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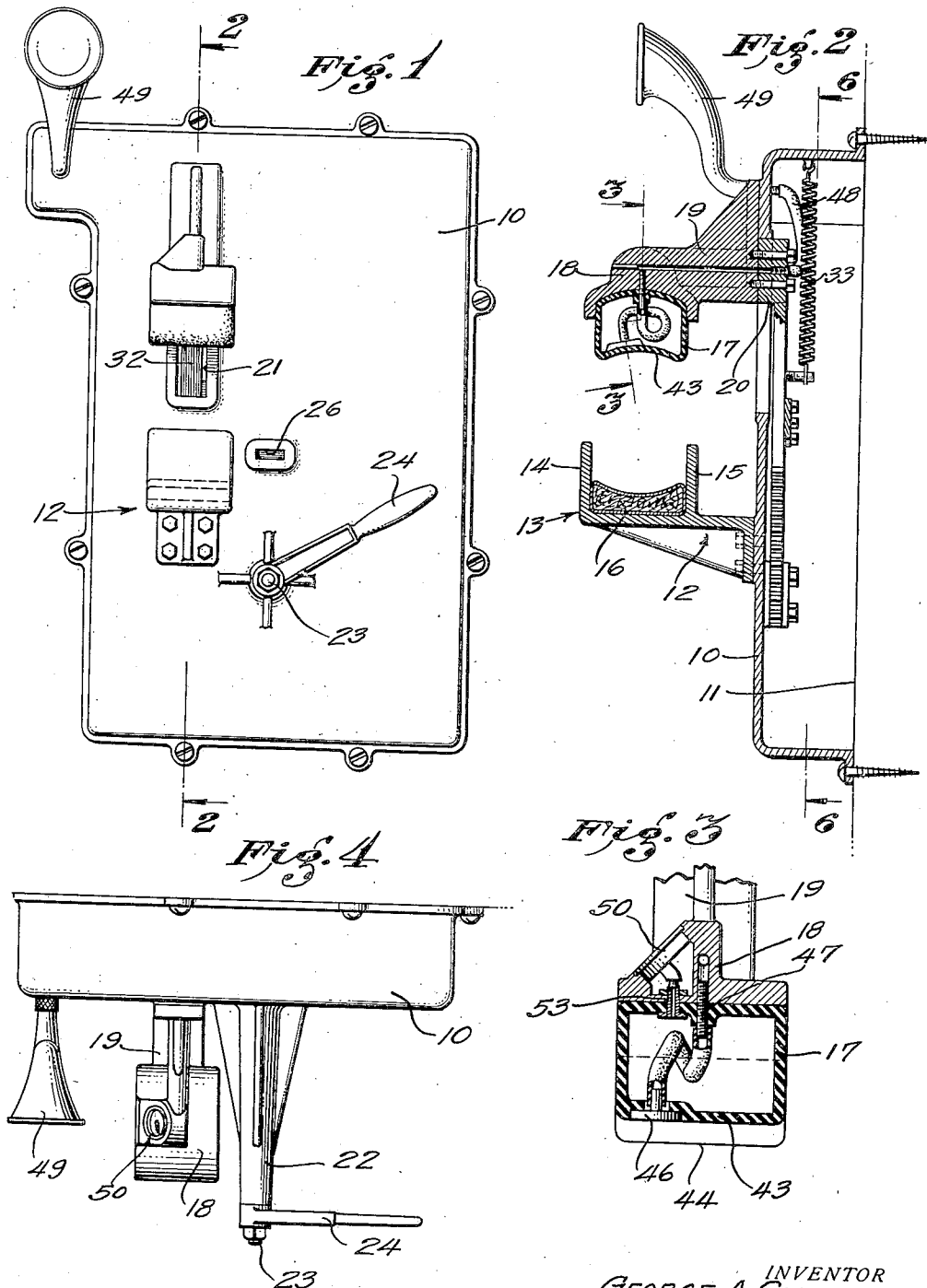
G. A. SNYDER

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BLOOD PRESSURE TESTING APPARATUS

