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Kawaguchi

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[54] **BLOOD CIRCULATION STIMULATING APPARATUS**

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[51] **Int. Cl.** **A61h 1/00**

[58] **Field of Search** ..... 128/24 R, 60, 64, 327, 128/24.1

[56] **References Cited**

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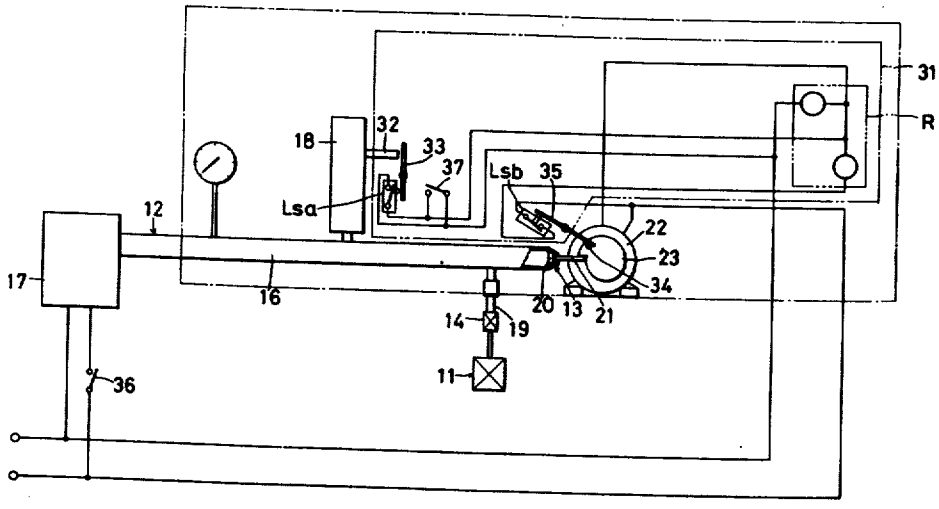
[57] **ABSTRACT**

A blood circulation stimulating apparatus which has an air bag to fit to the human body, a compressed air supply system for supplying compressed air set at a predetermined pressure to said air bag at a predetermined interval of time, thereby enabling it to inflate, a oneway valve type exhaust valve system for releasing the compressed air at a predetermined interval of time, and a compressed air conduit pipe for connecting the compressed air supply system with the air bag.

