Feb. 14, 1928.

1,659,393

F. S. DICKINSON ET AL.

MANOMETER

Filed March 2, 1925

4 Sheets-Sheet 1

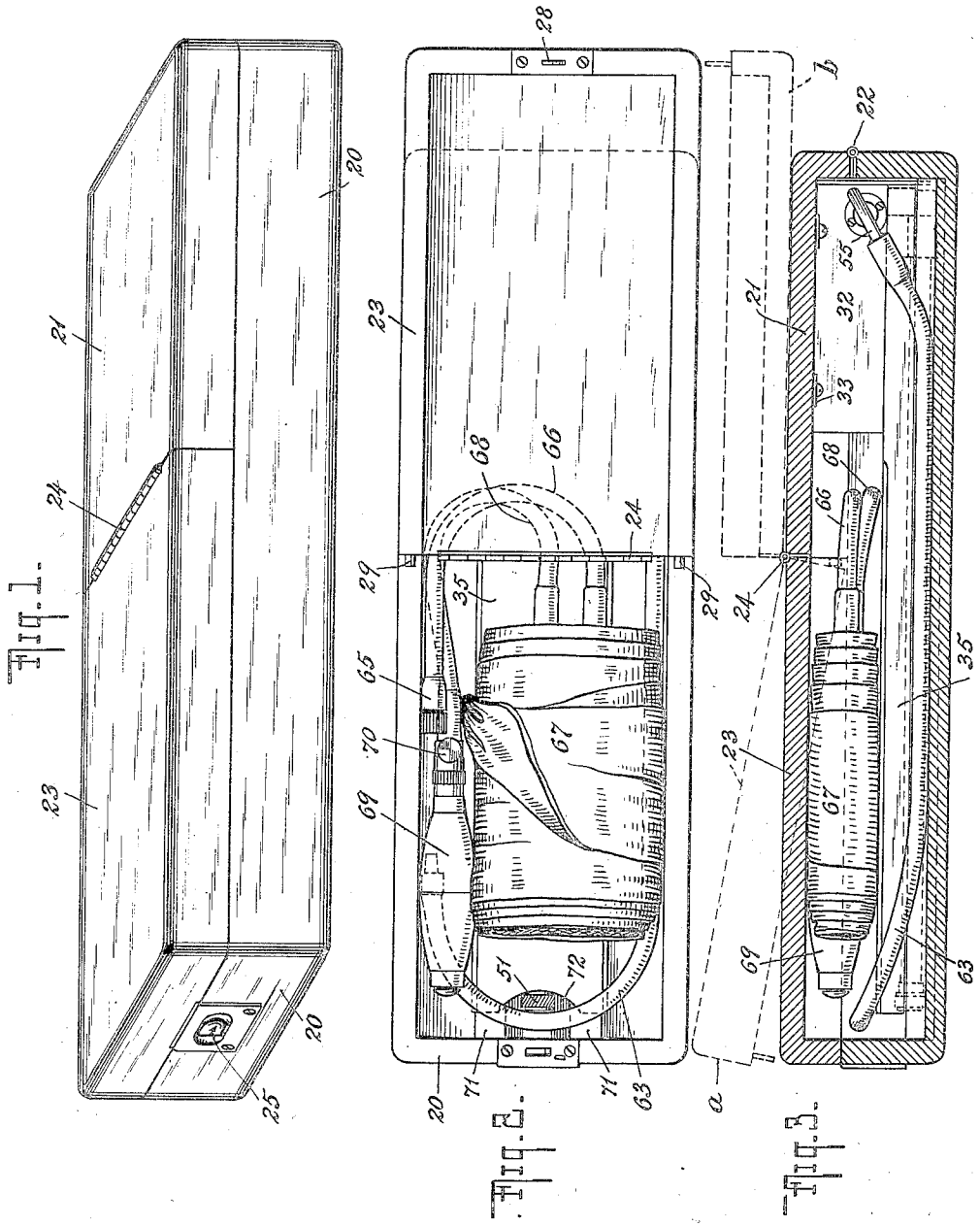


Fig. 1.

Fig. 2.

Fig. 3.

