

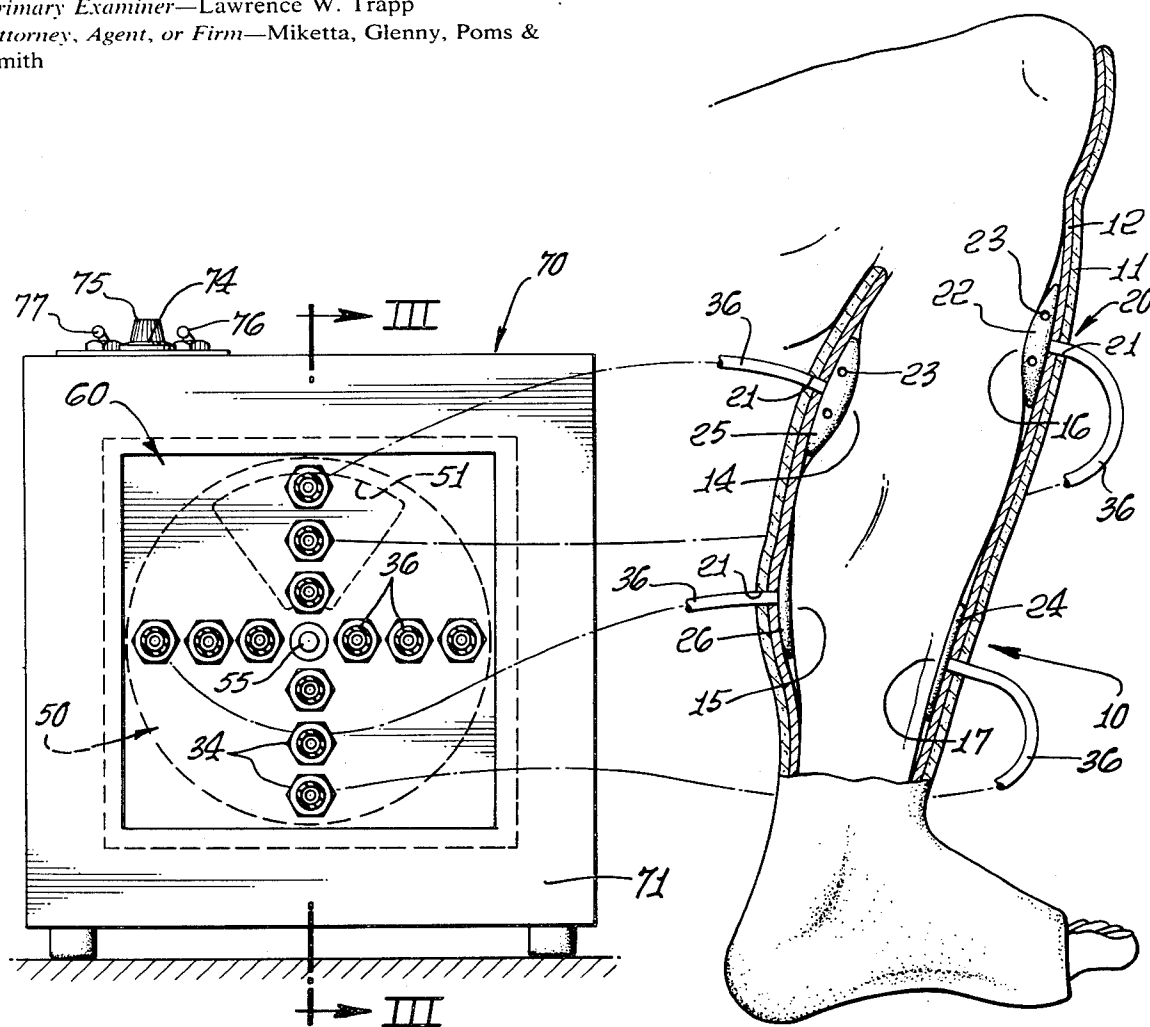
[54] MEANS FOR AERATING AND APPLYING
AIR PULSATIONS WITHIN CASTS[76] Inventor: **Pred Vinmont**, 11937 Sunset Blvd.,
Brentwood, Calif. 90049[22] Filed: **Oct. 29, 1973**[21] Appl. No.: **410,377**[52] U.S. Cl. **128/40; 128/82.1**[51] Int. Cl.² **A61H 1/00; A61F 15/00**[58] Field of Search 128/82.1, 40, 400, 87,
128/89, DIG. 20[56] **References Cited****UNITED STATES PATENTS**