2 Claims, 4 Drawing Figures



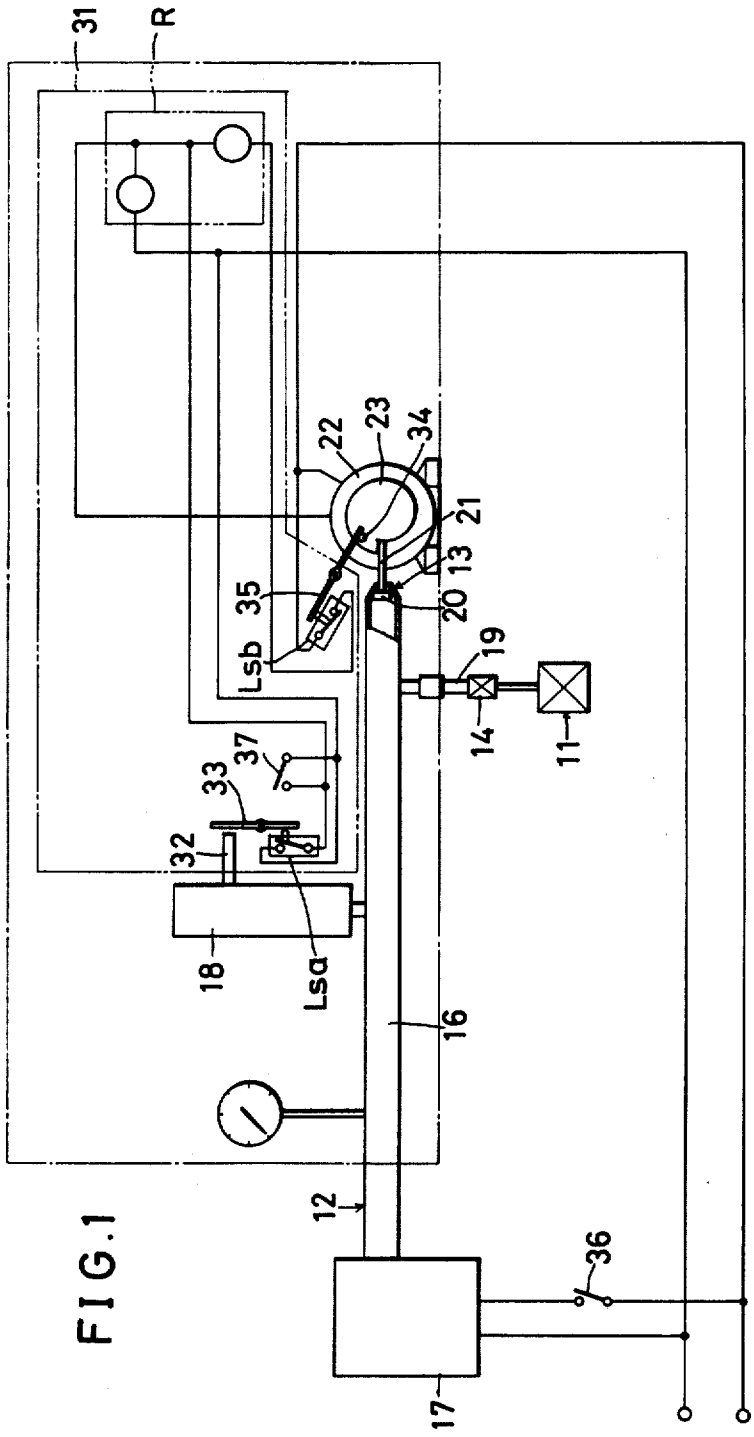


FIG.1

FIG.3

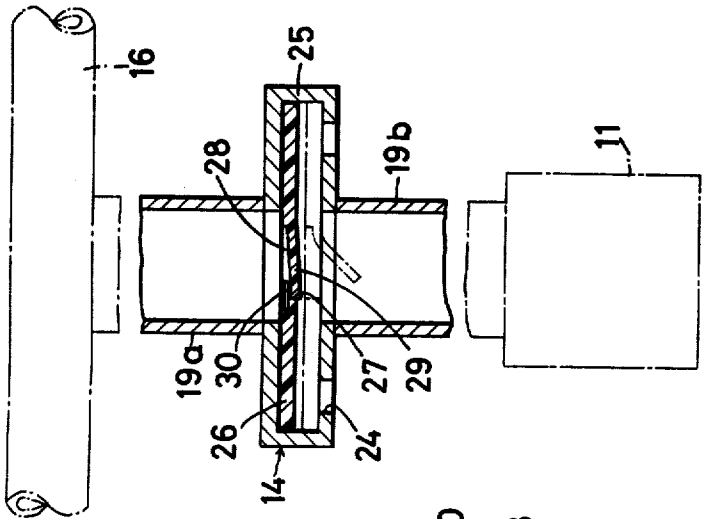


FIG.4

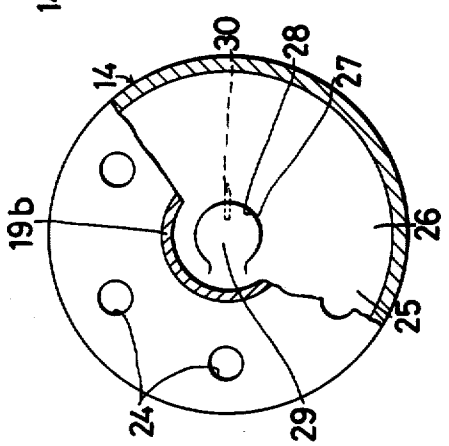
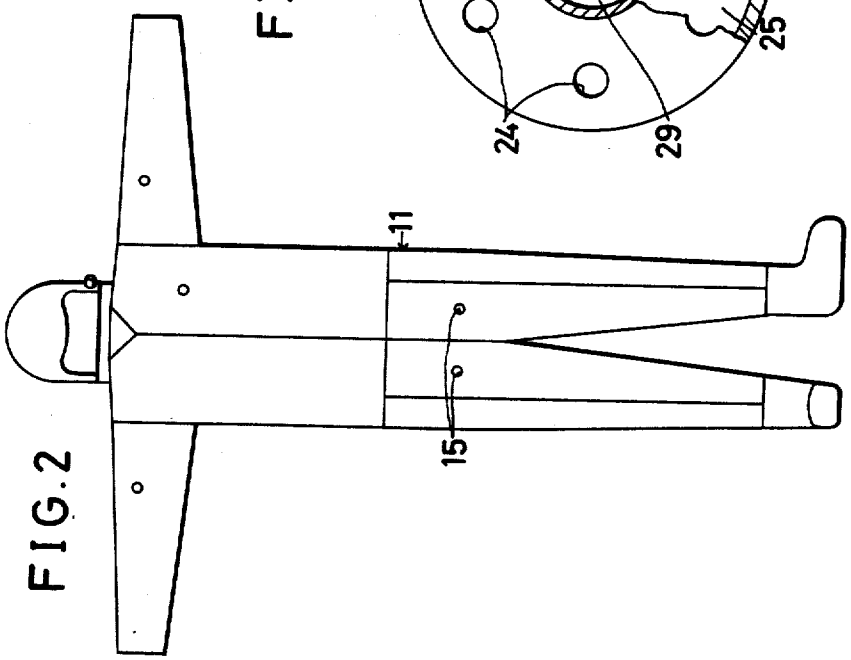


