

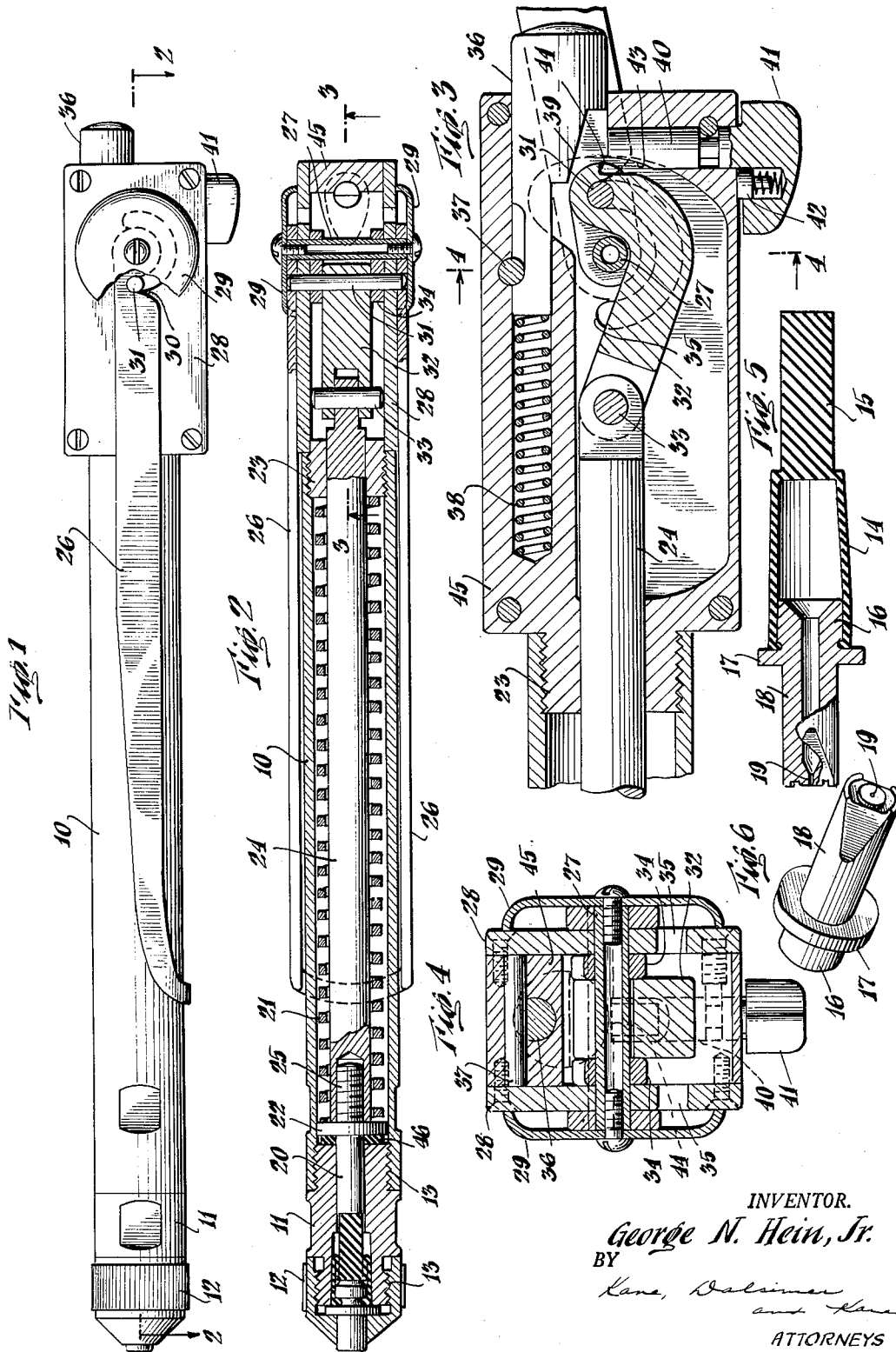
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INJECTION APPARATUS

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## INJECTION APPARATUS

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This invention relates to a structurally and functionally improved injection apparatus and in its specific aspects aims to provide a mechanism of this character primarily intended for the hypodermic injection of medicaments without the necessity of employing a skin-piercing needle, although such a needle may form part of the assembly.