WITNESS

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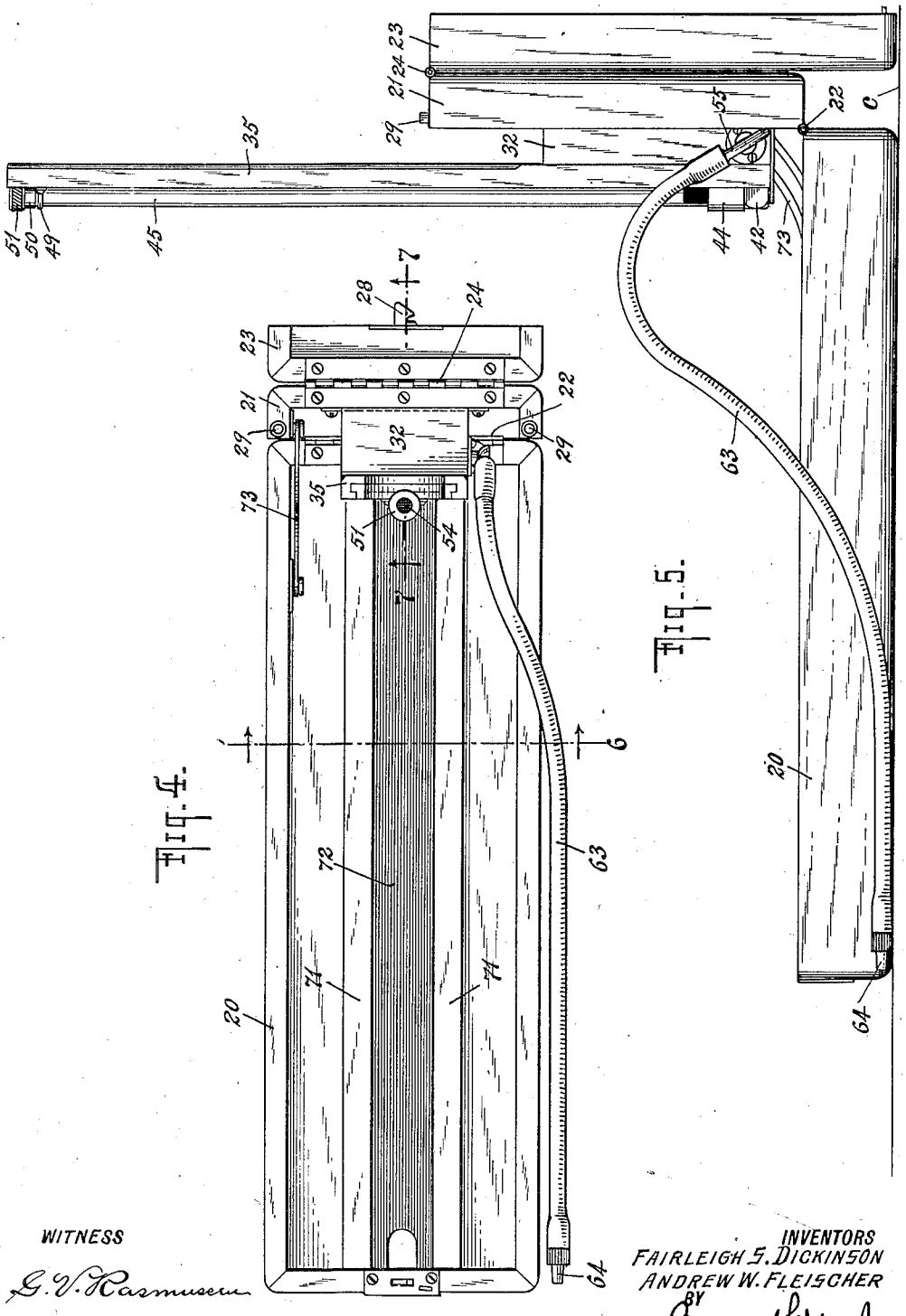


FIG. 4.

FIG. 5.

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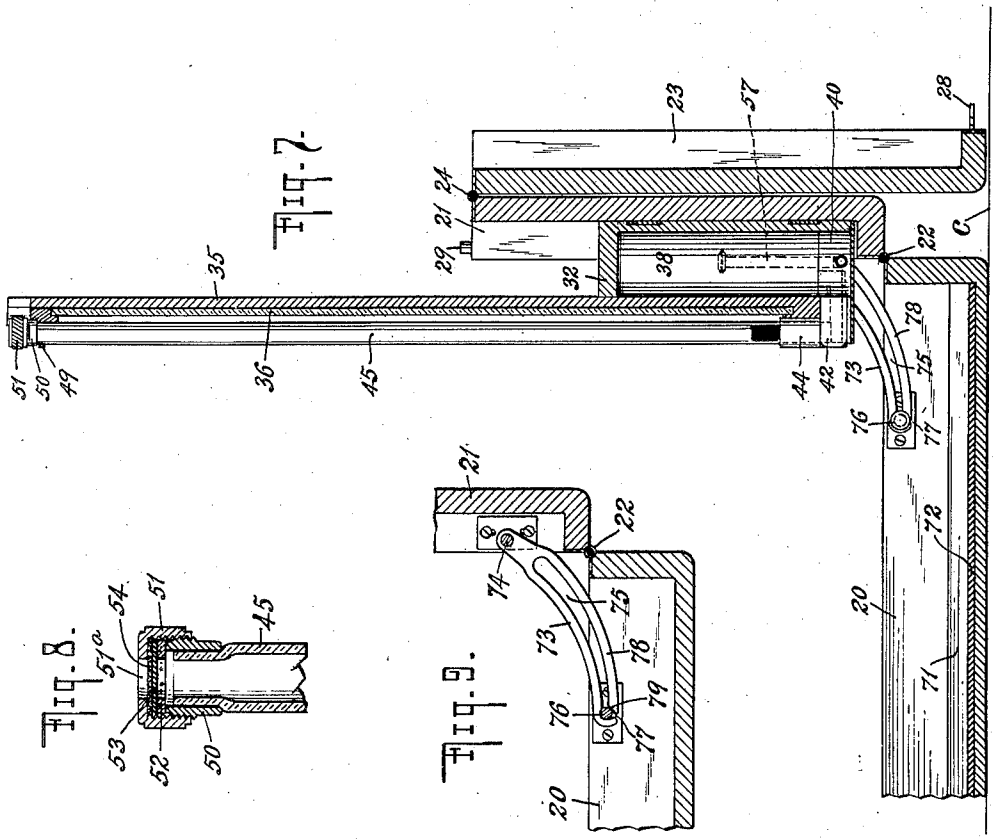


