

O. H. ROGERS & H. C. MACDONALD.

SPHYGMOMANOMETER.

APPLICATION FILED MAY 23, 1911.

1,063,287.

Patented June 3, 1913.

2 SHEETS-SHEET 1.

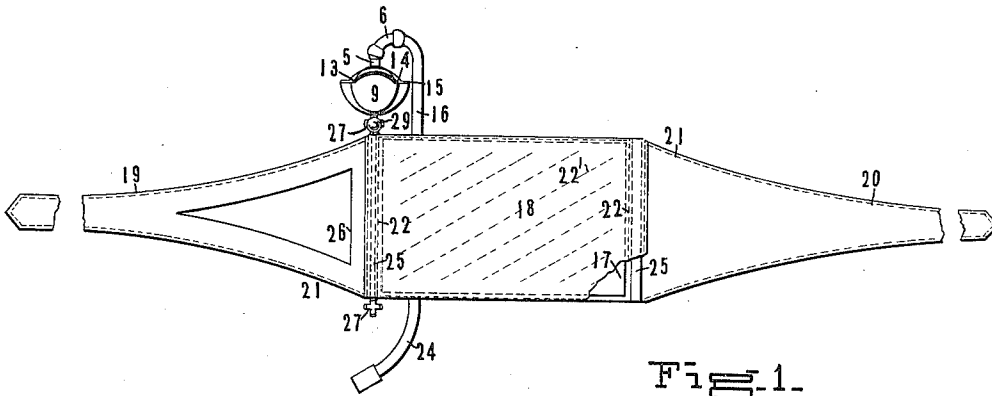


Fig. 1.

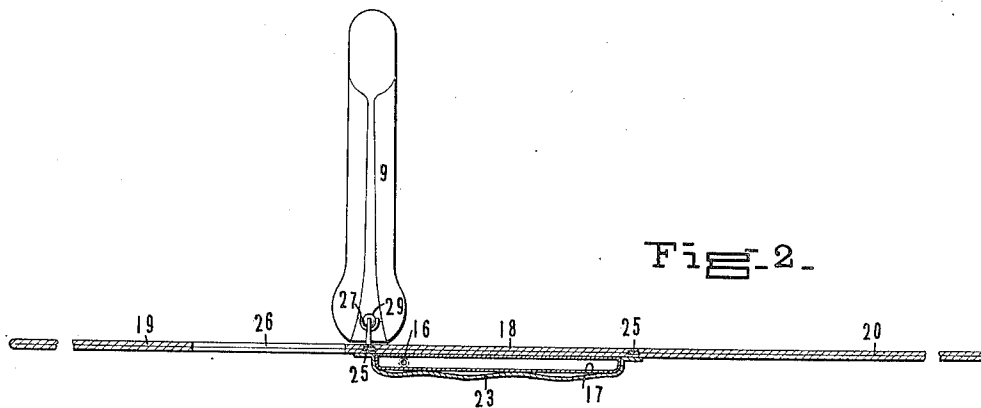


Fig. 2.

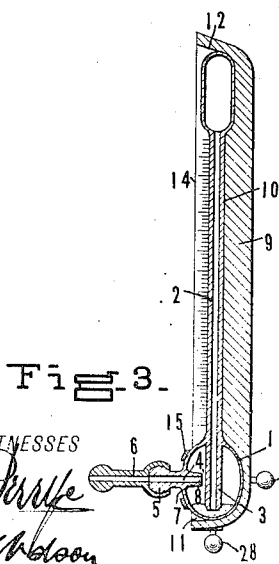


Fig. 3.

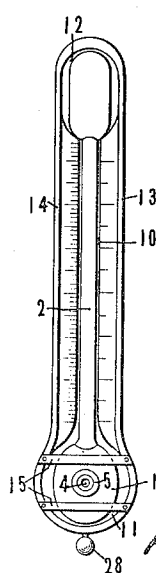
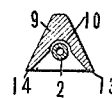


Fig. 4.

Fig. 5.



