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AMPOULE APPLICATOR

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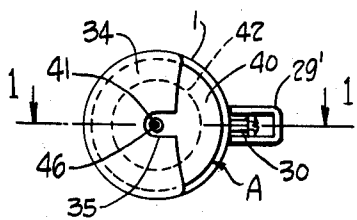
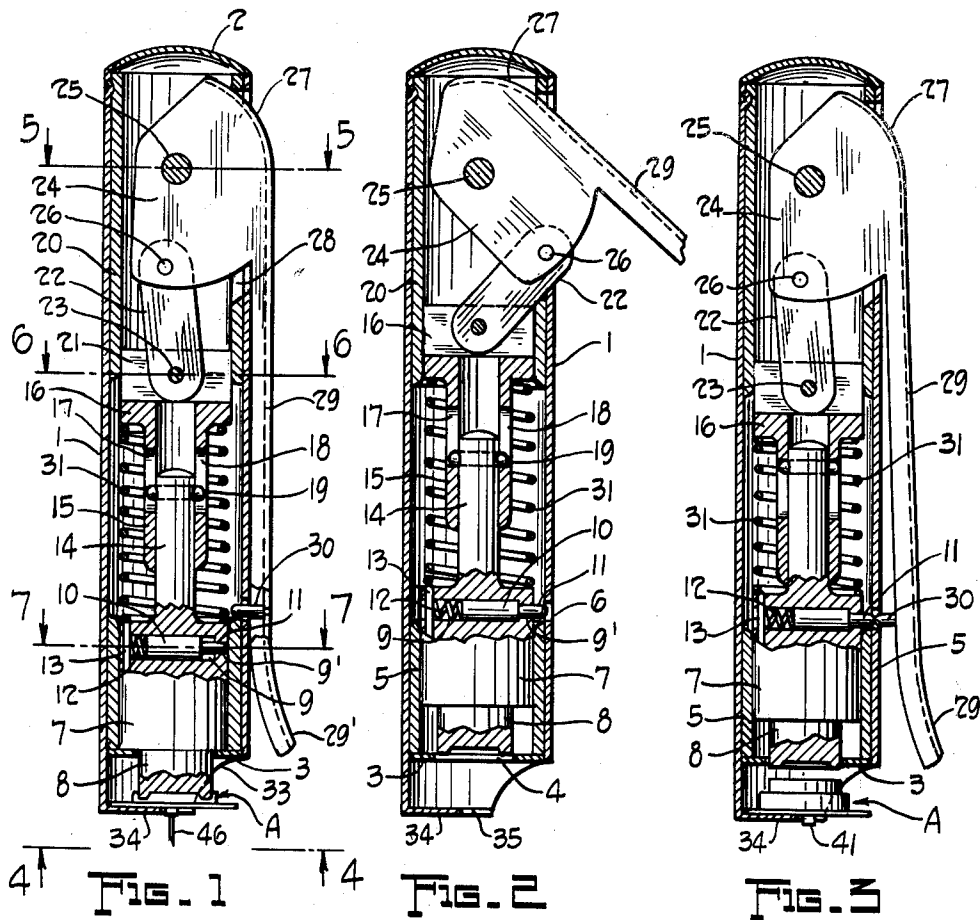


FIG. 4

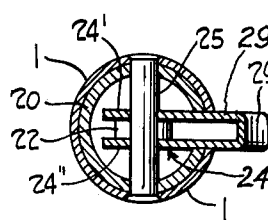


FIG. 5

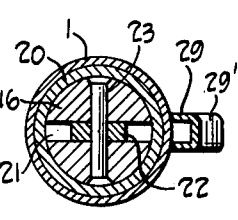


FIG. 6

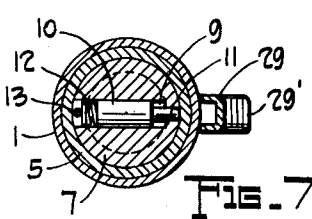


FIG. 7

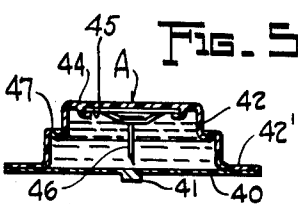


FIG. 8

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AMPOULE APPLICATOR

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8 Claims. (Cl. 128—218)

This invention relates to the hypodermic injection of fluids, and more particularly to apparatus for mechanically injecting medicaments or the like into a human being or other animal.