FIG.2



BLOOD CIRCULATION STIMULATING APPARATUS

The present invention relates to a blood circulation stimulating apparatus and in particular a blood circulation stimulating apparatus provided with a compressed air bag.

It is generally known that if the human body is subjected to external pressure and then released from said pressure alternately in succession, there will be an improvement of blood circulation at the pressure-applied location of the body to give an effect of medical treatment thereto as the result.

A first object of the present invention is to provide a blood circulation stimulating apparatus capable of automatically applying a pressure to the human body and releasing the pressure therefrom alternately at regular intervals.

A second object of the present invention is to provide the capability for rapidly releasing said pressure from a blood circulation stimulating apparatus as abovedescribed.

The said objects are accomplished by the improvement, combination and operation of every part constituting the present invention, the preferred embodiment of which is illustrated in relation with the annexed drawings as following:

FIG. **1** is a schematic view of the apparatus showing the embodiment of the present invention.

FIG. **2** is an elevation of an air bag to be incorporated in the above-described apparatus.

FIG. **3** is a longitudinal sectional view of an exhaust valve for promoting the release of compressed air from said air bag.

FIG. **4** is a partially-cutaway elevation of said exhaust valve as mentioned in FIG. **3**.

In the embodiment illustrated in the FIGS. **1** to **4**, the blood circulation stimulating apparatus of this invention comprises an air bag **11** inflatable and deflatable fitting to the human body, a compressed air supply system **12** for supplying compressed air to said air bag **11** for its inflation, a one-way type exhaust valve system **13** for releasing compressed air from within said air bag **11** at a predetermined interval of time, and an exhaust valve **14** for promoting the release of compressed air from within said air bag **11**.

Said air bag **11** is preferably shaped so that it may fit to the human body, e.g., in the shape of tights to cover all of the body including the head having openings **15** for the supply and discharge of compressed air provided at requisite locations therein. Among other shapes (not shown in the drawings) are the shape of a coat for medically treating the upper half of the body, the shape of a tights for the lower half of the body, a hood for the head and shoulders, a mask for covering the eye-balls for medically treating the eye bottom, a shirt-sleeve for the upper limbs, a glove for the hand, a stocking for the lower limbs, a sock for the foot, a hat for the head and the like.

The air bag **11** to fit to the abdomen and chest may well be shaped like "manchette" in a blood pressure gauge, and the same applies to the air bag to fit to part of limbs. The air bag **11**, as a matter of course, is made of an airtight material such as the material constituting the "manchette", life rafts and the like.

Said air bag **11** is selectable in shape in accordance with where to apply the blood circulation stimulating treatment and is preferable to be worn together with a constriction band and the like so that the air bag may not slide or shift.

The supply system **12** for supplying the compressed air to the air bag **11** comprises a compressed supply source, e.g. an air compressor **17**, and a compressed air pipe **16**, said compressed air pipe **16** connecting at one end thereof with the air compressor **17** thereby feeding compressed air continuously toward the air bag **11**, said air pipe **16** having a pressure control valve **18** between both ends thereof, said control valve **18** holding the pressure of air fed to the air bag **11** at a predetermined level, said air pipe **16** also being linked to the exhaust valve **14** by a conduit pipe **19** as shown in FIGS. **1** and **3**.

