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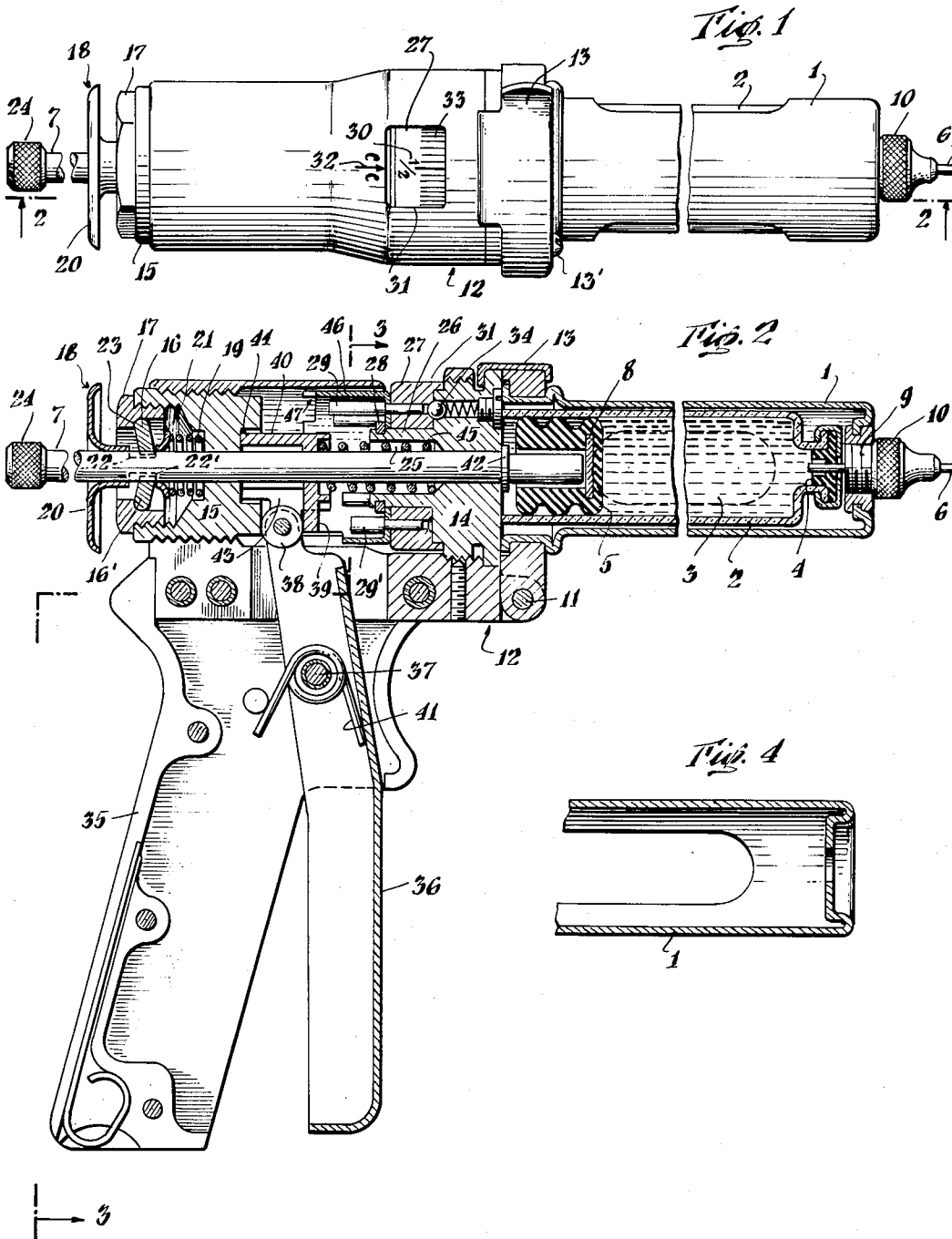
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ONE-HAND VETERINARY SYRINGE

