

(19)		Canadian Intellectual Property Office	Office de la Propriété Intellectuelle du Canada	(11)	CA 664985	(13)	A
		An Agency of Industry Canada	Un organisme d'industrie Canada	(40)	18.06.1963		

(12)

(21) Application number:	664985D	(51) Int. Cl:	
(22) Date of filing:	..		

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(54) **VASCULAR POSITIONING METHOD AND DEVICE**

(57) **Abstract:**

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This invention relates to a vascular positioning method and device.

In the use of vascular suturing apparatus, such as described in Canadian Patent No. 620,096 issued May 16, 1961, it is necessary to thread each severed end portion of a blood vessel through a bushing and then to evert such end portion over the end of the bushing. The everted ends, held in appropriate position by the bushings and associated holders, are then joined together by means of clips.

It will be apparent that the steps of threading the vessel through a bushing and then turning the vessel inside out over the end of the bushing are of exacting nature and very difficult to perform, particularly in respect of small vessels such as those of 4mm. or less in diameter.

It is an object of this invention to provide a method and device of simple structure which may be employed to effect with convenience and facility the threading and everting steps mentioned above in respect of very small as well as large sizes of blood vessels.

The invention will be described with reference to the accompanying drawing, in which

Figure 1 is a sectional side elevation of a device in accordance with the invention, showing one position thereof with associated parts of a suturing apparatus.

Figure 2 is a sectional side elevation of the device, showing another position thereof, and

Figure 3 is a sectional side elevation of parts of the suturing apparatus with associated means for threading the vessel through the bushing.

In the drawing, 1 is a bushing, 2 a bushing holder, and 3 a hemostatic clamp, all being parts of a suturing apparatus. The end portion of a severed blood vessel, which it is desired to position on the bushing, is indicated at 4.

The step of threading the blood vessel portion 4 through the bushing 1 will first be described with particular reference to Figure 3. A flexible tube 5 of suitable plastic composition has one end placed loosely over the end of the bushing and its other end connected to a moderately high volume suction air pump, such as that of a domestic vacuum cleaner. The other end of the bushing is applied to the free end portion of the blood vessel 4 and the flow of air through the bushing draws the vessel through the bushing without causing injury to the blood vessel. In this connection, the pressure difference through the suction pump at zero air flow should not be greater than normal blood pressure or about 2 pounds per square inch.

As shown, on completion of the threading operation, the hemostatic clamp 3 engages the holder 2 and may be locked thereto.

A vascular everting device in accordance with the invention is generally indicated at 6, and comprises a cylindrical body or cylinder 7 having a cylindrical bore 8. The cylinder has a rearward end closure plate 9, the forward end thereof being open. Preferably, the forward end edge 9a of the cylinder is of reduced thickness, as provided by the outer bevelled surface 10 and is of rounded contour. A piston 11 is reciprocally mounted in the cylinder and has a forwardly extending

nose 12 the end of which is tapered substantially to an apex, as shown, and through which extends a restricted orifice 13, thus providing a nozzle 14. The piston has a rearwardly extending rod 15 which extends through closure plate 9. The piston has a longitudinal interior passage 17 which extends through the nose 12 and rod 15 and with which the nozzle orifice 13 communicates. The rearward end of passage 17 is closed by a screw 18, the head 18a of which seats upon the closure plate 9 in one position of the piston and acts as a stop to define such position. In such position, the piston is located closely adjacent the forward end of the cylinder with the nose 12 projecting forwardly of the cylinder. Since the rod 15 is of less diameter than the piston, an annular space 19 is formed between the rod and the interior wall of the cylinder. Space 19 communicates with the passage 17 in the piston by means of holes 20 extending through the piston.

The cylinder 7 is provided with a stem 21 mounted on the rearward end thereof and having a longitudinal passage 22 therein communicating with space 19 through an aligned hole 23. A conduit 24 is removably connected to stem 21 for admitting fluid under pressure to the passage 22. The conduit 24 may be part of a syringe (not shown) or other source of fluid under pressure. The flow of fluid supplied through conduit 24 is controlled by operation of the syringe, when such is employed, or by a valve 24a when the conduit is connected to other source of fluid under pressure.

A flexible ring or collar 25 of soft rubber or like material is arranged to be applied to the nose 12. The ring 25 has a tubular sleeve or neck 26 adapted to be

seated on the nose 12 which preferably is provided with a recess 27, a radial annular flange 28 projecting outwardly from the neck, and a peripheral rib 29 adapted to seat on the forward outer surface of the cylindrical body 7.

10 In operation, the operator applies his thumb to the stop 18a to locate the piston in forward position, and a collar 25 is applied to the nose 12, as shown in Figure 1. The nozzle 14 is then applied to the mouth of the blood vessel and fluid under pressure is admitted to passage 22. The fluid may be any fluid of sterile nature, such as a low pressure gas or saline solution as commonly used in surgical operations. The fluid flows through passage 22, hole 23, space 19, hole or holes 20, passage 17, and emerges as a fine jet through nozzle orifice 13. Since the diameter of the piston rod 15 is less than the interior diameter of the cylinder, the piston will be held in its forward position under light load because of the fluid pressure in space 19.

