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F. W. KULICKE, JR., ET AL

2,442,416

SURGICAL INSTRUMENT

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Fig. 1

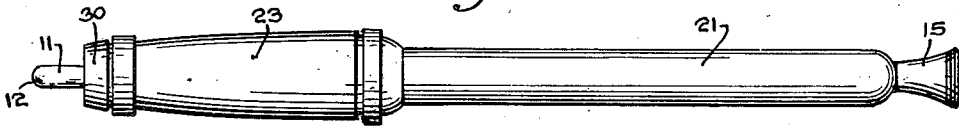


Fig. 2

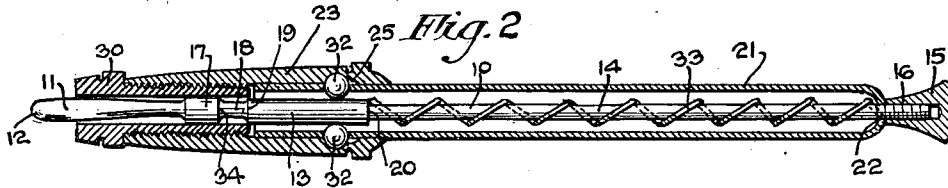


Fig. 3

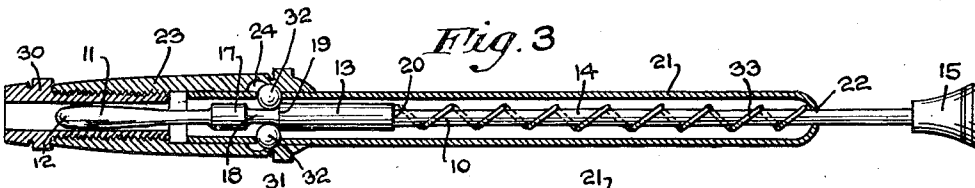


Fig. 4

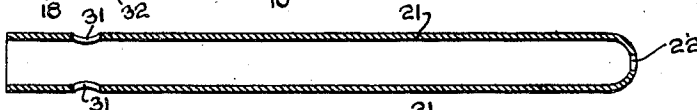


Fig. 5

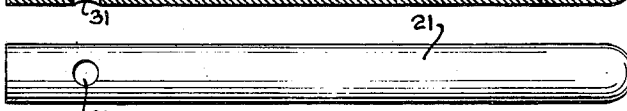


Fig. 6

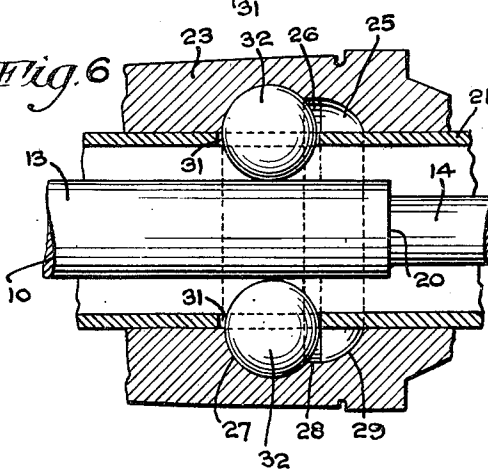
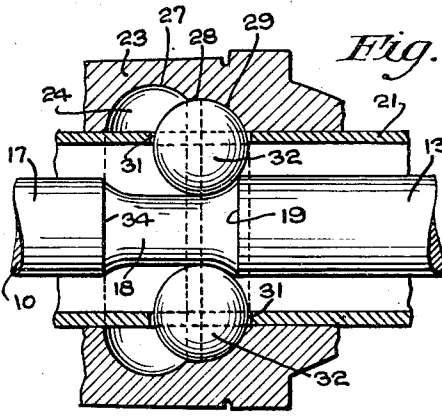


Fig. 7



INVENTOR.
FREDERICK W. KULICKE, JR.
BY GERALD O. TRANSUE
Gerald O. Transue
Attorney

UNITED STATES PATENT OFFICE

2,442,416

SURGICAL INSTRUMENT

Frederick W. Kulicke, Jr., Media, and Gerald O. Transue, Havertown, Pa.; said Kulicke, Jr., assignor to said Transue

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14 Claims. (Cl. 128—314)

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This invention relates generally to surgical instruments and more particularly to improvements in the construction of a surgical lancet wherein a plunger type blade or the like is operative to be instantaneously released from a cocked position to penetrate the body to be pierced to a predetermined fixed depth.