Preloaded, sterile, disposable, self-contained hypodermic syringe units in the form of collapsible shells or ampoules filled with the desired fluid and including a hypodermic needle enclosed within the shell, have been proposed and used to facilitate the proper and rapid hypodermic injection of serums or the like. One such device is illustrated in the R. P. Dunmire Patent No. 2,769,443 and comprises a shell or ampoule of flexible plastic material containing the proper amount of medicament for one injection, a hypodermic needle being also enclosed within the shell. When such an ampoule is positioned against the skin of the recipient and pressure is applied against the outer face of the ampoule, the hollow shell is collapsed causing the needle to be pushed through the wall of the shell into the body of the recipient and concurrently discharging the medicament through the needle.

It is desirable, in order to reduce the discomfort of the recipient of the injection and to expedite the procedure, particularly in the case of mass inoculation of large groups of people, that the ampoule be collapsed and the needle injected with rapidly applied and uniform force.

It is therefore an object of the present invention to provide an applicator device for conveniently, rapidly, and repeatedly positioning such ampoules and injecting the charge therefrom into the recipient. A further object is the provision of a mechanical applicator for hypodermic ampoules or the like which provides exactly the desired and predetermined pressure and speed of entry of the hypodermic needle, which facilitates the withdrawal of the needle after the injection, which may be easily and rapidly reloaded, which may be economically produced and has long and trouble free life, and which may be used by unskilled personnel with a minimum of instruction.

The above and other objects of our invention will appear from the following description of one embodiment thereof, reference being had to the accompanying drawings in which:

FIGURE 1 is a vertical cross sectional view through the body of an applicator unit, taken substantially on line 1—1 of FIGURE 4 and illustrating the device with the parts in the positions they assume when in firing position, the cocked plunger having been released, the ampoule compressed and the needle projected;

FIGURE 2 is a view generally similar to FIGURE 1 but illustrating the parts in the positions they assume when in retracted position, the handle having been swung out to move the plunger into its retracted position, but before the spring has been compressed;

FIGURE 3 is a view similar to FIGURES 1 and 2 but illustrating the parts in the positions they assume when in cocked position, the plunger actuating spring having been

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compressed by moving the operating handle toward the body, the plunger remaining in its retracted and cocked position;

FIGURE 4 is a bottom view of the device illustrated in FIGURES 1—3, taken substantially on line 4—4 of FIGURE 1;

FIGURE 5 is a horizontal cross sectional view taken on line 5—5 of FIGURE 1;

FIGURE 6 is a horizontal cross sectional view taken on line 6—6 of FIGURE 1;

FIGURE 7 is a horizontal cross sectional view taken on line 7—7 of FIGURE 1; and

FIGURE 8 is an enlarged vertical cross sectional view of a hypodermic ampoule before use.

As illustrated, our applicator device comprises an outer tubular shell or body structure 1, preferably closed at its upper end by a cap 2 and having a ring-like bottom end plate 3 provided with an opening 4 therein. The plunger guide bushing 5 is secured at the lower end of shell 1 and extends upwardly to a point just below the firing pin hole 6 (see FIG. 2) which extends through the wall of shell 1. Slidably supported in the bushing 5 is the spring actuated ampoule injection plunger 7 having a bottom ampoule engaging end portion 8 of reduced diameter and adapted to pass through the opening 4 in the bottom end plate 3 as will be later described.