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2 Sheets-Sheet 1



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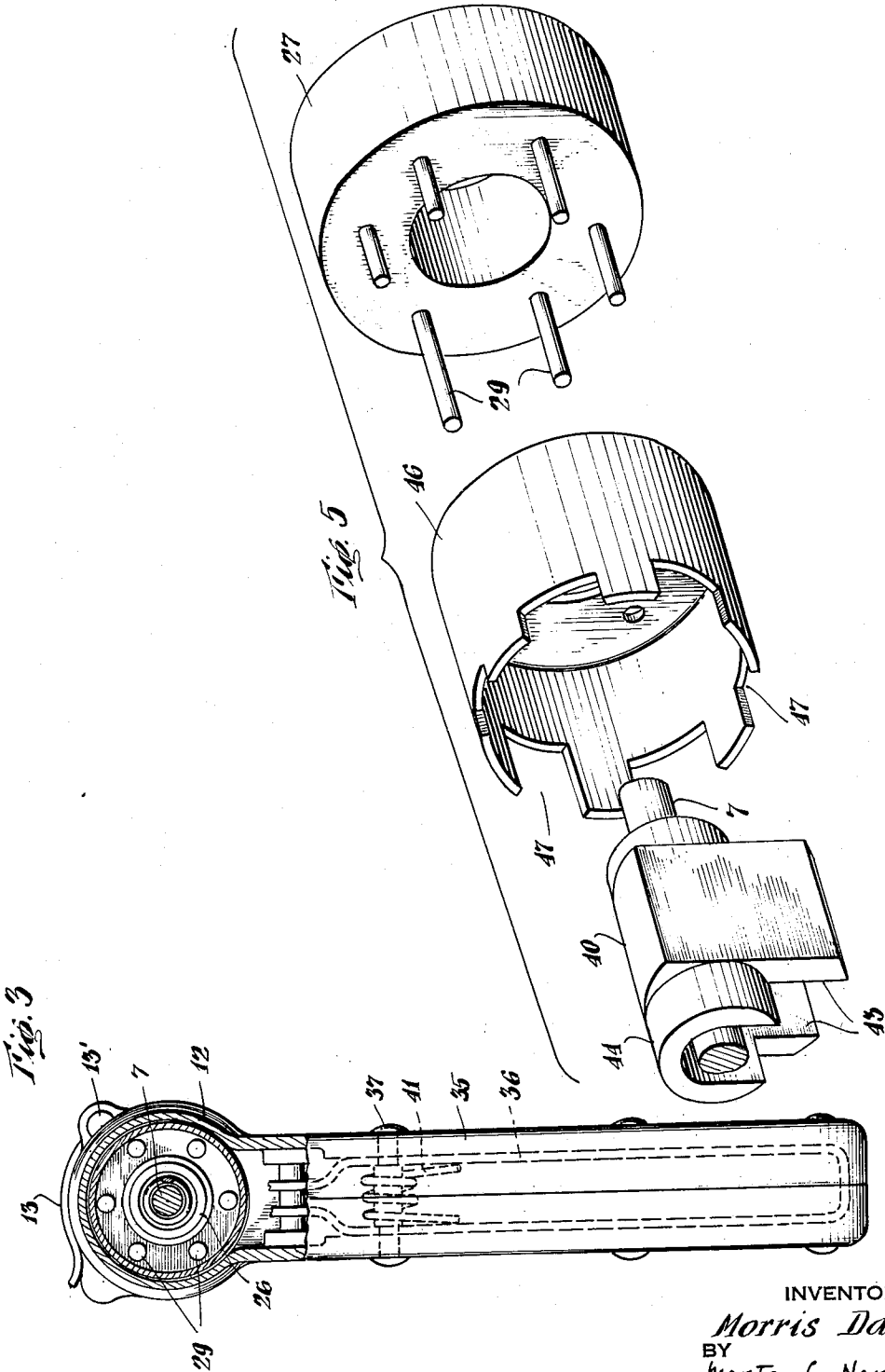
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ONE-HAND VETERINARY SYRINGE

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8 Claims. (Cl. 128—235)

This invention relates to a one-hand veterinary syringe of the type designed to administer by needle injection multiple doses of desired varying volume of an injectable drug from a single loading of the syringe.

Syringes of this general type have been used for a considerable time in veterinary practice, in which a series of successive injections must often be given to a large number of animals, e. g. a herd of cattle. In such a situation it is obviously an advantage to have available a syringe with a large ampule of injectable drug, e. g. 50 ml., from which repeated uniform doses may be administered in rapid succession, e. g. 1 ml. per dose. Such a syringe greatly reduces the number of reloadings required. It is also desirable to provide means in such a syringe for regulating the size of the dose, e. g. from 0.5 ml. to 5 ml. or more, to meet the requirements of each different situation.