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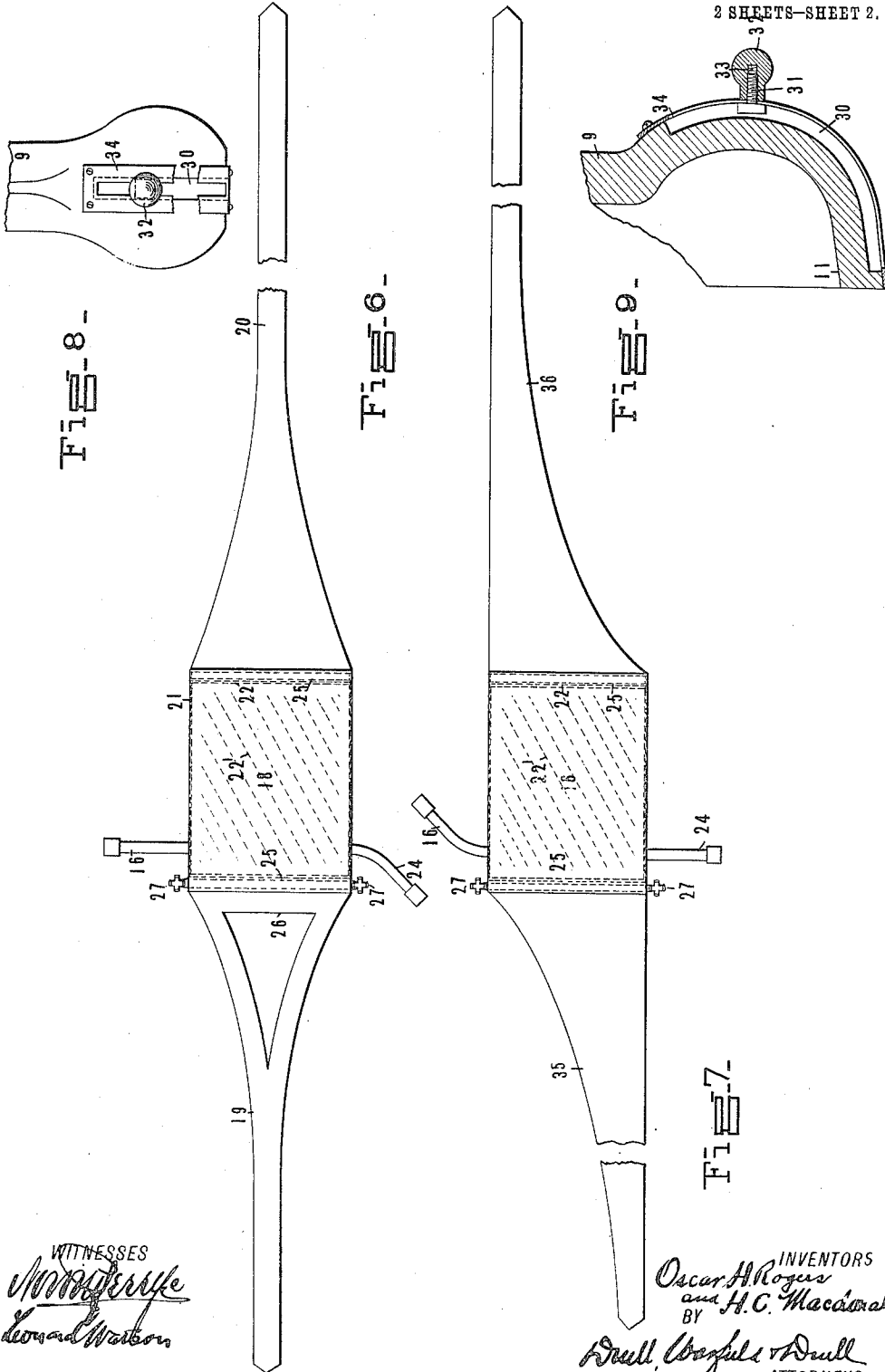
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2 SHEETS-SHEET 2.



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SPHYGMOMANOMETER.

1,063,287.

