

[54] TOOL FOR DESTROYING HYPODERMIC SYRINGES

[76] Inventors: **Harry N. Eldridge**, 8110 Mission, Glen Avon, Calif. 92509; **Robert K. Eldridge**, 3661 Pacific Ave., Rubidoux, Calif. 92509

[22] Filed: Nov. 23, 1973

[21] Appl. No.: 418,382

[52] U.S. Cl. 83/165, 83/164, 83/167, 83/545, 83/580, 83/586, 83/DIG. 1

[51] Int. Cl. B26d 3/16

[58] Field of Search 83/164, 165, 167, 545, 83/580, 586, DIG. 1; 225/103, 93

[56] References Cited

UNITED STATES PATENTS

3,469,750	9/1969	Vanderbeck.....	83/580 X
3,683,733	8/1972	Johan et al.	83/580 X
3,785,233	1/1974	Robinson	83/580 X

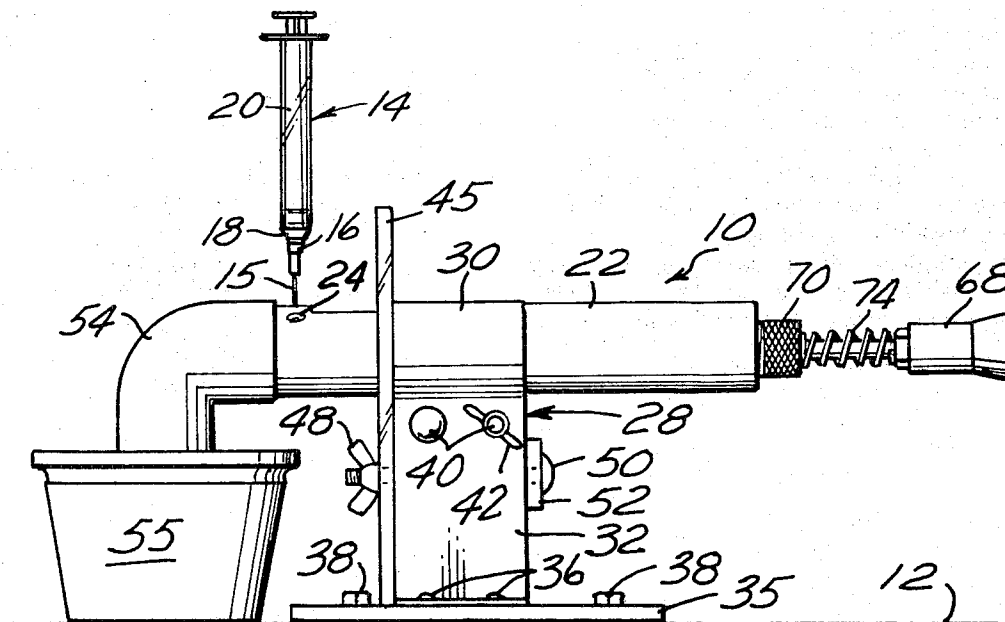
Primary Examiner—Frank T. Yost

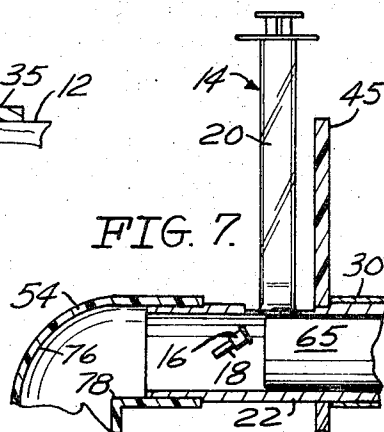
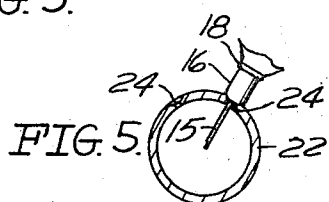
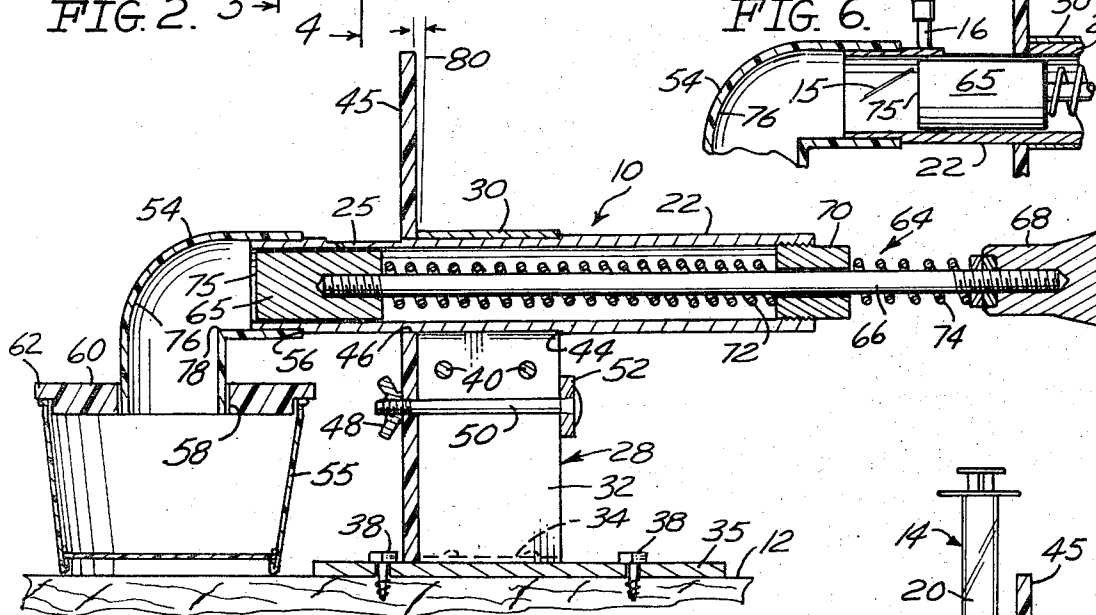
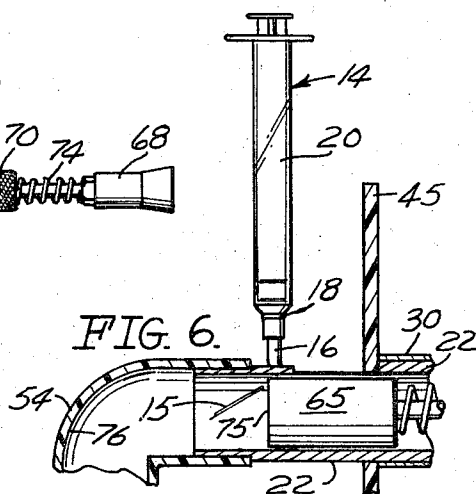
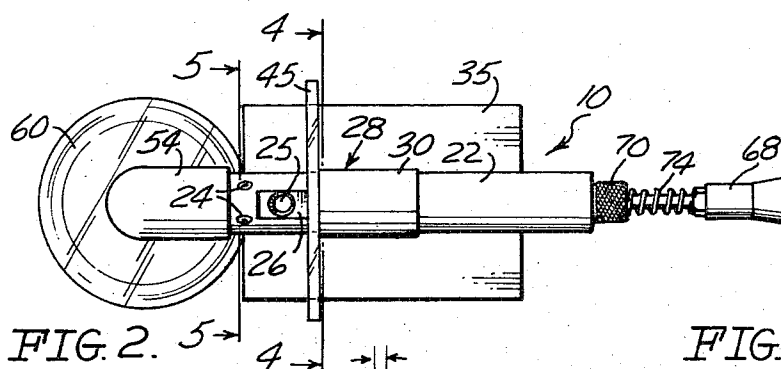
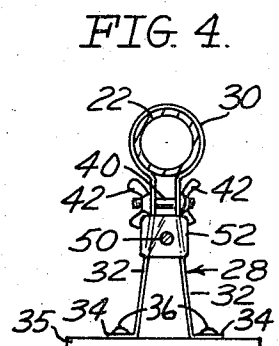
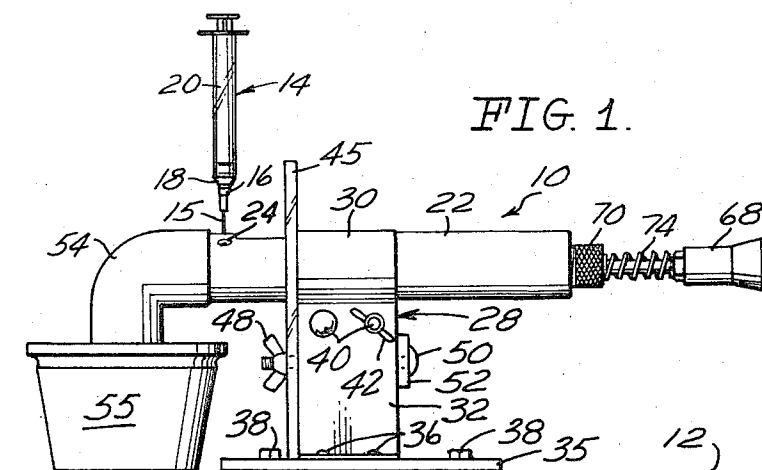
Attorney, Agent, or Firm—Herbert E. Kidder

