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(54) TOURNIQUET

(71) I, HEINZ DROOFF, a citizen of the Federal Republic of Germany, trading as PRAMETA PRAZISIONSMETALL-UND KUNSTSTOFFERZEUGNISSE G. BAUMANN & CO., of Hardtgenbuscher Kirchweg 111, 5 Köln 91, Federal Republic of Germany, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to tourniquets of the kind including a housing or casing which is combined with a band defining a loop which can be tightened relative to a limb.

In tourniquets of the kind aforesaid, the band is generally so arranged that both ends thereof pass through the casing and either or both are pulled to tighten the loop portion of the band about a limb. However, irrespective of the particular construction of the tourniquet, it is highly desirable that the loop be rapidly and reliably opened in order to remove the band from the limb. This is necessary in order that the tourniquet not be simply drawn along the limb because, for example, there may be encountered such obstacles as, for example, an inserted syringe. Thus, it is important that the loop of the tourniquet be rapidly and readily applied to and removed from a limb.

Tourniquets are also known in which the casings or housings thereof are formed of two or three parts. One part generally includes a clamping lever which can be operated to clam or unclamp one or both of the end portions of the band as either or both pass through the casing for tightening or loosening the loop. More often than not, one end of the band is attached to the closure and the opposite end is the only end clamped to the closure by the clamping lever. The clamping lever is generally operated by a locking and unlocking device and thus the overall construction is relatively complex. Moreover, in such conventional tourniquets, the band is generally attached to the casing by screws or rivets which makes the band difficult to remove which may be desirable for purposes of cleaning.

Tourniquets are also known in which the band may be readily releasably attached to the casing, but generally such attachments are complicated and costly from a standpoint of manufacture. The end of the band which is to be secured to the casing is generally riveted or screwed to a fork-shaped part whose legs engage in a slide which must be shifted transversely of the casing in order to release the band. Tilting or jamming during release or assembly can occur and any sudden release of the band from the casing is obviously highly undesirable.

An object of the present invention is to provide a tourniquet, in which the fastening device for the band end releasable from the clasp is simple and reliable in operation.

According to the present invention I provide a tourniquet comprising a casing, a clamping lever, means mounting said clamping lever for pivotal movement relative to said casing, a band, said band including first and second terminal end portions and a loop portion therebetween, an aperture in said casing having entry and exit ends for permitting the passage of said first terminal end portion through said casing, said clamping lever being adapted to clamp said first terminal end portion relative to said casing, a fitting carried by said second terminal end portion, a spring releasably clampingly securing said second terminal end portion fitting to said lever or said casing, and means for releasing the clamping effect of said spring to release said second terminal end portion from said clamping lever or said casing.

The second terminal end portion of the band may be readily and reliably snap-connected to either the clamping lever or the casing, and this is preferably accomplished by means of a leaf spring which clampingly

secures the fitting connected to said terminal end portion of the band between an abutment of the clamping lever and the leaf spring or simply providing the leaf spring with a locking nose which cooperates with the band fitting to lock the same to the casing.

The fitting may be either of a one-piece or two-piece construction, and in either event the fitting itself may include means for releasing the fitting from between the spring and the abutment in the form of a tab or projection directed toward the loop of the band which precludes accidental release of the band while the tourniquet effect is being applied.

In keeping with the embodiment of the invention in which the fitting of the band is carried by the clamping lever, the projection of the fitting is obliquely disposed in a direction toward the loop such that in order to release the tourniquet effect, the clamping lever is depressed and the tab, should it press against the limb of a patient will automatically cause the release of the band from its confinement between the abutment means and the spring.

A further desirable feature in keeping with the present invention is that the connection between the fitting and the clamping lever is such that upon the release of the fitting the same springs off in a downward direction which has the advantage that the band will reliably avoid interfering with the injection needles and the like in the limb of a patient when the tourniquet is being removed.

In further keeping with this invention, the lever may include a downwardly opening recess into which the fitting of the band is received and the spring is disposed transversely of the clamping lever in a bowed fashion such that the fitting is accurately located within the recess between the spring and the abutment means. Alternatively, the leaf spring may be of a generally Z-shaped configuration with a free terminal end thereof curving toward a bottom wall of the casing whereby only intentional depression of the release mechanism or tab, formed integrally with or as a separate component of the fitting, will disengage the fitting by the deflection of the spring.

