

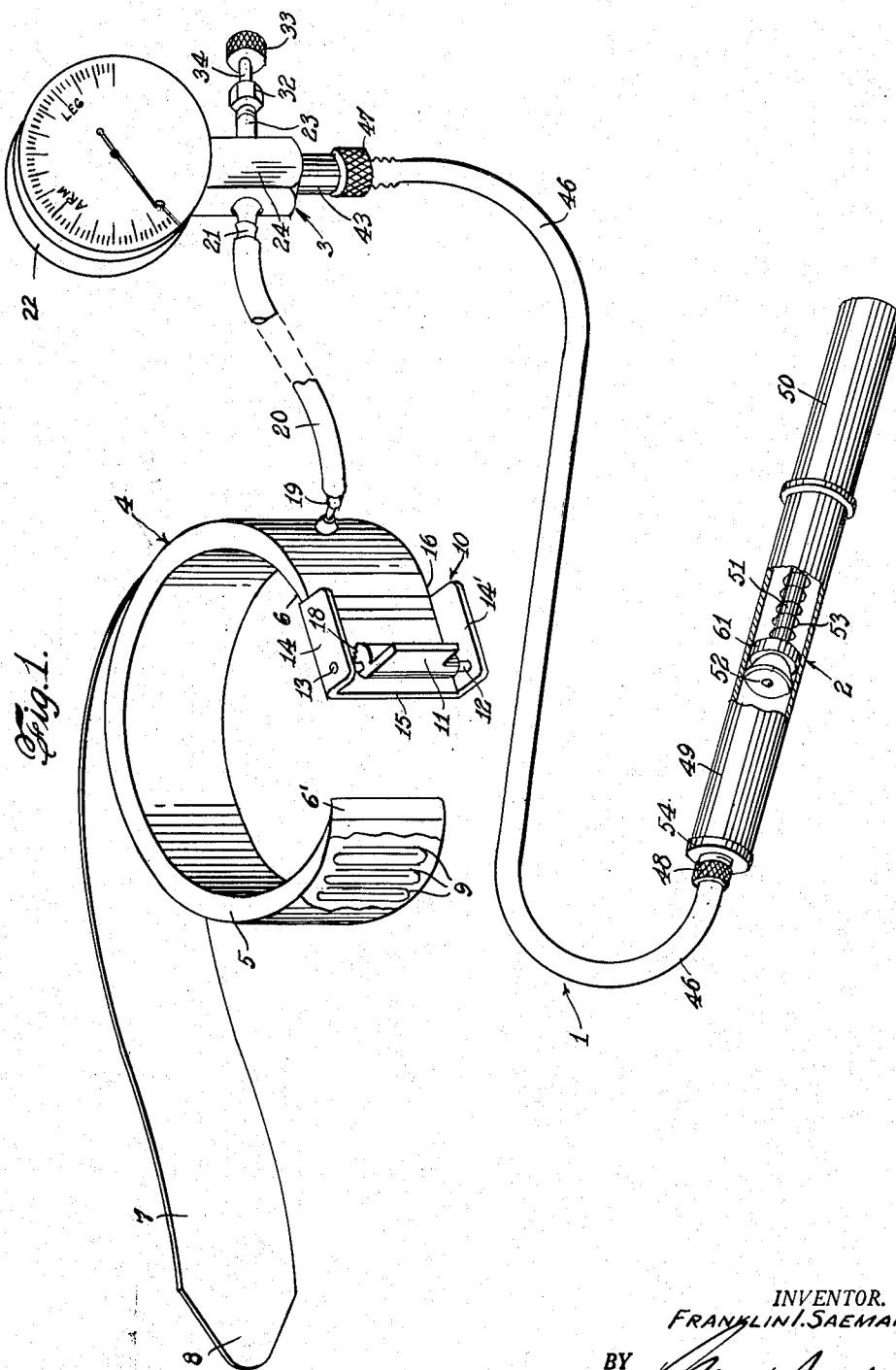
Nov. 24, 1953

F. I. SAEMANN
PNEUMATIC TOURNIQUET

2,660,174

Filed Nov. 9, 1951

2 Sheets-Sheet 1



INVENTOR.
FRANKLIN I. SAEMANN
BY *Paul H. ...*
ATTORNEY.