Filed Jan. 9, 1934

2 Sheets-Sheet 1



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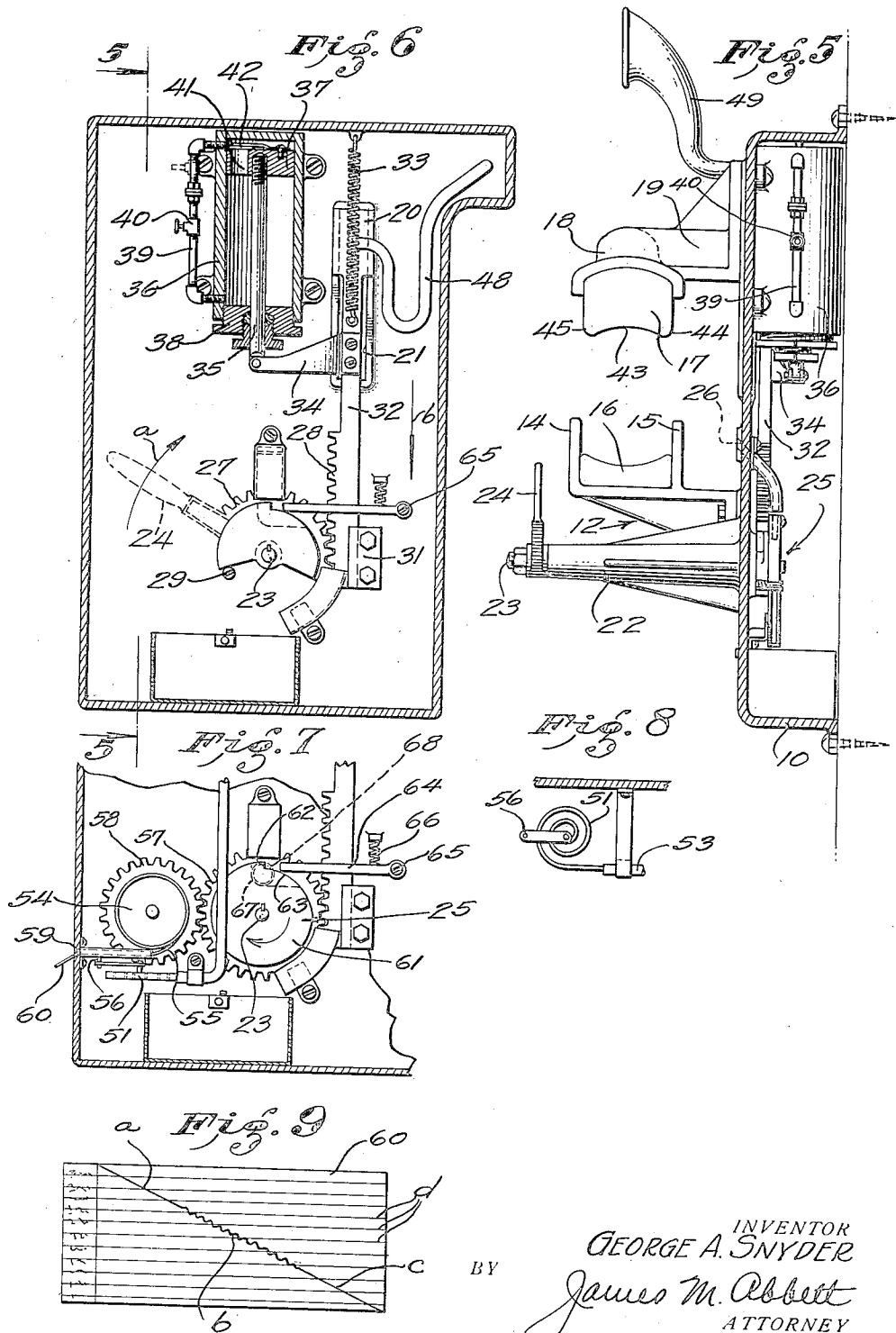
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BLOOD PRESSURE TESTING APPARATUS

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This invention relates to a machine for testing the blood pressure of a human being.

At the present time the medical profession is endeavoring to educate the general public as to the important relationship of blood pressure to the normal functioning of various organs of the human body, and particularly the danger which might result in the event a condition of high blood pressure is present in the circulatory system of the human body. Heretofore blood pressure tests have for the most part been conducted by members of the medical profession, but it is the principal object of the present invention to provide a blood pressure testing apparatus which may be manipulated by a layman without the requirement of any preliminary training in connection with such matters, and, in fact, a blood pressure testing apparatus which may be embodied in a slot machine installed in public places. Any one wishing to ascertain their own blood pressure may do so by adjusting the machine to themselves and taking a reading.

