June 22, 1965 A. W. KELSON 3,190,444

ROTATING TOURNIQUETS

Filed Jan. 24, 1964

Fig. 1.

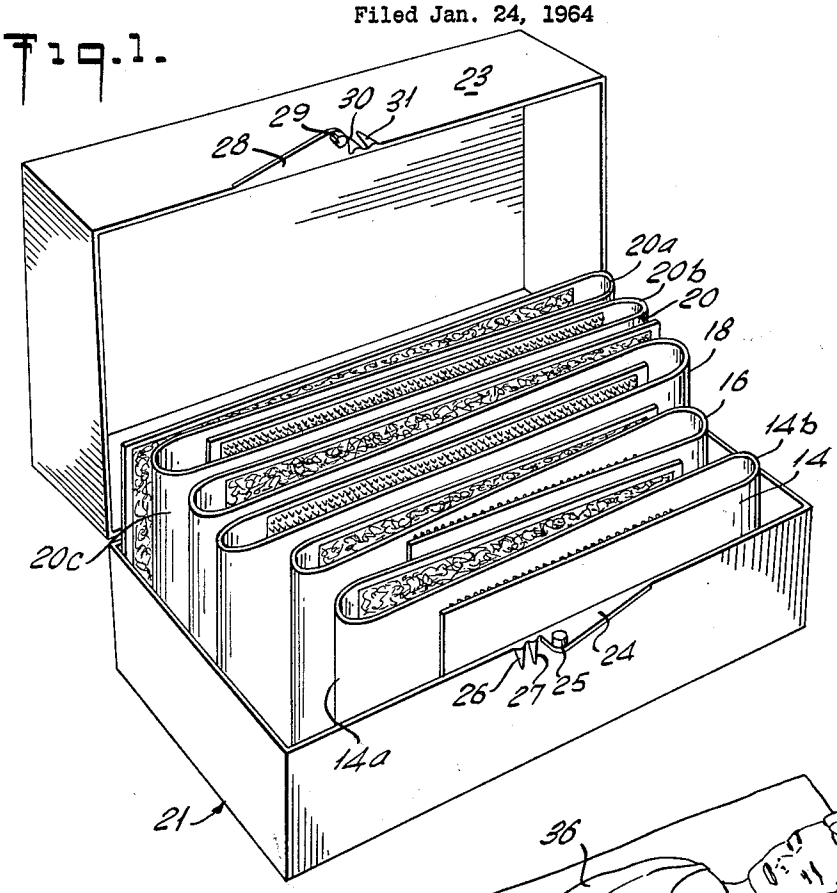


Fig. 4.

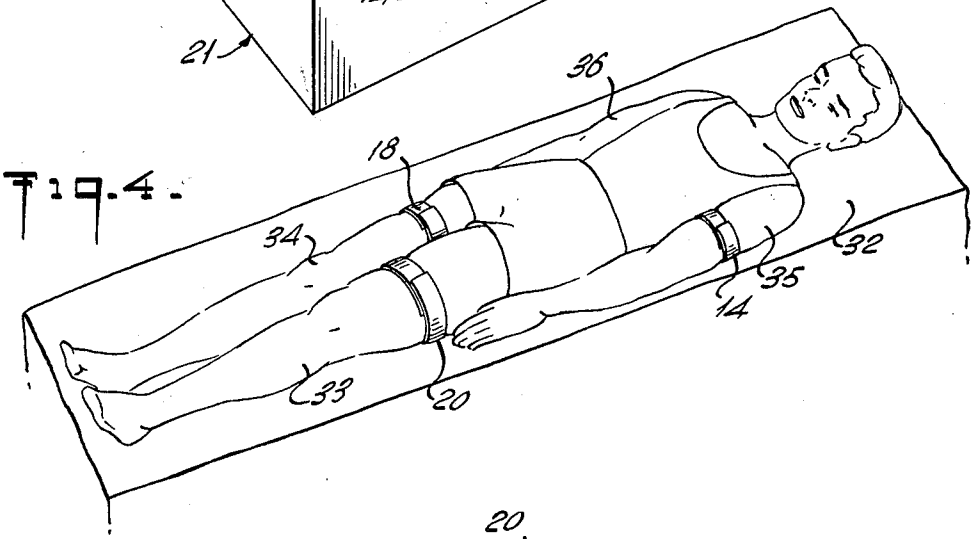


Fig. 2.

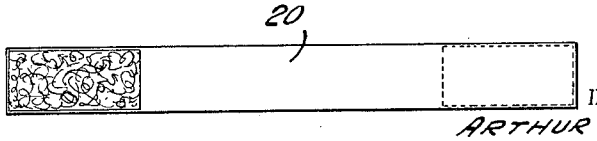
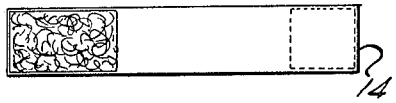


Fig. 3.



