April 23, 1963 M. M. MUNZ ETAL 3,086,529

CONSTRICTORS

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Fig. 1.

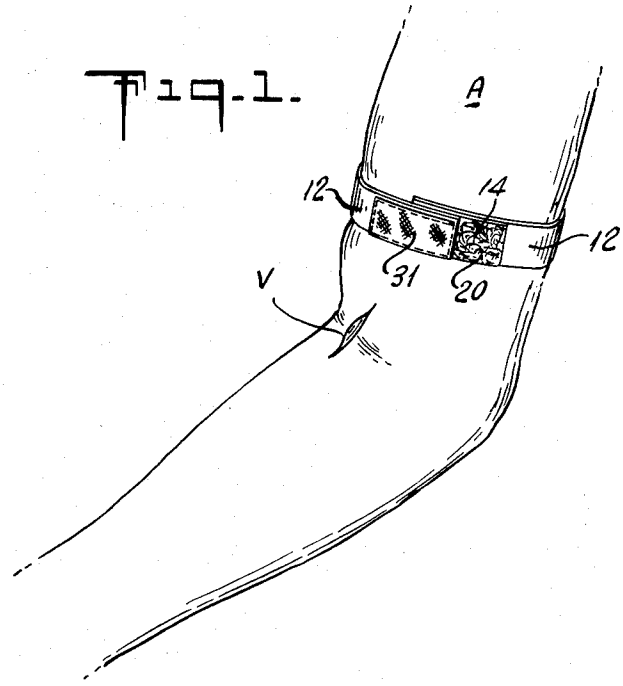


Fig. 2.

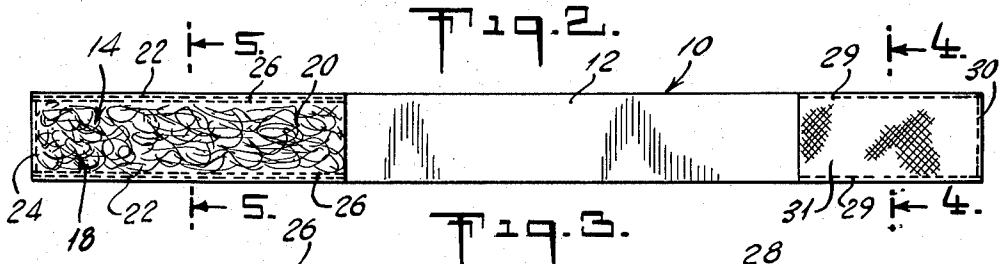


Fig. 3.

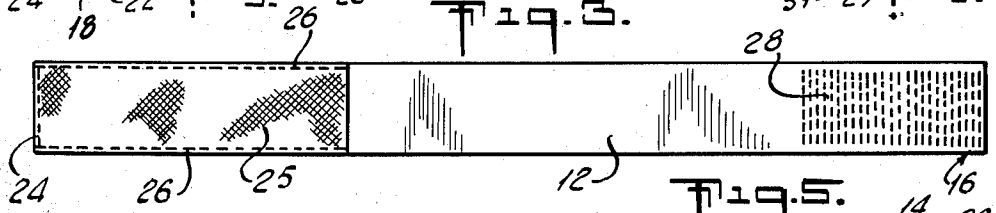


Fig. 4.

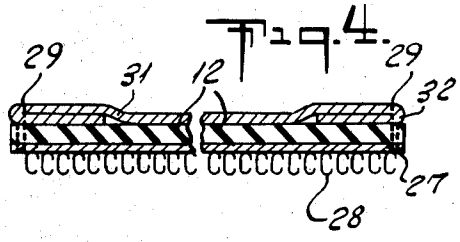
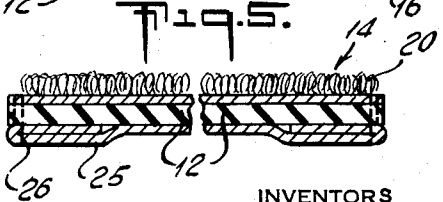


Fig. 5.