Nov. 24, 1953

F. I. SAEMANN
PNEUMATIC TOURNIQUET

2,660,174

Filed Nov. 9, 1951

2 Sheets-Sheet 2

Fig. 2.

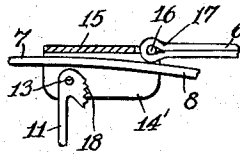


Fig. 3.

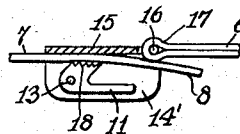


Fig. 4.

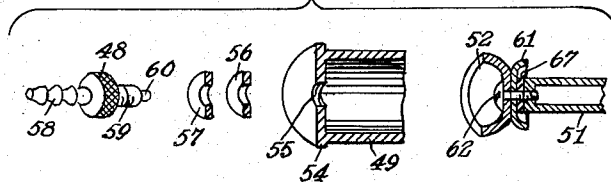


Fig. 5.

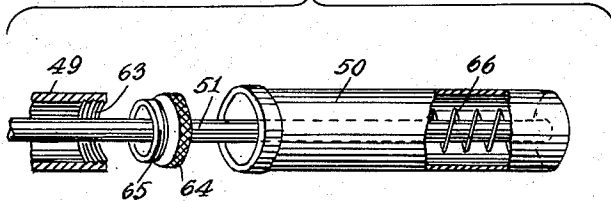


Fig. 6.

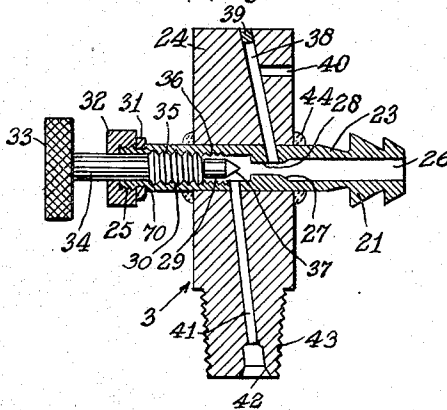
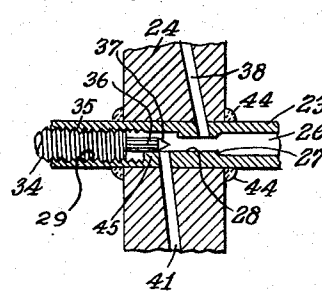


Fig. 7.



INVENTOR.
FRANKLIN I. SAEMANN
BY *[Signature]*
ATTORNEY.

UNITED STATES PATENT OFFICE

2,660,174

PNEUMATIC TOURNIQUET

Franklin I. Saemann, Warsaw, Ind.

Application November 9, 1951, Serial No. 255,610

10 Claims. (Cl. 128—327)

1

My invention relates generally to surgical instruments and particularly to hemostatic devices.

Various hemostatic devices have been known for use in constricting blood vessels or arteries. More specifically certain tourniquet devices have been devised which apply controlled pressure against arteries for arresting or preventing bleeding. Such tourniquet devices consist essentially of a pad for placing over the artery and apparatus for pressing the pad down on the artery.

It has been widely known that simple tourniquets may be devised such as a rubber tube drawn tightly around the limb as in the elastic tourniquet, a rigid band, as in the field tourniquet; or a screw, as in Petits tourniquet. However, all these devices have the obvious disadvantage of providing little control over the pressure applied to the artery and because of their non-uniform pressure area cause discomfort to the patient. Of more recent development is the pneumatic type of tourniquet wherein a smooth hollow belt is inflated under a controlled pressure means.

It is, therefore, an object of my invention to provide an improved pneumatic type of tourniquet. It is a further object of my invention to provide an improved pneumatic pressure means for a pneumatic type of a tourniquet. It is a still further object of my invention to provide a novel control valve arrangement in a pressurizing means for a pneumatic type of a tourniquet.

Further objects and advantages will hereinafter appear from a consideration of the accompanying drawings and description thereof forming a part of this application and in which:

Fig. 1 is a perspective view, partially in cross-section, of a pneumatic tourniquet embodying various features of the invention,

Fig. 2 is a cross-sectional view of the belt buckle in open position,

Fig. 3 is a cross-sectional view of the belt buckle in closed position,

Fig. 4 is an exploded view of the lower pump tube fitting partially in cross-section,

Fig. 5 is an exploded view of the upper pump tube fitting,

Fig. 6 is a cross-sectional view of the control valve assembly, and

Fig. 7 is a cross-sectional view of a portion of Fig. 6 showing a modification of the control valve assembly.