The present invention contemplates provision of a blood pressure testing machine which is fitted with pressure members between which the arm of the person whose blood pressure is to be tested, may be positioned in a manner to properly engage the area of the artery, after which pressure tests may be made with relation to the systolic pressure of the blood as well as with relation to the diastolic pressure, the device being preferably coin controlled.

The invention is illustrated by way of example in the accompanying drawings, in which:

Figure 1 is a view in front elevation showing one form of the present invention.

Fig. 2 is a view in vertical section through the machine as seen on the line 2—2 of Fig. 1, and showing the movable relationship of the pressure members to each other.

Fig. 3 is a view in vertical section through the stethoscope apparatus, as seen on the line 3—3 of Fig. 2.

Fig. 4 is a view in plan disclosing the device of Fig. 1.

Fig. 5 is an enlarged fragmentary view in section showing the connection of the stethoscope and pressure conduits with relation to the movable pressure pad or cushion.

Fig. 6 is an enlarged view in vertical section taken through the device on the line 6—6 of Fig. 2, and showing the pressure actuating and escapement mechanism.

Fig. 7 is a fragmentary view in vertical section

and elevation showing a tape operating mechanism.

Fig. 8 is a fragmentary view in elevation showing a stylus operating mechanism.

Fig. 9 is a view showing a section of recording tape or ticket by which blood pressure may be recorded.

Referring more particularly to the drawings 10 indicates the case of a machine of the character described, which case is designed to be secured against the face of a wall 11, or other supporting structure. Projecting from the face of the case is a horizontally extending supporting arm 12, carrying a saddle 13, here shown as channel shape and having opposite flanged edges 14 and 15 extending parallel to each other and parallel to the face of the case 10. Positioned between said flanged edges upon the saddle 13 is an arm rest pad 16 upon which the lower arm in the area of the elbow may rest in a position with the palm of the hand upwardly, so that an artery may be properly presented to the machine. Superposed with relation to the rest pad 16 is a pressure cuff or pad 17 carried by movable arm 18. This movable arm is mounted upon a horizontally extending bracket 19 slidably disposed with relation to the face of the case 10 and provided with a sliding block 20 extending through a slotted opening 21 in the face of this case. The slotted opening extends vertically so that the movable arm 19 may have a desired vertical movement with relation to the fixed arm 12 and so that the movable bracket may be pressed downwardly over the arm of the person whose blood pressure is to be tested in a manner and for a purpose to be hereinafter described.

Mounted upon the face of the machine and extending outwardly therefrom is a bearing bracket 22 which carries a shaft 23. This shaft is fitted at its outer end with an actuating lever 24 by which the pressure pad 17 may be forced against the arm of the person whose blood pressure is to be tested to create a pressure required for initiating said test. The operating arm 24 and its shaft 23 are normally locked against movement by a coin control mechanism such as shown in Fig. 7, and generally indicated at 25. The details of this mechanism will be hereinafter described, although it will be understood that any desired variation of this control mechanism could be made without departing from the spirit of the invention. The coin for actuating the mechanism is inserted into the machine through a coin slot 26 appearing in the face of the case 10. By referring to Fig. 6 it will be seen that the operating shaft