Among the principal objects of the present invention is to provide a lancet which is constructed of a minimum number of readily assembled parts, which is of a design adapted to be manufactured economically and with facility, which is adapted to be taken apart readily to facilitate its cleaning and sterilization, and which is exceedingly simple and effective in its operation.

More specifically, it is an object of the present invention to provide a lancet wherein readily releasable means in the form of a pair of balls is employed to frictionally retain the plunger type blade thereof in retracted or cocked position ready to be released for the piercing operation instantly upon contact of the instrument with the body to be pierced, the piercing operation being thus expeditiously effected by the operator while holding the instrument in one hand.

Other objects and advantages of the invention will appear more fully hereinafter, it being understood that the same consists in the combination, construction, location and relative arrangement of parts, all as described in detail hereinafter, as shown in the accompanying drawings and as finally pointed out in the appended claims.

In the accompanying drawings, which illustrate a preferred construction embodying the principles of the present invention:

Figure 1 is a side elevational view of a lancet embodying the present invention;

Figure 2 is a longitudinal sectional view thereof;

Figure 3 is a view similar to Figure 2 showing the plunger blade thereof in retracted or cocked position;

Figure 4 is a longitudinal sectional view of the carrier or cocking sleeve for the ball-like detainer elements;

Figure 5 is an elevational view of said carrier sleeve; and

Figures 6 and 7 are enlarged fragmentary views respectively showing the relative arrangement of operative parts of the instrument when the blade is released for the piercing operation and when it is held in retracted or cocked position prior to its release.

Referring now more particularly to the draw-

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ings, it will be observed that the present invention is shown embodied in that type of surgical instrument known as a lancet, said instrument consisting essentially of an elongated plunger element 10 having formed at its forward end a piercing blade 11, the tip of which is sharpened, as at 12, to readily penetrate the body to be pierced. The plunger element 10 is further characterized in that it is provided intermediate its length with an enlarged body portion 13 of cylindrical form from which rearwardly extends the coaxial shank 14 of the plunger element. An operating knob 15 is threadedly secured, as at 16, to the rear end of the shank 14 of the plunger element. Preferably, but not necessarily, the plunger element may be formed with a second enlarged cylindrical portion 17 spaced axially forwardly of the enlarged body portion 13, it being noted in this connection that regardless of the presence or absence of the enlarged portion 17, the plunger element 10 is provided with a shank portion 18 immediately in advance of the enlarged portion 13 which is of such reduced diameter as to provide an annular shoulder 19 between the forward end of said enlarged portion 13 and the rear end of said reduced diameter shank portion 18. A similar annular shoulder 20 is provided at the rear end of the enlarged portion 13.

Surrounding the major length of the plunger element 10 is a cocking sleeve 21, the rear end of which is closed except for a small aperture 22 sufficient to permit free projection therethrough of the shank 14 as shown, said shank being adapted for axial movement relatively to its embracing sleeve 21. Fitted more or less loosely upon the forward end of the sleeve 21 is a ball-retaining sleeve 23, the latter being provided in the rear portion thereof which overlaps the cocking sleeve 21 with an internal annular groove 24 of circular shape in transverse cross section. Immediately adjacent this annular groove 24 of circular cross section is a second annular groove 25 of a circular cross section corresponding to that of the groove 24, the grooves 24 and 25 being so relatively disposed that the transversely curved wall portion of the groove 25 is offset axially rearwardly and radially inwardly with respect to the correspondingly curved wall portion of the groove 24, the two grooves 24 and 25 being interconnected by an intervening annular passage 26, the peripheral wall of which is of cylindrical shape. Thus, the two grooves 24 and 25 and their communicating passage 26 form, in effect, within the ball-retaining sleeve 23, a single internal groove of an irregular shape in transverse cross section

having a forward portion delineated by the circular line 27, an intermediate portion delineated by the flat line 28 and a rear portion delineated by the circular line 29 (see Figures 6 and 7), the centers of curvature of the lines 27 and 29 being displaced from one another both axially and radially.

The forward end of the ball-retaining sleeve 23 is internally threaded for reception of a removable tubular extension tip 30, which embraces the blade portion of the plunger element 10 and which is axially adjustable relatively to the sleeve 23 to expose more or less of the blade when released for the piercing operation.