20 The issuing fine jet opens the mouth of the vessel. Since the hemostatic clamp produces a restriction in the blood vessel, further application of fluid under pressure and movement of the nose 12 into the vessel results in a return flow of fluid between the vessel wall and the piston nose which expands the vessel and permits the end of the vessel to slide over the sleeve 26 of the collar 25. At this point, admission of fluid under pressure is arrested, thus removing pressure on the piston and permitting it to move freely. The
30 everting operation is completed by moving the cylinder 7 towards the bushing, which causes the collar 25 to be turned inside out by engagement of the end edge 9a with the flange 28 of the collar. This action also

everts the overlying portion of the blood vessel, as shown in Figure 2.

After the suturing operation has been completed, the flexible collar 25 is removed by tearing it apart. It will be appreciated that a new collar 25 is employed for each operation.

10 The everting operation may be performed as described in a very short space of time and in a dependable and positive manner. Excessive pressure on the wall of the vessel between the end of the bushing and the nose of the piston is completely avoided. The everting device described is simple to manufacture, and is subject to convenient and effective washing and sterilization.

It will be apparent that the size of the various parts of the everter will be chosen to correspond with the size of the bushing employed in the suturing apparatus.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method of positioning the end of a blood vessel on a suturing apparatus bushing which comprises applying suction induced air flow to one end of said bushing while applying the other end of said bushing to the end of said blood vessel to draw said blood vessel end into said bushing, applying a jet of fluid to the mouth of said blood vessel while in said bushing to expand said mouth, and while maintaining said mouth in expanded condition turning said end of said blood vessel inside out upon the outside surface of said bushing.
2. A vascular everter comprising a cylinder of uniform internal diameter having a closed end and a free end edge defining an open end, a piston reciprocally mounted in said cylinder and having a nose of smaller diameter than the internal diameter of said cylinder directed towards said open end and having a large diameter portion engaging said cylinder, said large diameter portion having an end face contiguous with said nose and directed towards said open end, a nozzle axially arranged in said nose, and a piston rod extending through said closed end, said cylinder having an annular space surrounding said piston rod, said piston rod having a passage therein communicating with said annular space and said nozzle, said nose projecting forwardly of said cylinder in one position of said piston, means for admitting a controlled supply of fluid under pressure to said annular space to produce a fluid jet through said nozzle, and a flexible collar removably seated on said nose, said collar having a radially extending

annular portion of a diameter greater than the internal diameter of said cylinder for engagement by said free end edge of said cylinder to turn said collar inside out on reciprocation of said cylinder relatively to said piston.

3. A vascular everter comprising a cylinder of uniform internal diameter having a closed end and a free end edge defining an open end, a piston reciprocally mounted in said cylinder and having thereon a rearwardly extending piston rod, said piston having a forwardly projecting nozzle of smaller diameter than the internal diameter of said cylinder, and having a large diameter portion engaging said cylinder, said large diameter portion having an end face contiguous with said nozzle and directed towards said open end, a stop on the end of said piston rod engageable with said cylinder closed end to define a forward position of said piston, said nozzle projecting forwardly through said open end of said cylinder when said piston is in said forward position, said cylinder having an annular space surrounding said piston rod, said piston having a passage therein communicating with said annular space and with said nozzle, means for admitting a controlled supply of fluid under pressure to said annular space and a flexible collar removably seated on said nozzle and having a radially extending annular portion of a diameter greater than the internal diameter of said cylinder for engagement by said free end edge of said cylinder.

4. A vascular everter comprising a cylinder of uniform internal diameter having a closed end and a free end edge defining an open end, a piston reciprocally mounted in said cylinder and having thereon a rearwardly extending piston rod, said piston having a forwardly projecting nozzle of smaller diameter than the internal diameter of said cylinder, and having a large diameter portion engaging said cylinder, said large diameter portion having an end face contiguous with said nozzle and directed towards said open end, a stop on the end of said piston rod engageable with said cylinder closed end to define a forward position of said piston, said nozzle projecting forwardly through said open end of said cylinder when said piston is in said forward position, said cylinder having an annular space surrounding said piston rod, said piston having a passage therein communicating with said annular space and with said nozzle, and means for admitting a controlled supply of fluid under pressure to said annular space.



