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Ono

[11] **3,896,791**

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[54] **ELECTRONIC BLOOD PRESSURE METERS**

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[73] Assignee: **Seiwa Me Laboratories, Inc.**, Osaka, Japan

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[30] **Foreign Application Priority Data**

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Apr. 24, 1973 Japan 48-49090

[52] **U.S. Cl.** ..... **2.05 G**; 128/2.05 P; 174/47
[51] **Int. Cl.** **A61b 5/02**
[58] **Field of Search** .... 128/2.05 G, 2.05 M, 2.05 N, 128/2.05 P, 2.05 T, 2.05 C; 174/47

[56] **References Cited**

UNITED STATES PATENTS

2,193,945	3/1940	Strauss et al.	128/2.05 R
2,981,251	4/1961	Berman	128/2.05 C
3,480,005	11/1969	Edwards	128/2.05 M
3,542,011	11/1970	Langenbeck	128/2.05 G
3,613,668	10/1971	Beck	128/2.05 G
3,623,478	11/1971	Saba	128/2.05 G
3,659,592	5/1972	Natkanski	128/2.05 C

FOREIGN PATENTS OR APPLICATIONS

869,299	1/1942	France	174/47
323,095	8/1957	Switzerland	174/47

Primary Examiner—Richard C. Pinkham
Assistant Examiner—Lee S. Cohen
Attorney, Agent, or Firm—Charles W. Helzer

[57] **ABSTRACT**

In an electronic blood pressure meter of the class wherein air is admitted into an inflatable bag of an arm band from an air bulb and the blood pressure measured by a microphone carried by the arm band is displayed by a blood pressure meter, there are provided an elongated hollow casing, a blood pressure meter mounted on one end of the casing, an air bulb received in a recess on one side of the casing, an arm band including an inflatable bag and a microphone, a connecting pipe including an integral air supply pipe adapted to interconnect the air bulb and the inflatable bag and an electric cable adapted to interconnect the microphone and the blood pressure meter, and plug means for detachably connecting the connecting pipe to the other end of casing.