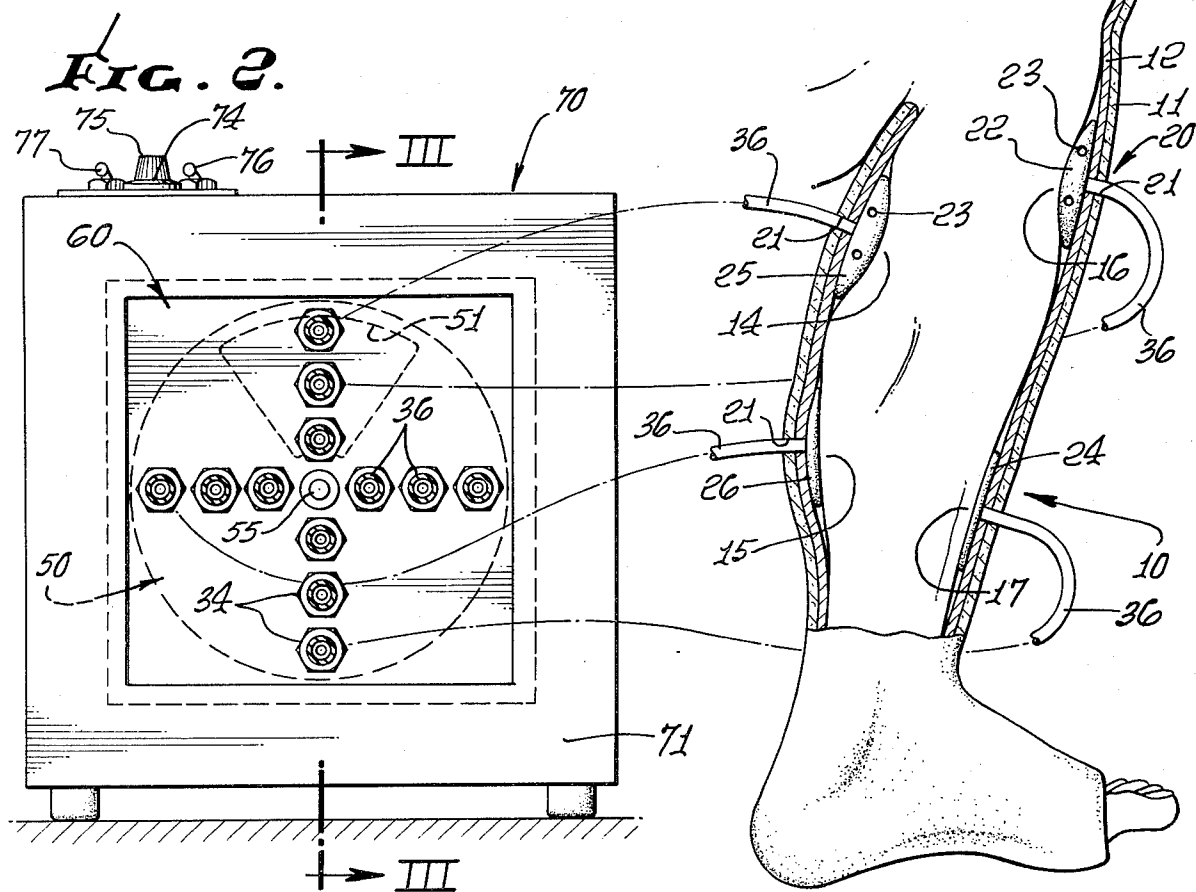
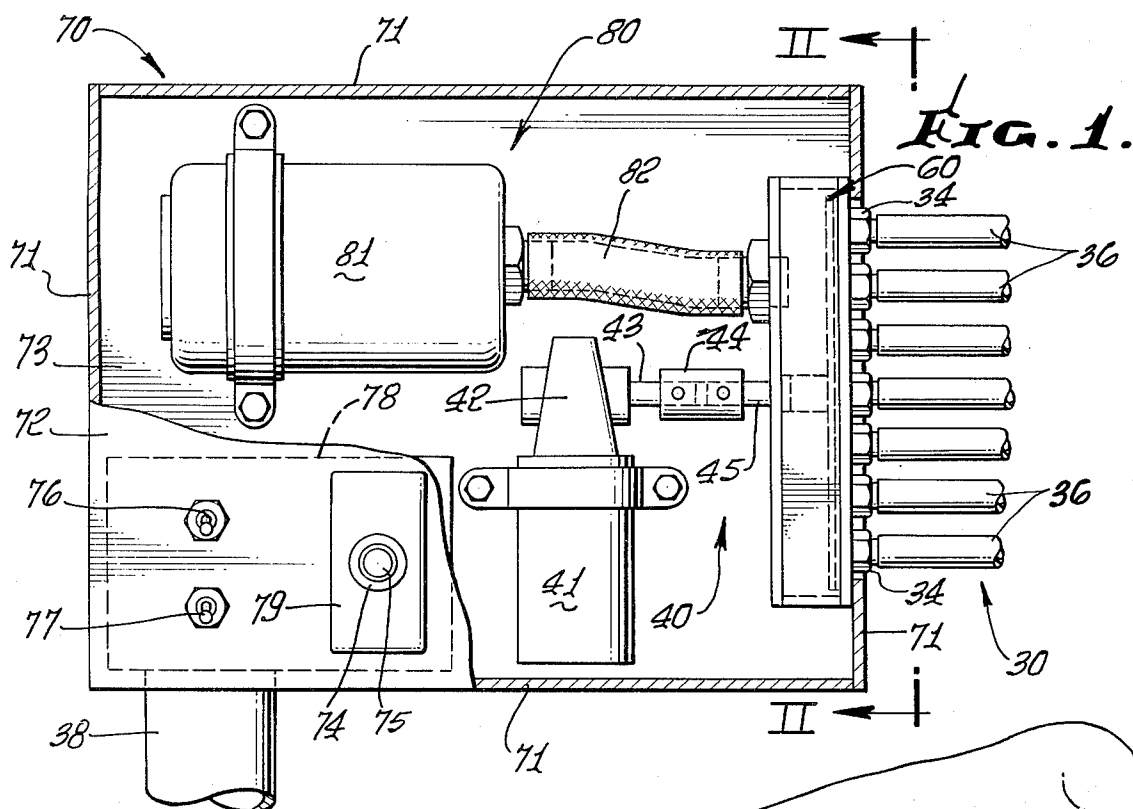
1,147,560	7/1915	Shurtleff	128/DIG. 20
1,884,927	10/1932	Van Raalte	128/DIG. 20
2,345,073	3/1944	Rosett	128/DIG. 20
2,354,407	7/1944	Shaks	128/40 UX
2,998,817	9/1961	Armstrong	128/40 UX
3,116,731	1/1964	Baxter	128/82.1 UX
3,477,427	11/1969	Lapidus	128/82.1
3,701,349	10/1972	Larson	128/82.1