Extending transversely inwardly from the left-hand side of the plunger 7 as seen in FIGURE 1 is a bore 9 in which piston member 10 has a sliding fit. This piston member carries a latch pin 11 of reduced diameter at its right-hand end and this pin is adapted to extend into and through the reduced diameter continuation 9' of the bore 9. A compression spring 12 is disposed behind the piston member 10 in the bore 9 and is held in place by a pin 13. This spring 12 tends at all times to urge the piston member 10 and latch pin 11 to the right as seen in FIGURES 1—3. Movement of the latch pin 11 to the right, however, is limited by the engagement of the right-hand end of the piston member 10 with the right hand end of the bore 9 as seen in FIGURE 2. When in this position the latch pin 11 may extend slightly into the firing pin hole 6 but not beyond the outer wall of the shell 1. When in this latching position the latch pin 11 will engage the top end of the bushing 5 thus locking the injection plunger 7 in cocked position against downward movement.

A cylindrical stem or shank portion 14 is integrally formed with and extends upwardly from the plunger 7. This shank portion 14 has a sliding fit within the downwardly extending tubular portion 15 of the spring compressing slide member 16. Extending through the wall of the tubular portion 15 are opposed elongated slots 17 and 18 and the ends of the guide pin 19, which extends through and is secured in the upper end of shank 14, project into and are guided by the slots 17 and 18, thus forming a lost motion connection between the plunger 7 and slide member 16.

The spring compressing slide member 16 is in the form of a cylindrical plunger having a sliding fit in the upper guide bushing 20. This bushing is secured within the outer shell or body 1 and a transverse slot 21 is formed in the upper end of slide member 16 to receive a first toggle link 22 which has a pivotal connection at one end in the slot 21 on the pivot pin 23.

A second toggle link member 24 is pivotally mounted on a pin 25 which extends transversely of the body 1 and is supported in the bushing 20 and body 1 (see FIG. 5). The toggle link member 24 has spaced side walls 24' and 24'' (see FIG. 5) between which the lower toggle link 22 extends. The adjacent ends of the two toggle link members 22 and 24 are pivotally connected together at a common pivot point by the pin 26.

Toggle link 24 includes an upper portion having a curved outer face 27 formed on a radius about the center of pin 25 and a portion of the right-hand side of toggle arm 24 extends out through a slot 28 in the bushing 20 and outer shell 1. As clearly seen in FIGURES 1-3, the upper end of slot 28 closely fits the outer curved face 27 of toggle link 24. As the width of slot 28 is just sufficient to give clearance for the width of toggle link 24 entry of dirt or other foreign matter into the interior of the mechanism through slot 28 is in a large measure prevented.

Preferably integrally formed with the toggle link 24 and extending downwardly from the portion of link 24 which lies outside of the housing 1, is an operating handle 29 which, as clearly seen in FIGURES 5-7, is channel shaped in cross section to give the desired strength and rigidity. The lower end portion 29' of the handle 29 is flared outwardly slightly to facilitate operation of the device. As seen in FIGURES 1-3, a firing pin 30 is secured to the handle 29 in position to enter the firing pin hole 6 in the outer shell 1 when the handle 29 is moved into the firing position seen in FIGURE 1.

Extending between the upper end of the plunger 7 and the lower end of the spring compressing slide member 16, and tending to move same apart is the compression spring 31. This is a coil spring which, as will appear later, is adapted to be compressed against the retracted and latched injection plunger 7 and, when this plunger is released, to supply the force necessary to collapse the ampoule, force the hypodermic needle into the recipient, and discharge the medicament through the needle.

The wall of the outer shell 1 extends downwardly from the bottom end plate 3 but is cut away at one side as indicated at 33 (FIG. 1) to permit the insertion of an ampoule A into firing position. The bottom ampoule retaining plate 34 is also cut away on the same side as the shell 1 and is provided with a centering slot 35 (see FIG. 4) which facilitates location of the ampoule A and permits projection of the hypodermic needle 46.