10 Claims, 11 Drawing Figures

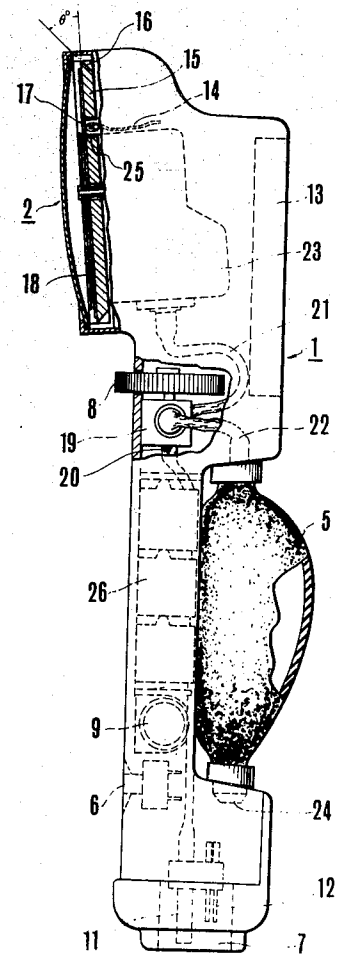

FIG. 3

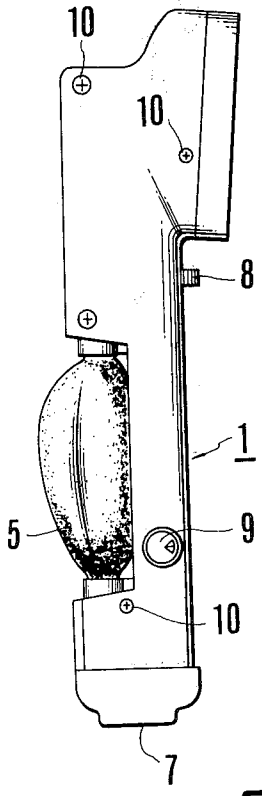

FIG. 1

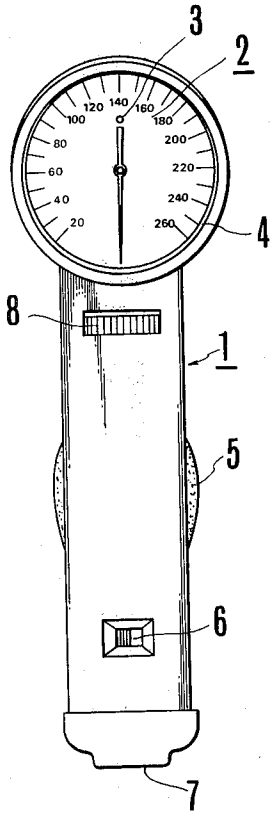

FIG. 2

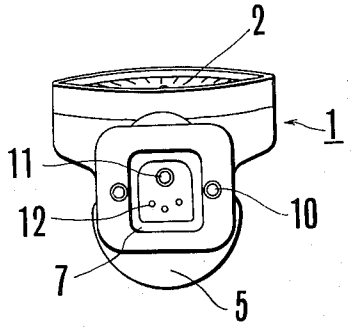

FIG. 4

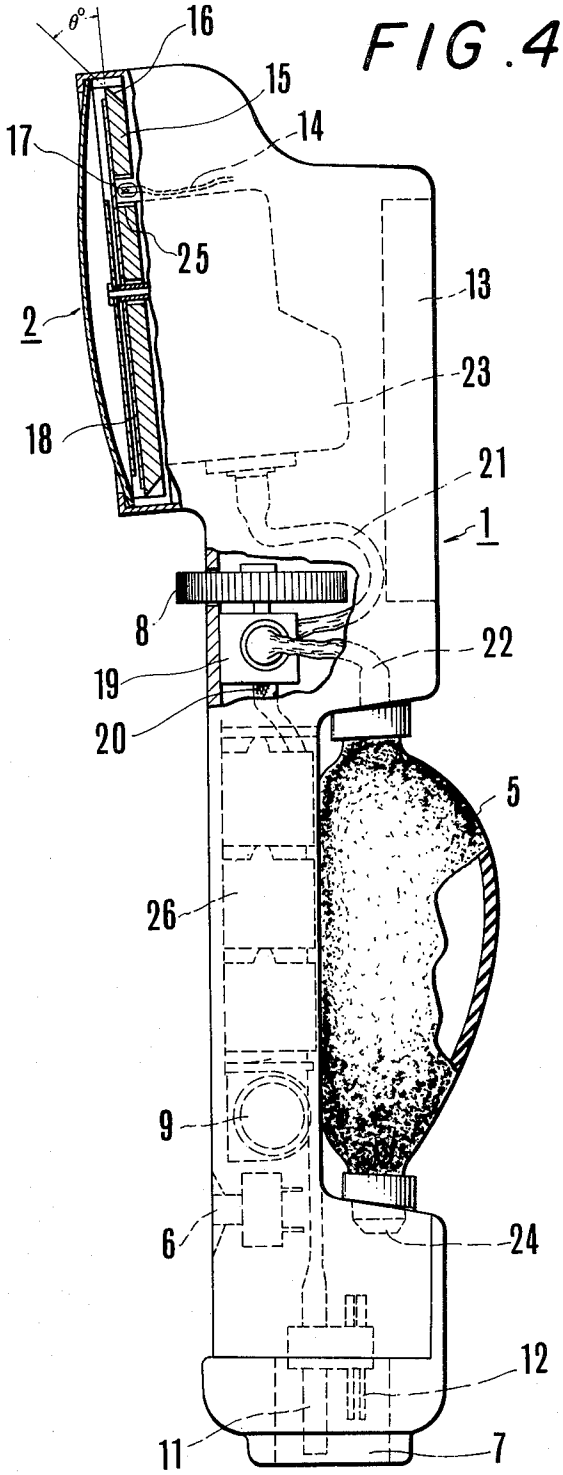

FIG. 5

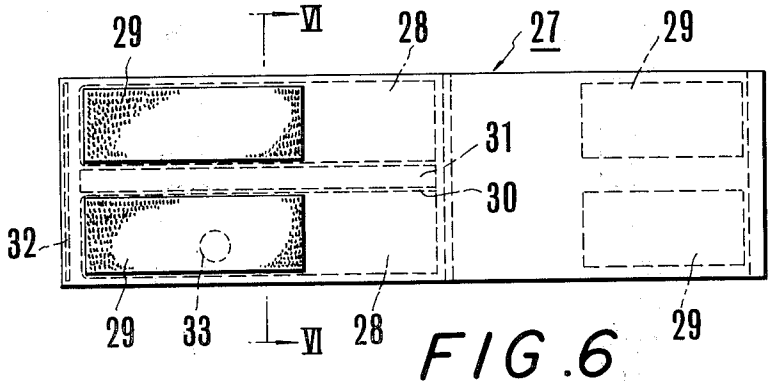

FIG. 6

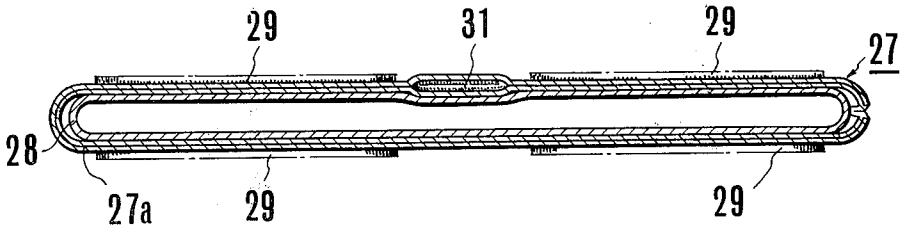

FIG. 7

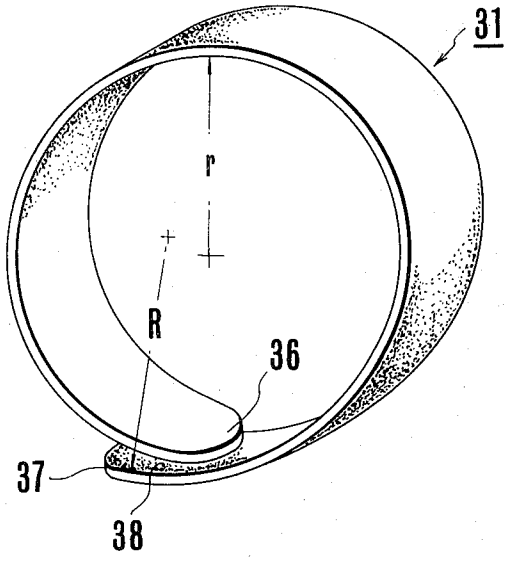

FIG. 8

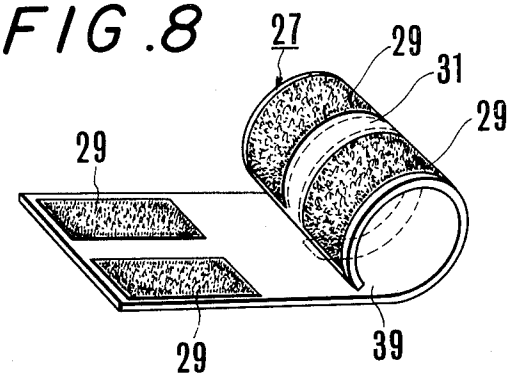

FIG. 9

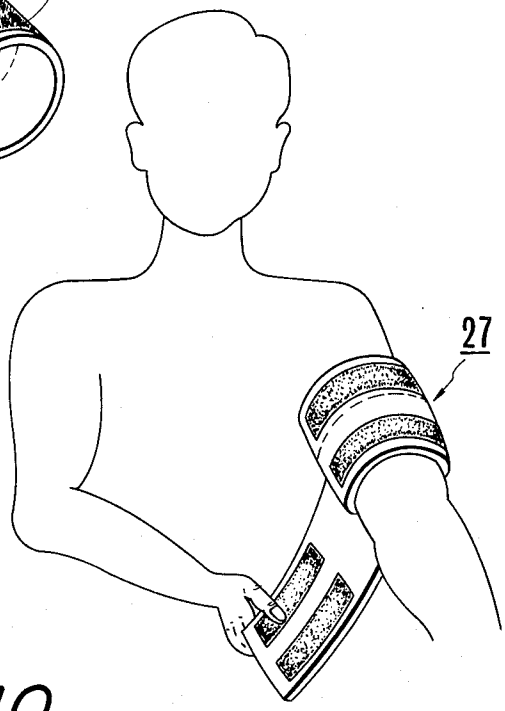

FIG. 10

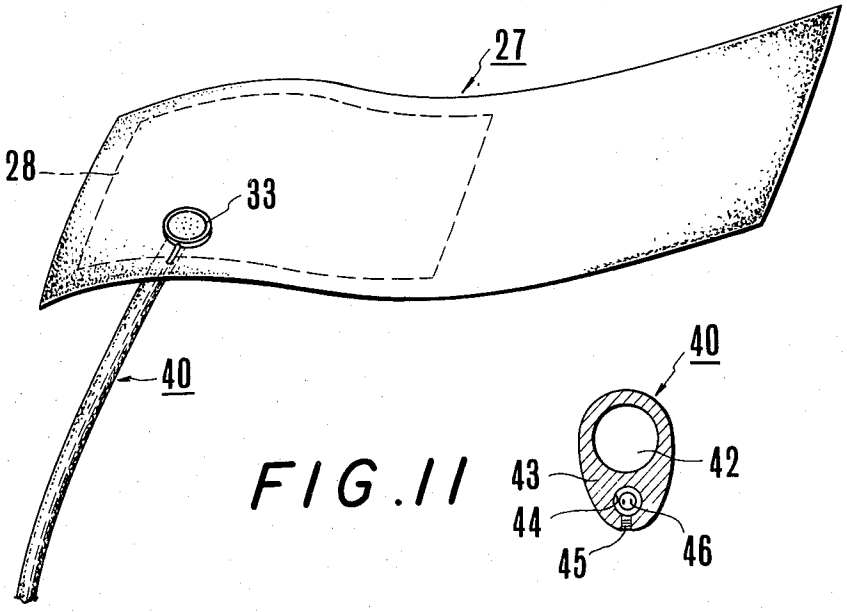

FIG. 11

ELECTRONIC BLOOD PRESSURE METERS

BACKGROUND OF THE INVENTION

This invention relates to an electronic blood pressure meter.

A conventional electronic blood pressure meter comprises a pressure meter, an arm band, an air bulb and a microphone stethoscope. Usually these elements are interconnected by a rubber tube and an electric cable and the pneumatic system and the electrical system were usually constructed as independent units. Moreover as the conventional electronic blood pressure meter was constructed to be mounted on a table, it was inconvenient to transport so that measurement was possible only at a particular place where the blood pressure meter is installed. Furthermore, as the pneumatic system and the electrical system were constructed as independent units such troubles as twisting tangling of the rubber tube and cable were inevitable.

When using such a blood pressure meter, an air bulb and an arm band containing or bonded to a rectangular rubber bag connected to a pressure meter are generally used. Doctors, nurses or specially trained persons can readily handle the blood pressure meter, but from the standpoint of health control it is desirable that unskilled persons can use such blood pressure meter without the aid of a specialist. In another type of blood pressure meter wherein the pulses of the blood vessel are detected and converted into electric signals which are applied to a display lamp or other device which indicates a correct time at which the blood pressure is measured by means of light signals, the pressure meter and the display lamp or other light signal means are usually located remotely so that it is necessary to independently observe the reading of the pressure meter and the light signal means which is not only inconvenient but also requires a skill.

SUMMARY OF THE INVENTION

Accordingly, it is an object of this invention is to provide an improved electronic blood pressure meter which is compact, light weight, convenient to carry and can be readily used by any unskilled person.