Multiple-dose syringes for one-hand operation are conventionally of a type superficially somewhat resembling the common caulking gun, having a pistol grip, a barrel containing an ampule with an injection needle affixed to one end, having a body with a plunger-operating mechanism, and a squeeze lever adjacent the pistol grip for operating the plunger.

While such syringes have met with some success, those with which I am familiar have been deficient in the accuracy of their plunger-operating means and metering or regulating control. They have been provided with teeth or notches on the plunger rod, or equivalent devices, which cooperate with a stop and a gathering pawl or similar means connected with a squeeze lever or trigger for advancing the push rod and thus ejecting a given dose. In such syringes it is clear that any dose must be a multiple of that ejected by advancing the plunger one tooth or notch unit.

The result of this is that these syringes are not readily modified to meet varying conditions that arise in practice. For example, to secure accurate delivery of a given volume, the travel of the plunger must be precisely related to the cross sectional area of the ampule. This value may vary sufficiently in ampules of the same nominal size from different manufacturing sources to interfere seriously with the accuracy of delivery of the syringe. In the prior syringes described, correction can only be made by the relatively difficult and expensive operation of machining a series of notches, teeth or the like on the plunger rod or equivalent element to the precise dimensions required to deliver as many as 50–100 or more equal successive portions of drug.

It is an object of my invention to provide a multiple-dose syringe capable of delivering a series of accurately metered doses of injectable drug.

It is another object of my invention to provide such a syringe having means for easily adjusting the delivery to several different volumes.

It is a further object of my invention to provide such a syringe capable of being standardized for ampules

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of a given diameter by simple manual or machine operations.

Other objects and advantages of my invention will be apparent to those skilled in the art from the following description.

A preferred embodiment of the syringe of my invention has a smooth push rod and surrounding this with a close but free slip fit (e. g. 0.002 inch clearance) a drive washer of substantial thickness. This washer is so arranged that pressure near one edge parallel to the axis of the push rod cocks (i. e. tilts) the washer slightly, causing it to engage the push rod; additional pressure advances washer and rod. On release of pressure, a return spring rectifies the washer and returns it to its original position, without moving the rod which is held by a one-way stop.

While this is my preferred mechanism for advancing the rod, I may use other known one-way linear clutch devices operating on a smooth surface, such as balls rolling in troughs inclined to the axis of the rod, wedges, dogs or the like.

In order to provide a means for limiting each advance of the rod, which bears on the plunger of an ampule, I furnish my syringe with a series of variously positioned stops. In the preferred embodiment, these are a series of pins of different lengths mounted in a rotatable selector disc around the push rod forward of the drive washer and so arranged that one and only one pin will be met by and stop the drive washer in its forward movement. The selector disc instead of surrounding the push rod may be rotatably mounted adjacent thereto. By rotating the selector disc so that one or another of the pins of different lengths is brought to this stop position, it will be seen that the travel of the push rod, and hence the volume of drug ejected, is automatically controlled. It will also be appreciated that the lengths of the pins can be adjusted with high precision without elaborate machine operations such as hobbing or other gear cutting methods, and that if necessary the pins can be readily changed without substantial modification of the syringe.

Instead of the pins described, I may use other adjustable stops equally adapted to precise fabrication and easy replacement such as a cam, a stepped snail as found in a clock striking train, or the like.

A more complete understanding of my invention may be had from the following description and the accompanying drawings, but these are to be taken as illustrative only and not at limiting the scope of my invention, which is defined in the appended claims. In this description "proximal" and "proximally" are used to indicate a direction away from the needle end of the syringe and "distal" and "distally" indicate the reverse direction.

In the drawings, Fig. 1 is a top plan view of a preferred embodiment of my syringe;

Fig. 2 is a vertical section on line 2—2 of Fig. 1;

Fig. 3 is a vertical section on the angled line 3—3 of Fig. 2;

Fig. 4 is a fragmentary section of the distal end of the barrel of a modified syringe; and

Fig. 5 is an exploded perspective view on an enlarged scale of a portion of the push rod, the drive washer, the selector and stop pins.

My syringe comprises a barrel 1 adapted to contain a glass ampule 2 containing an injectable drug 3, provided with a penetrable rubber stopper 4 at the distal end and a slidable rubber plunger 5 at the proximal end. The barrel is adapted to receive a double-cannula needle 6 at its distal end, one cannula of which traverses stopper 4. Plunger 5 is designed to mate with and be advanced by push rod 7 when the latter is advanced. A metal disc 8, with which the push rod makes contact, is molded in the forward part of plunger 5 to prevent dis-

tortion when pressure is applied by the push rod. For best results the disc should have a diameter not less than 80 per cent of the plunger diameter and should be spaced from the distal surface not more than 15 per cent of the axial length of the plunger.