It is an object of the invention to provide a unit of this type which will be light in weight and compact in design aside from the fact that it may be readily cocked, loaded and fired.

A further object is that of furnishing an injection apparatus which will involve a mechanism capable of being potentialized for firing with the expenditure of minimum effort. So potentialized, it will remain in condition for use for an indefinite period of time but will be instantly available for injection purposes when required. Moreover, the apparatus will lend itself for ready use by either physicians or technicians as well as by patients who desire to practice self-injection.

Still another object is that of designing a mechanism which includes relatively few parts, each individually simple and rugged in construction, such parts being capable of ready production and assemblage to furnish a unitary apparatus operating over long periods of time with freedom from all difficulties.

With these and other objects in mind, reference is had to the attached sheet of drawings illustrating one practical embodiment of the invention and in which:

Fig. 1 is a side elevation of the apparatus;

Fig. 2 is a longitudinal sectional view taken along the line 2—2 and in the direction of the arrows as indicated in Fig. 1;

Fig. 3 is an enlarged fragmentary sectional side view taken along the line 3—3 and in the direction of the arrows as indicated in Fig. 2;

Fig. 4 is a transverse sectional view taken along the line 4—4 and in the direction of the arrows as indicated in Fig. 3;

Fig. 5 is a sectional side view of the ampule or medicament-containing member which is preferably used in connection with this apparatus; and

Fig. 6 is a perspective view of the nozzle.

Referring primarily to Figs. 1 and 2, the numeral 10 indicates a casing which is of preferably tubular configuration and provides adjacent its outer end a medicament chamber. While the latter might take one of numerous different forms, it is preferred as shown that a space be provided within the parts for the reception of an ampule or medicament-containing member. To this end, an extension 11 is furnished at the outer end of casing 10 and mounts a loading cap 12. The connection between these parts is preferably established by means of screw threads 13 so that without difficulty, the loading cap may be applied or removed for the purpose of gaining access to the medicament chamber which is conveniently defined by this cap and the extension 11.

As in Fig. 5, the ampule may include a hollow body

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14 which is preferably tapered towards its closed or inner end at which point it may embrace a tail piece or extension 15. This body is conveniently formed of rubber and defines a volume such that it may receive a desired amount of liquid medicament so that a precise dosage will be established. A nozzle assembly, as shown, includes a rear extension around which the forward end of cup 14 may be fitted. This portion is continued in the form of a preferably integral flange 17 beyond which the nozzle portion 18 projects. These parts are formed with a bore 19 which—in the case of velocity injection—at least adjacent its outer end is relatively restricted. Such restriction may, for example, be on the order of from .004" to .012". In this manner, a liquid jet is defined when the medicament is subjected to pressure and which jet will have a fineness capable of readily penetrating the epidermis with a minimum of sensation on the part of the patient.

To effect an expulsion of medicament from the ampule, a plunger 20 is slidably mounted to be movable into the bore of extension 11. Power means are employed to project plunger 20. This power means may take one of numerous different forms. However, preferably, a spring 21 is employed. The outer end of this spring bears against the flange 22 which forms a part of plunger 20. The opposite end of the spring bears against a plug 23 secured against movement with respect to casing 10. A rod 24 is disposed for longitudinal movement within casing 10 and as shown is encircled by spring 21. At one end it is connected with plunger 20 by preferably forming it with a screw-threaded socket which engages with the corresponding threads formed on the rear extension 25 of that plunger. Adjacent its opposite end it slidably passes through the bore of plug 23.