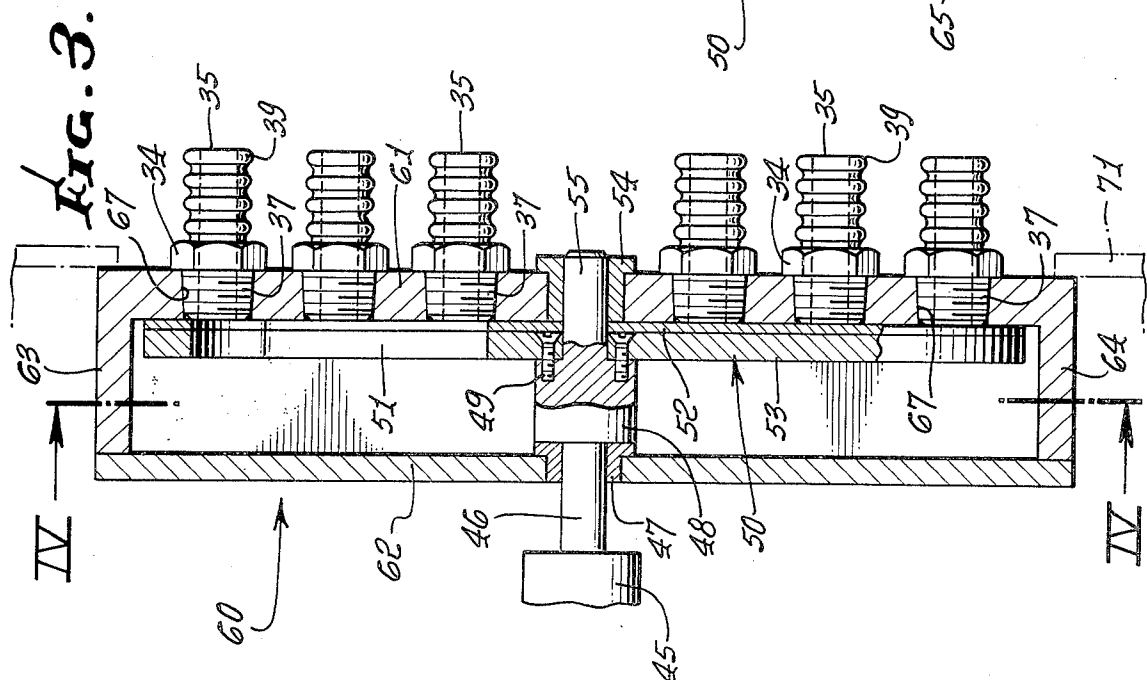
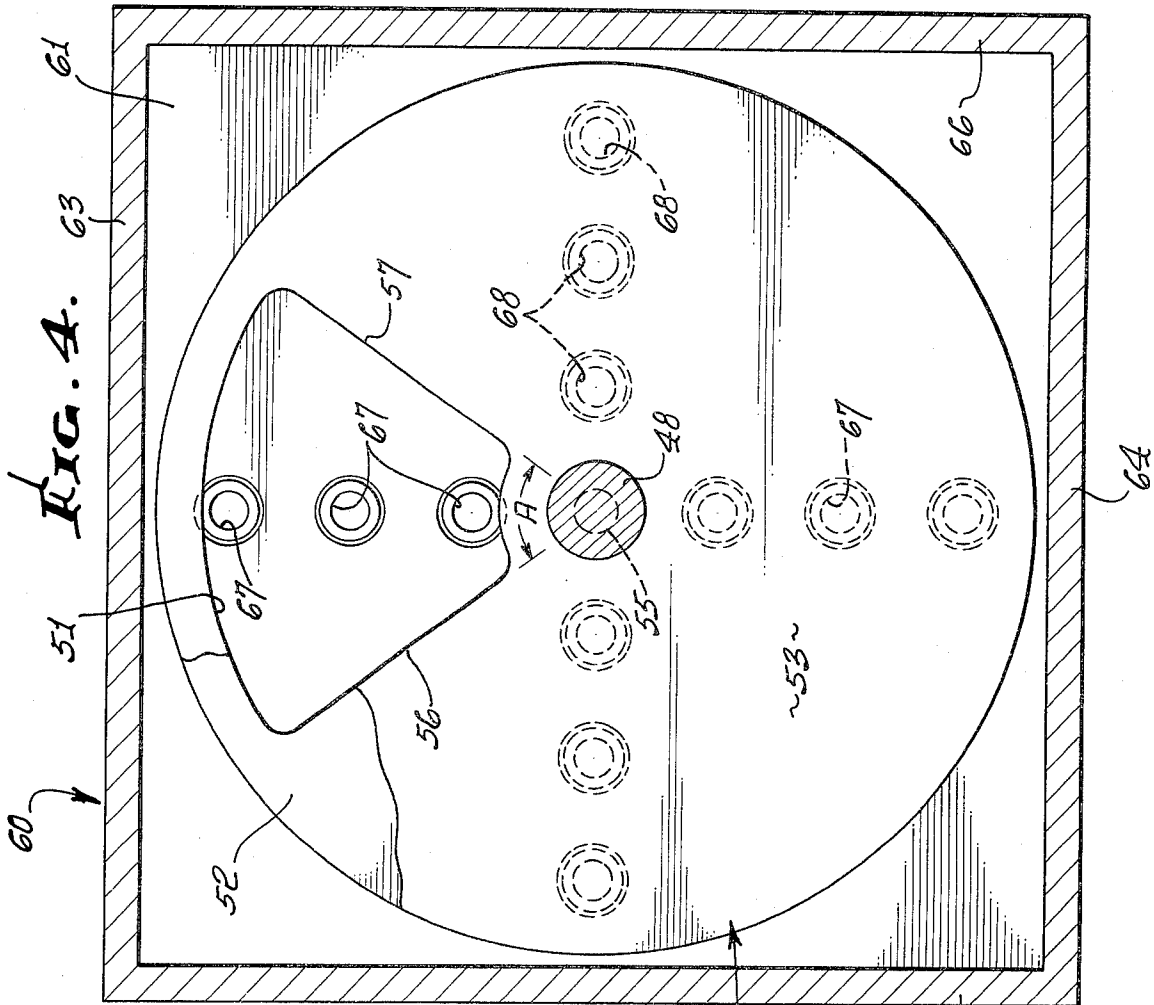
Primary Examiner—Lawrence W. Trapp