Specification of Letters Patent.

Patented June 3, 1913.

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To all whom it may concern:

Be it known that we, OSCAR H. ROGERS and HAROLD C. MACDONALD, citizens of the United States, residing at Yonkers, New York, and Bayonne, New Jersey, in the counties of Westchester and Hudson and States of New York and New Jersey, respectively, have invented certain new and useful Improvements in Sphygmomanometers, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to apparatus to be employed in physical diagnosis for measuring and indicating the degree of blood pressure in the arteries and sometimes known as a sphygmomanometer.

One object of the invention is the provision of a simple and efficient self-contained apparatus for measuring blood pressures and offering inelastic resistance thereto.

Another object is the production of a practical and efficient manometric instrument.

Another object is the provision of a sleeve or binder portion of such an apparatus adapted to provide or support and retain a flexible bag employed to compress the blood-vessels, and which shall be efficient in use, easily manipulated, and cheap to manufacture.

Another object is the provision of a practical and efficient means for attaching the manometer to the sleeve or binder in a manner such that the manometer may be rendered fixed and immovable when in use and easily detached and removed when not in use.

Still other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the application of which will be indicated in the following claims.

Referring to the accompanying drawings forming part of this specification and wherein similar reference characters refer to similar parts throughout the several views, Figure 1 is a plan of the apparatus showing the indicator or manometer mounted on the binder or sleeve. Fig. 2 is a rear view partly

in section showing the manometer mounted on the binder or sleeve and the flexible bag therein. Fig. 3 is a vertical section through the manometer and its protective case. Fig. 4 is a front elevation of the manometer and its case. Fig. 5 is a transverse section through the manometer and case. Fig. 6 is a plan of one form of binder. Fig. 7 is a plan of another form of binder. Figs. 8 and 9 are views on different enlarged scales of one form of manometer attaching means.

Blood pressure in the body may be determined by ascertaining the tension or pressure required to constrict an artery until the pulse ceases to be felt, and as the tension of the blood has an important bearing in the diagnosis of some diseases the provision of a simple and practical instrument for determining the blood pressure is very important and is one of the objects of the present invention. In the present instrument, the artery is constricted by means of an elastic pressure device consisting of an air-bag, and the pressure required to constrict the artery is ascertained from a suitable indicator preferably mounted in connection with the air-bag in order to form a light portable instrument, not likely to get out of order and one which is convenient in use.

Referring now more in detail to the drawings, in Figs. 2 and 3 is shown the preferred form of instrument for indicating the pressures. This indicator or manometer comprises a receptacle portion or bulb 1 and a reduced tubular portion or passageway 2 leading from the receptacle and adapted to serve to establish a fluid column to indicate different pressures. In the present embodiment, communication between the tube 2 and the bulb is established by means of a tubular portion 3, preferably a continuous portion of the tube 2, which extends to a point adjacent the wall or bottom of the bulb, where it opens into the bulb. The internal diameter of the tubular portion 3 is preferably the same as that of the tube 2. The other or outer end of the tube is closed and preferably enlarged as shown. A sufficient amount of mercury is introduced into the bulb to submerge the opening in the extended portion 3 of the tube 2, and so that when pressure is applied to the surface of the mercury in the bulb, a column of mercury will be formed in the tube which will compress the

air trapped in the upper portion of the tube and be cushioned and partly balanced thereby. In order to provide a passageway whereby the pressure in the receptacle may vary in accordance with external conditions, an opening 4 is located in the wall of the receptacle 1, around and from which projects a nipple 5, to which a flexible tubular connection 6 is attached, forming a flexible extension whereby the manometer may be conveniently connected to the other parts of the apparatus as will hereinafter appear. The opening 4 forms also a convenient way for permitting the introduction of the mercury into the instrument, and in order to retain the mercury therein in all positions of the instrument, the opening 4 is surrounded by a wall or tube 7, which projects into the space within the receptacle and has an opening 8 at a point above any level which might be assumed by the mercury. The bulb, tubes and nipples are preferably made of glass.