The one-way type exhaust valve system **13** as mentioned heretofore comprises a one-way type exhaust valve member **20** provided on the air bag at one end thereof, said valve member **20** having a valve rod **21** projecting therefrom, the forward tip of which abuts the periphery of a cam **23** which is driven by a motor **22**, said valve rod **21** playing the role of pushing said valve member **20** per every revolution of said cam **23** to result in the opening of said air pipe **16** at one end thereof, thereby lowering the air pressure inside the air pipe **16** until the atmospheric pressure is reached and, accordingly, the air bag **11** is brought to the pressure of the atmosphere via the conduit pipe **19** linking the air bag **11** with the air pipe **16**.

Said exhaust valve **14** is connected with a conduit pipe **19***a* in a hollow valve casing **25** at one end thereof and another conduit pipe **19***b* in said valve casing **25** at the other end thereof, said conduit pipe **19***a* connecting with the air pipe **16** and said conduit pipe **19***b* connecting to said air bag **11**, respectively, said valve casing **25** having a panel-like valve member **26** fitted axially movable therein, said valve member **26** being provided with an annular crevice **27** at central portion thereof, said annular crevice **27** enclosing a switch valve **29** which is openable only in the direction of the air bag **11**, as shown by a horizontal chain line in FIG. **3**. In the FIG. **3**, a valve port **28** is opened by said switch valve **29** and a stopper-pin **30** prevents said switch valve **29** from opening in the direction of the air pipe **16**.

A plurality of exhaust holes **24** are formed in the lower side of the valve casing **25** said exhaust holes **24** functioning as below: When compressed air is fed from said air pipe **16** to the air bag **11**, the valve member **26**, as shown also by a horizontal chain line in FIG. **3**, closes said exhaust holes **24** and opens said switch valve **29** under the pressure of the compressed air sent from the air pipe **16** thereby allowing the compressed air to flow into said air bag **11**. When the compressed air is released from within the compressed air pipe **16** by the exhaust valve system **13**, the compressed air within the air bag **11** rushes toward the air pipe **16** whereby the valve member **26** moves toward the air pipe **16** thereby opening the exhaust holes **24** releasing the compressed air from within the air bag **11**, and bringing the air pressure therein to the level of the atmosphere.

In FIG. **1**, an operation circuit **31** is provided for the automated operation of the motor **22** used for supplying compressed air to the air bag **11** and releasing said compressed air therefrom.

The operation circuit **31** linking the motor **22** with the power source is provided with a self-restitution type limit switch Lsa, a self-sustaining type relay R for sup-

plying power to the motor **22** with the closure of the limit switch Lsa, and another self-restitution type limit switch Lsb for resetting the relay R by way of cutting the power supply thereto during every revolution of said cam **23**.

The afore-mentioned limit switch Lsa is operated by a swinging lever **33** with a wind receiving plate (not shown in the drawings) at the forward tip thereof abutting on the front of a blow pipe **32** of the safety valve type pressure control valve **18**. The other limit switch Lsb is operated by another swinging lever **35** the forward tip of which abuts on the trace of the circle motion of a pin **34** planted on the cam **23**.

In FIG. **1**, there is a starting switch **36** for the compressor **17**, manually operated switch **37** inserted into the operation circuit **31**, said manual switch **37** working for starting the next cycle without fail no matter wherever the cam **23** may come to a halt. By way of turning the switch **37** on, the relay R functions to start the motor **22** for rotating the cam **23**.

The operation of the apparatus of this invention in the foregoing embodiment is described as following:

When the compressor **17** starts working by turning on the starting switch **36**, compressed air begins to be supplied to the compressed air pipe **16**, said compressed air being held at a predetermined pressure by the safety valve type pressure control valve **18**, said compressed air thereby opening the switch valve **29** and advancing into the air bag **11** while simultaneously pressing the valve member **26** of the exhaust valve **14** to close the exhaust holes **24**, said air bag **11** thereby inflating and causing pressure upon the human body inside as the result.

If the pressure of compressed air within the air pipe **16** exceeds the predetermined level and thereby rushes out of the blow pipe **32** of the pressure control valve **18**, the rushing air pressure will rush against the swinging lever **33** and close the limit switch Lsa. With the closing of the limit switch Lsa the relay R will engage the operation circuit **31** for supplying power to the motor **22** and thereby causing the cam **23** to rotate.