Fig. 7.

Fig. 8.

Fig. 9.

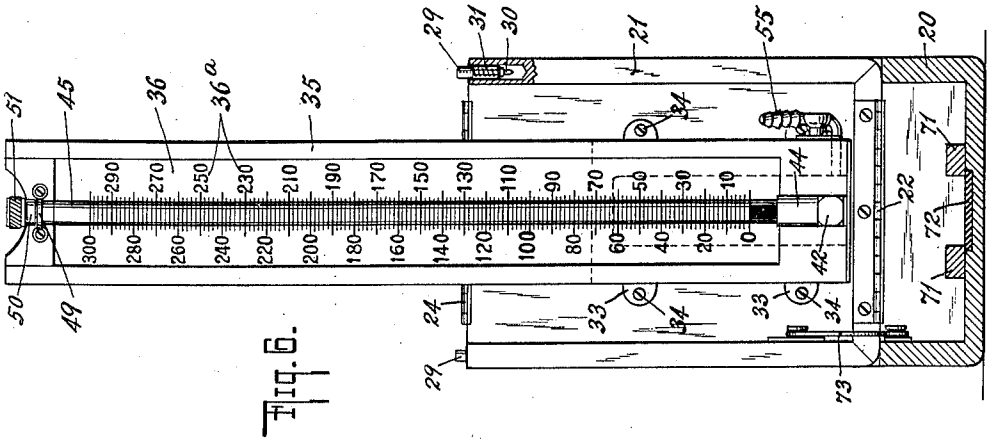


Fig. 6.

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Fig. 13.

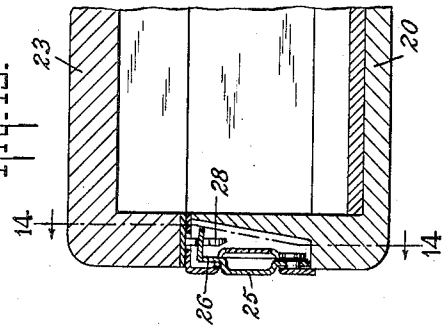


Fig. 14.

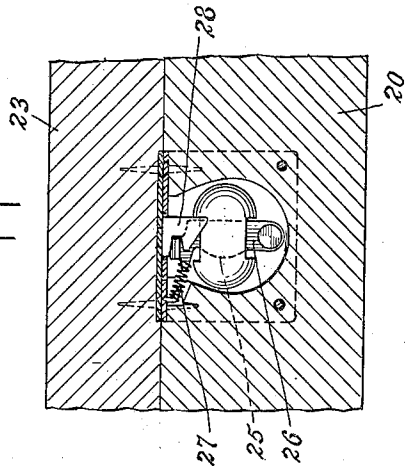


Fig. 11.

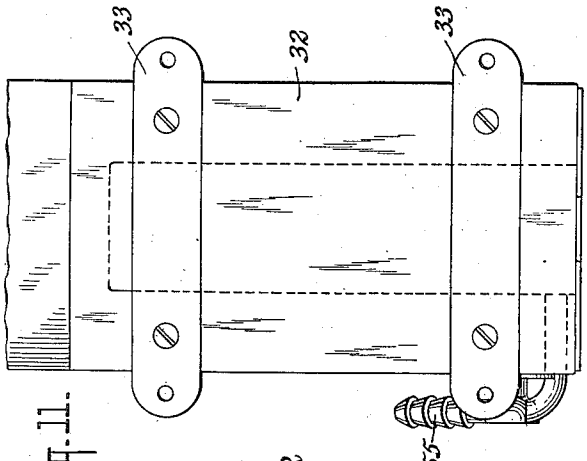


Fig. 10.