23 is provided with a gear sector 27 which engages a rack 28. A gear segment 27 is cut away to form a pair of shoulders; a pin 29 is interposed between the shoulders of the gear segment to limit the degree of oscillation between the gear segment 27 and a rack 28, since the shoulders will alternately contact the pin at the limit of oscillation. By pushing on the actuating lever 24 in the direction indicated by arrow "a" in Fig. 6, it will be seen that the segment will be moved in a like direction, and that the rack 28 will move downwardly. This rack is mounted in a suitable guideway 31 on the back of the case 10, and is attached to a pressure bar 32. This pressure bar is rigidly secured to the sliding block 29 of the pressure bracket 19. A spring 33 normally holds the pressure bar and the movable bracket 19 in their uppermost positions. A bracket 34 is secured to the pressure bar 32 and engages the piston rod 35 of a dash pot or cylinder 36. Mounted within this cylinder is a piston 37 which is attached to the rod 35 and is reciprocated therewith. The cylinder is closed at its opposite ends save for a packing gland 38 through which the piston rod 35 moves. A bypass pipe 39 communicates with the opposite ends of the cylinder 36 and is fitted at a point intermediate its ends with a regulating valve 40. Thus it will be evident that if a fluid is placed within the cylinder 36 to fill it, reciprocation of the piston 37 will force the fluid around the piston through the bypass pipe 39 as the piston alternately reciprocates. An escape opening 41 is formed through the piston as provided with a valve 42 which will open on the down stroke of the cylinder and will close on the up stroke of the cylinder, so that the fluid in the upper end of the cylinder will be required to move through the bypass pipe 39 as the piston moves upward under the influence of the spring 33. This gradual escapement will gradually relieve the pressure exerted by the pad 17 on an artery during the test, and will have the same effect as would be the case if air were permitted to leak out of the pressure pad or cuff 17. The pad 17 is hollow and is preferably formed of flexible material, such as rubber, within which a desired amount of air, or other fluid may be hermetically sealed. The lower face of the pressure pad as indicated at 43 is concave, so that it will fit snugly around the arm and so that its opposite edges 44 and 45 may project downwardly between the flanges 14 and 15 of the arm rest 13.

Embedded within the face of the portion of the pad 43 is the receiving disc 46 of a stethoscope. The stethoscope is so positioned with relation to the pressure pad 17 as to lie directly over an artery of the arm when the pad is in position for a test. The stethoscope is provided with a fitting 47 which leads out through the wall of the pad 17 and connects with the tube 48 leading to an ear piece 49 which is here shown in the shape of a horn rigidly mounted upon case 10, and with its outlet facing in a manner to permit the sound impulses from the stethoscope to be audible in the horn. A pressure indicator 50 is mounted upon the machine in a convenient position for observation, such as upon the bracket 18, as indicated in Fig. 3. The gauge as shown in the drawings is of the mechanical type embodying the use of a Bourdon tube 51 which is connected at its movable end through suitable mechanical means with an indicating hand, and which is connected at its fixed end with a pressure tube 53 leading to the pressure pad 17 in the manner shown in Fig. 3 of the drawings. It will be understood, however,

that if desired, a pressure indicator employing a mercury, or other fluid column may be used in place of the mechanical indicating pressure indicator shown in Fig. 3. The type of device shown in Figs. 1 to 7, inclusive, represents a blood pressure testing apparatus, embodying the most accurate methods of testing known at the present time, which is a combination of the use of a pressure indicator and a stethoscope to obtain the systolic and diastolic readings.

It may be found desirable to furnish a record of the reading, and while it is well known that recording pressure indicators have been made, it is believed to be novel to cause the pressure indicator to indicate on a small card or ticket a graph of the blood pressure reading, which card will be ejected from the machine after the reading has been completed. Various types of devices might be used to produce this result. It will be understood that in this connection the phenomenon associated with a blood pressure test is that at the initial pressure at which the blood pressure is able to pulsate through an artery, the systolic pressure is obtained, that is the maximum blood pressure of an individual when the pulsation begins to manifest itself in an apparatus it indicates the maximum or systolic pressure, and when the pulsation ceases to manifest itself in the apparatus, this indicates the minimum or diastolic pressure. It will thus be understood that the range of pressure between the maximum and minimum will be manifested by the pulsation of the blood through the artery. In order to ascertain this range it is usual to exert a pressure upon an artery in excess of any pressure which would correspond to that of the systolic pressure and to permit this pressure to gradually recede until it is at a pressure lower than that corresponding to any diastolic pressure. For this reason pressure indicators are conveniently calibrated in cubic millimeters of mercury column ranging from a maximum pressure of 300 cubic millimeters to a minimum pressure of zero. It will be evident, therefore, that if a graph is made by the use of a stylus and a chart it would initially indicate a pressure of the order of 300 cubic millimeters of mercury, and that since this pressure would gradually diminish the graph would gradually recede on the chart in a substantially straight line until the systolic pressure is reached at which time the stylus would continue to recede, but would be affected by the pulse of the heart so that a sinuous line would be made until the diastolic pressure is reached when the line would again appear as a substantially straight one.