Embodiments of the invention will now be described, by way of example, with reference to the accompanying diagrammatic drawings, in which:—

Fig. 1 is a side elevational view of a tourniquet constructed in accordance with this invention, and illustrates a housing or casing carrying a clamping lever with one end of a band attached thereto and the other end of the band passing through an aperture of the casing;

Fig. 2 is a top plan view of the tourniquet of Fig. 1, and illustrates means for releasing the band from the clamping lever with the releasing means being an integral portion of a fitting secured to a terminal end of the band;

Fig. 3 is a fragmentary longitudinal sectional view on a larger scale, through the housing or casing, and more clearly illustrates details of the fitting secured to the terminal end of the band, and a generally Z-shaped leaf spring which secures the fitting to the clamping lever;

Fig. 4 is a cross-sectional view taken generally along line IV–IV of Fig. 3, and illustrates details of the underside of the spring;

Fig. 5 is a fragmentary longitudinal sectional view of another tourniquet constructed in accordance with this invention, and illustrates an end of a band snap-connected to a fitting which in turn is snap-connected to a clamping lever;

Fig. 6 is a sectional view taken generally along line VI–VI of Fig. 5, and illustrates details of the leaf spring;

Fig. 7 is a longitudinal sectional view of another tourniquet constructed in accordance with this invention, and specifically illustrates a spring secured to a bottom wall of a casing at one end thereof with an opposite end clampingly securing an end of the band to a lower wall of the casing;

Fig. 8 is a top plan view of the tourniquet of Fig. 7 and illustrates the exposed area of the clamping lever which is depressed to release the band;

Fig. 9 is a longitudinal sectional view through a casing similar to that associated with the tourniquet of Fig. 7, and illustrates a mechanism for releasing an associated leaf spring;

Fig. 10 is a side elevational view with a portion broken away of the casing of Fig. 9, and illustrates a lever which can be raised to release the leaf spring;

Fig. 11 is a longitudinal sectional view on the line XI–XI of Fig. 12, of another casing similar to that shown in Figs. 7 and 9, and illustrates a pivotally mounted lever for releasing an associated leaf spring;

Fig. 12 is a top plan view of the casing of Fig. 11 with a portion thereof broken away for clarity and illustrates a portion of the lever projecting through a top or upper wall of the casing for actuating the lever to release the clamping effect of the leaf spring; and

Fig. 13 is an end elevational view of the casing of Figs. 11 and 12 with a portion thereof broken away for clarity, and illustrates details of the pivotal mounting of the lever.

Referring firstly to Figs. 1 to 4, a tourniquet 1 has a casing or housing 2 having an entry end to an exit end from an aper-

ture through which one end portion of a rubber band 3 is passed. The rubber band 3 is clamped in the casing 2 by a clamping lever 4, pivotally mounted on pivot pin 5 and actuated by a press-key 20. The clamping lever 4 is under the influence of a spring 6. The band 3 is clamped by a nose 4*a* of the lever which presses the band 3 against the lower wall of the casing 2. The other terminal end 3*a* of the band is releasably connected to the lever 4, and the band 3 forms a loop portion 7 between its two end portions and outside of the casing 2.

Secured to the clamping lever 4, there is a Z-shaped leaf spring 21, which advantageously extends substantially fully across the width of the internal space of the casing 2. The middle portion 22 of the leaf spring 21 bears on a shoulder 25 of the clamping lever, while one leg or terminal end portion 23 is held under tension between the pivot pin 5 and the clamping lever 4, and the other leg or terminal end portion 24 is free and forms a spring flap curved against the press key 20. By means of its contact with the shoulder 25, and the tensioning of the leg 23 between the pivot pin 5 and the clamping lever 4, the leaf spring 21 is secured in a simple way against displacement.

In the underside of press-key 20 there is a recess 26, defined at its rear by a transverse rib or abutment 27, and on the interior by shaped profiles, at least in the sidewalls 35 of clamping lever 4. Together with the spring flap 24, the recess 26 in the press-key 20 forms an insertion slot, open towards the loop 7, for the end 3*a* of the band.

The end 3*a* of the band 3 has a fitting which is continuous and forms a shoe 28 for the band end, a step forming a stop 29 and a tab 30. The recess 26 in the press-key 20 is adapted substantially to the shape of the shoe and of the stop 29 in the shoe 28, so that when the shoe 28 is inserted into the slot between the key 20 and the free terminal end portion or spring flap 24 of the leaf spring 21, the stop 29 engages behind the transverse rib or abutment 27 of key 20. As the spring flap 24 holds the end of the band with the shoe pressed into the recess 26, the engagement of the stop 29 with the rib or abutment 27 prevents the shoe from slipping out of the casing, and reliable location of the end 3*a* of the band in the casing is ensured.