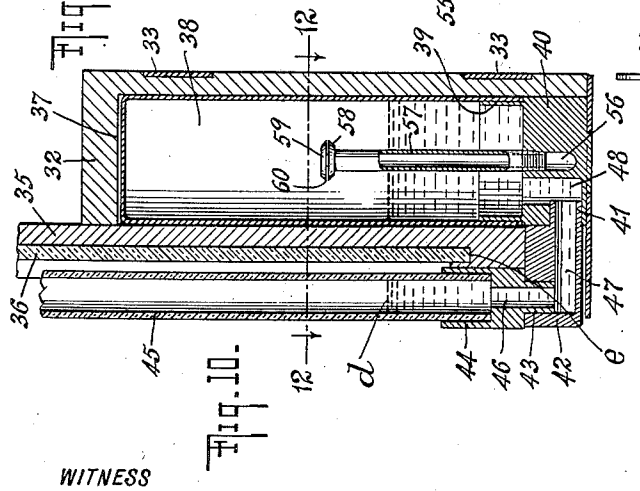
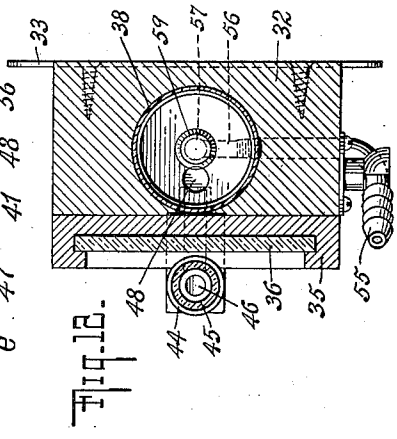


Fig. 12.



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UNITED STATES PATENT OFFICE.

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MANOMETER.

Application filed March 2, 1925. Serial No. 12,508.

The invention relates to manometers of that type commonly known as sphygmomanometers, which are utilized for ascertaining blood pressure and more particularly relates to that class of such instruments in which a fluid column is the indicating element; the invention has for its object to provide a manometer of simple construction and efficient operation in which difficulties and objections inherent in existing instruments of the class in question are obviated. Other more specific objects will appear from the description hereinafter and the features of novelty will be pointed out in the claims.

In the accompanying drawings, which illustrate an example of the invention without defining its limits, Fig. 1 is a perspective view of the instrument as it appears in condition to be transported about; Fig. 2 is a plan view; Fig. 3 is a longitudinal section of the instrument taken lengthwise of Fig. 1; Fig. 4 is a plan view of the instrument in its operative condition; Fig. 5 is a side elevation of Fig. 4; Fig. 6 is a sectional view on the line 6—6 of Fig. 4 looking in the direction of the arrow; Fig. 7 is a fragmentary section on the line 7—7 of Fig. 4; Fig. 8 is a detail section of the upper end of the fluid column tube; Fig. 9 is a detail fragmentary section of the case; Fig. 10 is a fragmentary section of the fluid reservoir and the adjacent end of the fluid column tube; Fig. 11 is a rear elevation of Fig. 10; Fig. 12 is a detail section on the line 12—12 of Fig. 10; Fig. 13 is a fragmentary section illustrating the lock whereby the cover is locked in position and Fig. 14 is a detail section on the line 14—14 of Fig. 13.

As shown in the illustrated example, the manometer comprises a casing consisting of a body 20 of suitable material and of generally rectangular shape and a cover consisting of a main cover section 21 hinged to the body at 22 and an auxiliary cover section 23 hinged to the main section 21 at 24, the two cover sections 21 and 23 together constituting a complete cover adapted to fit upon and close the body 20 as shown in Figs. 1 and 3. A suitable lock may be provided for locking the cover in its closed position, said lock in the illustrated example comprising a laterally movable button 25 and a pivoted tongue 26 located upon the body 20, the tongue being maintained in and returned to its locking position by means of a spring 27 and being arranged to engage a catch 28 carried by the cover section 23. In the preferred arrangement, means are provided whereby the auxiliary cover section 23 is automatically thrown to a partly open position as indicated, for instance, by the dotted lines *a* in Fig. 3, the moment the button 25 is actuated to release the tongue 26 from the catch 28. In the illustrated example, the means in question comprises plungers 29 carried by rods 30 and controlled by springs 31 which exert a tension tending to press the plungers to their outermost positions as shown in the drawings; the plungers are mounted in the end of the cover section 21 in a position to be engaged by and pressed inwardly against the tension of the springs 31 by the contiguous end of the cover section 23. In other words, the plungers are located at that point at which the cover sections 21 and 23 are hinged together by the hinge 24, it being understood that said plungers may be located upon the cover section 23 for engagement with the cover section 21 if this should be preferred. In the illustrated example, the hinge 24 is so located or in other words, the cover is so divided that the section 23, when folded back upon the section 21 will have its free end almost in contact with the surface upon which the instrument is resting in its operative position as shown in Fig. 7, the purpose of which will be more clearly pointed out hereinafter. At that end of the cover section 21 which is hinged to the body 20, a block 32 of suitable size and shape is secured to the inside thereof for instance by means of bracket plates 33 which preferably are countersunk in the block 32 and are fastened in place upon the cover section 21 by means of screws or similar fastening devices 34. A scale member 35 has its one end fixed to the block 32 and projects away from the same as shown in the drawings, said scale member being recessed and grooved for the accommodation of a scale plate 36 having a scale 36ª, suitable for the purpose for which the instrument is intended, produced thereon. The block 32 is hollowed out or recessed as indicated at 37 for the accommodation of a fluid reservoir 38 which may be constructed in the form of a cylinder having its outer end closed and its inner end frictionally fit-

