

[54] **FLUID OPERATABLE HEMOSTAT**

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[51] Int. Cl. **A61b 17/12, A61b 17/00**
[58] Field of Search **128/322, 325, 327, 346; 251/4, 251/5, 7**

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[57] **ABSTRACT**

A quickly attached and operated hemostat for controllably occluding a blood vessel comprises an inflatable bladder mounted in or on a housing which includes a rigid open channeled jaw against which the bladder may be expanded. The jaw is of a configuration preferably saddle shaped, rendering it openly receptive to a blood vessel.

2 Claims, 6 Drawing Figures

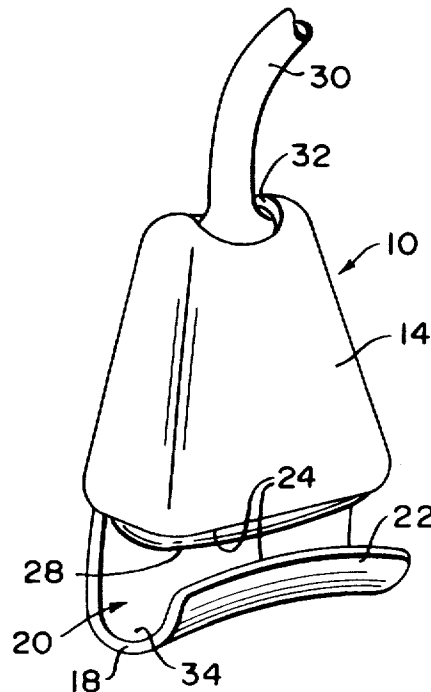


FIG. 1

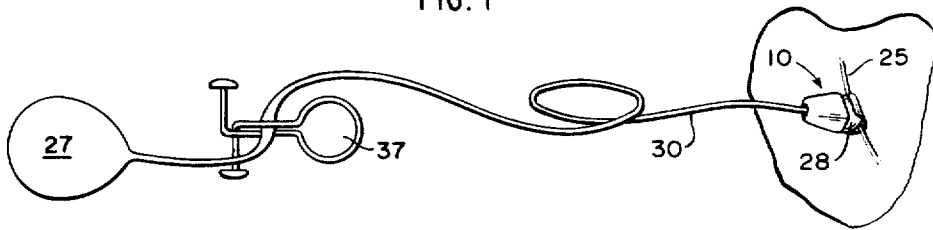


FIG. 2

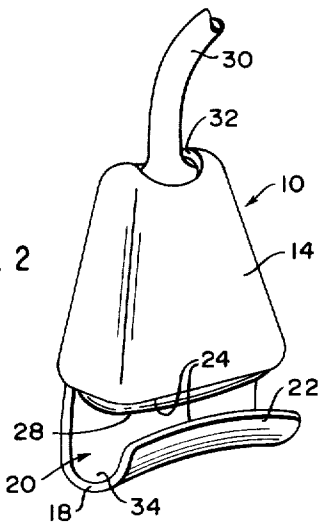


FIG. 3

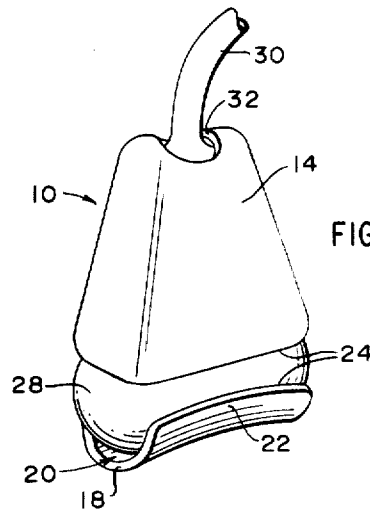


FIG. 6

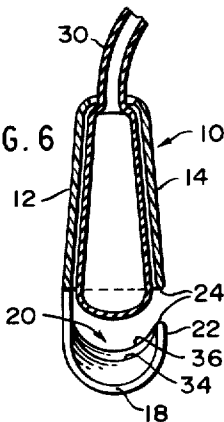


FIG. 4

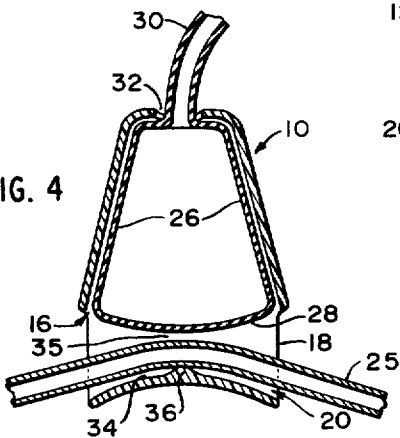
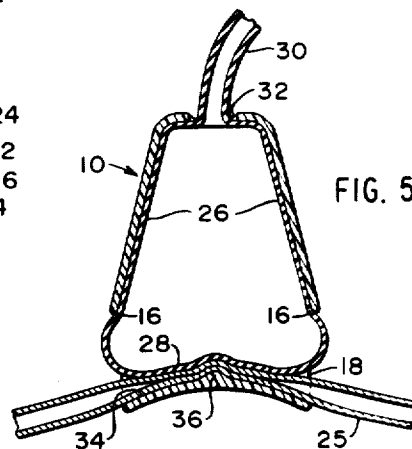


FIG. 5



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FLUID OPERATABLE HEMOSTAT

SUMMARY OF THE INVENTION

In many surgical procedures it is necessary to occlude a blood vessel, which may be done either by suturing the vessel or by applying a hemostat. Some conditions however are not well treated by either technique. Suturing is accomplished by tying off the blood vessel and is relatively inflexible in situations where the degree of occlusion should be altered periodically. The use of a hemostat on the other hand, while flexible, involves clamping rather bulky hardware to the vessel, and requires support so as not to apply excessive strain to the vessel.

One particular situation where both occlusion techniques are inadequate is in the case of aneurism of a small vessel, particularly one in the brain which if ruptured could lead to a serious cerebral hemorrhage. Ideally a hemostat for controlling such a condition should be small and light in weight, quickly and easily attached to the vessel, and operable quickly, both to occlude the vessel and to relieve the occlusion pressure as the vessel should periodically be disoccluded in order to permit some blood flow to the area in order to prevent anoxia.