In FIGURE 8 we have illustrated in cross section an ampoule of a type which is adapted for use with our applicator device. This ampoule A includes a bottom flat disc member 40 having a center boss 41 projecting outwardly therefrom. The remainder of the ampoule consists of a cup shaped shell 42 of flexible plastic material having a flange portion 42' which is sealed to the disc 40 during the manufacture of the ampoule and after the cup shaped portion has been filled with the medicament. The upper end face 44 of the shell 42 has integrally secured on its inner side a metal disc 45 which carries the hypodermic needle 46 and supports same so that fluid from within the ampoule can enter the inner end of the needle during application and be forced out through the pointed or lower end of the needle. To facilitate collapse of the ampoule under pressure of the plunger head 8, one or more grooves 47 may be formed in the side wall of the cup shaped shell 42. As seen in FIGURE 3, when the apparatus is cocked and ready for use an ampoule A is placed on the retaining plate 34 with the boss 41 projecting through the slot 35. Now, when the plunger 7 is released and the spring 31 moves the plunger 7 downwardly into the position seen in FIGURE 1, the ampoule is flattened and the pointed end of the hypodermic needle driven through the boss 41 on the bottom disc of ampoule A into the recipient and, as the cup shaped shell 42 is flattened, the fluid therein is forced out through the needle 46.

The operation of the above described mechanism will

now be explained in detail. The device as seen in FIGURE 1 is in the condition it assumes immediately after the application and discharge of an ampoule. Thus the ampoule A is seen in flattened or collapsed position with the hypodermic needle 46 projecting beyond the retaining plate 34. The reduced end 8 of the plunger 7 has been projected through the hole 4 in the bottom end plate 3 and the lower end of plunger 7 abuts the upper face of plate 3, thus positively limiting the movement of the ampoule engaging end 8. The latch pin 11 is held in firing or plunger released position by engagement of its end with the inner wall of bushing 5 (see FIG. 7) and the operating spring 31 has expanded to exert the force necessary to move the plunger 7 to collapse the ampoule A. The spring compressing slide member 16 is in its lowermost or spring compressed position and the common pivot pin 26 of the toggle formed by links 22 and 24 is on the left-hand side of a vertical center line drawn through the end pivot pins 23 and 25. Thus the action of spring 31, which still remains under some compression, tends to hold the toggle arms in this position and to hold the outer operating handle 29 in its closed or firing position as seen in FIGURE 1.

To set the device for another injection operation the operator grasps the handle 29 and manually swings it outwardly into the retracted position seen in FIGURE 2, breaking the toggle formed by links 22 and 24 and causing the spring compressing slide 16 to move upwardly in retracting direction in the bushing 20. After a certain initial upward movement of slide 16, during which plunger 7 remains in its projected position seen in FIGURE 1, the lost motion between plunger 7 and slide 16 is taken up and the bottom ends of the slots 17 and 18 in the tubular portion 15 engage the ends of pin 19 in the shank member 14. Further upward movement of slide 16 will then lift the shank 14 together with the plunger member 7. When the handle 29 reaches full retracted position at the limit of its outward stroke, which is determined by engagement of the side of the toggle link 22 with the bottom end of the slot 28 in the side wall of the housing as is clearly seen in FIGURE 2, the latch pin 11 in plunger 7 will have been moved upwardly just beyond the upper end of bushing 5, thus permitting the spring 12 to push pin 11 out into its extended or latching position as seen in FIGURE 2. During this outward swinging of the handle 29 the distance between the upper end of plunger 7 and the under side of the spring compressing slide 16 is increased, thus permitting the compression spring 31 to expand correspondingly.

After the handle 29 has been swung out into the position of FIGURE 2, lifting the plunger 7 into its cocked position and causing the latch pin 11 to move into latching position, the handle 29 is moved inwardly toward the body 1 of the device into the position seen in FIGURE 3. During this movement the toggle 22-24 is extended, causing the spring compressing slide 16 to be moved downwardly. As the plunger 7 is locked against the downward movement by the pin 11 engaging the upper end of bushing 5, the spring 31 will be compressed. At the end of this spring compressing or cocking stroke of handle 29 the common pivot point 26 of the toggle 22-24 crosses dead center position (i.e. moves to the left of a common center line drawn between pins 23 and 25). This occurs just as the outer end of firing pin 30 reaches approximately the outer surface of the tubular shell 1. When the handle 29 is released in this position it will remain stationary because the spring 26 will tend to urge it inwardly into engagement with the outer end of latch pin 11. However, the force exerted at this time by spring 31 through the extended toggle links 22-24 tending to rotate handle 29 in clockwise direction as seen in FIGURE 3 is not sufficiently great to overcome the friction between the latch pin 11 and the bushing 5 the force of the spring 12 which tends to hold the pin in latched position.