In accordance with my invention a control valve assembly is provided having a positive sealing arrangement wherein air is admitted to the hollow cuff band member and positively restricted while still allowing for a true barometric reading of the pressure in the cuff member at all times.

2

Referring to the drawings where like numerals designate similar parts throughout, I have illustrated in Fig. 1 a perspective view of a pneumatic tourniquet 1. The tourniquet 1 consists generally of a pump means 2, a control valve means 3 and a cuff tube member 4.

The inflation cuff member 4 is preferably made of a calendered cloth and has a main cuff portion 5 and a belt portion 7. The ends 6 and 6' of the cuff portion are tapered. One end 6 is formed in a loop portion 17 to enclose a gripper bar 16 of a buckle 10. The buckle 10 comprises a flat plate member 15 having upturned end flanges 14 and 14'. A shaft 12 is fixedly mounted as at 13 in the flanges 14 and 14'. Journaled on shaft 13 is a lock member 11 which has a gripping tooth portion 18. As shown in Figs. 2 and 3 end 8 of belt 7 can freely pass between plate 15 and lock member 11 and is held thereagainst by portion 18, when member 11 is rotated on shaft 13 to bring teeth 18 into engagement with belt 7. Cuff 5 is preferably reinforced as by steel wire 9. The inflation cuff has all its fabric well covered with rubber, e. g. by vulcanizing.

The cuff member 4 has a metal outlet fitting 19 affixed to portion 5. Tube member 20 interconnects cuff member 4 with the control valve means 3 and is mounted at one end on fitting 19 of cuff 4 and at the other end on fitting 21 of valve means 3.

The valve means 3 has a main body portion 24 of a generally square parallelepiped form. Mounted on the upper part of body portion 24 of valve 3 is Bourdon tube gage 22 which is adapted to indicate the pressure being applied by the tourniquet. The details of the valve means 3 are more fully described hereinafter in connection with the description of Figs. 6 and 7.

Mounted on the lower end of body 24 on the threaded end 43 is a hose fitting 47 of hose 46. The hose 46 is further connected by a hose fitting 48 to a hand pump means 2.

The pump means 2 comprises two main portions; a plunger rod 51 having a hand grip 50 at its upper end and cylinder 49. The rod 51 has a plunger 52 mounted on its lower end against a backup plate 61 spaced from the lower end of rod 51 by a lock washer 67 and held together by a screw 62 or other holding means, e. g. rivet. Mounted on rod 51 is a freely slidable spring 53 which abuts against the lower end of bushing 64 and the upper part of backup plate 61. The upper portion of cylinder 49 is internally threaded at 63. The freely slidable bushing 64 is threaded at its lower end 65 to thread into cylinder 49. The hand grip 50 is affixed to the

3

upper end of rod 51 and a second buffer spring 66 is rigidly affixed to the hand grip 50 and is compressed thereagainst when in engagement with the upper end of bushing 64. At the lower end of cylinder 49 is a flange 54 having an internally threaded opening 55 centrally thereof. Hose fitting 48 is mounted on the lower end of cylinder 49 by the engagement of its threaded extension 59 into opening 55 and is spaced therefrom by washers 56 and 57. The cascaded tapered portion 58 of fitting 48 fits within hose 46. Within fitting member 48 is a one-way pump valve means which may be a spring loaded valve, the core of which is shown at 60. Such a one-way valve is arranged to prevent air from escaping from cylinder 49, while allowing air to be drawn into cylinder 49 when plunger 52 is raised upward from flange 54.