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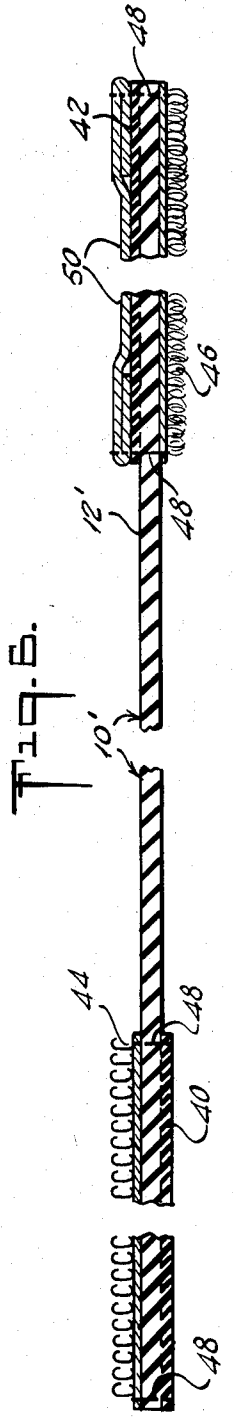

FIG. 6.

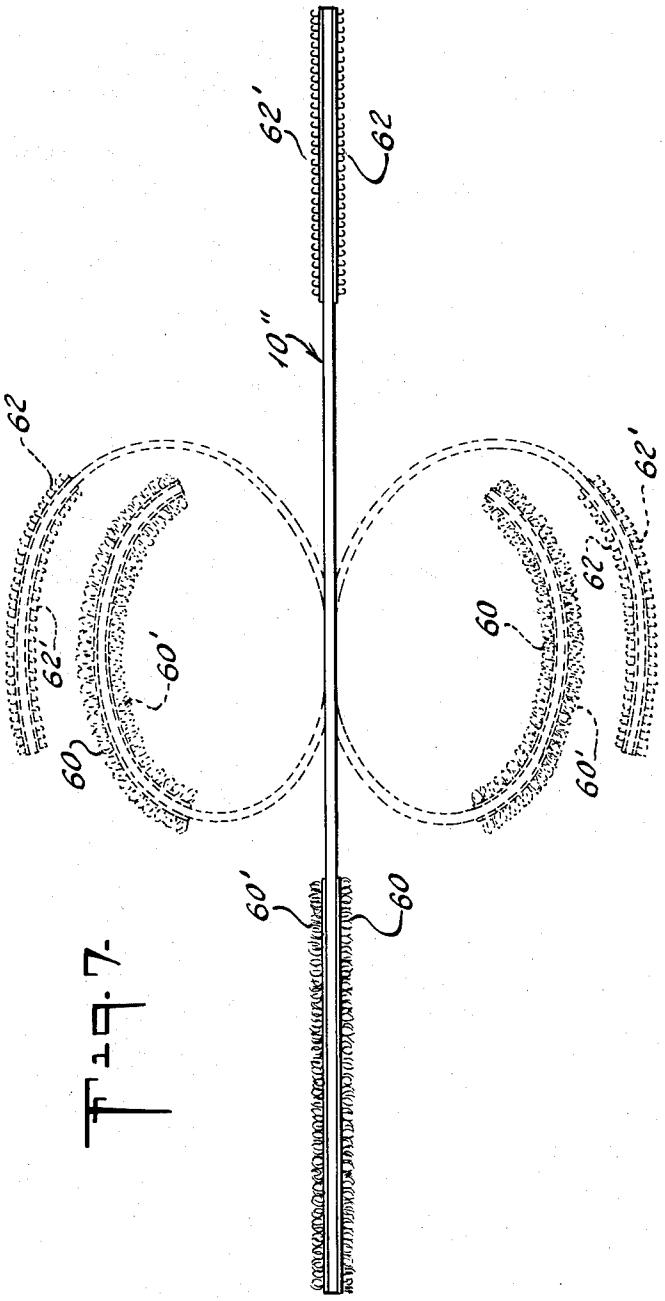

FIG. 7.

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United States Patent Office 3,086,529 Patented Apr. 23, 1963

3,086,529

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Filed Jan. 4, 1962, Ser. No. 164,344
3 Claims. (Cl. 128—327)

This invention relates generally to a medical appliance and more particularly to a new and novel device for applying constriction to a limb of the human body.

In the practice of medicine and in related areas of scientific practice the need frequently occurs for constricting a limb of the human body for the purpose of controlling the circulation through a blood vessel. In a physician's practice, use is frequently made of a constrictor, for example, on the arm above the elbow for controlling the blood flow in such a way as to cause distension of a vein to facilitate the insertion of a needle attached to a syringe either for drawing blood for laboratory tests or for introducing a medicine or plasma into the circulation. The most commonly employed device for effecting constriction of a limb in this manner is a small diameter rubber tube which is wrapped around the arm while under tension or while stretched, the ends of which are then tied into a loose or easily released knot. This practice while effective for producing the desired distension of the blood vessel, is cumbersome, time consuming and may also result in pain for the patient as it frequently occurs that the skin or flesh, particularly in obese subjects, is caught in the knot.