[57] ABSTRACT

A tube slidably confines a plunger and has a radial aperture to receive needle portions of hypodermic syringes, the aperture having a cutting edge to cooperate with the plunger to shear off the needle portions. The tube also has a larger radial aperture to receive the leading ends of the barrel portions of hypodermic syringes to shear off the leading ends after the needle portions are severed. A tubular elbow on the forward end of the tube extends downwardly to a collection receptacle. When the plunger is manually retracted and released, a spring strokes the piston for a shearing operation and at the end of the shearing stroke the plunger propels the severed material towards the elbow to drop it into the collection receptacle.

8 Claims, 7 Drawing Figures





TOOL FOR DESTROYING HYPODERMIC SYRINGES

BACKGROUND OF THE INVENTION

Hypodermic syringes for injections and for withdrawing blood samples are widely manufactured in disposable form because discarding such a syringe after a single use avoids the risk of transmitting infections from patient to patient and saves the substantial cost of sterilizing used hypodermic syringes. It is mandatory, however, to destroy disposable hypodermic syringes after a single use to keep them out of the hands of children and out of illicit narcotics traffic. Drug addicts seek opportunities to pick up unguarded hypodermic syringes at hospitals and even go so far as to search through trashcans. Accordingly, laws have been enacted that require prompt destruction of used disposable hypodermic syringes.

Typically, a hypodermic syringe has a needle portion at the leading end of a barrel portion. In a common construction, the needle portion has an internally tapered hub which fits onto a correspondingly tapered nose on the leading end of the barrel portion. To make sure that a hypodermic syringe is completely and irreversibly disabled, the needle portion should be sheared off, and in addition the adjacent leading end of the barrel portion should also be severed. Thus any device for destroying used disposable hypodermic syringes should be designed for two shearing operations.

The present invention relates to a particular type of syringe-destroying tool wherein a metal plunger reciprocates in a metal tube to carry out the two shearing operations, the wall of the tube having cutting edges to cooperate with one or more cutting edges of the reciprocative plunger. A device of this particular type for destroying hypodermic syringes is disclosed in the Vanderbeck U.S. Pat., No. 3,469,750.

The Vanderbeck device is relatively bulky because the tube and cooperating plunger are mounted inside a housing of substantial size, the housing being large enough to enclose not only the tube and a solenoid to actuate the plunger, but also a receptacle for the sheared-off parts. The Vanderbeck device is relatively expensive because of its size and complexity and also because it incorporates an electrical control system. A serious disadvantage of the device, moreover, is that the interior of the relatively large housing is subject to contamination, with numerous crevices to trap foreign material, and it is a time-consuming task to dismantle the housing for adequate access to its interior. Another disadvantage, of course, is that failure of the electrical system means that the device is rendered completely useless.

SUMMARY OF THE INVENTION

The primary object of the present invention is to meet the need for a simple, compact, inexpensive, non-electrical tool for the stated purpose, that may be quickly and easily cleaned and may be relied upon to function with complete satisfaction over a long service life.