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After cocking the device into the position of FIGURE 3 as above described it is ready for another injection operation. This is effected by placing a fresh ampoule A on the supporting plate 34 with the boss 41 thereof extending through the slot 35. Magnetic means may be incorporated in the flange of the ampoule to hold it in place on plate 34. Next, the plate 34 is properly positioned for the desired injection and the handle 29 is squeezed inwardly toward the body 1. When it moves from the position of FIGURE 3 into that of FIGURE 1 the latch pin 11 is pushed inwardly against the spring 12 until it clears the upper end of bushing 5. When this occurs the compressed spring 31 immediately moves the plunger 7 and its reduced end portion 8 downwardly against the adjacent end 44 of the ampoule A causing same to be flattened and driving the hypodermic needle 46 through the boss 41 on the end of the ampoule into the flesh of the recipient. As previously explained, as the ampoule is compressed and flattened the fluid therein is forced out through the needle 46. With this arrangement, by properly proportioning the dimensions of the parts, the strength of the spring 31, etc., the device will repeatedly hypodermically inject premeasured charges of medicament in a uniform and most desirable manner. The unloading and recocking operations are rapidly and easily accomplished by merely swinging the handle 29 out to the position of FIGURE 2 and back to the position of FIGURE 3. After the mechanism is placed in its cocked position (FIG. 3) it will not be fired until the handle is squeezed against the body. The force required for this operation is so designed that accidental discharge of the unit is not likely to occur. Furthermore, if desired, a removable safety stop or plug may be inserted between the handle 29 and the body 1 when in the cocked position of FIGURE 3 and removed just prior to use.

Although we have described the illustrated embodiment of our invention in considerable detail it will be understood that variations and modifications may be made in the form and arrangement of the several parts. We do not, therefore, wish to be limited to the exact mechanism herein illustrated and described but claim as our invention all embodiments thereof coming within the scope of appended claims.

We claim:

1. An ampoule applicator comprising a body structure, an ampoule injection plunger movably supported by said body structure for movement in ampoule injecting and retracting direction, means for supporting an ampoule in alignment with said injection plunger, a spring compressing slide member spaced from said injection plunger and movably supported by said body structure, means for effecting a lost motion connection between said injection plunger and said spring compressing slide member, a compression spring disposed between and acting upon said injection plunger and said spring compressing slide member and tending to move same apart, toggle means connected at one end to said spring compressing member and at the other end to said body structure, operating handle means effective on said toggle means and adapted when moved in one direction to move said spring compressing slide member in retracting direction and, when moved in the opposite direction, to move said spring compressing slide member in spring compressing direction, latch means for releasably locking said injection plunger against movement caused by said spring means, and means actuated by said handle means for releasing said latch means, said means for effecting a lost motion connection between said injection plunger and said spring compressing slide member being adapted to connect said slide member and said injection plunger and move said plunger in retracting direction during a portion of the movement of said slide member in retracting direction.

2. An ampoule applicator comprising a body structure, an ampoule injection plunger movably supported by said body structure for movement in ampoule injecting and re-

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tracting directions, means for supporting an ampoule in alignment with said injection plunger, a spring compressing member spaced from said injection plunger and movably supported by said body structure, means for effecting a lost motion connection between said injection plunger and said spring compressing slide member, a compression spring disposed between and acting upon said injection plunger and said spring compressing slide member and tending to move same apart, toggle means connected at one end to said spring compressing member and at the other end to said body structure, said toggle means having a common pivot point intermediate said ends, operating handle means effective on said toggle means and adapted to be moved between retracted, cocked and firing positions, said handle means, when moved in one direction into said retracted position, being adapted to move said spring compressing slide member in retracting direction and, when moved in the opposite direction into said cocked position, to move said spring compressing slide member in spring compressing direction, injection plunger latch means for locking said injection plunger in cocked position against movement in ampoule injecting direction when said handle means substantially reaches said retracted position, and means for releasing said injection plunger latch means when said handle means is moved from said cocked to said firing position, said means for effecting a lost motion connection between said injection plunger and said spring compressing slide member being adapted to connect said slide member and said injection plunger and move said plunger in retracting direction during a portion of the movement of said slide member in retracting direction.