It is an object of the present invention, in the light of the foregoing, to provide a new and novel type of constrictor which can be easily and quickly applied and removed, and which obviates the deficiencies of heretofore used constrictors.

It is another object of the invention to provide a new and novel type of constrictor which is readily adjusted to the desired tightness and wherein the means of effecting the securement of the constrictor is such that the degree of tightness, after the constrictor has once been applied, can easily be increased or decreased if a change therein is found desirable, without having to bother with the untying and retying of a knot of the heretofore used constrictors.

Constrictor devices have heretofore been devised which may be applied and secured without having to resort to the formation of knots, as in the use of the thin elastic tube, through the provision of interengaging button devices on a strip of material or through the provision of a stud member on one end of a strip of constrictor material, which stud member is adapted for selective engagement in apertures formed throughout the length of the material. This arrangement makes it necessary that the user of the device hold the same in stretched condition around the limb while fumbling around to find an aperture properly located to receive the coupling stud.

It is another object of the present invention in the light of the foregoing, to provide a new and novel constrictor device which is so designed that the desired firm connection or coupling of overlapped ends of the constrictor may be made while the constrictor is held in stretched or tensioned condition around a limb with the desired degree of constriction, merely by pressing the overlapped ends of the constrictor together.

It is still a further object of the invention to provide a constrictor device wherein the quick and positive coupling together of overlapped ends thereof may be effected in the manner above described and wherein further the overlapped and coupled together ends will maintain a

strong adherence one to the other without the employment of extraneous fastener or accessory elements.

It is a still further and broader object of the invention to provide an improved constrictor device which may be readily employed by persons other than doctors, nurses or others having medical training, as a tourniquet where necessary to restrict hemorrhaging on an arm or leg. Furthermore, the improved constrictor device of the present invention may be used in relation to cardiac failure wherein the work load on the heart can be minimized by taking one of the four limbs out of circulation alternately. More particularly, the constrictor device may be applied to a selected limb for a short period of time to minimize the work load on the heart by cutting off the blood supply to the selected limb during such time, with this sequence repeated with respect to the other limbs.

In addition to the foregoing it is a special object of the invention to provide a constrictor device which is quickly and smoothly releasable whereby the jerking or jarring of the limb to which the device is applied is avoided in the operation of removing it from the limb.

Yet another object of the present invention is the provision of a generally improved constrictor device of the aforenoted character, which is adjustable in virtually infinite steps and may be applied and removed with utmost ease and simplicity by even the relatively unskilled and without the exercise of manual dexterity.

The invention will be best understood from a consideration of the following detailed description taken in connection with the accompanying drawings, wherein:

FIG. 1 illustrates one embodiment of constrictor constructed in accordance with the present invention, applied to the upper arm in the manner customarily employed for distending a blood vessel for taking a blood sample or making an intravenous injection;

FIG. 2 is a plan view of the constrictor as seen when looking at one side thereof showing the applied pile material covering a portion of one end of the elastic band and showing a portion of the other end covered by a reinforcing fabric;

FIG. 3 is a plan view of the constrictor reversed from the position shown in FIG. 2 and showing at one end the hook material covering the portion thereof opposite to the fabric with the other end of the constrictor having a fabric covering in opposed relation with the pile material;

FIG. 4 is a sectional view taken transversely of the constrictor substantially on the line 4—4 of FIG. 3;

FIG. 5 is a sectional view taken transversely of the constrictor substantially on the line 5—5 of FIG. 2;

FIG. 6 is a longitudinal sectional view of another embodiment of constrictor constructed in accordance with the present invention; and

FIG. 7 is a side elevational view of yet another embodiment of constrictor with schematic showings of alternate modes of securement.

Referring now more particularly to the drawings one embodiment of improved constrictor (FIGS. 1–5) is generally designated **10** and comprises an elongate elastic body **12** carrying at its opposite ends and on opposite faces the cooperating components **14** and **16** by means of which the ends of the band are coupled together in the manner hereinafter described.

The constrictor is shown in FIG. 1 applied to the upper part of a human arm which is generally designated A, above the elbow in the usual position selected for applying a constrictor whereby to cause distension of the vein V in the bend of the elbow. As hereinbefore stated, such distension of the vein is frequently produced to facilitate the introduction of a hollow needle attached to a syringe for extracting blood for laboratory tests

or for the introduction of a substance into the blood stream.

The constrictor of the present invention may be made in various lengths and widths according to the particular use to which it may be desired to put it. For example, where it may be desired for use on the arm or leg of a child it would be of shorter length than would be the case if it is designed for application to the limb of an adult. Furthermore, the band could be made still longer and heavier than a conventional adult band for special uses or it may be of considerably greater length and width for use, for example, as an unbilical band. Where it is desired that the constrictor be used for thigh application, it may be made wider than constrictors used for arm applications.