Formed in the forward end of the cocking sleeve 21 are a pair of diametrically opposed apertures 31—31 adapted to be disposed approximately in registry with the internal groove of the ball-retaining sleeve 23 when the latter is fitted upon the sleeve 21, as shown. Adapted for operative association with the cocking sleeve 21 are a pair of detaining balls 32—32, these latter being respectively received within the apertures 31—31 of the sleeve 21 in such manner that upon retraction of the plunger element 10 from its position shown in Figure 2 into that shown in Figure 3, the balls 32—32 become wedged between the sleeve 23 and the plunger element 10 to frictionally retain the latter in a cocked position ready for immediate piercing release thereof instantly as desired. To effect both the cocking and the instantaneous release of the plunger element 10, there is employed a compression spring 33 which embraces the shank 14 of the plunger element with its opposite ends respectively abutting the closed end of the cocking sleeve 21 and the annular shoulder 20 formed at the rear end of the enlarged intermediate portion 13 of the plunger element.

It will be observed, as shown in Figure 2, that said enlarged intermediate portion 13 of the plunger element 10 is of such diameter relatively to the overall diameter of the annular groove 24 and the diameters of the balls 32—32 as to permit said portion 13 to be freely centered between the balls while the latter are seated in the groove 24. In this condition of the parts, upon removal of the extension tip member 30 from the sleeve 23 and the operating knob 15 from the rear end of the plunger element, the latter is free to be entirely withdrawn from the assembly. Also, in this condition of the assembled parts, as shown in Figures 2 and 6, the plunger element 10, through the intervention of the coiled compression spring 33, is in its fully extended condition, as when the piercing operation has been completed.

To cock the instrument into condition ready for use, as shown in Figures 3 and 7, the ball-retaining sleeve 23 is held in one hand while the knob 15 of the plunger element is grasped by the other hand and pulled outwardly of the sleeve 21. Upon so pulling the plunger element relatively to the sleeve 23, the compression spring 33 exerts a thrust against the rear end of the sleeve 21 and so causes the latter to rearwardly shift axially with respect to the sleeve 23, thereby tending to shift the balls 32—32 from the groove 24 into the adjoining groove 25. However, such shifting of the balls 32—32 is prevented until the instant that the enlarged portion 13 of the plunger element clears the groove 25, whereupon the balls 32—32 are cammed, by the cocking sleeve 21, from their original position shown in Figures 2 and 6 into their position

shown in Figures 3 and 7. In this latter position, the balls 32—32 are wedged between the reduced shank portion 18 of the plunger and the flat wall of the passage 26 between the grooves 24 and 25, and so frictionally retain the plunger element in its retracted or cocked position.

To release the plunger element for its piercing operation, it is merely necessary for the operator to grasp the sleeve 21 and press the tip of the instrument against the body to be pierced, whereupon, due to the slight relative movement which thus ensues between the sleeves 21 and 23, the plunger is freed of its frictional retention by the balls 32—32 and is instantly forced by the kinetic energy of the compressed spring 33, axially of the sleeves 21 and 23 into its outwardly extending body-piercing position as shown in Figure 2. As will be apparent from a study of Figures 3 and 7, the release of the balls 32—32 from their frictional retention between the sleeve 23 and the plunger element is instantly effected upon such relative shifting of the sleeves 21 and 23 as will cause the balls to be freed for radial displacement into the groove 24, such displacement being obtained by the forward shoulder 19 as the enlarged portion 13 of the plunger is thrust forwardly between the balls by the action of the spring 33. In order to obviate any possibility for the plunger to be retracted rearwardly beyond its normal cocked position, shown in Figure 2, it is preferred to provide the plunger element with the additional enlarged portion 17, previously mentioned, to thereby form a shoulder 34 which limits movement of the plunger rearwardly of the balls 32—32. Forward movement of the plunger is, of course, limited by interengagement of the operating knob 15 with the rear end of the cocking sleeve 21. By adjusting the extension tip member 30 axially of the sleeve 23, the depth of the piercing cut may be controlled as desired.

It will be understood, of course, that the present invention is susceptible of various changes and modifications which may be made from time to time without departing from the real spirit or general principles thereof, and it is accordingly intended to claim the same broadly, as well as specifically, as indicated in the appended claims.

What is claimed as new and useful is:

1. In a surgical instrument of the character described, a spring-pressed plunger element having a sharpened body-piercing terminal end, a cylindrical casing for said plunger element including a pair of relatively shiftable telescopically associated tubular members, and means disposed within the telescoped portions of said tubular members and positively engageable with said plunger to releasably retain the latter in retracted condition.