Another object of this invention is to provide a novel electronic blood pressure meter provided with an improved blood pressure meter having means for indicating the instant at which the blood pressure is measured.

A further object of this invention is to provide an electronic blood pressure meter including an inflatable bag connected to a hollow casing containing the blood pressure meter, an electronic circuit and an air bulb by means of an improved connecting pipe including an integral air supply pipe and an electric cable so that troubles caused by twisting and tangling of the cable and air supply pipe can be obviated.

Still further object of this invention is to provide a novel electronic blood pressure meter including a novel arm band capable of mounting and dismounting with a single hand.

These and other objects of the invention can be accomplished by providing an electronic blood pressure meter of the class wherein air is admitted into an inflatable bag of an arm band from an air bulb and the blood pressure measured by a microphone carried by the arm band is displayed by a blood pressure meter, characterized in that there are provided an elongated hollow casing, a blood pressure meter mounted on one end of the casing, an air bulb received in a recess on one side of the casing, an arm band including an inflatable bag and a microphone, a connecting pipe including an integral air supply pipe adapted to interconnect the air bulb and the inflatable bag and an electric cable adapted to interconnect the microphone and the blood pressure meter, and plug means detachably connecting the connecting pipe to the other end of the casing.

The blood pressure meter is mounted parallel to or at predetermined angle with respect to the longitudinal axis of the casing and is provided with light means for indicating the instant at which the blood pressure is measured.

The connecting pipe is made of a flexible material provided with two parallel conduits, one acting as the air supply pipe and the other accomodating the cable.

The arm band is provided with a resilient member having a tendency of taking the form of a ring.

BRIEF DESCRIPTION OF THE DRAWINGS

Further objects and advantages of the invention can be more fully understood from the following detailed description taken in conjunction with accompanying drawings in which,

FIG. 1 is front view of the main body or casing of the blood pressure meter embodying the invention;

FIG. 2 shows the bottom plan view of the main body shown in FIG. 1;

FIG. 3 is a left hand side view of the main body Shown in FIG. 1;

FIG. 4 is an enlarged side view, partly in section of the main body shown in FIGS. 1 and 3;

FIG. 5 is a plan view of an unfolded arm band embodying the invention;

FIG. 6 is a cross-sectional view of the arm band shown in FIG. 5, taken along a line VI—VI;

FIG. 7 shows a perspective view of a spring member contained in the arm band;

FIG. 8 shows a perspective view of a completed partly folded arm band;

FIG. 9 shows a manner of mounting the arm band of this invention;

FIG. 10 is a perspective view showing the position of a microphone in the arm band; and

FIG. 11 is a sectional view of a flexible connecting member containing an air pipe and an electric cord which are assembled as an integral unit.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of this invention shown in FIGS. 1, 2 and 3 comprises an elongated hollow casing 1 or main body made of a synthetic resin such as ABS (Acrylonitrile-Butadiene-Styrene) resin or vinyl chloride resin. A pressure meter 2 is mounted on the top of the casing 1 parallel to or at a predetermined angle with respect to the longitudinal axis of the casing 1. An air bulb 5 is seated in a recess at one side of the casing near the bottom thereof and an air pressure adjusting knob 8 in the form of a dial position is located on the opposite side of the air bulb. A source switch 6 and a connector 7 are provided at the bottom of the casing 1 for attachment to an air supply pipe 11 and electric terminals 12. There is also provided a volt meter 9 for indicating the voltage of a source and a plurality of screws 10 are used to hold the casing 1.

The detail of the main body will be described with reference to FIG. 4. More particularly, a hybrid type integrated circuit 13 is contained in the bottom of the top of the casing 1, and a power source in the form of batteries 26 is contained in the hollow casing just behind the air bulb 5. The battery may be recharged when discharged so that it is not necessary to replenish it frequently. The electric system of the blood pressure meter comprises terminals 12 to be connected with a microphone to be described later, the integrated circuit 13 described above, and a light source 17 in the form of a display lamp. The signal detected by the microphone is sent to the integrated circuit 13 via terminals 12 to be amplified by the integrated circuit to form a pulse which is used to light the display lamp for indicating to the observer the correct time at which the blood pressure is measured.