ted over the reduced collar 39 of a cylindrical head 40 as shown in Fig. 10; in its prefered form the fluid reservoir is made of metal or other suitable material which is not easily broken or injured, the reservoir being preferably provided with a lining of enamel or the like. In the illustrated example, the head 40 is provided with an aperture for the reception of the reduced neck 41 of a fitting 42 located at the inner end of the scale member 35 which as shown in Fig. 10 is recessed for the accommodation of said fitting, the latter having an aperture for the reception of the reduced neck 43 of a socket member 44 recessed for the reception of one end of the fluid column tube 45; as shown in the drawings, the tube 45 extends lengthwise of the scale plate 36 in close parallel relation thereto as shown in Figs. 6 and 7. When the arrangement set forth is used, the socket member 44 is further provided with a channel 46 which communicates with a passage 47 formed in the fitting 42, the passage 47 in turn communicating with a channel 48 located in the head 40 and leading to the interior of the fluid reservoir 38. The outer end of the tube 45 may be attached to the scale member 35 by means of a clamping member 49 and is provided with an externally screw threaded collar 50 fitted upon said outer end, which may be reduced for this purpose as shown in Fig. 8. A cap 51 is screwed upon the sleeve 50 and serves to clamp a cork washer 52, a porous disk 53 preferably made of kangaroo skin, sheepskin, or the like, and a screen 54 against the sleeve 50, it being understood that the cap 51 is provided with a central air outlet 51^a as shown in Fig. 8. With this arrangement, the outer end of the tube 45 is closed in a manner to prevent the escape of any of the fluid which constitutes the column in the tube 45 but to permit the ready escape of air and to thereby prevent the formation of an air cushion in said tube as the column rises therein. In addition to preventing the fluid, which generally speaking is mercury, from spilling out of the tube 45, the described closure for the outer end thereof stabilizes the mercury column or its equivalent against undue oscillations; this is essential in order to obtain correct blood pressure readings, particularly at the diastolic. An inlet nozzle 55 is mounted upon the block 32 and is connected with the fluid reservoir 38 through the medium of a passage 56 formed in the head 40; the inlet nozzle 55 serves to permit the admission of a pressure creating medium into the interior of the fluid reservoir 38. As shown in the drawings, the passage 56 of the head 40 communicates with a tube 57 which may be screw threaded into said head 40 and at its free end is provided with a circular flange 58 and a disc 59 located in close proximity to each other and forming a reduced exit passage 60 extending transversely to the axis of the tube 57 and comprising a trap which permits the admission of air to the fluid reservoir 38 and prevents the escape of the fluid *d*, such as mercury therefrom. In the operative condition of the instrument, the inlet nozzle 55 is connected with the customary bladder and with the conventional air bulb. Thus in the illustrated example, a rubber tube 63 has its one end detachably connected with said nozzle 55 and at its other end is provided with a tapering nozzle 64 adapted to be fitted into the coupling 65 located at one end of a rubber tube 66 which leads to the aforesaid bladder, the latter being contained in the well known bandage 67 and being connected by means of a rubber tube 68 with the inflating bladder 69 in the conventional manner. A controlling valve 70 for relieving the pressure at will is combined with the bulb 69 in the customary manner.