Attorney, Agent, or Firm—Miketta, Glenny, Poms &
Smith**ABSTRACT**

[57] Pulsating air is forced through openings in a cast around a limb. Diaphragms or bladders receive the air coming through the openings and expand and contract with the pulses of air, and vents are provided in the bladders to allow the air to escape therefrom. The expansion and contraction of the bladders in different locations beneath the casts massages the muscles. The air passing through the vents also ventilates the cast. The combined massaging and ventilation results in increased comfort and blood circulation. The air is fed through the openings in the cast by tubes which are also connected to a distributor. Air enters one side of the distributor under pressure. On the other side of the distributor are a plurality of connections for the hoses attached to the cast. A revolving plate covers the connectors except those under a cut-out section in the plate which are exposed to the pressure inside the distributor so that pressurized air can pass into the exposed connectors. Rotation of the plate sequentially causes air to flow through different hoses.

6 Claims, 4 Drawing Figures





MEANS FOR AERATING AND APPLYING AIR PULSATIONS WITHIN CASTS

BACKGROUND OF THE INVENTION

To one who has ever had a broken arm or broken leg and has had it in a cast for any length of time, he knows that the disabled limb becomes very uncomfortable within the confines of the cast. First, because the limb is immobilized, the normal flow of blood through the veins is impaired. Normally the contractions of the limb's muscle assist in forcing blood through the veins, but when a cast is placed around the limb, normal exercise cannot and should not take place. Second, dead skin, which is normally regularly washed away, builds up under the cast. Moreover, it is difficult for ventilation to reach the interior of the cast. The accumulation of dead skin and perspiration can cause severe discomfort to the wearer of the cast.

Cast ventilation has been proposed. For example, Blank, U.S. Pat. No. 2,731,963 teaches a cast provided with air vents through which air can be forced down to the skin. Moses, U.S. Pat. No. 2,704,067 discloses a ventilated surgical cast and states that a bulb may be inserted in the provided nipples in order to blow air to cause forced circulation.

It has also been proposed to use an air distribution system to cause a member around the skin to undulate or pulsate to increase circulation. See Strehler, U.S. Pat. No. 3,411,496.

However, none of the prior art attempts have taught a device which will both ventilate a cast and provide pressure on the muscle to cause increased circulation. It is an object of the present invention to provide means for aerating a cast and applying a pulsating pressure within the cast in a new manner. A further object of the invention is to provide such means for aerating and pulsating air within a cast which can be modified to yield the maximum comfort to the limb. The device must also be safe so that any pressure to the limb must be slight and so that localized pressure cannot stop blood circulation and act like a tourniquet. Further objects will be evident from the following description of an exemplary embodiment of the present invention.

SUMMARY OF THE INVENTION

This invention is an improved device for aerating casts and for easing discomfort to the body part beneath the cast. The cast is provided with opening means 20. Bladders are provided beneath the cast to receive pulses of air through the opening means. The air is supplied from a source 80 to a distributor 60 where it is distributed to the opening means via delivery means 30. Pulsating means 40 causes the air leaving the distributor means to flow in pulses of pressurized air which expand the bladders to massage the muscles. Air venting from the bladders ventilates the skin beneath the cast.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cutaway top view of the means to cause the air to flow and to pulsate.

FIG. 2 is an end view of the device taken along line II—II of FIG. 1. FIG. 2 also shows the device connected beneath a cast around a user's calf.

FIG. 3 is a sectional view taken along line III—III of FIG. 2.