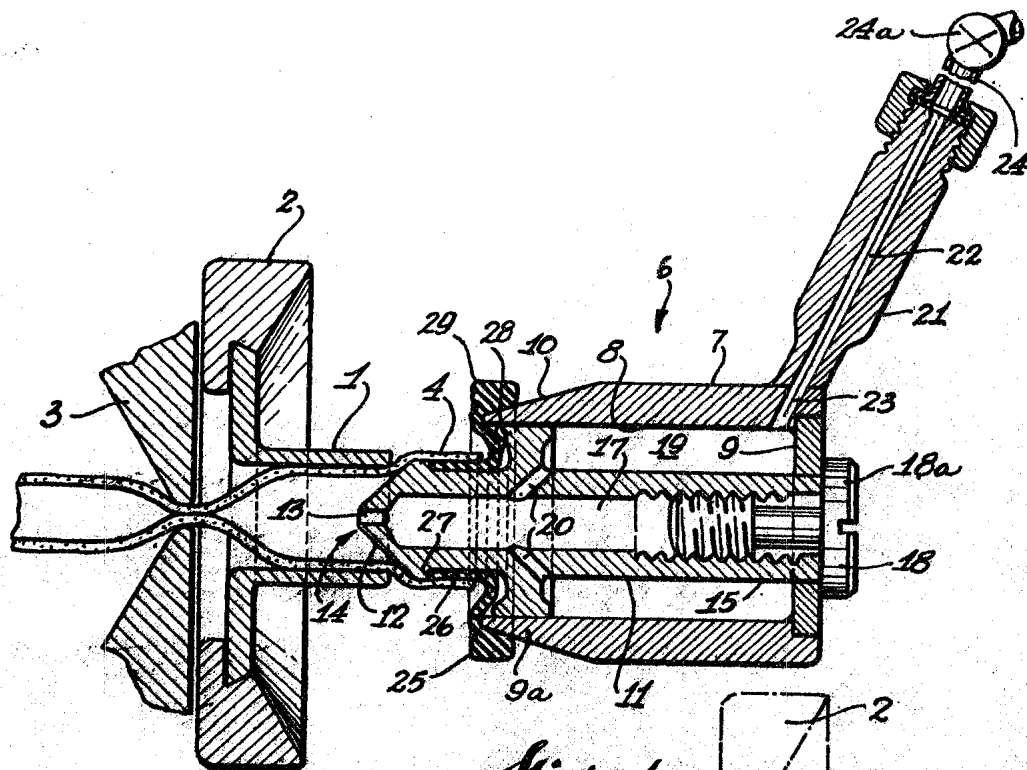


Fig. 1.

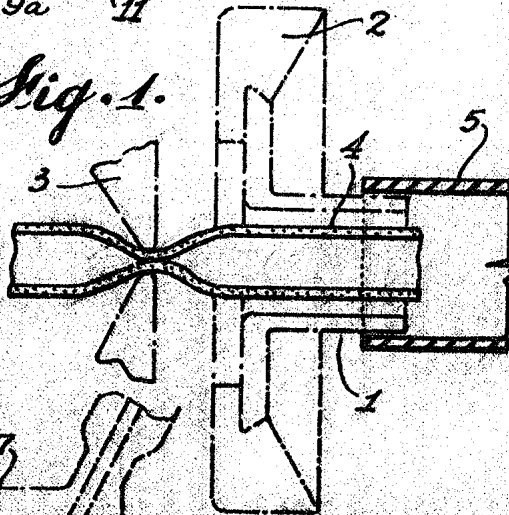


Fig. 3.

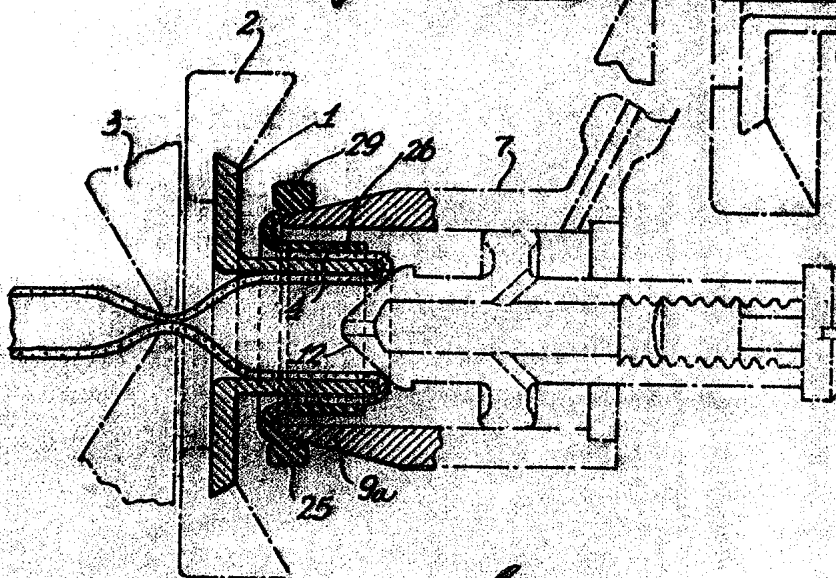


Fig. 2.

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