The tab 30 is a releasing means which is an integral extension of the fitting and, to release the end 3*a* from its anchorage in the casing 2, a key-like bent-over portion 30*a* of the tab 30 is pressed, so that the spring flap 24 is flexed downwards, and the stop 29 of the shoe 28 is freed from the rib or abutment 27. The end 3*a* of the loop is thus released, and the tourniquet can be removed from the limb to which it was applied.

In this embodiment of the tourniquet, both the press-key 20 for leasing or securing the band by means of the clamping lever 4, and the tab 30 for releasing the end 3*a*, can be actuated by the same digit, preferably with the thumb of one hand, so that they can only ever be released one after the other, and accidental pressure on the tab 30 during the tourniquet effect is eliminated. This safety measure against unintentional release of the band end 3*a* is further effectively reinforced by the fact that the tab 30 extends obliquely towards the loop 7 in an upward direction, so that, when the tourniquet is applied to a limb, the tab 30 bears on the limb, so that the limb forms a counter-support against depression of the tab 30, this being increasingly effective, particularly if the key 20 is actuated.

Reference will now be made to Figs. 5 and 6. In this embodiment, the shoe is formed as a moulding made of plastics material, having a stop 29, a tab 30, and a key-like projection 30*a*. The tab 30 has a slot 30*b*, and the end 3*a* of the loop is held in the slot 30*b* by a resilient fork or clip 28*a* which is fitted over the end 3*a* and fits into the slot 30*b* with a snap action. The clamping lever includes a press-key portion 31 in the underside of which is a recess 32 defined in part by a transverse rib 33 at the end of the press-key 20. The clamping lever 4 has depending side walls 35 having obliquely-inclined edges 34 which project over the recess 32 and with the latter and the rib 33 defines a space taking in a portion of the solid component in sandwiched relationship between the rib 33 and a leaf spring 36 which is arcuate, and has one end tightly received in a slot 37 in one of the side walls 35 of the clamping lever 4. The slot 37 is shown transverse to the wall 35, but is preferably oblique. The other end of the leaf spring 36 is free, in order to attain the required spring action. The leaf spring 36 presses against the end of the shoe remote from the tab 30, so that the stop 29 is pressed against the rib 33. The end 3*a* of the band is released by pressing on the key-like projection 30*a* of the actuating tab 30 of the shoe, so that the latter can slip out of the slot between the rib 33 and the oblique surface 34, and the band end 3*a* is free. The shoe with its tab and key-like projection may alternatively be as shown in Fig. 3.

The construction of the tourniquets described enables a pressure spring for the clamping lever to be dispensed with. The press-key of the clamping lever is automatically lifted, providing a clamping action, on the band passing through the casing, by the tension in the loop 7. Thus, a spring for the clamping lever can be eliminated, as

shown for example in Figs. 5 and 6. This facilitates pushing of the band through, and movement of the casing along the band.

Reference will now be made to Figs. 7 to 12 which show a way of mounting the leaf spring in the casing.

The casing 2 in Figs. 7 and 8 has upper and lower spaced walls and the leaf spring has first and second ends respectively remote from and more adjacent to the entry end of the aperture between said upper and lower spaced walls. The spring 8 preferably extends across substantially the width of the interior of the casing 2. At its free or second end, the leaf spring 8 has an angled portion 9 which, seen in cross-section, is preferably oriented slightly inwards. At its first end whereat it is secured to the lower wall of the casing, the spring 8 is provided with a transverse groove 10, which lies under a pin 11 the ends of which are housed in opening in the side walls of the casing 2. Thus, the leaf spring 8 is secured against longitudinal and vertical movement. The end 3*a* of the band 3 is provided with a sheath forming a shoe 12. The angled end portion 9 of the leaf spring 8 engages behind the shoe 12 of the end 3*a* of the loop.

The actuating device for raising the leaf spring 8 is a press-button 13, whose inner end rests against the leaf spring 8. On pressing the button 13, the leaf spring 8 is raised so that its angled portion 9 clears the shoe 12, so that the band end 3*a* is released from the casing 2.

In the embodiment in Figs. 9 and 10, the leaf spring 8 is disposed in the same way as in the embodiment in Figs. 7 and 8. The actuating device is a lever 14 a first terminal end portion of which engages under the leaf spring 8 and is formed at its second and free terminal end portion as an actuating head 14*a*, guided in a slot in the casing 2. When the head 14*a* is raised, the arm 14 is supported on the lower casing wall. In this way, the leaf spring 8 is raised. This movement is sufficient to release the end 3*a* from the casing 2.