FIG. 4 is a sectional view taken along line IV—IV of FIG. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. 2, the user's leg is shown within cast means 10. Customarily, the cast means 10 comprises an outer cast 11 made of hard material which surrounds a cast liner 12 made of softer material. Opening means, generally indicated at 20 to allow air beneath the cast comprises in the preferred embodiment cast openings 21 through which bladders or diaphragms 22 or 24 are inserted. The bladders may either be inserted through the openings after the cast has been made, or the bladders may be placed against the skin with delivery hoses 36 extending away from the skin. Then the cast is placed on the leg in the usual manner over the bladders and around the delivery hoses.

In a manner to be described hereinafter, air is forced through the delivery hoses 36 in a pulsating manner. Bladder 22 is shown inflated, and at the same time bladder 24 is shown in a deflated condition. At a different time bladder 22 might be deflated and bladder 24 might be inflated. When air is forced through hose 36 into bladder 22 it inflates against the muscle; in this case the tibialis anterior muscle is depressed at 16. Likewise, the gastrocnemius muscle is depressed at 14 by bladder 25. The tibialis anterior at 17 and the gastrocnemius at 15 are in their released positions because bladders 24 and 26 are deflated. Vents 23 are provided in the bladders to allow air to escape therefrom. These vents are of such size that the air entering through hose 36 will fill the bladder quickly and then the vents will release the air slowly so that the bladder can fill.

As the pressure inside each bladder is increased, more air will pass through the vent. More pressure will be exerted on each bladder if the cast is tighter. This results in a built-in safety feature because if the cast is tight, the added pressure to each bladder will cause a greater volume of air to pass through vents 23. Therefore, the inflated size of each bladder depends on the tightness of the cast. This will prevent a tourniquet effect if all the bladders around a certain portion of the limb were inflated simultaneously and remained inflated for a length of time.

As the bladders inflate and deflate in sequence, the pressure on the skin in different locations will cause the muscle to be massaged to increase blood circulation. In FIG. 2, only four bladders are attached. However, other bladders can be connected around the limb. The hoses may be attached to the pulsating air supply in any manner.

A source of pressurized air is shown generally at 80 in the preferred embodiment in FIG. 1 and comprises a compressor 81 which draws air in from air intake 38. The compressor forces air through air hose 82 and into distributor means 60.

The distributor means 60 connects the compressor and the delivery hoses, is associated with pulsating means in a manner to be described hereinafter, and the preferred embodiment is shown in more detail in FIGS. 3 and 4. Preferably the distributor comprises a front wall 61, back wall 62, top wall 63, bottom wall 64, and side walls 65 and 66. A plurality of openings 67 extend through the front wall 61. The openings are arranged in the front wall in a manner shown in FIG. 4.

Delivery means 30 delivers air from the distributor means 60 to the opening means 20. In the preferred embodiment, the delivery means includes a connector

tube 35 screwed into opening 67 by screw threads 37. Nut 34 locks the connector tube to front wall 61. The connector tube is provided with hose gripping means 39 to facilitate holding the delivery hoses 36 on the connector tube. The device may also include suitable means to allow disconnecting the delivery hoses from the opening means of the cast.

The pulsating means causes air to flow in periodic pulses from the source to the delivery means and in the exemplary embodiment is shown generally at 40. As shown in FIG. 1 pulsating means 40 comprises a motor 41 with a right angle drive 42 connected to shaft 45 by shaft 43 and coupling member 44. It is contemplated that the motor 41 could directly drive shaft 45 without the use of a right angle drive. However, right angle drive 42 also has capabilities of speed reduction, and in the preferred embodiment, the use of right angle drive allows for a neater placement of the components within the device.

Referring now to FIG. 3, the shaft 45 terminates in a smaller shaft 46. Shaft 46 passes through an oilite bushing 47 and becomes shaft 48. Shaft 48 is of a greater diameter than shaft 46 because screws 49 which secure the rotating plate means 50 are connected to it. Shaft 55 is of smaller diameter than shaft 48 and extends therefrom through bushing 54 in front wall 61.

The rotating plate means 50 comprises in the preferred embodiment a metal or plastic plate 53 which has a polyethylene or Teflon face bonded to the plate 53. The polyethylene or Teflon face helps reduce friction between the plate 53 and front wall 61 of the distributor means. Plate 53 has an opening 51 which is shown more clearly in FIG. 4.