The present invention provides just such a hemostat. It consists of a clamp arrangement, having a rigid jaw of channelled cross section, preferably oppositely curved in the longitudinal direction to present a saddle shape. An inflatable diaphragm or bladder is mounted opposite the channel and is arranged to be expanded toward the jaw to provide a readily and remotely controllable clamping action. The diaphragm is mounted to a housing including an extension which leads into the channelled jaw portion on one side only. The opposite side of the channel is open so that the vessel can be engaged simply by placing the hemostat around it with the vessel hooked, so to speak, in the channel and opposite the diaphragm. A tube leading from the diaphragm to a pressure source, such as a syringe bulb provides for the application of fluid to inflate or deflate the diaphragm.

In the preferred embodiment of the invention the housing and channelled jaw are unitary, the former being bell shaped with an extension from one side of the opening which curves around to form the saddle shaped channel jaw. This is formed of a rigid plastic, e.g. an epoxy resin, or metal. The diaphragm is a balloon of silicone rubber mounted in the bell, with a tubular extension through a hole in the apex leading to a syringe bulb or other device for controlling the inflation of the balloon. The entire hemostat may be extremely small, e.g. 2 mm across at the jaw channel.

Further objects and advantages of my invention will be apparent from the following detailed description thereof with reference to the accompanying drawings wherein:

FIG. 1 is an illustration of an attached hemostat and a syringe bulb connected to the hemostat to effect its operation;

FIG. 2 is an illustration of the hemostat in a relaxed condition, receptive to a blood vessel;

FIG. 3 is an illustration of the hemostat with the bladder expanded;

FIG. 4 is a sectional view of the relaxed hemostat showing a blood vessel in an unconstricted condition;

FIG. 5 is a view similar to FIG. 4 illustrating the expansion of the bladder to constrict the blood vessel; and

FIG. 6 is a side elevation of the hemostat.

As shown in the figures, the hemostat employs a housing 10 of a generally bell-shaped configuration. The housing 10 has opposed front and back walls 12 and 14, which terminate, at their lower ends, to define an opening 16. An extension 18 is formed integrally with the front wall 12 and terminates in a channelled jaw 20 which is spaced from and faces the opening 16. The side of the jaw 20 opposite the extension 18 presents a reverted lip 22 opposite the edge of the back wall 14 but spaced therefrom to define a slot 24. The blood vessel 25 is intended to be passed through the slot and be retained within the jaw 20.