2. In a surgical instrument of the character described, a plunger element having a body-piercing terminal end, said plunger element being provided intermediate its length with adjoining sections of relatively different diameters, a casing for said plunger element including a pair of relatively shiftable telescopically associated sleeve members, one of said members being provided with a lateral opening in the wall thereof and the other of said members being provided with an internal annular groove in substantial registry with said opening, said groove being of asymmetric form in transverse section to provide a pair of axially spaced, radially offset annular seats, and a ball detent interposed between said

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groove and said plunger element and confined within said lateral opening, said ball detent being adapted for disposition in one or the other of said annular seats accordingly as said plunger element is shifted to present one or the other of its intermediate sections aforesaid in registry with said lateral opening.

3. In a surgical instrument of the character described, a plunger element having a body-piercing terminal end, said plunger element being provided intermediate its length with adjoining sections of relatively different diameters, a casing for said plunger element including a pair of relatively shiftable telescopically associated sleeve members, one of said members being provided with a lateral opening in the wall thereof and the other of said members being provided with an internal annular groove in substantial registry with said opening, said groove being of asymmetric form in transverse section to provide a pair of axially spaced, radially offset annular seats, and a ball detent interposed between said groove and said plunger element and confined within said lateral opening, said ball detent being adapted for disposition in one or the other of said annular seats accordingly as said plunger element is shifted to present one or the other of its intermediate sections aforesaid in registry with said lateral opening, said ball detent being operative when disposed between the plunger section aforesaid of smallest diameter and the inner one of said radially offset annular seats to frictionally retain the plunger element in retracted position within its casing.

4. In a surgical instrument of the character described, a plunger element having a body-piercing terminal end, said plunger element being provided intermediate its length with adjoining sections of relatively different diameters, a casing for said plunger element including a pair of relatively shiftable telescopically associated sleeve members, one of said members being provided with a lateral opening in the wall thereof and the other of said members being provided with an internal annular groove in substantial registry with said opening, said groove being of asymmetric form in transverse section to provide a pair of axially spaced, radially offset annular seats, and a ball detent interposed between said groove and said plunger element and confined within said lateral opening said ball detent being adapted for disposition in one or the other of said annular seats accordingly as said plunger element is shifted to present one or the other of its intermediate sections aforesaid in registry with said lateral opening, said ball detent being operative when disposed between the plunger section aforesaid of greatest diameter and the outer one of said radially offset annular seats to permit free movement of said plunger element axially of its casing.

5. In a surgical instrument of the character described, a plunger element having a body-piercing terminal end, said plunger element being provided intermediate its length with adjoining sections of relatively different diameters, a casing for said plunger element including a pair of relatively shiftable telescopically associated sleeve members, one of said members being provided with a lateral opening in the wall thereof and the other of said members being provided with an internal annular groove in substantial registry with said opening, said groove being of asymmetric form in transverse section to provide a pair of axially spaced, radially offset annular

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seats and a ball detent interposed between said groove and said plunger element and confined within said lateral opening, said ball detent being adapted for disposition in one or the other of said annular seats accordingly as said plunger element is shifted to present one or the other of its intermediate sections aforesaid in registry with said lateral opening, and a coiled compression spring operatively associated with said plunger element and its casing for imparting to the plunger element a normal bias tending to shift it axially of the casing.

6. In a surgical instrument of the character described, a plunger element having a body-piercing terminal end, said plunger element being provided intermediate its length with a limited section of uniform diameter and with an immediately adjoining section of different diameter, a casing for said plunger element including a pair of relatively shiftable telescopically associated sleeve members, the telescoped portions of said sleeve members being respectively provided with an internal annular groove and with a plurality of circumferentially spaced lateral openings, said groove being of asymmetrical form in transverse section to provide a pair of axially spaced, radially offset annular seats, and a plurality of ball detents respectively disposed within said lateral openings and adapted to be shifted into radial registry with one or the other of said annular seats accordingly as said plunger element is shifted axially of its casing to present one or the other of the aforesaid intermediate sections of said plunger element centrally between said ball detents.

7. In a surgical instrument of the character described, a plunger element having a body-piercing terminal end, said plunger element being provided intermediate its length with a limited section of uniform diameter and with an immediately adjoining section of different diameter, a casing for said plunger element including a pair of relatively shiftable, telescopically associated sleeve members, the telescoped portions of said sleeve members being respectively provided with an internal annular groove and with a plurality of circumferentially spaced lateral openings, said groove being of asymmetrical form in transverse section to provide a pair of axially spaced, radially offset annular seats, and a plurality of ball detents respectively disposed within said lateral openings and adapted to be shifted into radial registry with one or the other of said annular seats accordingly as said plunger element is shifted axially of its casing to present one or the other of the aforesaid intermediate sections of said plunger element centrally between said ball detents, and a coiled compression spring operatively associated with said plunger element and its casing for imparting to the plunger element a normal bias tending to shift it axially of the casing.