As shown in Fig. 4, the body 20 of the casing may be provided interiorly with a pair of parallel spaced ribs 71 extending lengthwise of the bottom of the body in a position to engage and form a rest for the scale member 35 when the instrument is in its inoperative position and folded into the case as shown in Figs. 1 and 3. In the space between the ribs 71, a resilient member 72 is located so as to provide a resilient cushion against which the tube 45 is adapted to rest when the instrument is in its folded inoperative condition. With this construction, the scale plate 36 and the tube 45, both of which are generally made of glass, are supported in a manner to reduce the danger of breakage from shocks and jars to a minimum. To lock the parts in the upright position shown in Figs. 5, 6, and 7, a suitable brace 73 may be included in the apparatus, said brace being pivotally connected at 74 with the cover section 21 and being provided with a slot 75 adapted to ride over a headed pin 76 located in the body 20. The brace 73 is so constructed that it will automatically lock the cover section 21 in its upright position, and to permit a restoration of the parts to their normal condition by exerting a pressure upon the cover section 21 toward its closed position.

In the normal condition of the parts, when the instrument is not in use, the cover sections 21 and 23 are closed and locked upon the body so that the scale member 35, scale plate 36, and tube 45 together with their associated parts, lie within the body 20 with the scale member 35 extending lengthwise of and in engagement with the ribs 71 and the tube 45 extending lengthwise of and in engagement with the cushion 72. Because of the fact that the cover comprises the section 21 and 23 connected with each other by the hinge 24, it is possible to swing the cover section 23 back upon the

cover section 21 to the position indicated by the dotted lines *b* in Fig. 3. The interior of the body 20 at its forward end portion may thus be rendered accessible even though the scale member 35 and its connected parts have been folded into the body 20. As a result of this arrangement, the bandage 67, rolled upon the customary bladder in the manner indicated in Figs. 2 and 3, may be placed upon the back of the scale member 35 within the aforesaid forward portion of the body 20, the bulb 69 and the tubes 66 and 68, together with the tube 63, being folded into the said body 20; in other words the entire inflation system may be placed within the case when not in use, as indicated in Figs. 2 and 3. After this has been done, the cover section 23 may be brought to its closed position and locked therein, so that the instrument in its inoperative condition constitutes a self-contained apparatus, all parts of which are contained in the casing and completely enclosed by the body 20 and the cover 21—23 thereof. When the cover occupies its closed position, the plungers 29 being engaged by the inner end of the cover section 23 will be pressed inwardly against the tension of the springs 31 and held in their innermost positions.

When it is desired to utilize the instrument for its intended purposes, the button 25 is actuated to release the tongue 26 from the catch 28; as soon as the release has been brought about, the plungers 29 by the action of their springs 31 will immediately and automatically throw the cover section 23 to the partly open position indicated by the dotted lines *a* in Fig. 3. This leaves the said cover section in a position to be readily handled with one hand by the physician or other operator, who is thus free to use his other hand for any other purpose necessary. The setting up of the instrument to its operative position may be completed with one hand by swinging the cover section 23 back to the dotted line position *b* in Fig. 3, in which said cover section is folded back over and in surface engagement with the cover section 21. The latter may now be swung on the hinge 22 to its upright position shown in Fig. 5 and carries with it the cover section 23 and also the block 32, scale member 35, scale plate 36, tube 45, and their associated elements, so that in this position the scale member 35, scale 36, and tube 45, project upwardly in a direction perpendicular to the body 20 of the casing. The cover section 23 in the operative condition of the instrument, as shown in Fig. 7, extends downwardly in surface engagement with the cover section 21 and has its lower free end in close proximity to and almost in engagement with the surface *c* upon which the instrument is resting. The cover section 23 thus acts in the nature of a prop or brace, whereby any tendency of the instrument to tilt over in a backward direction will be efficiently resisted. To complete the setting up of the instrument for use, after the bandage has been applied in the customary manner, for instance, to the arm of a person whose blood pressure is to be tested, the nozzle 64 is connected with the coupling 65 of the hose 66 and the instrument is ready for use; the bladder within the bandage 67 may then be inflated by the action of the bulb 69 in the customary way and other necessary operations performed in the usual manner. As this inflation of the bladder takes place, air will pass through the tube 63 and the inlet nozzle 55 and passage 56 into the tube 57 and will flow from the latter through the passage 60 between the flange 58 and the disc 59 into the interior of the fluid reservoir 38 and there becomes effective upon the mercury or other fluid *d* which accordingly rises in the tube 45 in the form of a fluid column whereby the indicating upon the scale 36 is accomplished.