In the embodiment in Figs. 11 to 13, a further kind of actuating mechanism for the leaf spring 8 is provided. A lever having a finger tab 16 on one arm is pivotally mounted on a pin 5 on the casing. The other lever arm 15 has a lug 17 engaging under the leaf spring 8. The tab 16 projects above the upper side of the casing. Depression of the tab 16 raises the lever arm 15 and its lug 17 and, thus the leaf spring 8, releasing the end of the band.

WHAT I CLAIM IS:—

1. A tourniquet comprising a casing, a clamping lever, means mounting said clamping lever for pivotal movement relative to said casing, a band, said band including first and second terminal end portions and a loop portion therebetween, an aperture in said casing having entry and exit ends for permitting the passage of said first terminal end portion through said casing, said clamping lever being adapted to clamp said first terminal end portion relative to said casing, a fitting carried by said second terminal end portion, a spring releasably clampingly securing said second terminal end portion fitting to said lever or said casing, and means for releasing the clamping effect of said spring to release said second terminal end portion from said clamping lever or said casing.

2. A tourniquet as claimed in Claim 1, wherein said spring is a leaf spring.

3. A tourniquet as claimed in Claim 2, wherein said leaf spring includes a free terminal end portion, and said releasing means is operative against said leaf spring inwardly of said free terminal end portion.

4. A tourniquet as claimed in any one of Claims 1 to 3, wherein said releasing means is an integral extension of said fitting.

5. A tourniquet as claimed in any one of Claims 1 to 3, wherein said releasing means and said fitting are separate components.

6. A tourniquet as claimed in any one of the preceding claims, wherein said clamping lever includes an abutment in opposed spaced relationship to said spring, and said fitting is sandwiched between said abutment and said spring and is released from the latter sandwiched relationship upon the actuation of said releasing means.

7. A tourniquet as claimed in Claims 4 and 6, wherein said releasing means includes a first portion sandwiched between said abutment and said spring, and a second portion exterior of said casing for actuation to release said first portion from the sandwiched relationship.

8. A tourniquet as claimed in any one of the preceding claims, wherein said fitting is snap-connected to said claimping lever.

9. A tourniquet as claimed in Claim 2, or any one of Claims 3 to 8 when dependent upon Claim 2, wherein said first terminal end portion includes a longitudinal axis, and said leaf spring is carried by said clamping lever in transverse relationship to said longitudinal axis.

10. A tourniquet as claimed in Claim 2, wherein said casing includes upper and lower spaced walls, said leaf spring has first and second ends respectively remote from and more adjacent to the entry end of said aperture, said leaf spring is secured to said lower wall, and said leaf spring first end clampingly secures said second terminal end portion to said casing.

11. A tourniquet as claimed in Claim 10, wherein said releasing means is operative through said lower wall to move said leaf

shown for example in Figs. 5 and 6. This facilitates pushing of the band through, and movement of the casing along the band.

Reference will now be made to Figs. 7 to 12 which show a way of mounting the leaf spring in the casing.

The casing 2 in Figs. 7 and 8 has upper and lower spaced walls and the leaf spring has first and second ends respectively remote from and more adjacent to the entry end of the aperture between said upper and lower spaced walls. The spring 8 preferably extends across substantially the width of the interior of the casing 2. At its free or second end, the leaf spring 8 has an angled portion 9 which, seen in cross-section, is preferably oriented slightly inwards. At its first end whereat it is secured to the lower wall of the casing, the spring 8 is provided with a transverse groove 10, which lies under a pin 11 the ends of which are housed in opening in the side walls of the casing 2. Thus, the leaf spring 8 is secured against longitudinal and vertical movement. The end 3*a* of the band 3 is provided with a sheath forming a shoe 12. The angled end portion 9 of the leaf spring 8 engages behind the shoe 12 of the end 3*a* of the loop.

The actuating device for raising the leaf spring 8 is a press-button 13, whose inner end rests against the leaf spring 8. On pressing the button 13, the leaf spring 8 is raised so that its angled portion 9 clears the shoe 12, so that the band end 3*a* is released from the casing 2.

In the embodiment in Figs. 9 and 10, the leaf spring 8 is disposed in the same way as in the embodiment in Figs. 7 and 8. The actuating device is a lever 14 a first terminal end portion of which engages under the leaf spring 8 and is formed at its second and free terminal end portion as an actuating head 14*a*, guided in a slot in the casing 2. When the head 14*a* is raised, the arm 14 is supported on the lower casing wall. In this way, the leaf spring 8 is raised. This movement is sufficient to release the end 3*a* from the casing 2.