Now with a view to providing a cocking mechanism such that the spring is placed under proper compression for the purpose of projecting the plunger, a lever unit 26 is employed. This lever, as shown, is conveniently formed to include a pair of arms extending parallel to each other and having at their outer ends a connecting or yoke portion which engages the outer face of the casing to thus act as a stop. The inner ends of the lever are supported for pivotal movement by a shaft which may be in the form of a tubular member 27. The latter extends through side plates 28 forming a part of the casing assembly. Cap members 29 may serve to cover the inner ends of the lever and are retained in position by securing elements such as bolts which conveniently extend into the bore of tube 27. Both parts of the lever are preferably formed with notches 30 which have a width such that they may receive a transversely disposed pin 31. The latter extends into a connecting link 32 which has its outer end connected by, for example, a pin 33 with the inner end of shaft or rod 24. A crank preferably including a pair of plates 34 has the inner ends of these elements connected for rotation around the tube or shaft 27. The opposite ends of these elements are provided with openings through which pin 31 extends.

With a view to providing a guide structure, each of plates 28 may be formed with an arcuate groove 35. This has been best shown in Fig. 3. Conveniently, each groove may extend through 180°. In any event, it is concentrically disposed with respect to tube 27 and is spaced from the axis of the latter a distance such that the ends of pin 31 may traverse the groove. Also, the inner or right-hand end of the groove or slot 35 as viewed in Fig. 3 extends to a point beyond a straight line intersecting the axes of pins 33 and 31 and continued beyond the latter. Therefore, with link 32 preferably being bent or curved as shown in the figure under consideration, it follows that with pin 31 having its ends in the rear parts of slots or grooves 35, rod 24 will be fully retracted and the axis of

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pin 31 will be beyond dead center position. Therefore, the powering means provided by spring 21 will be urging rod or shaft 24 to projected position but such urging will merely result in the ends of pin 31 bearing more firmly against the end portions of the trackways defined by the rear ends of grooves 35.

To release plunger 24 for movement, a trigger is provided. This, as shown in Fig. 3, may include a button portion extending beyond the encasing structure of the unit; such button being the outer end of a plunger 36. Movement of the latter is limited by, for example, a pin and slot structure 37. A spring 38 urges plunger 36 outwardly. A wedge face 39 forms a part of this plunger and is normally disposed adjacent, but to the rear of the trackways 35. A "safety" pin 40 is supported for rotational movement adjacent these parts and may be turned by an outer knob 41. The latter conveniently carries a spring-pressed detent 42 which may either frictionally bear against the outer face of the assembly or cooperate with indentations in that outer face. Pin 40 has a part of its inner end removed to furnish a curved surface 43 corresponding generally to the path of movement of the rear end of link 32. The latter at this point is conveniently furnished with a shoulder 44.

It is apparent that when the parts are in the positions shown in Fig. 3, pin 40 will not interfere with swinging movement on the part of the rear end of link 32. If pin 40 is rotated through 180°, its arcuate face will extend away from the rear end of link 32. Under these circumstances, the pin will project into the recess defining the shoulder 44 of the link. Therefore, the latter may not move in a clockwise direction towards the opposite end of trackways or slots 35. With final reference to the over-all structure, it will be noted that the main rear portion of the apparatus may include a body in the form of a block 45 to which the side plates 28 are attached and which houses the rear end of rod 24, link 32, pins 31 and 33, etc. Plug 23 is conveniently integral with block 45. Also as shown especially in Fig. 2, a washer 46 may be interposed between the inner face of extension 11 and the flange 22 of plunger 20. Such washer will serve to cushion shocks and prevent direct contact between that flange and the extension.