It will be noted that the scale plate 36 is slidably mounted in the grooves of the scale member 35 with its inner end in positive engagement with a rigid fixed shoulder *e* forming part of said scale member 36 at the inner ends of its grooves as shown in Fig. 10. With this arrangement, a blank scale plate 36 may be placed in position in the grooves of the member 35 and behind the tube 45 with which it is intended to be used. The blank plate 36 may then be marked in predetermined manner in accordance with various known positions assumed by the fluid or mercury column in the tube 45 and then removed from the member 35. After its removal, the aforesaid marks may be used as guides in the production of the scale 36^a on the plate 36; because of the fact that the latter, at this stage is capable of being handled as an independent unit, the production of the scale 36^a may be conveniently and very accurately carried out and is reduced to a comparatively simple operation. After the scale 36^a has been completed, the plate 36 is replaced in the grooves of the member 35 with its inner end again in engagement with the shoulder *e;* as the latter bears a definite fixed relation to the tube 45, this simple operation accurately and positively positions the scale plate 36 correctly in the instrument without the need for any adjustments of any kind. With the described arrangement, each scale plate may be easily graduated and etched to positively conform to the particular tube for which the scale is intended and with which it accurately cooperates. In the preferred form, the scale plate 36 and the tube 45 are constructed to have the same co-efficient of expansion and contraction so that the accuracy of the instrument is constant at all times.

By making the fluid reservoir and its associated elements of metal or other material not easily broken or damaged, the durability of the instrument is increased and the necessity for extreme care in the handling thereof is avoided.

The manometer is extremely simple in construction and is easily manipulated to and from an operative position and in its operative position maintains the fluid column tube with its associated scale plate and scale member in an upright position in which the parts are positively fixed against unintentional tilting without requiring the assistance of the operator to maintain them in such position. The manometer is adapted for any use for which such an instrument is generally intended and obviates disadvantages and objections which up to the present time have been inherent in existing apparatus of the indicated class.

Various changes in the specific form shown and described may be made within the scope of the claims without departing from the spirit of my invention.

Some of the features not claimed herein but shown in detail in the drawings and described in the specification in compliance with the requirement that the best mode in which the applicants have contemplated applying their invention be set forth, are the subject matter of a co-pending application, Serial No. 56,428, filed by Fairleigh S. Dickinson on September 15, 1925.

We claim:

1. A manometer of the kind described comprising a casing having a body, a main cover section hinged to said body and movable to an upright position relatively thereto, manometer instrumentalities mounted upon said main cover section and movable therewith to an upright position and an auxiliary cover section hinged to said main cover section and forming therewith the complete cover for the casing body, said auxiliary cover section being free from said manometer instrumentalities and folding downwardly relatively thereto and to the main cover section in the upright position of the latter to constitute a prop to prevent tilting over of the manometer.

2. A manometer of the kind described comprising a casing having a body, a main cover section hinged to said body and movable to an upright position relatively thereto, manometer instrumentalities mounted upon said main cover section and movable therewith to an upright position and an auxiliary cover section hinged to said main cover section and forming therewith the complete cover for the casing body, said auxiliary cover section being of greater major length than the main cover section and folding downwardly relatively to the latter in the upright position of said main cover section into close proximity to the surface on which the instrument is resting and thereby forming a prop to prevent tilting over of said instrument.

3. A manometer of the kind described comprising a casing having a body, a main cover section hinged to said body and movable to an upright position relatively thereto, a block fixed upon said main cover section and provided with a recess, a fluid reservoir fitted in the recess of said block, a scale carried by said block, a tube mounted in operative relation to said scale in fixed relation to said block, said tube being connected with said reservoir, an inlet nozzle carried by said block and communicating with said reservoir for the admission thereto of a pressure creating medium and an auxiliary cover section hinged to said main cover section and forming therewith the complete cover for said body, said auxiliary cover section being of greater major length than the main cover section and folding downwardly relatively to the latter in the upright position of said main cover section into close proximity to the surface on which the instrument is resting and thereby forming a prop to prevent tilting over of said instrument.

4. In a manometer of the kind described, the combination of a casing having a body, a main cover section hinged to said body and movable to an upright position relatively thereto, a fluid reservoir mounted upon said main cover section near the hinged end thereof, a scale plate fixed upon said chamber and projecting therefrom, a fluid-column tube connected with said chamber and extending lengthwise of said scale plate, the latter and said tube being movable, with said main cover section to an upright position, an inlet for admitting a pressure creating medium to said chamber to cause the fluid column to rise in said tube, and an auxiliary cover section hinged to the main cover section and of greater major length than the latter, said auxiliary cover section being foldable backward over the same into surface contact therewith to constitute a prop in the upright position of the main cover section and its associated elements whereby tilting over of the instrument is resisted, said cover sections together constituting a complete cover for the casing body.

5. In a manometer of the kind described, the combination of a casing having a body, a member hinged thereto and movable to an upright position relatively to said body, a fluid reservoir mounted upon said member, a fluid-column tube connected with said reservoir and movable with said member, to an upright position and lying within the casing body in the normal position of the member, an inlet for admitting a pressure creating medium into said reservoir and a resilient cushion extending lengthwise of

said casing in registry and engagement with said tube throughout the major portion of its length when the tube is in said casing.