Briefly described, the presently preferred embodiment of the tool includes a metal tube with a metal plunger slidingly mounted therein and a bracket for rigidly mounting the tube on a countertop or the like. The tube has at least one small radial aperture to receive the

needle portion of a hypodermic syringe for shearing action and has a larger aperture to receive the leading end of the barrel portion of the hypodermic syringe in order to shear off said leading end.

The plunger is manually retracted to store energy in a mainspring that drives the plunger through a shearing stroke for cutting off the needle portion of a syringe and the operation is repeated to shear off the adjacent leading end of the barrel portion of the syringe. If the drive spring fails, temporary manual stroking of the plunger is possible.

All of the sheared material is confined by the tube and by the passage means that leads from the tube to a closed receptacle. Thus the total area of interior surfaces that is subject to contamination is relatively small and the device is constructed for quick and easy access to all such interior surfaces.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of the presently preferred embodiment of the tool mounted on a suitable support surface such as a countertop;

FIG. 2 is a plan view of the tool;

FIG. 3 is a longitudinal vertical section of the tool;

FIG. 4 is a transverse section along line 4—4 of FIG. 2, showing the construction of the bracket that holds the tube;

FIG. 5 is a transverse section of the tube, taken at line 5—5 of FIG. 2, showing a pair of apertures to receive needle portions of hypodermic syringes;

FIG. 6 is a fragmentary sectional view showing how the plunger shears off the needle portion of a hypodermic syringe; and

FIG. 7 is a fragmentary sectional view showing how the plunger severs the hub end of a syringe.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The drawings illustrate a tool, generally designated by reference numeral 10, which incorporates the preferred form of the invention and is adapted to be mounted on a support surface 12, such as a tabletop or the like. As best shown in FIG. 1, a typical disposable hypodermic syringe, generally designated 14, that is to be incapacitated by the tool, has a needle portion 15 formed with an internally tapered hub 16 that fixedly telescopes over a correspondingly tapered conical nose (not shown) at the leading end 18 of a barrel portion 20 of the syringe.

Tool 10 has a body in the form of a tube 22 that is provided near its leading end with a pair of small chamfered apertures 24 to receive needle portions 15 of the hypodermic syringes, and a larger chamfered aperture 25 on a flat area 26 of the tube to receive leading end portions 18 of the syringes. The tube 22 is removably engaged and rigidly supported by an upright bracket, generally designated 28, that is made of a single piece of sheet metal. The sheet metal forms a loop 30 to embrace the tube and has a pair of supporting legs 32 having bottom flanges 34. The bottom flanges are secured to a base plate 35 by rivets 36, and the base plate is provided with holes to receive suitable screws 38 for fastening the base plate to the support surface.

Bracket 28 has a pair of bolts 40 which extend transversely through the two legs 34 from opposite sides, and which are provided with wing nuts 42 that may be tightened to close the loop 30 of the bracket tightly

around the tube 22. As shown in FIG. 3, approximately the forward half of the tube is of reduced outside diameter to form a circumferential shoulder 44 that abuts the read end of the loop 30 to serve as a stop for positioning the tube in the loop.

Preferably, a splash plate 45 made of a suitable transparent plastic is provided to protect the operator from flying fragments and droplets of liquid from the regions of the apertures 24 and 25 that may be created by the shearing operation of the tool. The splash plate 45 has a circular opening 46 through which the tube 22 passes, with the splash plate abutting the legs 34 and the loop 30 of the bracket 28. The splash plate 45 is releasably secured by a wing nut 48 on the end of a bolt 50 that extends through the splash plate and through a transverse bar 52 that abuts the rear edges of the two legs 34.