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United States Patent Office 3,190,444 Patented June 22, 1965

3,190,444

ROTATING TOURNIQUETS

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Filed Jan. 24, 1964, Ser. No. 340,105
1 Claim. (Cl. 206—63.2)

This invention relates generally to a medical appliance, and more particularly to an appliance comprising a plurality of devices for applying constriction to the different extremities of the human body.

In the practice of medicine and in related areas of scientific practice the need frequently occurs for constricting the limbs of the human body for pooling blood in the extremities away from the heart. Thus, in cases such as pulmonary edema, it is necessary to block the return of venous blood to the heart (to thereby lower the work load of the heart) and, more important, not to stop arterial flow of blood from the heart. Usually, this object is achieved by placing so called "rotating tourniquets" or "alternating tourniquets" about three of the limbs of the patient and periodically sequentially moving the tourniquets from limb to limb. The degree of constriction is such as to permit arterial flow of blood from the heart to the circulatory systems in the extremities and is such as to prevent venous flow of blood back to the heart from these constricted limbs. The most commonly employed devices for effecting constriction of the limbs in this manner have been a triangular bandage, or a piece of small rubber tube which is wrapped around the limb while under tension or while stretched whereupon the ends are then tied into a loose or easily released knot. This practice, while effective for producing the desired distension of the blood vessels, 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. Moreover, the desired quantity of such constrictors (at least three being required) is not always immediately available.

It is an object of the present invention to provide a rotating tourniquet package including a container and a plurality of tourniquets which are differently proportioned so each may be efficiently utilized on a particular limb and which can easily and quickly be applied to and removed from the limbs of a patient.

It is another object of the present invention to provide a rotating tourniquet package comprising constrictors which are easily adjusted to the desired tightness and wherein the means of effecting the securement of a specific 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 or retying of a knot of the heretofore used constrictors.

It is another object of the present invention to provide a rotating tourniquet package comprising a plurality of tourniquets which are so designed that the desired coupling of overlapped ends of the tourniquets may be made while the tourniquet is held in stretched or tensioned condition, around the particular limb, of the desired degree of constriction, merely by pressing the overlapped ends of the constrictors together.

Another object of the present invention is to provide a rotating tourniquet package comprising a plurality of tourniquets wherein the length of the fastening devices at the ends of each tourniquet are designed so that when a tourniquet is in use the arterial flow of blood will not be cut off.

It is still a further object of the invention to provide a rotating tourniquet package comprising a plurality of constrictor devices wherein the quick and positive coupling together of overlapped ends may be effected in the manner above described and wherein further the overlapping coupled together ends will maintain a strong adherence, one to the other, without the employment of extraneous fasteners or accessory elements.

It is still another object of the present invention to provide a rotating tourniquet package including a container and a plurality of tourniquets which are particularly adapted to efficient sequential periodic placement and removal on the particular limbs of a patient.

In accordance with the foregoing objects, the present invention comprises a set of four constrictors which may advantageously be of the type described in Patent No. 3,086,529, issued to M. M. Munz et al. on April 23, 1963, and assigned to the assignee of the present invention. Two of the four constrictors are longer than the remaining two and are designed to be placed about the thighs of the patient. The shorter constrictors are adapted to be placed about the upper arms of the patient. In use, three of the constrictors are respectively placed about three extremities of the patient and are maintained in place for a predetermined time. Thereafter, a constrictor is placed about the limb having no constrictor thereon and a constrictor is removed from one of the limbs then containing a constrictor. This operation is repeated periodically so that each limb will be completely free of any constriction for one quarter of the time the patient is subject to rotating tourniquet treatment. The bearing surfaces of the fastening elements on each tourniquet are of a length such that the tourniquet may be applied to the limb without cutting off the arterial flow of blood but will prevent venous return of blood to the heart.

It is a feature of the present invention to provide a rotating tourniquet package including a plurality of tourniquets and a container for receiving same wherein two of said tourniquets are longer than the other two tourniquets for placement about the thighs of the patient.

The above and other objects and features of the present invention will become more apparent from a consideration of the following detailed description, when taken in conjunction with the drawings which:

FIG. 1 is a perspective view of the kit of the present invention;

FIG. 2 is a front elevational view of one of the tourniquets of the kit of the present invention which is adapted to be placed about the thigh of the patient;

FIG. 3 is a front elevational view of one of the tourniquets of the kit of the present invention which is adapted to be placed about the upper arm of the patient; and

FIG. 4 is a diagrammatic view illustrating how the tourniquets in the kit of the present invention may be applied to a patient.