In order to make a graph of blood pressure based upon the phenomena previously described, a mercury column might be used in which a float upon the column operated a stylus, or a mechanically operating device embodying a Bourdon tube might be used as generally indicated in Figs. 7 and 8 of the drawings. Here it will be seen that a drum 54 carries a tape of paper 55, against which a stylus 56 rests. This stylus is carried by mechanism associated with a Bourdon tube 51 so that the stylus may have movement in direct ratio to the pressure of the fluid within this tube. Means are provided and associated with the operating shaft 23, such, for example, as the sector 57 shown in Fig. 7 of the drawings, and engaging a pinion 58 mounted on a shaft of the drum 54 so that as the pressure rod 32 is restored to its original and initial position, the drum 54 may be rotated and the tape 55 ejected through an opening 59 in the face of the

case 10. The ejected portion of the tape may then be torn off to provide a ticket 60 as in Fig. 9 of the drawings, upon which the graph will appear as a continuous line comprising a straight line "a", a sinuous line "b" and a straight line "c", here shown as passing diametrically across a field marked by parallel pressure lines "d". The lines "d" on the chart are calibrated to indicate various pressures so that it is possible for a person to read the pressure range from systolic to diastolic pressures.

The pressure testing device described in the preceding portion of the specification may be utilized as desired, although it is contemplated in the present case to control the operation of the device by a coin controlled mechanism.

Various types of coin controlled mechanisms are commonly known, and may be used, however, one form of device is shown in the drawings which includes a disc 61 having a lock shoulder 62 thereon and an eccentric face 63 leading to the lock shoulder. A lock member 64 is pivoted at 65 and rides over the face of the marginal edge of the disc and is so disposed as to cause its swinging end to abut against the lock shoulder to prevent rotation of the disc. A spring 66 normally holds the lock member 64 in its abutting and locking relation with relation to the disc. A pocket 67 is formed in the edge of the disc 61 so that it will receive a coin 68. When the coin is in position it will tend to lift the lock member 64 from its abutting position relative to the shoulder 62 and allow the disc 61 to rotate. This disc is secured upon the shaft 23 and will be held against rotation except when a coin is disposed in the device to lift the lock member 64.

In operation of the present invention the testing device may be assembled in the manner shown in Figs. 1 to 8, inclusive, and secured in some fixed convenient position. The arm of the person to be treated is then disposed upon the rest pad 16 after which a coin is dropped through the coin slot 26 to find its proper position in the seat 67 of the disc 61. The operating lever 24 may then be moved in the direction of the arrow "a" and this in turn will swing the sector 27 downwardly and move the pressure bar 32 in the direction of the arrow "b", as shown in Fig. 6. While this pressure is being applied the operator may observe the indicating hand of the pressure indicator 50 until this hand reaches a representative pressure of approximately 300 cubic millimeters of mercury in a column. This pressure is indicated due to the fact that the pad 17 is forcefully pressed against the upward portion of the arm in the area just below the elbow and a portion which is characterized by the presence of an artery near the surface of the flesh. The pressure is reflected on the indicator 50 through the tube 53. As the pressure pad 17 is forced downwardly, it also draws the piston 37 downwardly within the dash pot cylinder 36. During this time the valve 42 carried by the piston 37 is opened to allow free flow of a fluid, such as oil, through the opening 41 in the piston. When the lever is released, the piston 37 will tend to move upwardly within the cylinder 36 as urged by the spring 33. The valve 42 will at this time close and it will be necessary for the fluid above the piston 37 to bypass through the pipe 39 and the valve 40 and to then enter the cylinder 36 below the piston. The rate of fluid flow will be controlled by adjustment of the valve 40. As the piston 37 gradually moves to its uppermost position the pressure of the pad 17 against the arm of the person being examined will gradually

decrease in the same manner as though air or fluid was leaking from the pneumatic pad 17.

In the type of device shown in Figs. 1 to 4, inclusive, it is contemplated that the operator will listen in the megaphone horn 49 for the first evidence of an audible pulse beat transmitted to the megaphone horn through pipe 48 from the stethoscope 46. By observing the gauge it will be evident to accurately determine at what pressure this pulse beat is first audible. The pressure observed will be the systolic pressure of the blood which is commonly known as the blood pressure of the patient. By continuing to watch the pressure indicator, whether it be the gauge 50, or a column of mercury or other fluid in a tube, and by continuing to listen to the pulse beat in the megaphone, it is possible to ascertain when this pulse beat discontinues, and to thus be advised of the diastolic pressure of the circulatory system.