Passage means in the form of a tubular elbow 54 connects the forward end of tube 22 to a collection receptacle 55 which may, for example, be a conventional paper cup. As shown in FIG. 3, one leg of the elbow 54 slidably telescopes over the forward end of the tube 22 against an outer circumferential shoulder 56 of the tube and the other, downwardly extending leg projects downwardly through a circular opening 58 in a relatively thick plastic cover 60. Cover 60 telescopes into the rim of the cup 55 with a radial flange 62 of the cover resting on the rim. An important feature of the invention is that the elbow 54 and tube 22 in cooperation with the cup 55 form an enclosed storage space that confines and controls the sheared material together with any residual liquid droplets from the syringes. Thus, the only surfaces that can normally be contaminated are the walls of this enclosed space, and it is apparent that the total area of these interior surfaces is relatively small.

Slidably mounted inside the tube 22 is a plunger, generally designated 64, having a solid cylindrical head 65 and a shank 66 of reduced diameter that carries an external knob 68. The shank 66 of the plunger slidably extends through a knurled bushing 70.

Inside the tube 22, a coiled drive spring 72 normally acts under compression between the plunger head 65 and the bushing 70 to urge the plunger forward, while outside of the tube 22 a shorter buffer spring 74 normally acts under compression between the bushing 70 and the knob 68. These two springs are in balanced compression at the normal or idle position of the plunger that is shown in FIG. 3.

The tube 22 and the plunger head 65 are preferably made of stainless steel, with the plunger head made of hardened stainless steel to minimize wear on its forward circumferential shearing edge 75. It is to be noted that the plunger 64 is free to rotate in the tube 22 so that the plunger takes random rotational positions in the repeated operation of the plunger to bring different portions of its circumferential cutting edge 75 into cooperation with the cutting edges of apertures 24 and 25 over a period of service of the device to promote prolonged shearing efficiency on the part of the plunger.

To process a used disposable hypodermic syringe 14, the operator grasps the knob 68, retracting the plunger 64 to a rearward limit position at which the drive spring 72 is compactly contracted against the bushing 70 with the buffer spring 74 fully extended and hanging loose on the shank 66 of the plunger. With the plunger re-

tracted in this manner, the operator first inserts the needle portion 15 of a syringe into one of the small chamfered apertures 24 in the manner shown in FIG. 5 and then releases the knob 68 to permit the compressed drive spring 72 to stroke the plunger forward.

The forward stroke of the plunger has a first stage in which the drive spring 72 accelerates the plunger to give the plunger sufficient momentum for the shearing action, and has a second, deceleration stage in which the buffer spring 74 is progressively compressed to decelerate the plunger. The plunger head 65 reaches the apertures 24 and 25 at high velocity for effective shearing operation (illustrated in FIGS. 6 and 7) and while the plunger is still at high velocity it forcefully propels the severed parts into the tubular elbow 54, the severed parts usually striking the curved inner surface of the elbow to be deflected downward into the cup 55. Thus the plunger 64 has a dual function in that it not only shears portions of the hypodermic syringes but additionally propels the severed parts into the collection cup 55.

After the needle portion 15 of a syringe is sheared at one of the two apertures 24 of the tube, the operator again retracts the plunger 64 and while the plunger is thus retracted inserts the leading end 18 of the barrel portion of the syringe into the tube aperture 25. The plunger is again released to shear off the leading end of the barrel in the manner shown in FIG. 7, the hub 16 of the needle being carried by the severed leading end as the said end is propelled forward into the elbow 54.

Inevitably some of the hypodermic syringes retain residual liquid which may be medication or blood, and some of this liquid enters the forward end of the tube 22. The plunger head 65 strokes this residual liquid toward the inner brink 78 of the elbow 54 and preferably the tube 22 is slightly inclined to cause the residual liquid to gravitate to and over the brink into the collection cup. In FIG. 3 a vertical plane is indicated by a broken line 80, and it can be seen that splash plate 45 which is perpendicular to the axis of tube 22 is inclined a few degrees forward from this vertical plane.

It is apparent that the tool 10 is of simplified, economical construction and may be depended upon to function reliably over a long period. It is not subject to electrical failure and in the event that the drive spring 72 should fail, the plunger 64 may be stroked manually pending replacement of the drive spring. When a substantial quantity of severed parts accumulates in the collection cup 55, the cup and the elbow 54 may be moved forward to disengage the cup for appropriate disposal. A suitable plastic lid (not shown) may then be snapped over the rim of the collection cup. A new collection cup is then engaged with the cover 60 and the elbow 54 is again telescoped over the forward end of the tube 22 with the new cup resting on the support surface 12. An alternative procedure for changing cups is simply to move the cup upward to slide the cover 60 upward over the downwardly projecting leg of the elbow 54 and thereby permit the elbow to be rotated to swing the cup clear of the support surface 12.