A preferred form of the valve means 3 is shown in Fig. 6. The body portion 24 has several passageways to conduct air therethrough. Diagonal passage 41 provides a connection with hose 46 and is countersunk at its lower end as at 42. Passageway 33 having a plug 39 at its upper end is provided diagonally extending in the upper part of body 24. The passageways 33 and 41 may be considered as being a single discontinuous passageway. Although Figures 6 and 7 show this passageway as consisting of diagonally extending portions, such positioning is not essential, i. e. they may be deviated from the diagonal, as long as the portions 33 and 41 remain discontinuous. Communicating with passageway 33 is a horizontally extending passage 40 to conduct air to the Bourdon gage 22. A bleeder barrel or cross member 23 is fitted into an opening extending transversely of body 24 and is soldered therein as at 44. Alternatively cross member 23 can be made integral with body member 24. Formed on one end of cross member 23 is a cascaded taper hose fitting 21. Extending entirely through member 23 is a longitudinal passageway 26 which intersects the discontinuous passageway referred to hereinabove (i. e., passageways 41 and 33) at the discontinued portion. The passageway 26 is composed of several portions, i. e. a third portion which is shown at the right end of Fig. 6, which is reduced at 27 to provide a short reduced passage or second portion 28 and thereafter the passageway 26 widens to form a valve chamber or first portion 29. Member 23 is internally threaded at 30 to receive valve member 33. An air-tight seal is provided by packing nut 32 threaded at 25 onto member 23 and compressing washer 31 against shoulder 70. The valve member 33 has a shank 34 threaded at 35 to be assembled into member 23. At its inner end valve member 33 has a reduced portion 36 and a valve tip 37. As made apparent from the above description, air is pumped through hose 46 into passage 41 and conducted by passages 29, 28, 26 and hose 20 to the cuff member while communicating passages 33 and 40 allow the gage to record instantaneously the pressure within cuff 4.

The valve tip 37 as shown in Fig. 6 is conical shaped and, since passage 28 is narrower than chamber 29, a valve seat is provided at their junction. Alternatively this valve seat may be frustoconically shaped to more securely receive conical valve tip 37. When the proper gage pressure is reached the valve 33 is rotated to seat tip 37 within the bleeder barrel to immediately cut off passageway 28 and positively prevent any leakage of air out of the cuff member. Thus a

4

positive seal is provided through the line contact valve which allows for a true barometric reading on the gage of the pressure in the cuff tube at all times.

Fig. 7 shows a modification of the valve structure which provides a double seating valve. The passageway 26 is constituted by three portions as indicated in connection with Figure 6, however the valve chamber or first portion 29 is narrowed by a shoulder 45 is the bleeder barrel positioned on the side of passage 41 opposite the reduced passage or second portion 28 which may be in eccentric longitudinal disposition with first portion or chamber 29, as shown in the drawings. However such eccentric positioning is not essential and may be deviated therefrom, as long as a second valve seat is provided for valve portion 36. The right end of passageway 26, or the third portion is in axial alignment with the passage 28, and may be in eccentric disposition with regard to chamber 29 (as shown in Figure 7), however this positioning is also not essential and may be deviated therefrom as long as a communicating passageway is provided from passage 28 to tube member 20. When valve 33 is rotated the reduced portion 36 thereof engages shoulder 45 which is so dimensioned that a sliding fit is provided, a preliminary seal is provided by portion 36 closing passage 41 and substantially simultaneously valve tip 37 is seated to close off passages 28 and 38 as the final seal.

Although only two embodiments of the valve structure of the invention have been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention e. g., as hereinabove stated. While passages 33 and 41 are shown as being diagonally directed, it is obvious that they can deviate from the diagonal, as long as a discontinuous passageway is provide, and it is intended that the invention be limited only by the scope of the appended claims.

What I claim is:

1. In a pneumatic tourniquet comprising a cuff tube member, a pump means, a control valve means and conduit means interconnecting said cuff tube member to said control valve means and said control valve means to said pump means, and a pneumatic gage means operatively associated with said control valve means, the improvement in said control valve means including a main body portion and an intersecting cross member affixed thereto, said conduit means including interrelated intersecting passageways in said main body portion and the cross member providing communication between said cuff tube, pump means and gage means, and a valve and a valve seat so arranged adjacent the intersection in said passageways to be operable in providing a positive seal between those portions of the passageways which interconnect the pump means to the cuff member when desired while still providing a direct communication to those portions of said passageways interconnecting said gage and said cuff member.