Without intending to limit the invention in any respect, it may be stated that actual clinical trials have indicated that a constrictor of approximately 1" width and about 10" in length is desirable for general use. However, these dimensions may be increased or decreased as may be found desirable, as will be obvious.

The elastic body portion **12** comprises a band or ribbon of rubber. The coupling component **14** comprises a strip of Velcro pile **18** which preferably extends for a substantial length of the band from one end thereof and across the width of the band. This pile material is composed of densely matted strand loops **20** of a suitable elastic synthetic resin fabric. This pile material may be secured to the face of the elastic band in a number of different ways as, for example, it may be stitched along the longitudinal edges as indicated at **22** and across the end of the material at the end of the elastic band as indicated at **24**. The opposite end of the pile material remains unsecured to the elastic band across the width of the latter.

The opposite face of the elastic band from the pile component **14** has positioned thereagainst a strip of fabric **25**, such as twill, and the stitching securing the longitudinal edges and outer end edge of the component **14** may be extended along at least one line thereof as indicated at **26**, through the elastic band and the reinforcing fabric **25** so as to effect the secure connection of the elastic in between the body of the component **14** and the fabric backing.

The coupling component **16** which cooperates with the component **14** to effect the securement of the band ends together consists of the Velcro hook carrying fabric body **27** from the face of which extend the transverse lines of hooks **28**. This fabric **27** and the hooks **28** which form a part thereof is also woven of elastic synthetic resin fibers, the ends of the hooks being turned toward the body of the fabric as shown whereby to catch in the loops **20** of the pile material when the two components are pressed together in confronting relation to force the hooks into the pile.

As will be readily apparent, the hook component of the Velcro material extends for a portion of the length of the elastic band at the opposite end from the component **14** and on the opposite face of the band from this latter component. The fabric of the component **16** is also here shown as being stitched along the longitudinal edges as at **29** and across the outer end edge as at **30**, to the elastic band and as shown in FIG. 4, the opposite side of the elastic band from the hook carrying fabric is backed up by the reinforcing fabric backing **31**, some of the rows of stitching being carried through as indicated at **32** to secure this fabric backing, preferably of twill, to the elastic band. The inner end portion of the hook component is left unsecured across the width of the elastic band.

It is also to be understood that while in the illustration of the invention the cooperating components **14** and **16** have been disclosed as being stitched to the elastic band the invention also contemplates effecting the attachment of these components to the elastic band by vulcanization or by a suitable adhesive.

The pile component **14** of the coupling means is preferably of a length materially greater than the length of the hook component **16**. Thus, where the band may be applied to a limb of relatively large size requiring the use of substantially the entire length of the band so that only a small length of the hook component will be overlapped with the free end of the pile component only a relatively small part of the hook component will be in contact with the skin. It will be, of course, apparent that in using the constrictor band in the manner illustrated in FIG. 1, for example, the elastic band will be stretched and while in this stretched condition it will be wrapped around the limb with the reinforced backing **25** of the pile component against the limb, thus positioning the pile to face outwardly and the hook component end of the band is then drawn to the desired degree of tightness across the end of the pile component and placed against the pile and firmly pressed thereon. This action will cause the hook members of the hook component **16** to enter the pile and the hooks will thus become engaged in or will grip the loops of the pile and effect the firm coupling together of the overlapped ends of the stretched band. The hook and pile components have a certain degree of elasticity and accordingly, being coupled together with the band under stretch or tension, there will be a tendency to pull the components apart along planes paralleling the contacting faces of the components. While this will create a certain degree of tension in the interlocked components, the components will maintain a dynamic coupling which will yield somewhat but will, however, coact with the elastic action of the band to hold the band with a constant degree of tension around the limb.

Release of the cooperating interlocked elements of the components is effected by grasping the free end of the hook component and pulling outwardly on the same from the pile component. This will cause the hook members and the loops of the pile to disengage from interlock. The transverse line of disengagement will progress lengthwise of the interlocked components so that the components will separate smoothly and without jar or shock to the member about which the constrictor is engaged. Reference is made to Patent No. 2,717,437 issued on September 13, 1955, for a more detailed disclosure of the Velcro components.

While in the illustration of the invention the pile component has been shown and described as comprising a single length of material, it is also within the scope of the present invention to use two or more sections or pieces of the pile component secured to the elastic band in spaced relation.