The hemostat employs a bladder 26 which fits snugly within the housing and which has a facing portion 28 exposed through the opening 16. The bladder 26 is in communication with a source of fluid under pressure by means of a lead-in tube 30 which is connected to the upper end of the bladder 26 and which protrudes upwardly through a hole 32 formed in the top of the housing. The source of pressure may be a rubber syringe bulb 27, as shown in FIG. 1 or may consist of a manifold (not shown) to which a number of such lead-in tubes 30 and associated hemostats may be connected. Suitable valving arrangements may be provided to operate any or all of the hemostats connected to the manifold, as desired. When used with a syringe bulb, it is convenient to provide a spring pinch clamp 37 on the lead in 30 for pressure control. The bladder 26 is formed from a resilient, expandable, yet tough material such as silicon rubber or other physiologically inert material. The housing 10, extension 18 and jaw 20 may be formed from rigid plastic or metal, provided that the material selected also is physiologically inert.

When the hemostat is in a relaxed, inoperative position, the bladder is unexpanded, as shown in FIGS. 2, 4, and 6, so that its exposed facing surface 28 is spaced from the bottom of the jaw 20 to enable the blood vessel 25 to pass through the slot as the lip 22 is slipped thereabout. Once the blood vessel 25 is disposed within the jaw 20 the pressurized fluid may be applied to the bladder 26 as shown in FIGS. 1, 3, and 5. Increasing the pressure within the bladder causes the facing portion 28 to expand downwardly toward the channel 20 and causes the retained blood vessel 25 to be pressed firmly into the channel 20 and cause its constriction. The rigidity of the cuff 18 insures that expansion of the bladder 26 will constrict the blood vessel to the degree desired.

The jaw 20 is of a special construction which retards the blood vessel from slipping out of the channel, even when the bladder 26 is deflated and is not pressing the blood vessel 25 firmly to the channel of the jaw 20. Thus, the bottom surface 34 of the channel is curved along its length to present a convex surface to the facing surface 28 of the bladder 26, giving the jaw a saddle shape. The facing surface 28 of bladder 26 also is provided with a slight convex contour and collaborates with the convex bottom surface 34 of the jaw 20 to provide a slight clearance 35 between the blood vessel 25 and the surface 28 of the bladder 26. The clearance 35 is sufficient to preclude the blood vessel 25 from undesired pinching, yet it is not large enough to enable the blood vessel to slip easily out of the channel through the slot 24. Additionally, an upwardly protruding ridge 36 is formed at the bottom surface 34 of the channel 20, intermediate its ends. The ridge 36 aids in maintaining the blood vessel in place within the channel while the bladder 26 is deflated and, additionally, is effective to pinch the blood vessel 25 when the bladder is expanded, shown in FIG. 5, to insure complete constriction of the blood vessel.

When a number of such hemostats are employed during a surgical operation, each hemostat and its associated syringe or valve on the operating manifold may be color coded to enable rapid recognition thereof.

The hemostat may be operated by any pressurized fluid and is effective equally when actuated by air as well as by a fluid such as water.

Thus, it will be seen that I have provided a hemostat which occupies little space and which may be controlled, in its operation, from a remote location. Additionally, the hemostat is of a simple construction and may be attached to a blood vessel rapidly and accurately without requiring any further or additional time consuming manipulations. When connected to and operated by a small syringe bulb with the pinch clamp adjacent, as illustrated, it is easy to operate both the bulb and clamp with one hand. This arrangement is preferred because of its light weight and ease of operation.

It should be understood that the foregoing description is intended merely to be illustrative of my invention and that other modifications and embodiments thereof will be apparent by those skilled in the art without departing from its spirit.

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

1. A hemostat comprising

a housing defined by at least two wall portions and having an open end situated at an edge of said wall portions, one of said wall portions extending beyond said open end continuing as a curl over and in spaced relation to said open end and terminating in a reverted lip that extends toward said edge to form a channel, said reverted lip being spaced from said edge to define a slot therebetween thereby to enable insertion of a blood vessel into said channel through said slot, said channel being curved in the longitudinal direction to present a convex surface to said open end and being

curved in the transverse direction to present a concave surface to said open end, a resilient inflatable bladder carried by said housing with a part thereof situated at said open end and spaced from said channel, said part and said channel cooperating as a clamp when said bladder is inflated; and

means communicating said bladder with a source of fluid pressure to control the inflation of said bladder.

2. The hemostat defined by claim 1 wherein said channel is formed with a transverse ridge disposed within said channel and intermediate the ends thereof, said ridge protruding toward said part of said bladder.

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