As noted hereinabove, the tourniquets of the present invention may be of the type stated and described in Patent No. 3,086,529. This patent discloses a tourniquet comprising a band of rubber having a strip of Velcro pile which extends longitudinally for a substantial length of the band from one end thereof across the width of the band. The coupling component which cooperates with the Velcro pile to affect the securement of the tourniquet ends consists of a Velcro hook portion which is secured to the other end of the band on the side opposite the side containing the pile fabric and extends longitudinally for a predetermined length from said other end across the width of said band. The end of the hooks are turned in toward the body of the fabric so that they may catch the loops of the pile material when the two components are pressed together in confronting relation to force the hooks into the pile. However, the present invention contemplates Velcro hook and pile strips which

are substantially longer than those disclosed in the previously mentioned patent, as set out below.

As illustrated in FIG. 1, the present invention comprises four such tourniquets which are denoted by the numerals **14**, **16**, **18** and **20**. Tourniquets **18** and **20** are equal in length and are longer than tourniquets **14** and **16**, which are also equal in length, as illustrated in FIGS. 2 and 3, respectively. Thus, tourniquets **18** and **20** are adapted to fit about the thighs of the patient while tourniquets **14** and **16** are adapted to fit about the upper arms of the patient. The tourniquets **14**, **16**, **18** and **20** may be contained within a receptacle **21** until they are ready for use.

Receptacle **21** comprises a lower container portion **22** and an upper container portion **23** hinged to portion **22** by hinges (not shown). A locking member is contained on portion **22** and comprises a wedge shaped member **24**, the front edge of which projects outwardly perpendicularly from approximately the center of the front panel of portion **22** at the upper edge thereof and tapers inwardly toward the right as taken in FIG. 1 to define said wedge shape. A pin **25** projects upwardly perpendicularly from the widest portion of the wedge **24**. Two inverted conically shaped projections **26** and **27** are located adjacent pin **25** at the upper edge of the front panel of portion **22**, and are separated from each other by a predetermined distance and taper downwardly and inwardly from the top of the panel. Similarly, the upper portion **23** contains a wedge shaped element **28** the front edge of which projects outwardly perpendicularly from the lower edge of the front panel of portion **23** and tapers inwardly toward the left as taken in FIG. 1 to define said wedge shaped element. A pin **29** projects downwardly perpendicularly from the widest point of the wedge shaped element. The two conical shaped elements **30** and **31** are located adjacent wedge **28** on the front panel of portion **23** and taper upwardly inwardly from the lower edge of the front panel. When receptacle **21** is closed, pin **25** will be received between projections **30** and **31** and pin **29** will be received between projections **26** and **27**. The container is preferably made of plastic material so the tapering of the respective pins **26** and **27** and **30** and **31** will cause the associated pins **29** and **25** to be displaced outward, thereby exerting a force inward against these projections to maintain the receptacle in the shut position. Thus, a minimum amount of force in the upward direction exerted against element **28** (or minimum amount of force exerted downward against element **24**) will cause the receptacle to open.

It is desirable to have the respective tourniquets folded within receptacle **21** in such a manner that none of the Velcro pile portions on any of the tourniquets will be in contact with any of the Velcro hook portions. If, in fact, any of these portions were in contact with one another, precious time would be wasted (especially in the case of emergencies) in separating the tourniquets and then applying them. (Since tourniquets **14** and **16** are folded the same way only the folding of tourniquet **14** will be described.) That end of tourniquet **14** containing the Velcro pile is folded along the fold **14***a* with the Velcro pile pointing inward toward the mid-portion of the band. The end of tourniquet **14** containing the Velcro hook portion is folded along the fold **14***b* with the hook portion pointing inward toward the mid-portion of tourniquet **14**. Hence, the pile portion and the hook portion are separated from each other by the mid-portion of tourniquet **14** and neither of these portions are exposed so as to come into contact with the respective hook or pile portion of another tourniquet. Tourniquets **14** and **16** are then placed in container **21** with their lower longitudinal edge in contact with the bottom (not shown) of receptacle **21** and the lateral edges of the tourniquets perpendicular to the bottom of the receptacle.

Since tourniquets **18** and **20** are folded in the same manner, only the folding of tourniquet **20** will be described. The end of tourniquet **20** containing the Velcro pile portion is folded along the fold **20***a* with the Velcro pile facing inward toward the mid-portion of tourniquet **20**. The end of tourniquet **20** containing the Velcro hook portion thereon is folded along the fold **20***b* inward toward the mid-portion of tourniquet **20**. The mid-portion of tourniquet **20** is folded along the fold **20***c* so that the end containing the Velcro hook portion is sandwiched between two surfaces of the mid-portion of tourniquet **20**. Thus, neither the Velcro hook portion nor the Velcro pile portion will be exposed in either tourniquet **18** or **20**. Tourniquets **18** and **20** are inserted into receptacle **21** with their longitudinal bottom edges abutting the bottom (not shown) of receptacle **21** and the lateral edges of the tourniquets perpendicular to said bottom.