In order to protect the manometer, it is located in a case 9 consisting of a light shell of wood or any other suitable material having a longitudinally extending channel 10 terminating at each end in enlarged cavities 11 and 12, the tube 2 being designed to lie in the channel 10, while the bulb 1 and the outer enlargement of the tube occupy the cavities 11 and 12. The tube 2 lies below the edges 13 and 14 of the channel 10 so as to be protected by the walls of the case, and said walls are relatively angularly disposed to nicely accommodate the tube 2, and are graduated with a pressure scale adapted to cooperate with the mercury column in the manometer. Any efficient means may be employed to retain the manometer in the case, such as bands 15 lying across the bulb and fastened to the walls of the case.

The manometer is removably connected by means of a suitable tube or passage 16, with a flexible, preferably elastic, bag 17 adapted to contain a readily compressible fluid such as air, and whereby the variations in the pressure in the bag may be reproduced in the receptacle 1, and indicated on the pressure scale. The air-bag 17 is designed to be applied against the anatomical part carrying the artery under investigation, and air is then forced into the bag until the artery is compressed sufficiently, or until the pulse therein ceases. The pressure in the air-bag is transmitted to the manometer and the mercury will rise in the tube responsive to the increased pressure in the receptacle, the height to which it rises determining the arterial pressure at the point of application of the bag. In order to efficiently hold the bag on the part to which it is applied and to offer a substantial and inelastic resistance to outward expansion so that when the bag is inflated it will swell toward the artery, a binder is

provided. This binder comprises a flexible, inelastic strip of fabric having a portion adapted to contact the air-bag, and portions adapted to be passed around the anatomical part and secured. In the preferred embodiment the binder has a relatively broad substantially rectangular intermediate portion 18 and oppositely extending portions 19, 20, of sufficient length to pass around the anatomical part and tapering or narrowing from the broad portion of the binder to each end so that when wrapped around the anatomical part the binder will be smooth and free from wrinkles and offer a uniform surface of resistance to the pressure of the bag. The extreme ends of the binder are preferably made quite narrow so that they may be tied, this being regarded as a practical and efficient way of securing the binder in place. It is evident, however, that viewed in some aspects, the invention contemplates securing the binder in position by any suitable means, capable of ready adjustment and removal, as by a buckle on one end which is suitably engaged by the other end. Preferably the binder is composed of two or more layers of fabric sewed together at their edges as at 21 and transversely as at 22 and several lines of stitches 22' may be passed across the binder, in order to slightly stiffen the same and preserve the contiguity of the layers while permitting the easy folding of the binder around the part to which it is applied. The air-bag is located against one face of the fabric, and is preferably retained in such position by a layer of fabric 23 of appreciable fullness sewed around outside the edge of the bag and providing for the expansion of the bag toward the anatomical part to which it is applied. Silk fabric of flexible consistency has been found to be a suitable substance of which to make the binder, and it is preferred that the portion 23 be of thinner, more flexible material than the other portion of the binder. It will be understood, however, that any other material suitable for the purpose may be employed, such as cotton cloth, etc. The air-bag is provided with suitable tubes 16 and 24 extending outside the binder, by means of which connection may be made with the indicator and a pumping apparatus respectively.

The binder constructed as above described comprises, in effect, a flexible sleeve in which the air-bag is carried and by means of which it may be easily, accurately and efficiently secured and retained in position against the anatomical part under investigation. On account of the flexibility of the binder and the narrowed securing portions, tension thereon has a tendency to collapse or fold the air-bag, thus interfering with the accurate positioning of the bag on the part to which it is applied. To avoid this

and offer a bearing for the securing extensions commensurate with the width of the bag, stiffening pieces 25 of flat, flexible brass, or other suitable material, are secured transversely of the binder on each side of the bag, preferably by being sewn in between the layers of material, as shown. while it is evident that the ends 19 and 20 may be passed alongside each other around the anatomical part, it is preferred to provide one of the extensions with an opening 26, preferably situated close to the air-bag, and designed to allow the other extension to pass freely therethrough. By passing the extension 20 beneath the extension 19 and up through the opening 26 any fold or wrinkle which might otherwise result is avoided.