2. The pneumatic tourniquet of claim 1 wherein said cuff tube member is hollow and comprises a cuff portion and a belt portion attached thereto, a fitting member mounted on said cuff portion communicating with the hollow interior thereof and providing a communicating fluid passageway between said cuff portion and said conduit means.

3. The tourniquet of claim 2 wherein the im-

5

provement in said pump means comprises a cylinder and a plunger rod having a plunger at its lower end and mounted within said cylinder, spring means mounted on said rod and abutting said cylinder, a hand grip affixed to the upper end of said rod, a fitting member mounted on the lower end of said cylinder communicating with said conduit means to provide a fluid passageway between said pump and said control valve means, and a pump valve means contained within said fitting member operable to admit air into said conduit means and to restrict its efflux.

4. In a pneumatic tourniquet comprising a cuff tube member, a pump means, a control valve means and conduit means interconnecting said cuff tube member to said control valve means and said control valve means to said pump means, and a pneumatic gage means operatively associated with said control valve means, the improvement in said control valve means including a main body portion and an intersecting cross member affixed thereto, a first and a second spaced passageway extending longitudinally of said main body portion, one on each side of said cross member, a third passageway extending longitudinally of said cross member and intersecting said first and second passageway, valve seat means provided adjacent the intersection of said third passageway with said first and second passageways, a valve member mounted for axial movement in one end of said third passageway in a sealing relationship therewith, a fourth passageway communicating with said first passageway and spaced from said second and third passageways to provide a direct communication between said gage member and said valve, a fitting means at the other end of said third passageway providing a sealed communication with said conduit means, said valve member being adapted to be seated on said valve seat to interrupt fluid flow from said second passageway to said third passageway while allowing for communication between said first and third passageways.

5. A valve means comprising a main body portion, an intersecting cross member affixed thereto, a first and a second spaced passageways extending longitudinally of said main body portion one on either side of said cross member, a third passageway extending longitudinally of said cross member and intersecting said first and second passageways, valve seat means provided adjacent the intersection of said third passageway with said first and second passageways, a valve member mounted for axial movement in one end of said third passageway and in a sealing relationship therewith, fitting means at the other end of said third and second passageways, whereby said valve member is adapted to be seated on said valve seat to interrupt fluid flow from said second passageway to said third passageway while allowing for communication between said first and third passageways.

6. A valve means comprising a main body por-

6

tion, an intersecting cross member affixed thereto, a discontinuous first passageway extending longitudinally of said main body portion, a second passageway extending longitudinally of said cross member and intersecting said first passageway, valve seat means adjacent the intersection of said two passageways, a valve member adjacent the valve seat means and arranged to be movable into seating relationship with said valve seat means to interrupt fluid flow from said second passageway to a section of said first passageway while allowing for communication between said second passageway and at least one other section of said first passageway.

7. The valve means of claim 5 wherein said third passageway includes a first portion adapted to receive said valve member and a second portion of reduced diameter in axial concentric alignment with said first portion and forming a valve seat between said first and second passageways.

8. The valve means of claim 5 wherein said third passageway includes a first portion adapted to receive said valve member, a second portion of reduced diameter in longitudinal disposition with said first portion, and means including a shoulder portion positioned in the first portion adjacent the second portion providing a second valve seat whereby said valve member is adapted to directly seal off said second passageway.

9. The valve means of claim 6 wherein said second passageway includes a first portion adapted to receive said valve member and a second portion of reduced diameter in axial concentric alignment with said first portion and forming a valve seat between said first and second passageways.

10. The valve means of claim 6 wherein said second passageway includes a first portion adapted to receive said valve member, a second portion of reduced diameter in longitudinal disposition with said first portion, and means including a shoulder portion positioned in the first portion adjacent the second portion providing a second valve seat whereby said valve member is adapted to directly seal off said second passageway.

FRANKLIN I. SAEMANN.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
767,600	Sjoberg	Aug. 16, 1904
1,058,961	Garrison	Apr. 15, 1913
2,045,750	Buschenfeldt	June 30, 1936
2,193,945	Strauss et al.	Mar. 19, 1940
2,239,697	Buechmann	Apr. 29, 1941
2,444,161	Hanafin	June 29, 1948

OTHER REFERENCES

"Rubber Age," May 1945, p. 195. (A copy of this publication is available at the Scientific Library of the Patent Office.)