It will be evident that the stethoscope may be suitably connected with electrical sound amplifying means if desired without departing from the spirit of this invention.

In the form of this device shown as embodying the features of Figs. 7 and 8, of the drawings, it will be seen that when the maximum pressure is applied by the lever 24, the stylus will start plotting a graph at the upper left hand corner of the ticket or card 60 and that this graph will gradually move downwardly across the sheet at an inclination determined by the rate of speed of travel of the ticket, and will successively pass the marks "d" indicating various pressure readings. The graph will be substantially straight in direction, although diagonal as far as the ticket is concerned until the systolic pressure of the circulatory system has been reached, when the sinuous line "b" will be made and will continue until the diastolic pressure has been reached.

It will thus be seen that the device here disclosed provides means whereby blood pressure in the human circulatory system may be readily ascertained by the layman without difficulty, and that the apparatus may be conveniently controlled by a coin control mechanism whereby pressure readings may be obtained audibly or by recording charts.

While I have shown my apparatus and the method of using the same, it will be understood that various changes may be made by those skilled in the art without departing from the spirit of my invention as claimed.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:—

1. A blood pressure testing apparatus comprising a pair of members relatively movable toward and away from each other, between which the arm of a person may be placed to make a blood pressure test, one of said members having a sealed flexible inflated portion, a pressure gauge connected to said inflated portion, manually set means for applying a desired pressure to said arm by the members, separate means causing the pressure to be gradually and uniformly reduced while acting to automatically separate the members, and means carried by one of the pressure members and adapted to be associated with an artery of the arm of the person whose blood pressure is being tested, whereby the systolic and diastolic pressures may be ascertained when the varied pressure of the two pressure members corresponds therewith, and a gauge for continuously indicating the amount

of pressure being applied to the arm during the operation.

2. A blood pressure testing device comprising an arm rest upon which the arm of a patient may be disposed, a movable pressure pad opposed to said rest and adapted to cooperate with the rest in gripping the arm therebetween, manually set means creating a desired maximum pressure upon the arm as gripped between said rest and pressure pad, separate means to uniformly and automatically operate and progressively reduce said pressure over a predetermined period of time by causing said pad and rest to gradually separate from their manually set position, a pressure indicator operatively connected with said pressure pad whereby the degree of pressure being exerted upon the arm of the patient may be ascertained and whereby the range of pressure from systolic pressure to diastolic pressure may be indicated.

3. A blood pressure testing device comprising an arm rest upon which the arm of a patient may be disposed, a movable pressure pad opposed to said rest and adapted to cooperate with the rest in gripping the arm therebetween, manually set means creating a desired maximum pressure upon the arm as gripped between said rest and pressure pad, separate means causing a uniform and progressive separation of the previously manually set rest and pad thus relieving said pressure over a predetermined period of time, a pressure indicator operatively connected with said pressure pad whereby the degree of pressure being exerted upon the arm of the patient may be ascertained and whereby the range of pressure from systolic pressure to diastolic pressure may be indicated.

4. A device of the character described comprising a fixed arm support, a movable arm pad having a sealed inflation portion adapted to be manually set against the arm of a person whose blood pressure is to be tested while resting upon the fixed arm support, means tending to relieve the pressure of the pad from the arm and fixed support, a pressure indicating means in communication with said inflated portion of the pad to indicate said relief of pressure and to designate systolic and diastolic blood pressure, and means progressively and uniformly controlling the degree of relief of the pressure exerted by the pad.

5. A blood pressure testing machine comprising a fixed arm rest for the patient, a pressure pad opposed thereto and adapted to move against the patient's arm, manual means operated by the patient for producing movement of the pad and to create a desired pressure against the arm of the patient, a pressure indicating means for indicating the degree of said pressure, means tending to move the pressure pad from its set position to relieve said pressure and pneumatic means resisting said movement to permit the relief to take place uniformly and progressively.

6. A blood pressure testing machine comprising a fixed arm rest for the patient, a pressure pad opposed thereto and adapted to move against the patient's arm, manual means operated by the patient for producing movement of the pad and to create a desired pressure against the arm of the patient, a pressure indicating means for indicating the degree of said pressure, means tending to move the pressure pad from its set position to relieve said pressure and pneumatic means resisting said movement to permit the relief to take place uniformly and progressively, and means for adjusting the operation of the pneumatic relief means.

