot **22**. Thus, one applicator section will at all times be inflated, so as to apply a holding pressure therein. This holding pressure is constantly maintained, but is translated or advanced along the sections of the applicator and the portion of the body being treated, in the same manner as passages **19** are connected at one end of slot **22** and disconnected at the opposite end of slot **22**.

This continues until the slot **22** starts moving into the space interval, at which time the last passages **19** will be successively disconnected from communication with slot **22**. Consequently, movement of slot **22** over the space interval will form a dwell period, during which there will be no fluid pressure supplied to the sections of the applicator unit. At the end of this dwell period, the cycle will again be repeated. The passages **19** which are not in communication with slot **22** will be in communication with slot **23**, and thus vented to atmosphere, so that these sections will be deflated.

In order to prevent a building up of pressure in slot **22** during time of its passage through the space interval, atmospheric bleed ports **30** are provided in the path of travel of slot **22**, these bleed ports opening into the confronting face of plate member **11** and being connected through the plate with atmosphere.

As previously stated, it may be desirable to utilize cyclic translation of constrictive pressure from one end of the limb being treated to the other, the cycle being immediately commenced upon completion without an inactive or dwell period between each cycle as previously explained. In such cases, the fluid pressure control and distribution unit may be constructed with a uniform interval between the passages **19**, in which case the cycle will be immediately repeated without going through a dwell period.

The power device in this instance is disclosed as comprising an electric motor **31** having an energizing circuit **32** which is selectively connectible to operate the motor in reversed directions of rotation. The motor is provided with a fan **33** for circulating cooling air, and is connected to speed reducing means **34** which delivers power to a driving shaft **35** at relatively low speed. This shaft is connected through a universal coupling **36** with a connection bracket **37** of generally U-shaped construction, this bracket straddling the projecting head **15** of shaft **14** and the associated spring **16**. The legs of the bracket are

secured to the plate member **12** by means of securing screw **38**.

As an example of the speed of operation and cycle time for the equipment described herein, it may be stated that a time cycle has been utilized which requires two seconds from the time of initial inflation of the first section of the applicator until the inflation of the last section, the total cycle requiring a time of three seconds to complete. As a general rule, the speed of rotation of the plate member **12** will be slower when a rest period is included between the cycles than when the treatment is given without a rest period. In the first case, a speed of approximately 20 R. P. M. has been utilized, and in the latter, a speed of approximately 30 R. P. M. This difference in speed may be obtained in any suitable manner.

As shown in Fig. 3, provision is made for introducing a lubricant to the confronting faces of the plate members 11 and 12. For such purpose, an oil cup **39** is mounted at the upper end of plate member **11**, this cup communicating with a passage **40** which connects with an annular groove **41** which opens into the confronting face of plate member **11** and is normally filled with a suitable packing **42** which regulates flow of lubricant between the confronting faces of the plate members.

I claim:

A fluid pressure control and distribution unit, comprising: rotary valves means including a pair of plate members supported for relative rotation, said plate members having confronting faces in contact; a first shaft supported by one of said members for longitudinal movement therein and projecting through the other of said members to form a support therefor; a coil spring surrounding said shaft for resiliently maintaining the confronting faces of said members under pressure contact, one of said spring ends being anchored with respect to said shaft; anti-friction means interposed between the other end of said spring and said other plate member; a driving shaft axially aligned with said first shaft, said driving shaft being positioned on the same side of the assembled plate members as the spring, and having a driving connection with said other plate member; and means operable from the opposite side of the assembled plate members for longitudinally adjusting the position of said first shaft with respect to said one of said members to vary the effect of said spring.

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