In using an apparatus of this nature, the cartridge or ampule 14 is filled in any desired manner with the solution to be injected. Loading cap 12 is removed. If the device has not theretofore been cocked, pin 40 is swung or rotated to the position shown in Fig. 3. Thereupon, by grasping casing 10 and lever 26, the latter may be swung in a counterclockwise direction as viewed in Fig. 1. With such swinging, the base portions of notches 30 will engage the outer ends of pin 31 and move the latter in a counterclockwise direction to the position shown in Fig. 3. The parts will now remain in the positions to which they have been shifted, due to the fact that the axis of pin 31 has moved to a position beyond center with respect to the axes of pin 33 and tube 27. Despite this, however, pin 40 should now be rotated through 180°. This will bring the inner end of the pin to a position at which it extends into the recess defined by shoulder 44. Therefore, the parts may not accidentally shift.

Under the afore described operation, rod 24 and plunger 20 will have been retracted. The ampule as in Fig. 5, or any functionally equivalent unit may now be disposed in position within the enlarged bore section of extension 11. Under these circumstances, tail piece 15 will extend in the direction of the plunger. Loading cap 12 may now be mounted upon the extension 11 so that the stem portion 18 extends through the opening in the cap and beyond the same as shown in Fig. 2. Prior to thus disposing the parts, lever 26, will, of course, have been returned to its initial position as shown in Figs. 1 and 2.

The device is now ready for operation. With a site of injection having been selected, the end of nozzle 18 is brought to a position overlying the desired area of the

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epidermis. Pin 40 is now turned so that its arcuate face extends adjacent link 32. Now, if the extending button portion of plunger 36 is projected inwardly against the action of spring 38, wedge or flared surface 39 of that plunger will engage the rear end of link 32. Under continued projection, it will shift that portion of the link and, consequently, pin 31 in a clockwise direction. That shifting will continue until the axis or center of pin 31 extends below (as viewed in Fig. 3) a line intersecting the axes of pin 33 and tube 27. When this once occurs, the power of the spring or equivalent unit will immediately cause the rear end of link 32 to travel in an arc as defined by the tracks 35. Therefore, rod 24 will be rapidly projected as will also plunger 20. The latter will bear against tail piece 15 to shift the same towards nozzle 18. This will cause body 14 to invert upon itself as shown in Fig. 2 and thus the solution within the ampule or cartridge will be discharged through orifice 19 at velocities such that a hypodermic injection will be completed. With such completion, loading cap 12 may again be dismounted and the nozzle and ampule assembly can be withdrawn from the chamber. After this, the entire operation, as afore described, may be repeated.

From the foregoing, it will be apparent that among others the several objects of the invention as specifically aforementioned are achieved. Obviously, numerous changes in construction and rearrangement of the parts might be resorted to without departing from the spirit of the invention as defined by the claims.

I claim:

1. An apparatus for performing hypodermic injections comprising in combination a casing, said casing providing adjacent one end a medicament chamber, a plunger slidably mounted by said casing and projectable towards said chamber to expel liquid therefrom, power means carried by said casing and connected to said plunger to project the same, cocking means for compressing said power means, said cocking means comprising a lever, means for pivotally connecting one end of said lever for swinging movement with respect to said casing, means coupling said lever with said power means for compressing the latter as said lever is swung in one direction, a lost-motion connection forming a part of said coupling means whereby said lever may be swung in an opposite direction without movement of said power means and further means for retracting said plunger as said cocking means is operated.

2. An apparatus for performing hypodermic injections comprising in combination a casing, said casing providing adjacent one end a medicament chamber, a plunger slidably mounted by said casing and projectable towards said chamber to expel liquid therefrom, power means carried by said casing and connected to said plunger to project the same, cocking means for compressing said power means, said cocking means comprising a lever, means for pivotally connecting one end of said lever for swinging movement with respect to said casing, means coupling said lever with said power means for compressing the latter as said lever is swung and said lever comprising a pair of arms and a connecting portion at the outer ends of said arms, said connecting portion engaging with the surface of the casing when the lever is swung to a position extending substantially axially of the same.