The cam **23** continues to revolve until is presses the one-way valve member **20** and thereby opens the air pipe **16** at one end thereof for releasing the compressed air from within the air pipe **16** into the atmosphere. The valve member **26** of the exhaust valve **14** moves and opens the exhaust holes **24** thereby releasing the compressed air from within the air bag **11** and bringing the air bag **11** to a normal pressure.

When the pressure within the compressed air pipe **16** becomes that of the atmosphere, the limit switch Lsa opens by way of self-restitution, but the operation circuit **31** remains closed because of the functioning of the self-sustaining relay R, and the cam **23** continues to revolve. The limit switch Lsb opens when the pin **34** planted on the cam **23** presses on the swinging lever **35** at the completion of one revolution of said cam **23**; the power supply to the relay R is thereby cut and said relay R is reset simultaneously with the cutting of power to the motor **22**, thereby bringing the revolving cam **23** to a halt. One revolution of the cam **23** beings the cam **23** to a position whereby the the smallest diameter thereof abuts the valve rod **21** and closes the air pipe **16** at one end thereof by the functioning of the one-way type exhaust valve system **13**.

The operation cycle of the apparatus in the present invention as above described is repeated. The operation cycle comprising supply and release of compressed air set at a predetermined pressure to and from the air bag **11** at a predetermined interval, thereby repeating the inflation and deflation of said air bag **11** and stimulating the blood circulation in the human body at a location where said air bag **11** is fitted.

The suitable frequency of the inflation and deflation of the air bag of the present invention varies to a large extent according to the location and the kind of disease to be treated. Generally, however, the applicable frequency of the inflation and deflation of said air bag is as follows:

The inflation of said air bag continues for about 5 – 15 seconds, the deflation of said air bag, that is to the state of normal pressure, continues for about 5 – 15 seconds also. It is desirable that the deflation of the air bag be conducted with rapidity so as to afford a greater blood circulation effect therewith. Technical means for conducting this rapid deflation can be embodied in the system **13** in which the one-way type exhaust valve **20** provided in the compressed air pipe **16** is adapted to be rapidly opened by the cam **23**.

The suitable pressure of the compressed air employed in the present invention varies according to the location and the kind of disease to be treated. Generally, however, the suitable pressure in the case of the whole body treatment is 0.1 – 0.25 kg/cm^2, and preferably 0.15 – 0.2 kg/cm^2. The suitable pressure in case of local treatment is 0.1 – 0.6 kg/cm^2, and preferable 0.35 – 0.5 kg/cm^2 for the arms and legs; 0.18 – 0.2 kg/cm^2 for abdomen and chest; 0.1 kg/cm^2 for the bottom of eyeball; 0.3 – 0.4 kg/cm^2 for the head and shoulders. All these indicate the gauge pressures respectively.

What is claimed is:

1. A blood circulation stimulation apparatus comprising:

an air tight suit-like bag conformed to fit the human body;

compressed air supply means for supplying compressed air from a source at a predetermined pressure;

a conduit connecting said compressed air supply means to said bag for supplying compressed air to said bag;

control means for regulating the pressure buildup and the exhaust of the compressed air from the apparatus;

a one-way exhaust valve located in said compressed air supply means and coupled to said control means for releasing said compressed air from said supply means in response to said control means; and

valve means located in said conduit for controlling the directional flow of compressed air into and out of said air bag.

2. An apparatus as claimed in claim **1** wherein said valve means comprises:

a valve casing having a plurality of exhaust holes open to the atmosphere in the side of the casing opposite the inlet opening from the compressed air supply means;

a panel-like valve member within said casing axially moveable away from the inlet opening in response to air flowing into said air bag for covering said exhaust holes and away from said exhaust holes in response to air flowing out of said air bag for opening said exhaust holes to the atmosphere; and

a switch valve operatively positioned within said panellike valve member and adapted to open only in the direction to allow compressed air to flow into said air bag, whereby lower air pressure in said air bag than in said compressed air supply means causes air to flow from said supply means toward said air bag through said valve casing, forces said panel-like member against said exhaust holes, and forces said switch valve to open, thus allowing compressed air to enter said air bag while maintaining said exhaust holes closed, and whereby lower air pressure in said compressed air supply means caused by the opening of said one-way exhaust valve causes air to flow from said air bag thus forcing said switch valve to close, forcing the panel-like member away from said exhaust holes, and permitting the compressed air within the air bag to exhaust into the atmosphere.

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