The compressor, the distributor means, the pulsating means, and the motor are all housed within the case means 70. The case means consists of side walls 71, top wall 72, and bottom wall 73. Knob 74 is connected to electronic speed control 79 to modify the speed of rotation of motor 41. Knob 75 is also connected to the electronic speed control 79 to modify the output of compressor 31. Switches 76 and 77 are on-off switches for the compressor and motor respectively. Switches 76 and 77 and knobs 74 and 75 project through the top of the case 72. Also mounted within the case is a filter 78 to filter the air from intake 38 going to compressor 81. The case might also contain heating or cooling means (not shown) to modify the temperature of air flowing to the cast.

The operation of the device will now be described. Compressed air from compressor 81 passes through air hose 82 to the distributor means 60. Rotating plate means 50 seals the end of the distributor means. The compressed air in distributor 60 may only pass from the distributor through plate opening 51. In the preferred embodiment, the plate opening leaves uncovered three adjacent openings 67 in wall 61 for approximately one-fourth revolution of the rotating plate means 50. As the trailing edge 56 of opening 51 passes over openings 67 to seal them from further air flow, the leading edge 57 will be about to uncover the next set of front wall openings 68. Further rotation exposes those openings 68 to the compressed air which will force air through different delivery hoses 36 connected to connector tubes 35 in openings 68.

In the preferred embodiment, the opening 51 in plate 53 extends slightly less than one-quarter revolution of

the plate. To make pulsing more pronounced, during small portions of the rotation of the plate, no openings 67, 68 will be exposed as the trailing edge 56 covers one set of openings before the leading edge 57 uncovers another set of openings. Angle A will vary depending on the size of openings 67, but the angle should be less than 90°. A larger opening 51 could be used, as could a plate with smaller multiple openings 51. However, the present arrangement balances the depression of muscles by bladders 22, 24, 25 and 26 to better exercise the muscles. Moreover, the amount of air released into the case is not excessive.

It will be seen that the improvement of the present invention described in its exemplary form meets all of the aforementioned objects to provide a novel structure whose definition is limited only by the following claims.

I claim:

1. An improvement in means for aerating casts for easing discomfort to a person's body part beneath a cast wherein the cast is provided with opening means for introducing air beneath the cast and delivery means are provided for delivering pressurized air from a source thereof through said opening means, comprising the provisions of:

pulsating means associated with said air delivery means for receiving pressurized air from said source and converting it into periodic pulses of pressurized air to flow in pulses through said opening means and against the body part beneath the cast,

wherein the opening means comprises bladder means locatable under the cast and next to the skin, inflatable to press against the skin and the cast;

vent means in said bladder means to release air from said bladder means, said vent means releasing air beneath said cast to ventilate the skin beneath the cast.

2. The improvement of claim 1 wherein the vent means are of such size and number that said vent means release air from said bladder at a rate which prevents the bladders from exerting the full air pressure on the limb.

3. An improvement in means for aerating casts for easing discomfort to a person's body part beneath a cast wherein the cast is provided with opening means for introducing air beneath the cast, and delivery means are provided for delivering pressurized air from a source thereof through said opening means, comprising the provision of pulsating means including rotating plate means associated with said air delivery means for receiving pressurized air from said source and converting it into periodic pulses of pressurized air to flow in pulses through said opening means and against the body part beneath the cast,

distributor means to distribute air from said source to said delivery means, said plate having a cut-out section, and said delivery means being connected in fluid communication with said distributor means and said plate means preventing air from flowing from said distributor means to said delivery means except through said cut-out section.

4. The improvement of claim 3 wherein said distributor means has a front wall, said wall having a plurality of openings, said delivery means comprising delivery connector tubes, each of said delivery connector tubes

5

being connected to said distributing means at an associated opening of said plurality of openings, said rotating plate covering certain of said plurality of opening and said cut-out section covering others of said plurality of openings, said rotatable plate means being mounted for rotation whereby rotation of said rotatable plate means exposes different openings of said plurality of opening to fluid communication with said delivery means to cause pulsating air to flow through different tubes of said connector tubes to cause alternating, sequential inflating and deflating of said opening means.

6

5. A method of eliminating discomfort to a body part beneath a cast comprising:
- a. driving periodic pulses of air to spaced locations beneath the cast,
 - b. applying the periodic pulses of air to the limb beneath the cast by introducing said periodic pulses into bladder means beneath the cast,
 - c. venting the air out of the cast.
6. The method of claim 5 including the step of venting the bladder means to deflate the bladder and ventilate the limb under the case.

* * * * *

15

20

25

30

35

40

45

50

55

60

65