In the form of binder illustrated in Fig. 7, the opening 26 is omitted and the extensions are so shaped as to fold around the anatomical part and readily pass each other without substantial wrinkling, this result being accomplished by tapering but one edge of each extension on opposite sides, leaving the other edge continuous and parallel or substantially so with the edge of the broad bag retaining portion of the binder.

In both forms of binder, the tubes 16 and 24 preferably extend from the bag retaining portion of the binder at opposite edges thereof so that though observations may be taken at different anatomical parts, the tubes will assume convenient positions suitable for ready attachment of the manometer, etc.

In taking an observation, the manometer should be supported on the binder in erect position and so that the indications may be readily observed, and at the same time in such a fashion as to be practically fixed during such observation. To this end the apparatus is provided with a device for holding and supporting the manometer in upright substantially fixed position at either side of the binder, and while this portion of the apparatus may be of any suitable construction, one preferred means, illustrated in Figs. 1 to 6, is to provide the binder at its opposite edges with the socket portions of a ball and socket clasp. In the present embodiment, the elastic sockets 27 are conveniently provided on extended portions of the stiffening brass piece adjacent the edge of the air-bag. Correspondingly the protective case of the manometer is provided with the balls 28 and 29, designed to fit into the socket selected for support, and secure the manometer in fixed position. Two balls are shown, either of which may be used depending upon the position assumed by the binder, the one being employed which will support the manometer in erect position. By another preferred arrangement, as shown in Figs. 8 and 9, the manometer is

provided, preferably at its lower portion, with a slot 30 following the curved outline of the surface of the case 9, and within the slot is secured the head of a pin 31, having a threaded end portion projecting from the slot and engaged by a ball 32 having a neck, and a threaded opening 33. Preferably the slot 30 is formed in the material of the case at the position referred to, and fastened opposite thereto is a thin metallic plate 34 slotted in line with the slot of the case, the edges of the slot of the plate 34 overhanging the edges of the slot 30. The head of the pin 31 is preferably rectangular and is wider than the slot in the plate so that when in position, the ball 32 may be turned on the threaded end of the pin to clamp the same in any position in the slot to which it may be adjusted, the shape of the head preventing the pin from turning. By this construction, a single ball may be conveniently adjusted to support the manometer in upright position, for the various positions assumed by the binder. The elastic socket portion of the joint above referred to is fixed on the binder and is conveniently provided on extended portions of the stiffening brass piece adjacent the edge of the air-bag, as in the form previously described.

Whether one or the other form be employed, it will be understood that the position of the clasp elements may be reversed, the ball being secured to the binder and the socket to the manometer, as will be apparent. By the above described constructions, the binder is provided with means for securing the manometer thereto in fixed position and in a manner such as not to interfere with the efficient securing of the binder to the anatomical part. In the forms of binder illustrated the end portions may be readily passed over the air-bag, and it will be observed that the fastening devices for the manometer are so positioned and formed as to permit this, said fastening means presenting themselves at either edge portion of the binder, though the stiffening brass piece which, in the form shown acts as their support, may lie beneath the folds of material when the binder has been secured in position.

In operation, the binder is applied to the part over the artery under investigation, the relatively wide portion containing the air-bag resting immediately over the artery. The extensions 19 and 20 are then passed around the part, say the arm, and, when the form illustrated in Figs. 1 and 6 is employed, the end 20 is passed through the opening 26 and the two ends are then drawn tight and tied together. When the modified form of binder illustrated in Fig. 7 is used, the extensions are passed by each other, the cut away or curved edges 35 and 36 being preferably so designed and proportioned that