It is a simple matter to dismantle and clean the tool periodically. The first step may be to move the elbow 54 forward until it is free from tube 22 and then the wing nuts 42 on opposite sides of the bracket may be removed to expand the loop 30 of the bracket to permit

withdrawal of the tube from the bracket. The knurled bushing 70 may then be unscrewed to free the plunger 64. With the tool dismantled in this manner the tube 22 and the plunger 64 with the bushing 70 thereon may be immersed in a sterilizing detergent solution and both the plastic elbow 54 and the plastic cover 60 may be cleaned in the same manner.

While the presently preferred embodiment of the invention has been described in considerable detail, it will be understood by those skilled in the art that the invention is not limited to such details, but may take various other forms within the scope of the following claims.

What I claim is:

1. In a tool for irreversibly disabling both the needle portions and the barrel portions of disposable hypodermic syringes, the combination of:

a tube having a forward end and a rearward end;

a receptacle to receive severed parts of the hypodermic syringes;

passage means placing the forward end of the tube in communication with the receptacle;

said tube, passage means and receptacle forming a closed space to confine the severed parts of the hypodermic syringes;

the forward end of the tube having at least one aperture to receive needle portions of the hypodermic syringes and having at least one larger aperture to receive the leading ends of the barrel portions of hypodermic syringes after the needle portions are severed;

a plunger slidably mounted in the tube to cooperate with the edges of said apertures to shear the needle portions of the hypodermic syringes and to shear the leading ends of the barrel portions of the hypodermic syringes;

said plunger being manually retractable through the rear end of the tube;

spring means to oppose retraction of the plunger and to store energy to drive the plunger through a shearing stroke; and

support means to releasably engage and immobilize the tube.

2. A combination as set forth in claim 1 in which said support means holds the tube in a position more nearly horizontal than vertical and said passage means includes an elbow having a first leg connected to the forward end of the tube and a second downwardly extending leg connected to the receptacle.

3. A combination as set forth in claim 1 which includes an exterior upright guard rearwardly of said apertures to intercept any material that may be projected

exteriorly rearwardly by the shearing action of the plunger.

4. In a tool for irreversibly disabling both the needle portions and the barrel portions of disposable hypodermic syringes, the combination of:

a tube having a forward end and a rearward end;

said tube having at least one radial aperture near its forward end to receive the needle portions of the hypodermic syringes and having at least one larger aperture near its forward end to receive the ends of the barrel portions of the hypodermic syringes;

passage means cooperative with the forward end of the tube to form therewith an enclosed space to confine the severed parts of the hypodermic syringes;

a plunger slidably mounted in the tube and having a leading shearing edge to cooperate with the edges of said apertures to shear the needle portions of syringes and the leading ends of the barrel portions of the syringes;

said plunger being manually retractable from a normal idle position to a position extending rearward of the tube;

a drive spring to oppose manual retraction of the plunger and to store energy to drive the plunger forward through a shearing stroke; and

a buffer spring to cushion the end of the shearing stroke of the plunger;

said drive spring and buffer spring being constructed and arranged to divide the stroke of the plunger into an acceleration stage to give the plunger momentum for shearing action and a deceleration stage to a limit position beyond said apertures to propel the severed parts towards said passage means.

5. A combination as set forth in claim 4 in which said passage means has a brink near said limit position towards which the plunger propels the severed parts and over which the said severed parts may drop into a collection zone.

6. A combination as set forth in claim 5 in which said tube is inclined to urge fluid in the tube gravitationally towards said brink.

7. A combination as set forth in claim 4 in which said shearing edge of the plunger extends around the circumference of the plunger and the plunger is free to rotate to distribute wear around the circumferential shearing edge.

8. A combination as set forth in claim 4 in which said two springs oppose each other in balanced stress at said normal position of the plunger.

* * * * *