The pneumatic pressure applied to the upper arm of a patient for measuring the blood pressure is provided by the following pneumatic system. When the air bulb 5 is repeatedly compressed and released by the hand of an operator, air is sucked into the bulb 5 through an intake port 24 and compressed air is admitted into the pressure meter through pipes 22 and 21 and into the inflatable rubber bag of an arm band to be described later via a pressure regulating valve 19 and pipes 20 and 11 so as to indicate the pressure in the rubber bag by the deflection of the pointer of the pressure meter. As shown by dotted lines in FIG. 4, the pressure meter is housed in a casing 23.

With the blood pressure meter of this invention constructed as above described it is possible to grasp by a single hand both the central portion of the casing 1 and the air bulb 5 so that by repeating compression and release of the air bulb it is possible to apply pressurized air to the arm band while observing the pressure meter.

Another feature of this invention lies in an improved construction of the display member of the pressure meter 2. More particularly, an inclined surface 16 having an inclination angle θ (45° in the example illustrated) is formed around the periphery of a transparent base plate 15 made of glass or acrylic resin, and a light shield plate 18 having a diameter smaller than that of the base plate 15 so that the inclined surface 16 will not be covered by the shield plate is superposed upon the base plate 15. The scale (not shown) of the pressure meter is graduated on the periphery of the base plate 15. It should be understood that the light shield plate 18 may be substituted by a coating of an opaque coating material. An opening 25 is formed at a suitable portion of the base plate 15 to receive the light source 17 in the form of an incandescent lamp or a luminous diode. With this construction, when the light source 17 is lighted in synchronism with the blood pulse. Hence light emanated from the light source 17 transmits through the base plate 15 and then is reflected by the inclined surface 16 to illuminate the graduated periphery of the base plate only during each instant when the pressure is to be read. For this reason, it is possible to read the position of the pointer of the pressure meter only at the instant during which the blood pressure is to be measured. Furthermore, since the pulsed instantaneous lighting of the light source 17 occurs in synchronism with the blood pressure pulses power consumption is very small. By applying a coloured film on the inner surface only of the opening 15, it is possible to produce light of any desired colour.

Another feature of this invention lies in the novel construction of the arm band 27 as shown in FIGS. 5, 6 and 8. As shown in these figures, the arm band comprises a hollow bag 27*a* comprising a plurality of sheets of cloths which are sewed together and an inflatable rubber bag 28 contained in the bag 27*a* and connected to an air supply pipe to be described later. A microphone 33 is disposed between the bag of cloth 27*a* and the rubber bag 28. A longitudinal pocket 30 is formed on one side of the arm band to receive a spring member 31 having a construction as shown in FIG. 7. A reenforcing member 32 is provided on one side of the arm band and adhesive tapes 29 are bonded to the arm band at the opposite ends thereof on the opposite surfaces. As an example, the spring member 31 has a length of 260 mm, a width of 16 mm and a thickness of 0.4 mm and normally has a configuration as shown in FIG. 7 in which $r = 35$ mm and $R = 40$ mm. In other words, the spring member normally has a configuration of a ring with two ends 36 and 37 overlapped as at 38. When this spring member 31 is inserted in pocket 30 of the arm band 27, the latter will have a configuration as shown in FIG. 8. Under these conditions, it is possible to readily mount the arm band 27 about the upper arm of one hand by spreading the opening 39 (see FIG. 8) with the other hand. Due to the resiliency of the spring member, the arm band 27 can be mounted firmly about the arm.

Still another feature of this invention lies in the novel connecting pipe 40 in which an air supply tube and the cable for the microphone are combined into an integral unit as shown in FIG. 11. The connecting pipe 40 is made of rubber or synthetic resin and has a cross-sectional configulation as shown in FIG. 11 which includes parallel air supply pipe 42 and cable duct 44 which is provided with a longitudinal slit 45 through which cable 46 connected to microphone 33 is pressed into cable duct 44. After mounting the cable in this manner, the slit 45 may be closed with a bonding agent. One end of the connecting pipe is connected to the arm band while the other end is connected to a plug, not shown, cooperating with the connector 7 at the bottom of the main body.