3. An apparatus for performing hypodermic injections comprising in combination a casing, said casing providing adjacent one end a medicament chamber, a plunger slidably mounted by said casing and projectable towards said chamber to expel liquid therefrom, power means carried by said casing and connected to said plunger to project the same, cocking means for compressing said power means, said cocking means comprising a lever, means for pivotally connecting one end of said lever for swinging movement with respect to said casing, means coupling said lever with said power means for compressing the latter as said lever is swung in one direction with re-

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spect to the casing and lost-motion means forming a part of said coupling means whereby said lever may be swung in an opposite direction without decompressing said power means.

4. An apparatus for performing hypodermic injections comprising in combination a casing, said casing providing adjacent one end a medicament chamber, a plunger slidably mounted by said casing and projectable towards said chamber to expel liquid therefrom, power means carried by said casing and connected to said plunger to project the same, cocking means for compressing said power means, said cocking means comprising a lever, means for pivotally connecting one end of said lever for swinging movement with respect to said casing, a crank rockingly mounted with respect to said casing, a link pivotally connected to said crank and plunger and means for coupling said lever with said crank.

5. An apparatus for performing hypodermic injections comprising in combination a casing, said casing providing adjacent one end a medicament chamber, a plunger slidably mounted by said casing and projectable towards said chamber to expel liquid therefrom, power means carried by said casing and connected to said plunger to project the same, cocking means for compressing said power means, said cocking means comprising a lever, means for pivotally connecting one end of said lever for swinging movement with respect to said casing, a crank rockingly mounted with respect to said casing, a link pivotally connected to said crank and plunger, means for coupling said lever with said crank to move the latter as said lever is swung in one direction and said coupling means being inoperative to move said crank when said lever is swung in an opposite direction.

6. An apparatus for performing hypodermic injections comprising in combination a casing, said casing providing adjacent one end a medicament chamber, a plunger slidably mounted by said casing and projectable towards said chamber to expel liquid therefrom, power means carried by said casing and connected to said plunger to project the same, cocking means for compressing said power means, said cocking means comprising a lever, means for pivotally connecting one end of said lever for swinging movement with respect to said casing, a link pivotally connected to said crank and plunger, means for coupling said lever with said crank to move the latter as said lever is swung in one direction, said coupling means being inoperative to move said crank when said lever is swung in an opposite direction and the point of pivotal connection between said link and crank being disposable in a plane beyond a line intersecting the point of pivot-

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ing of said crank and the crank and plunger when the latter is in a cocked position.

7. An apparatus for performing hypodermic injections comprising in combination a casing, said casing providing adjacent one end a medicament chamber, a plunger slidably mounted by said casing and projectable towards said chamber to expel liquid therefrom, power means carried by said casing and connected to said plunger to project the same, cocking means for compressing said power means, said cocking means comprising a lever, means for pivotally connecting one end of said lever for swinging movement with respect to said casing, a crank rockingly mounted with respect to said casing, a link pivotally connected to said crank and plunger, means for coupling said lever with said crank and a member rotatably mounted by said casing and having a portion projectable into the path of movement of said crank for preventing movement of the latter along said path.

8. An apparatus for performing hypodermic injections comprising in combination a casing, said casing providing adjacent one end a medicament chamber, a plunger slidably mounted by said casing and projectable towards said chamber to expel liquid therefrom, power means carried by said casing and connected to said plunger to project the same, cocking means for compressing said power means, said cocking means comprising a lever, means for pivotally connecting one end of said lever for swinging movement with respect to said casing, a crank rockingly mounted with respect to said casing, a link pivotally connected to said crank and plunger, means for coupling said lever with said crank, a member presenting a tangentially extending surface, a plunger portion connected with said member to project the latter and said surface being engageable with parts of said mechanism adjacent said crank to shift the latter.

9. A hypodermic injection apparatus according to claim 6 and also comprising a trigger slidably mounted by said casing and a cam surface forming a part of said trigger and acting against said point of pivotal connection to shift the latter from the position in which it has been disposed.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

2,380,534 Lockhart ----- July 31, 1945

##### FOREIGN PATENTS

652,945 Great Britain ----- May 2, 1951  
664,044 Great Britain ----- Jan. 2, 1952