In the modification shown in Fig. 2, the distal end of the barrel 1 is provided with a female thread 9 mating with the male thread on needle hub 10. The female thread may, however, be omitted as shown in Fig. 4 for use with cartridges of a different type.

Barrel 1 is hinged at 11 to a housing 12 to permit its being swung downwards for insertion of ampule 2. It is secured in working position, as shown in Fig. 2, by latch 13 pivoted at 13'.

In housing 12, push rod 7 is slidably mounted in bearing bushings 14 and 15. Associated with bearing 15 is a split washer, the halves of which, designated by 16 and 16', are canted internally forward and surround push rod 7, as may be seen in Fig. 2. A threaded bushing 17, screwed into bushing 15, serves to retain the split washer in position in cooperation with thumb piece 18 and lock spring 19.

Thumb piece 18 is in the form of a tube surrounding push rod 7. At its proximal end it is provided with a wide exterior thumb flange 20 and at its distal end with a narrow exterior flange 21. The tubular portion has two slots 22 and 22' through which the halves 16 and 16' of the split washer bear on push rod 7. Spring 19 is a compression spring confined between bearing washer 15 and flange 21. Bushing 17 is provided with an internal flange 23 against which the outer edges of washer halves 16 and 16' bear. As may be seen in Fig. 2, the effect of the pressure of spring 19 on thumb piece 18 is to force the inner edges of washer 16—16' against push rod 7, thus preventing retrograde movement of the latter. When it is desired to withdraw the push rod, forward axial pressure on thumb piece 18 relieves the pressure of spring 19 on the split washer and permits withdrawal of the push rod. A knurled knob 24 is threaded on the proximal end of the push rod both to afford a grip for withdrawal of the rod and to permit assembly and disassembly of the syringe.

Bearing bushing 14 at the distal end of the push rod is formed with an axial recess 25 and a reduced extension 26 serving as a bearing for rotatable selector disc 27. The latter is kept in place by retaining spring 28. Selector disc 27 bears fixed on its proximal face a series of stop pins 29 arranged in a circle around its axis and projecting proximally in a direction parallel to the axis. These pins are of different lengths interposed one at a time in the path of a drive washer (as explained below), depending on the rotational position of selector disc 27. The latter has indicia 30 on its periphery. These are visible through window 31 in the top of housing 12 and may be brought in turn into registry with reference mark 32 by action of the operator's thumb in knurling 33, thus bringing an appropriate pin 29 into the stop position. Selector disc 27 is also provided with series of friction stops corresponding to the stop positions of individual stop pins. These friction stops 34 consist of indentations on the distal face of the selector disc cooperating with a spring loaded ball carried by bearing bushing 14, as shown in Fig. 2.

Attached to selector disc 27 is a cup-shaped guide shell 46 having in its proximal rim notches 47 aligned with stop pins 29, each being of just sufficient width to permit the entrance of downward and side extensions 39 and 43 of drive washer 40, as described below.

Affixed to the bottom of housing 12 is a hollow pistol grip 35 in which finger lever 36 is pivoted at 37. An upper extension of this lever bears roller 38 which engages downward extension 39 of drive washer 40. Lever spring 41 biases lever 36 as shown in Fig. 2 with the

roller 38 in a proximal and the lower part in a distal position.

Push rod 7 is provided with a fillet 42 which engages bearing washer 14 when the rod is retracted and prevents inadvertent removal of the rod.

Drive washer 40 is formed with a central aperture through which push rod 7 passes with a close but free slip fit. The diameter of this aperture may advantageously be 0.002 inch greater than that of the push rod. The drive washer is prevented from rotating around the push rod by two downward side extensions 43 of hemicylindrical proximal extension 44. The side extensions enclose the upper end of lever 36 and roller 38. One end of a compression spring 45 is seated in recess 25 of bushing 14 and at its other end exerts pressure on the face of drive washer 40 to urge it proximally to its limit position against bushing 15.

It will be seen from Fig. 2 that finger pressure on lever 36 against the action of springs 41 and 45 will advance roller 38 distally, first slightly cocking drive washer 40 because of the eccentric pressure, thus engaging the drive washer with push rod 7; further advance of roller 38 will advance drive washer and push rod together until the drive washer is brought to a stop against the lowermost stop pin 29'. The advance of the push rod moves plunger 5 forward, ejecting a dose of drug 3 through needle 6, the volume being determined by the length of lowermost stop pin 29' and the cross sectional area of ampule 2.