6. In a manometer of the kind described, the combination of a casing having a body, a cover hinged thereto and movable to an upright position relatively to said body, a fluid reservoir mounted upon said cover, near the hinged end thereof, a scale member movable with said reservoir and cover, a tube connected with said reservoir and extending lengthwise of said scale member, the latter and said tube being movable, with said cover, to an upright position, said scale member and tube lying within said casing body in the closed position of said cover, an inlet for admitting a pressure creating medium to said reservoir, and a pair of spaced parallel ribs extending lengthwise of the bottom of said casing body and engaging said scale member throughout the major portion of its length to provide rests for said scale member in the closed position of the cover, said tube lying in the space between said ribs when said cover is closed.

7. In a manometer of the kind described, the combination of a casing having a body, a cover hinged thereto and movable to an upright position relatively to said body, a fluid reservoir mounted upon said cover, near the hinged end thereof, a scale member movable with said reservoir and cover, a tube connected with said reservoir and extending lengthwise of said scale member, the latter and said tube being movable, with said cover, to an upright position, said scale member and tube lying within said casing body in the closed position of said cover, an inlet for admitting a pressure creating medium to said reservoir, a pair of spaced parallel ribs extending lengthwise of said casing body and engaging said scale member throughout the major portion of its length to provide rests for said scale member in the closed position of the cover, and a resilient member extending lengthwise of said casing body between said ribs and providing a yielding cushion in surface engagement with said tube when said cover is closed.

8. In a manometer of the kind described, a fluid reservoir for mercury and the like, a tube connected with said reservoir, an inlet nozzle connected with said reservoir for admitting a pressure creating medium thereto whereby said mercury or the like is forced lengthwise of said tube in the form of an indicating column, a scale in operative relation to said column, a disk of animal skin at the outer end of said tube for preventing the spilling of mercury without arresting the escape of air therefrom, a foraminous disk in surface engagement with said disk of skin and an apertured cap connected with said tube for fixing said disks in place thereon.

9. In a manometer of the kind described, a fluid reservoir for mercury and the like, a tube connected with said reservoir, an inlet nozzle connected with said reservoir for admitting a pressure creating medium thereto whereby said mercury or the like is forced lengthwise of said tube in the form of an indicating column, a scale in operative relation to said column, a disk of animal skin at the outer end of said tube for preventing the spilling of mercury without arresting the escape of air therefrom, a foraminous disk in surface engagement with the outer surface of said disk of skin, a cork washer in surface engagement with the inner surface thereof and an apertured cap connected with said tube for clamping said disks and washer in place thereon.

10. In a manometer of the kind described, a casing comprising a body, a cover hinged thereto, a block fixed upon said cover and provided with a recess, a fluid reservoir fitted in the recess of said block, a scale member mounted upon said block and provided with longitudinal grooves and with a fixed shoulder at the inner ends thereof, a tube extending lengthwise of said scale member and combined therewith in fixed relation to said shoulder, and a scale plate slidably mounted in said grooves and having its one end in engagement with said shoulder whereby said scale plate is automatically positioned in proper operative relation to said tube.

11. In a manometer of the kind described, a casing comprising a body, a main cover section hinged thereto, and movable to an upright position on said body, an auxiliary cover section hinged to said main cover section and foldable backward upon the same to constitute a prop for the instrument in the upright position of said main cover section, a block fixed upon said main cover section and provided with a recess, a scale member mounted upon said block and provided with longitudinal grooves and with a fixed shoulder at the inner ends thereof, a tube extending lengthwise of said scale member and combined therewith in fixed relation to said shoulder, and a scale plate slidably mounted in said grooves and having its one end in engagement with said shoulder whereby said scale plate is automatically positioned in proper operative relation to said tube.

12. In a manometer of the kind described, the combination of an elongated casing having a body, a main cover section hinged to one end of said body, manometer instrumentalities mounted upon said main cover section and movable therewith, an auxiliary cover section hinged to said main cover section and forming therewith the complete cover for the casing body, a latch securing said cover in closed position, said cover sec-

tions having abutting end edges at their hinged connection, and spring-pressed plungers mounted in the abutting end edge of one of said cover sections and engaging the abutting end edge of the other cover section whereby said plungers are placed under tension when the complete cover is closed and the auxiliary cover section is automatically thrown to a partly open position when said latch is released.

13. In a manometer of the kind described, the combination of a casing having a body, a cover section hinged to said body, a reservoir for mercury or the like carried by said cover section, said reservoir being formed of enameled metal, a transparent tube, means connected with said reservoir for admitting a pressure-creating medium thereto whereby said mercury or the like is forced lengthwise of said tube in the form of an indicating column, and a scale in operative relation to said column.

In testimony whereof we have hereunto set our hands.

FAIRLEIGH S. DICKINSON.
ANDREW W. FLEISCHER.