7. A blood pressure testing machine comprising

ing a fixed arm rest for the patient, a pressure pad opposed thereto and adapted to move against the patient's arm, manual means operated by the patient for producing movement of the pad and to create a desired pressure against the arm of the patient, a pressure indicating means for indicating the degree of said pressure, means tending to move the pressure pad from its set position to relieve said pressure and pneumatic means resisting said movement to permit the relief to take place uniformly and progressively.

8. A blood pressure testing machine comprising a housing, a fixed arm rest carried by the housing and upon which the arm of the patient may rest, a pressure pad adjustably mounted upon the housing for movement toward and away from the arm rest, mechanical means for moving said pressure pad toward the arm rest for causing said pressure pad to exert a desired pressure upon the patient's arm, means automatically tending to relieve said pressure and to move said pressure pad from the patient's arm, means resisting said pressure relief and allowing it to take place at a uniform rate of diminishment, and means associated with the housing and the pressure pad for indicating blood pressure within the arm of the patient during the period of application of pressure of the pad thereagainst.

9. A blood pressure testing machine comprising a housing, a fixed arm rest carried by the housing and upon which the arm of the patient may rest, a pressure pad adjustably mounted upon the housing in opposed relation to the arm rest, mechanical means for causing said pressure pad to exert a desired pressure upon the patient's arm, means tending to relieve said pressure, means resisting said pressure relief and allowing it to take place at a uniform rate of diminishment, and means associated with the housing and the pressure pad for indicating blood pressure within the arm of the patient during the period of application of pressure of the pad thereagainst, the pressure relief resisting means comprising a pneumatic cylinder and plunger operatively connected with the pressure pad and from which fluid may gradually leak.

10. A blood pressure testing machine comprising a housing, a fixed arm rest carried by the housing and upon which the arm of the patient may rest, a pressure pad adjustably mounted upon the housing in opposed relation to the arm rest, mechanical means for causing said pressure pad to exert a desired pressure upon the patient's arm, means tending to relieve said pressure, means resisting said pressure relief and allowing it to take place at a uniform rate of diminishment, and means associated with the housing and the pressure pad for indicating blood pressure within the arm of the patient during the period of application of pressure of the pad thereagainst, said pressure relief resisting means comprising a pneumatic cylinder and plunger operatively connected with the pressure pad and from which fluid may gradually leak, and a by pass valve adapted to control the leakage of fluid from one end of said cylinder to the other to thereby establish the degree of relief of the pressure pad.

11. A blood pressure testing device of the type described comprising a housing, a fixed arm rest carried by the housing and upon which the arm of the patient may rest, a pressure pad adjustably mounted upon the housing in opposed relation to the arm rest, manually controlled and mechanically operable means for adjusting the pressure pad against and exerting a desired pres-

sure upon the patient's arm, means tending to separate the arm rest and the pressure pad whereby the pressure against the patient's arm will be released at a uniform rate, means associated with the pressure pad to permanently record upon a graph the systolic and diastolic blood pressure of the patient.

12. A blood pressure testing apparatus of the type described, comprising a fixed arm rest mounted upon a housing and upon which the patient's arm may rest, a pressure pad opposed thereto and adapted to move against the patient's arm, manual means operated by the patient to move the pressure pad against his arm and to produce the desired pressure thereto, automatic means tending to move the pressure pad from its position on the arm to relieve the pressure, and means associated with the automatic pressure releasing means to release the pressure at a uniform rate.

13. A blood pressure testing apparatus comprising two pressure pads relatively movable toward and away from each other, one of said pads having a hermetically sealed flexible in-

flated portion, manually set means for moving one of the pads toward the other for creating a desired pressure against an arm disposed between said pads, means acting to gradually separate the pads to relieve the pressure against the arm of a patient, and a pressure guage in communication with the hermetically sealed inflated portion of the pad.

14. A blood pressure testing apparatus comprising two pressure pads relatively movable toward and away from each other, one of said pads having a hermetically sealed flexible inflated portion, manually set means for moving one of the pads toward the other for creating a desired pressure against an arm disposed between said pads, means acting to gradually separate the pads to relieve the pressure against the arm of a patient, a pressure guage in communication with the hermetically sealed inflated portion of the pad, and a sound pickup associated with one of the pads whereby systolic and diastolic blood pressure readings may be made in conjunction with the guage.

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