The patient receiving the tourniquet treatment is placed in a prone position on, for example, a cot **32**, as shown in FIG. 4. The arms of the patient are generally denoted by **35** and **36** and the legs of the patient are denoted by **33** and **34**. In operation, the receptacle **21** is opened and the tourniquets removed therefrom. In a preferred procedure only three tourniquets will be placed about three extremities at any one time. Thus, tourniquet **18** is placed about the thigh of leg **34** with the Velcro hook portion and the Velcro pile portion engaging one anther to secure the tourniquet in place (as noted in the aforementioned patent). Tourniquet **20** is placed about the thigh of leg **33** with the Velcro end portions overlapping. Tourniquet **14** is placed about the upper arm of arm **35** with the Velcro ends overlapping to maintain the desired constricting forces and to maintain the band in place. It is to be noted that tourniquets are specifically adjusted so the constricting forces exerted by the tourniquets do not stop arterial flow from the heart but just block the return of venous blood thereto thereby lessening the work load of the heart and allowing the blood to pool in the extremities having the constrictors thereon. The Velcro end portions of each tourniquet are made sufficiently long so this required degree of constriction may be achieved. This is in contradistinction to tourniquets which are used to cut off the arterial flow of blood. In these type of tourniquets the fastening elements are purposely made short to effect a greater constricting force. Moreover, the overall length and width of the tourniquets of the present invention are made greater than the ordinary tourniquet (which is used to restrict arterial flow of blood) so as to insure only venous return of blood will be cut off.

After approximately 15 minutes a constrictor is placed about the upper arm of arm **36** and a constrictor is removed from one of the other limbs of the patient. Thereafter, a constrictor is placed on the then free limb and removed from one of the two remaining limbs that had not been free. Thus, each limb will be constricted for 45 minutes and will be free of constriction for 15 minutes out of every hour thereby preventing extended periods of circulatory block which could cause serious damage.

When the treatment has been completed, the tourniquets **14**, **16**, **18** and **20** are then folded, as described above, and replaced in receptacle **21** until such time as their use is again required.

Thus, in accordance with the objects of the present invention I have provided a new and useful rotating tourniquet package, which comprises a container and four tourniquets specifically proportioned for the respective limbs which may easily and quickly be applied to and removed from the extremities of a patient to block the venous return of blood to the heart, thereby lightening the work load of the heart.

Although a preferred embodiment of the present invention has been described, it will be apparent to those skilled in the art that modifications may be made therein without departing from the spirit of the invention.

What is claimed is:

A rotating tourniquet package comprising a plurality of elongated elastic bands, each of said bands having a respective Velcro pile portion connected to one end thereof across the width of said bands and extending longitudinally for a predetermined length, each of said bands having a respective Velcro hook portion connected to the other end of said bands on the face opposite the face containing said pile portion across the width of said band and extending longitudinally for a predetermined length from said other end, the predetermined length of the respective Velcro pile and hook portions of each band extending a sufficient distance to allow said band to be placed about a limb without restricting arterial blood flow, said plurality of elongated bands comprising four in number, two of said elongated bands being of equal length and being longer than the remaining two bands and being adapted to be placed about the thigh of a patient, the two remaining shorter bands being of equal length and being adapted to be placed about the upper arm of a patient, a container for receiving said plurality of elongated bands, each of said plurality of elongated bands being foldedly received in said container with the lateral edges of said elongated bands perpendicular to the bottom of said container so a particular band may easily be removed therefrom, each of said longer bands being folded inwardly on itself along

transverse lines proximate to the termination of each of the Velcro portions and along an intermediate transverse line wherein each Velcro portion of the longer of said bands is in contact with a plain surface of said band thereby preventing the Velcro portions from contacting one another and from contacting Velcro portions of the remaining bands in said container, each of the shorter of said bands being folded along transverse lines on itself whereby said Velcro portions are in contact with opposite sides of the center portion of said shorter band to maintain said Velcro portions out of contact with one another and out of contact with the Velcro portions of the remaining bands in said container, whereby said plurality of elongated bands may easily be removed from said container and respectively placed about the limbs of a patient with the Velcro end portions of said bands overlapped and interengaged so the respective bands constrict the respective limbs of the patient to prevent return of venous blood flow from the constricted limbs to the heart.

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THERON E. CONDON, *Primary Examiner.*