3. An ampoule applicator comprising a body structure, an ampoule injection plunger movably supported adjacent one end of said body structure, a spring compressing slide member spaced from said injection plunger and movably supported by said body structure, means for effecting a lost motion connection between said injection plunger and said spring compressing slide member, a compression spring disposed between and acting upon said injection plunger and said spring compressing slide member and tending to move same apart, a first toggle link pivotally connected at one end to said spring compressing member, a second toggle link pivotally connected at one end to said body structure, said toggle links being pivotally connected to each other at a common pivot point intermediate said ends, operating handle means secured to said second toggle link and adapted to be moved relative to said body structure between retracted, cocked and firing positions, said handle means, when moved into said retracted position, being adapted to move said common pivot point of said toggle links to one side of the common center line between said end pivots of said toggle links and to move said spring compressing slide member in retracting direction and, when moved in the opposite direction into said cocked position, to move said common pivot point to the other side of said common center line and said spring compressing slide member in spring compressing direction, injection plunger latch means for locking said injection plunger in cocked position against movement in ampoule injecting direction when said handle means substantially reaches said retracted position, means operable by said handle means for releasing said injection plunger latch means when said handle means is moved from said cocked to said firing position, and means for retaining an ampoule in alignment with said injection plunger, said means for effecting a lost motion connection between said injection plunger and said spring compressing slide member being adapted to connect said slide member and said injection plunger and move said plunger in retracting direction during a portion of the movement of said slide member in retracting direction.

4. An ampoule applicator comprising a tubular body structure, an ampoule injection plunger slidably supported adjacent one end of said body structure, means for

limiting the movement of said injection plunger toward said one end of said body structure, a spring compressing slide member spaced from said injection plunger and slidably supported for movement in said body, means for effecting a lost motion connection between said injection plunger and said spring compressing slide member, a compression spring disposed between and acting upon said injection plunger and said spring compressing slide member and tending to move same apart, a first toggle link pivotally connected at one end to said spring compressing member, a second toggle link pivotally connected at one end to said body structure, said toggle links being pivotally connected to each other at a common pivot point spaced from said end pivots, operating handle means secured to said second toggle link and extending outwardly of said body structure and adapted to be manually moved between full retracted, cocked and firing positions, said handle means, when moved outwardly away from said body structure into said full retracted position, being adapted to move said common pivot point of said toggle links to one side of a common center line between said end pivots of said toggle links and to move said spring compressing slide member in retracting direction and, when moved inwardly toward said body structure into said cocked position, to move said common pivot point to the other side of said common center line and to move said spring compressing slide member in spring compressing direction, said lost motion connection between said spring compressing slide member and said injection plunger being adapted to connect said slide member and injection plunger and move said plunger in retracting direction during the final portion of the movement of said slide member in retracting direction, injection plunger latch means for locking said injection plunger in cocked position against movement in ampoule injecting direction when said handle means substantially reaches said full retracted position, a firing pin carried by said handle means and adapted to engage said injection plunger latch means after said common pivot point of said toggle links moves past said common center line into said cocked position, said first toggle link being effective on said spring compressing slide member to move same toward the cocked injection plunger during movement of said handle means toward said body structure and to compress said operating spring, said operating spring being effective on said toggle links to tend to hold said handle in said cocked position, and means for supporting an ampoule in alignment with said injection plunger, said plunger being adapted to be released from said cocked position by moving said handle means and firing pin toward said body structure beyond said cocked position into firing position to engage and release said plunger latch means whereby said plunger will be projected by said operating spring to compress said ampoule.