8. In a surgical instrument of the character described, a plunger element having a body-piercing terminal end, said plunger element being provided intermediate its length with a limited section of uniform diameter and with an immediately adjoining section of different diameter, a casing for said plunger element including a pair of relatively shiftable telescopically associated sleeve members being respectively provided with an internal annular groove and with a plurality of circumferentially spaced lateral openings, said groove being of asymmetrical form in transverse section to provide a pair of axially

spaced, radially offset annular seats, and a plurality of ball detents respectively disposed within said lateral openings and adapted to be shifted into radial registry with one or the other of said annular seats accordingly as said plunger element is shifted axially of its casing to present one or the other of the aforesaid intermediate sections of said plunger element centrally between said ball detents, and a coiled compression spring operatively associated with said plunger element and its casing for imparting to the plunger element a normal bias tending to shift it axially of the casing, said ball detents being operative when disposed between the reduced diameter intermediate section of the plunger element and the inner one of said radially offset annular seats to frictionally retain the plunger element in retracted or cocked position against the compressive force exerted by said coiled compression spring.

9. In a surgical instrument of the character described, a plunger element having a body-piercing terminal end, said plunger element being provided intermediate its length with a limited section of uniform diameter and with an immediately adjoining section of different diameter, a casing for said plunger element including a pair of relatively shiftable, telescopically associated sleeve members, the telescoped portions of said sleeve members being respectively provided with an internal annular groove and with a plurality of circumferentially spaced lateral openings, said groove being of asymmetrical form in transverse section to provide a pair of axially spaced, radially offset annular seats, and a plurality of ball detents respectively disposed within said lateral openings and adapted to be shifted into radial registry with one or the other of said annular seats accordingly as said plunger element is shifted axially of its casing to present one or the other of the aforesaid intermediate sections of said plunger element centrally between said ball detents, and a coiled compression spring operatively associated with said plunger element and its casing for imparting to the plunger element a normal bias tending to shift it axially of the casing, said compression spring being operative upon retraction of said plunger element to exert a rearward thrust against the sleeve member having said lateral openings whereby to shift said last-mentioned sleeve member relatively to the other and so effect frictional retention of the ball detents between the inner one of said radially offset annular seats and the reduced diameter intermediate section of the plunger element.

10. In a surgical instrument of the character defined in claim 9 wherein said frictional retention of the ball detents is automatically and instantaneously released upon axial movement of said sleeve members toward each other with resultant thrust of the plunger element axially of its casing under the compressive force of said coiled compression spring.

11. In a surgical instrument of the character described, a spring-pressed plunger element having a sharpened body-piercing terminal end, a cylindrical casing for said plunger element including a pair of relatively shiftable telescopically associated tubular members, and means disposed between said plunger element and said cylindrical casing operative to positively retain the plunger in retracted position and to release said plunger element from its retracted position automatically upon relative axial movement of said tubular members.

12. In a surgical instrument of the character described, a spring-pressed plunger element having a sharpened body-piercing terminal end, a cylindrical casing for said plunger element including a pair of relatively shiftable telescopically associated tubular members, and means disposed within the telescoped portions of said tubular members and positively engageable with said plunger to releasably retain the latter in retracted condition, said means being operable to release the plunger for body-piercing operation automatically upon relative axial movement of said tubular members.

13. In a surgical instrument of the character described, a spring-pressed plunger element having a sharpened body-piercing terminal end, a cylindrical casing for said plunger element including a pair of relatively shiftable telescopically associated tubular members, and means disposed between said plunger element and said cylindrical casing operative to positively retain the plunger in spring-biased retracted position and to release said plunger element from its retracted position for spring-pressed axial movement automatically upon relative axial movement of said tubular members.

14. In a surgical instrument of the character described, a spring-pressed plunger element having a sharpened body-piercing terminal end, a cylindrical casing for said plunger element including a pair of relatively shiftable telescopically associated tubular members, and means disposed within the telescoped portions of said tubular members and positively engageable with said plunger to releasably retain the latter in spring-biased retracted condition, said means being operable to release the plunger for body-piercing operation automatically upon relative axial movement of said tubular members.

FREDERICK W. KULICKE, Jr.
GERALD O. TRANSUE.

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The following references are of record in the file of this patent:

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