As above described, in accordance with this invention since the air supply pipe and the electric cable are combined into a unitary connecting pipe, there is no fear of trouble caused by twisting or tangling of them.

From the foregoing description it will be clear that the invention provides a novel electronic blood pressure meter which can be readily used by unskilled persons, can measure the blood pressure accurately with a minimum time, and is convenient to carry.

While the invention has been shown and described in terms of a preferred embodiment thereof many changes and modifications will readily occur to one skilled in the art without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. In a portable hand held electronic blood pressure meter of the class wherein air is admitted into an inflatable bag of an arm band from an air bulb and the blood pressure measured with the assistance of a microphone carried by the arm band and displayed by a blood pressure meter, the improvement which comprises an elongated hollow casing capable of being held in the hand of a human being, a blood pressure meter having a calibrated scale mounted on one end of said casing, an air

pressurizing bulb connected to said blood pressure meter secured on one side of said casing and capable of being hand actuated by a holder of the casing, an arm band including an inflatable bag and a microphone secured to said inflatable bag, a connecting pipe including an integral air supply pipe interconnecting said air bulb and said inflatable bag, electric circuit means for amplifying electric signals produced by said microphone, light means for lighting the calibrated scale of said blood pressure meter and energized by said electric circuit means, and an electric cable interconnecting said microphone and said electric circuit means, said electric circuit means synchronously illuminating the calibrated scale of said blood pressure meter instantaneously with the occurrence of the blood pulses being measured.

2. The electronic blood pressure meter according to claim **1** wherein said casing further contains a battery source of electricity for operating said electric circuit means.

3. The electronic blood pressure meter according to claim **1** wherein said calibrated scale of the blood pressure meter is disposed at an angle with respect to the longitudinal axis of said casing and said casing further includes detachable plug means at the end of said casing remote from said calibrated scale for detachably connecting said connecting pipe, said connecting pipe comprising both said integral air supply pipe and said electric cable.

4. The electronic blood pressure meter according to claim **3** wherein said connecting pipe is made of a flexible material provided with two parallel conduits, one acting as said air supply pipe and the other accomodating said electric cable.

5. The electronic blood pressure meter according to claim **4** wherein said other conduit is provided which a longitudinal slit for inserting said cable from outside into said other conduit, said slit being closed after said insertion of the cable.

6. The electronic blood pressure meter according to claim **5** wherein said arm band comprises a hollow bag of flexible sheets forming said inflatable bag and said microphone is disposed within said hollow bag, said hollow bag being provided with a pocket extending lengthwise along the arm band, and a resilient member received in said pocket, said resilient member having a tendency of taking the form of a ring.

7. The electronic blood pressure meter according to claim **6** wherein said blood pressure meter calibrated scale comprises a transparent base plate having a calibrated scale graduated thereon and an opening therein, a dial disc having a diameter smaller than that of said transparent base plate, and an inclined surface formed on the periphery of said base plate, and said light means comprises a light source received in said opening in said base plate so that the light emanated from said light source illuminates the calibrated scale and an image thereof is deflected toward a viewer by said inclined surface.

8. The electronic blood pressure meter according to claim **7** wherein said casing further contains a battery source of electricity for operating said electric circuit means.

9. The electronic blood pressure meter according to claim **1** wherein said blood pressure meter calibrated scale comprises a transparent base plate having a calibrated scale graduated thereon, and an opening therein, a dial disc having a diameter smaller than that of said transparent base plate, and an inclined surface formed on the periphery of said base plate, and said light means comprises a light source received in said opening in said base plate so that the light emanated from said light source illuminates the calibrated scale and an image thereof is deflected toward a viewer by said inclined surface.

10. The electronic blood pressure meter according to claim **9** wherein said light source is an incandescent lamp.

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