5. An ampoule applicator comprising a tubular body structure, an ampoule injection plunger slidably supported adjacent one end of said body structure, means for limiting the movement of said injection plunger toward said one end of said body structure, a spring compressing slide member spaced from said injection plunger and slidably supported for movement in said body, means for effecting a lost motion connection between said injection plunger and said spring compressing slide member, a compression spring disposed between and acting upon said injection plunger and said spring compressing slide member and tending to move same apart, toggle means connected at one end to said spring compressing member and at the other end to said body structure, said toggle means having a common pivot point intermediate said ends, operating handle means effective on said toggle means and adapted to be manually moved between full retracted, cocked and firing positions, said handle means, when moved outwardly away from said body structure into said full retracted position, being adapted to move said common pivot point of said toggle means to one side of a common center line between said toggle ends and to move said

spring compressing slide member in retracting direction and, when moved inwardly toward said body structure into said cocked position, to move said common pivot point to the other side of said common center line and said spring compressing slide member in spring compressing direction, said lost motion connection between said spring compressing slide member and said injection plunger being adapted to connect said slide member and injection plunger and move said plunger in retracting direction during the final portion of the movement of said slide member in retracting direction, injection plunger latch means for locking said injection plunger in cocked position against movement in ampoule injecting direction when said handle means substantially reaches said full retracted position, a firing pin carried by said handle means and adapted to engage said injection plunger latch means after said common pivot point of said toggle links moves past said common center line into said cocked position, said first toggle link being effective on said spring compressing slide member to move same toward the cocked injection plunger during movement of said handle means toward said body structure and to compress said operating spring, said operating spring being effective on said toggle links to tend to hold said handle in said cocked position, and means for supporting an ampoule in alignment with the line of travel of said injection plunger.

6. An ampoule applicator including a body structure, an ampoule injection plunger movably supported by said body structure for movement in ampoule injecting and retracting directions, means for supporting an ampoule in alignment with said injection plunger, a spring activating slide member movably supported by said body structure, means for effecting a lost motion connection between said injection plunger and said slide member, a spring carried by said body structure and adapted to act upon said injection plunger and move same in ampoule injecting direction, toggle means connected at one end to said slide member and at the other end to said body structure, operating handle means effective on said toggle means and adapted when moved in one direction to move said slide member in retracting direction and when moved in the opposite direction to move said slide member in spring energizing direction, means for releasably locking said injection plunger in retracted position against movement caused by said spring means, and means for releasing said plunger locking means, said means for effecting a lost motion connection between said ejecting plunger and said slide member being adapted to move said plunger in retracting direction during the movement of said slide member in retracting direction.

7. An ampoule indicator including a body structure, an ampoule injection plunger movably supported by said body structure for movement in ampoule injecting and retracting directions, means for supporting an ampoule in position to be engaged and discharged by said injection plunger, a spring supported by said body structure and effective to move said injection plunger in ampoule injecting direction, handle means supported on said body structure, means for connecting said handle means and said injection plunger whereby when said handle means is moved in one direction said injection plunger will be moved in retracting direction into retracted position, means for releasably locking said injection plunger in said retracted position, means operable by said handle means and adapted to activate said spring when said handle means is moved in the opposite direction and said plunger member is locked in said retracted position, and means for releasing said plunger member from said locked position.

8. An ampoule applicator including a body structure, an ampoule injection plunger movably supported by said body structure for movement in ampoule injecting and retracting directions, means for supporting an ampoule in position in said body structure to be engaged and discharged by said injection plunger, a slide member mov-

ably supported by said body structure, means for operatively connecting said injection plunger and said slide member, spring means carried by said body structure and adapted to act upon said injection plunger and move same in ampoule injecting direction, handle means supported on said body structure, means for connecting said handle means and said slide member whereby movement of said handle means in one direction will move said slide member and injection plunger in retracting direction, releasable means for locking said plunger member in retracted position, said slide member being adapted to activate said spring means when said handle means is moved in the opposite direction when said injection plunger is in said

locked position, and means for releasing said plunger member from said locked position to permit said spring means to effect injecting movement thereof.

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