the extensions afford a broad bearing surface against the body at the portion opposite the bag, thereby maintaining the expansion of the bag substantially uniform throughout its area, and at the same time not unnecessarily binding the blood-vessels at the portion directly adjacent thereto. It will be understood that the extensions of the form illustrated in Fig. 6 are also preferably so designed and proportioned as to provide a similar broad bearing portion. Having fastened the bag in position, the manometer is attached to the binder by springing one of the sockets over a ball, is adjusted to the desired position where it is held immovable during the observation, and one of the tubes 16 or 24 of the air-bag is connected to the tube 6 leading to the manometer. Air is then forced into the bag in any suitable manner, by means of any suitable form of air-pump, as a hand ball, applied to the other tube of the bag. As the pressure increases the bag swells and eventually constricts or compresses the artery so as to obliterate the pulse therein, the mercury column of the manometer indicating to some appropriate scale the pressure at which the pulse ceases and thus measuring the pressure of blood at that point in the body.

As before stated, mercury is preferably the fluid employed in the receptacle to give the indication, and a sufficient amount of mercury is provided to form a mercurial column continuous with the supply in the receptacle. This gives a positive indication, which is capable of more ready control and which is relatively constant, as the oxidation of the mercury, taking place only at the surface, does not affect that portion of the mercury which passes into the tube to form the mercury column, thus rendering the instrument constant and its life practically unlimited. By the above described arrangement, the mercury naturally assumes a position over the opening into the indicating tube when the indicator is in upright position on the binder, and observations may be made efficiently and rapidly by merely setting the indicator in position and applying pressure.

In the forms of binder illustrated, the longitudinal dimension is generally rectilinear, this form being regarded as of widest utility, but it will be understood that the binder may have a different longitudinal form, and that the sides of the air-bag and the retaining portion of the binder may be otherwise shaped to conform to special parts of the body, such as the forearm, etc.

The practicability and efficiency of the apparatus will be apparent. It is composed of few parts, is not likely to get out of order, and is readily and easily applied notwithstanding the difficult situations in which it may be employed. The sleeve or binder

offers a simple and convenient way of affixing the air-bag to different portions of the anatomy, and of nice adjustment. The binder and bag may be rapidly applied and removed by a very simple manipulation, a feature of considerable importance on account of the pain which ensues upon long constriction of the arteries. At the same time it causes little constriction of superficial veins and capillaries other than those closely adjacent its point of application to the artery under investigation. The manometer being in an erect position and being attached to the binder and held immovably upon it while in use, its indications are easily and rapidly read, and it is in the most favorable position for constant attention to the patient. Thus, by the above-described construction is provided a device capable of efficiently accomplishing, among other things, the objects hereinbefore stated.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having described our invention, what we claim as new and desire to secure by Letters Patent is:

1. In an apparatus of the character described, in combination, a binder comprising a flexible inelastic fabric having an intermediate bag retaining portion, an air bag retained by said portion, a relatively stiff portion at each side of the intermediate portion, and oppositely extending portions adapted to secure the binder in position.

2. In an apparatus of the character described, in combination, a binder adapted to hold an air bag in position against an anatomical part, and means on said binder adapted to support an indicator.

3. In an apparatus of the character described, in combination, a binder adapted to hold an air bag in position against an anatomical part, a clasp device permanently secured to said binder, and a manometer adapted to be held in operative position by said clasp.

4. In an apparatus of the character described, in combination, a binder comprising a flexible inelastic strip of fabric having means for retaining an air bag, and an air bag retained thereby and having flexible tubular portions extending from opposite edges of the binder.

5. In an apparatus of the character described, in combination, a binder comprising a flexible inelastic strip of fabric having means for retaining an air bag, and an air bag retained thereby and having flexible

tubular portions extending in opposite directions therefrom.

6. In an apparatus of the character described, in combination, a flexible binder, an air bag secured thereto, and a stiffening piece secured to the binder and providing a clasp device thereon.

7. In an apparatus of the character described, in combination, an air bag, a flexible inelastic strip adapted to retain the air bag, a clasp device thereon, and an indicator adapted to be removably secured to the clasp device and held immovably thereon.

8. In an apparatus of the character described, in combination, a binder comprising superposed strips of flexible inelastic material, an air bag intermediate said strips and having tubular portions projecting from opposite sides of said binder, and stiffening pieces disposed on opposite sides of said bag.