In the embodiment in Figs. 11 to 13, a further kind of actuating mechanism for the leaf spring 8 is provided. A lever having a finger tab 16 on one arm is pivotally mounted on a pin 5 on the casing. The other lever arm 15 has a lug 17 engaging under the leaf spring 8. The tab 16 projects above the upper side of the casing. Depression of the tab 16 raises the lever arm 15 and its lug 17 and, thus the leaf spring 8, releasing the end of the band.

WHAT I CLAIM IS:—

1. A tourniquet comprising a casing, a clamping lever, means mounting said clamping lever for pivotal movement relative to said casing, a band, said band including first and second terminal end portions and a loop portion therebetween, an aperture in said casing having entry and exit ends for permitting the passage of said first terminal end portion through said casing, said clamping lever being adapted to clamp said first terminal end portion relative to said casing, a fitting carried by said second terminal end portion, a spring releasably clampingly securing said second terminal end portion fitting to said lever or said casing, and means for releasing the clamping effect of said spring to release said second terminal end portion from said clamping lever or said casing.

2. A tourniquet as claimed in Claim 1, wherein said spring is a leaf spring.

3. A tourniquet as claimed in Claim 2, wherein said leaf spring includes a free terminal end portion, and said releasing means is operative against said leaf spring inwardly of said free terminal end portion.

4. A tourniquet as claimed in any one of Claims 1 to 3, wherein said releasing means is an integral extension of said fitting.

5. A tourniquet as claimed in any one of Claims 1 to 3, wherein said releasing means and said fitting are separate components.

6. A tourniquet as claimed in any one of the preceding claims, wherein said clamping lever includes an abutment in opposed spaced relationship to said spring, and said fitting is sandwiched between said abutment and said spring and is released from the latter sandwiched relationship upon the actuation of said releasing means.

7. A tourniquet as claimed in Claims 4 and 6, wherein said releasing means includes a first portion sandwiched between said abutment and said spring, and a second portion exterior of said casing for actuation to release said first portion from the sandwiched relationship.

8. A tourniquet as claimed in any one of the preceding claims, wherein said fitting is snap-connected to said claimping lever.

9. A tourniquet as claimed in Claim 2, or any one of Claims 3 to 8 when dependent upon Claim 2, wherein said first terminal end portion includes a longitudinal axis, and said leaf spring is carried by said clamping lever in transverse relationship to said longitudinal axis.

10. A tourniquet as claimed in Claim 2, wherein said casing includes upper and lower spaced walls, said leaf spring has first and second ends respectively remote from and more adjacent to the entry end of said aperture, said leaf spring is secured to said lower wall, and said leaf spring first end clampingly secures said second terminal end portion to said casing.

11. A tourniquet as claimed in Claim 10, wherein said releasing means is operative through said lower wall to move said leaf

spring first end from its clamping securement with said second terminal end portion.

12. A tourniquet as claimed in Claim 10 or 11, wherein said leaf spring first end is directed downwardly toward said lower wall.

13. A tourniquet as claimed in any one of Claims 10 to 12, wherein said casing has a pair of spaced opposite side walls, said leaf spring second end includes a transverse groove opening upwardly toward said upper wall, and a pin is spanningly received in said groove and secured to said side walls for securing said leaf spring to said casing.

14. A tourniquet as claimed in Claim 10, wherein said releasing means is a lever mounted for pivotal movement relative to said casing, and including a first terminal end portion underlying said leaf spring first end for moving the latter away from said lower wall upon the pivoting of said lever to release the leaf spring first end from its clamping securement with said second terminal end portion.

15. A tourniquet as claimed in Claim 14, wherein said lever further includes a second terminal end portion projecting outwardly of said upper wall.

16. A tourniquet according to Claim 1 and substantially as hereinbefore described with reference to Figs. 1 to 4 of the accompanying drawings.

17. A tourniquet according to Claim 1 and substantially as hereinbefore described with reference to Figs. 5 and 6 of the accompanying drawings.

18. A tourniquet according to Claim 1 and substantially as hereinbefore described with reference to Figs. 7 and 8 of the accompanying drawings.

19. A tourniquet according to Claim 1 and substantially as hereinbefore described with reference to Figs. 7 and 8 of the accompanying drawings, when modified in accordance with Figs. 9 and 10.

20. A tourniquet according to Claim 1 and substantially as hereinbefore described with reference to Figs. 7 and 8 of the accompanying drawings, when modified in accordance with Figs. 11, 12 and 13.

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