Referring now to FIG. 6, there is shown another embodiment **10'** of the present invention which differs from the constrictor **10** in that constrictor **10'** has vulcanized to elastic body **12'**, at opposite end portions thereof and on opposite sides, strips **40** and **42** of a suitable nonstretchable fabric, such as a cloth tape, or the like. This vulcanization process eliminates the elasticity of body **12'** at such end portions while retaining the elasticity therebetween. The strips **40**, **42** are substantially coextensive with the Velcro strips **44** and **46** which are stitched to the end portions of the elastic body by the lines of stitching **48** which extend marginally along all four sides of each strip. As in the previous embodiment the Velcro strips are oppositely disposed at the ends of the constrictor. Thus the Velcro strips are secured to the elastic body at nonelastic end portions thereof whereby such strips may be secured in position by a conventional stitching operation which is unaffected by the elastic character of the constrictor between such end portions. Thus the sewing operation is effected at only nonelastic areas of the band. The strip **50** is merely a cloth identification label

which is secured in place by the lines of stitching **48** on the opposite side of strip **46**.

Referring now to FIG. 7, there is shown yet another embodiment **10''** which is similar to the embodiment **10'**, differing therefrom in the respects now to be described. The constrictor **10''** has a pair of Velcro pile strips **60** and **60'** at one end and a pair of Velcro loop strips **62**, **62'** at the opposite end whereby the alternative modes of assembly as schematically illustrated in FIG. 7 may be achieved. More particularly, pursuant to this embodiment securement can be achieved regardless of the surface positioned against the limb and in one manner of securement strips **60** and **62'** may be secured to each other and in the other manner of securement strips **60'** and **62** may be interengaged for securement of the constrictor around the limb of the patient. The Velcro strips are preferably stitchedly secured to the band having fabric strips vulcanized to end portions thereof in the manner illustrated in FIG. 6.

It is within the scope of the present invention to provide suitable supplementary securement means to any of the constrictor embodiments aforedescribed to insure against inadvertent release or separation of the constrictor as in the case of accident when it is necessary to leave the patient unattended for an interval, or other conditions making the use of such supplementary securement desirable. Any conventional securement means may be utilized for this purpose such as hooks and eyes, buttons and loops, snap fasteners, etc., integrated with end portions of the constrictor in any desired manner.

As this invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, the present embodiments are therefore illustrative and not restrictive, since the scope of the invention is defined in the appended claims, and all changes that fall within the metes and bounds of the claims, or that form their functional as well as conjointly cooperative equivalents, are therefore intended to be embraced by those claims.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:

1. A constrictor comprising a length of elastomer adapted to be stretched to encircle a human limb with substantial lengths of overlap and be releasably coupled thereat in band formation, said length of elastomer having inelastic strips secured thereto at opposite end portions throughout a substantial area of said strips to form inelastic end portions, complementary releasably engageable coupling components of strip material stitchedly secured to said end portions, said coupling components being constituted by strips of Velcro, one of which comprises projecting hook-like elements with the other comprising a multiplicity of projecting loop elements, said components being overlapped and pressed together into surface-to-surface engagement to releasably retain the constrictor in stretched band formation, the inelastic strip at each end extending for at least the major portion of the length of its companion coupling strip.

2. A constrictor comprising a length of elastomer adapted to be stretched to encircle a human limb with substantial lengths of overlap and be releasably coupled thereat in band formation, said length of elastomer having inelastic strips vulcanized thereto at opposite end portions throughout a substantial area of said strips to form inelastic end portions, complementary releasably engageable coupling components of strip material secured to said end portions by lines of stitching, said coupling components being constituted by strips of Velcro, one of which comprises projecting hook-like elements with the other comprising a multiplicity of projecting loop elements, said components being overlapped and pressed together into surface-to-surface engagement to releasably retain the constrictor in stretched band formation, the inelastic strips and coupling strips at each end being substantially coextensive.

3. A constrictor comprising a length of elastomer adapted to encircle a human limb and be releasably coupled thereat in band formation, said length of elastomer having inelastic strips vulcanized thereto to form inelastic end portions, a pair of like coupling components of strip material stitchedly secured to opposite sides of one inelastic end portion, and another pair of like coupling components of strip material releasably engageable with said first mentioned components stitchedly secured to opposite sides of the other inelastic end portion, either selected component at one end portion being adapted to be overlapped and pressed together with a selected component at the other end portion into surface-to-surface engagement to releasably retain the constrictor in band formation, said coupling components being constituted by strips of Velcro, one of which comprises projecting hook-like elements with the other comprising a multiplicity of projecting loop elements, the inelastic strips and coupling strips at each end being substantially coextensive.

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