9. In an apparatus of the character described, in combination, a binder comprising superposed strips of flexible inelastic material, an air bag intermediate said strips and having tubular portions projecting from opposite sides of said binder, stiffening pieces disposed on opposite sides of said bag, and supporting devices on the ends of one of said stiffening pieces.

10. In an apparatus of the character described, in combination, a binder adapted to hold an air bag in position against an anatomical part, a manometer, and means adapted to retain the manometer immovably in operative position relative to said binder.

11. In an apparatus of the character described, in combination, a binder adapted to hold an air bag in position against an anatomical part, a manometer, and means adapted to retain the manometer removably in immovable operative position relative to said binder.

12. In an apparatus of the character described, in combination, an air bag, a manometer adapted to be supported thereby, means adapted to secure the air bag in position, and means adapted to secure the manometer at either side of the air bag.

13. In an apparatus of the character described, in combination, a binder adapted to be wrapped around an anatomical part to secure an air bag in position, and manometer attaching means carried thereby and so arranged as to permit the manometer to be disposed in fixed upright position for different positions of the binder.

14. In an apparatus of the character described, in combination, a binder adapted to hold an air bag in position against an anatomical part, and means on said binder adapted to support an indicator immovably while in use.

15. In an apparatus of the character described, in combination, a binder adapted to

hold an air bag in position against an anatomical part, a clasp device permanently secured to the binder, and a manometer adapted to be held while in use immovably in operative position by said clasp.

16. In an apparatus of the character described, in combination, an air bag, a binder comprising a flexible inelastic fabric having an intermediate portion adapted to contact said air bag, the portion of the binder at each side of the air bag contacting portion being relatively stiff, and oppositely extending portions adapted to secure the binder in position, one of said extensions having an opening adapted to receive the other extension.

17. In an apparatus of the character described, in combination, means adapted to hold an air bag in position against an anatomical part, and means adapted to support a manometer immovably relative to said part.

18. In an apparatus of the character described, in combination, a binder comprising a strip of flexible material, an air bag adapted to be secured against an anatomical part by said strip, said bag having tubular portions projecting in opposite directions relative to said strip, and a manometer secured to said strip and adapted to be connected to a tubular portion of the bag.

19. In an apparatus of the character described, in combination, an air bag, a binder adapted to secure said bag in position against an anatomical part, a manometer, and means adapted to secure the manometer to the binder, said air bag comprising a plurality of flexible tubular extensions respectively at opposite edges of the bag and either of which is adapted for connection to the manometer.

20. In an apparatus of the character described, in combination, an air bag, a manometer adapted to be supported thereby, means adapted to secure the air bag in position against an anatomical part, and means adapted to secure the manometer to and in different positions relative to the last-mentioned means.

21. In an apparatus of the character described, in combination, an air bag, a binder comprising flexible inelastic material adapted to hold said bag in position against an anatomical part, a manometer, said bag having a plurality of tubular extensions adapted to be connected to the manometer, and means adapted to retain the manometer immovably in operative position relative to the binder.

22. In an apparatus of the character described, in combination, an air bag, a binder comprising flexible inelastic material adapted to hold said bag in position against an anatomical part, a manometer, said bag having a plurality of tubular extensions adapt-

ed to be connected to the manometer, and means adapted to retain the manometer immovably in different operative positions relative to the binder.

5 23. In an apparatus of the character described, in combination, an air bag having a plurality of tubular extensions, a binder comprising flexible material adapted to hold the bag against an anatomical part, a ma-
10 nometer adapted to be connected to one of said extensions, and means adapted to secure the manometer in different operative positions on said binder.

15 24. In an apparatus of the character described, in combination, an air bag, a binder

comprising flexible inelastic material adapted to retain the bag against an anatomical part, a manometer adapted to be connected to said bag to indicate the pressure therein, and means adapted to secure the manometer in different operative positions relative to said binder.

In testimony whereof we affix our signatures, in the presence of two witnesses.

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Witnesses:

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HELEN M. SEAMANS.