The relationship of push rod 7, drive washer 40, guide shell 46 and stop pins 29 is shown in Fig. 5. The function of guide shell 46 is to prevent ejection of a dose in case selector disc 27 is inadvertently positioned between dosage unit positions. In such a case no stop pin would register with extension 39 of drive washer 40, but one of the lands between notches 47 would prevent advance of the drive washer.

On release of finger pressure on lever 36, the axial pressure of spring 45 uncocks drive washer 40 and returns it to the position shown in Fig. 2. Simultaneously lever 36 is returned to its original position by the action of springs 41 and 45. Retrograde movement of rod 7 is prevented by the one-way stop action of split washer 16—16'.

When ampule 2 is empty it may be removed as follows: Thumb piece 18 is pressed inward, thus disengaging split washer 16—16' from push rod 7 against pressure of spring 19. Push rod 7 is then retracted to the limit. This permits the syringe to be "broken" when latch 13 is disengaged, the barrel swinging down around pivot 11. The empty ampule may then be withdrawn and replaced.

I have found it advantageous to construct my syringe for use with a 50 ml. ampule and to standardize the lengths of the stop pins, with regard to the cross sectional area of the ampule, to deliver respectively 1/2, 1, 2, 3, 4 and 5 ml. doses, but ampules of other sizes may be used and different doses readily provided for.

While I have indicated that my syringe is especially adapted for veterinary use, it may obviously find application in other fields and be made in various sizes and modifications within the scope of the following claims.

I claim:

1. A multiple-dose injection syringe comprising a barrel adapted to contain an ampule connected with an injection needle and having a slidable plunger, a smooth push rod adapted when advanced in the syringe to move the slidable plunger distally in the ampule, one-way drive means engageable with the push rod and adapted to move the push rod distally but to permit proximal movement of the push rod, releasable stop means engaging the push rod and adapted to prevent proximal movement of the push rod, manually operated release means to disengage said releasable stop from the push rod, manually operable means adapted to act on said drive means to cause

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it to engage the push rod and advance it distally, and a plurality of adjustable stops adapted to be brought one at a time into the path of the drive means to limit its distal movement and thus to regulate the volume displaced by the slidable plunger.

2. A multiple-dose injection syringe as defined in claim 1 in which the drive means is a washer of substantial thickness surrounding the push rod with a close but free slip fit and having an eccentric extension engaging a manually operable lever, whereby pressure of the lever on said extension cocks the washer and engages it with the push rod and movement of the lever then advances drive washer and push rod.

3. A multiple-dose injection syringe as defined in claim 1 in which the adjustable stops consist of a plurality of pins of different lengths mounted parallel to the push rod on a rotatable disc and arranged to be brought one at a time into the path of the drive means on rotation of the disc.

4. A multiple-dose injection syringe as defined in claim 3 having affixed to the rotatable disc a cup-shaped guide shell, said shell having a rim projecting from the disc in the same direction as the pins and surrounding the pins, the rim being provided with alternate notches and lands, the notches being radially aligned with the pins and the lands serving to prevent distal movement of the drive means when out of alinement with a pin.

5. In combination with a multiple-dose injection syringe as defined in claim 1, an ampule the slidable plunger of which consists of an elastomeric substance having embedded in it a rigid disc perpendicular to its axis, said disc having a diameter at least 80 percent of the plunger diameter and being spaced from the distal surface of the plunger not more than 15 percent of the plunger axial length.

6. A multiple-dose injection syringe as defined in claim 1 having check means interposed between adjacent stops of the plurality of adjustable stops, said means being

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adapted to prevent distal movement of the drive means when out of alinement with an adjustable stop.

7. In a multiple-dose injection syringe of the type having a barrel adapted to contain an ampule connected with an injection needle and having a slidable plunger, having a body containing drive means for the plunger and having manually operated means acting on said drive means to advance the plunger, the improvement which comprises: a smooth push rod adapted when advanced in the syringe to move the slidable plunger distally in the ampule, one-way drive means consisting of a drive washer of substantial thickness surrounding the push rod with a close but free slip fit and having an eccentric extension engaging a manually operated lever arranged to cock the washer on the rod and advance washer and push rod distally, a compression spring opposing the cocking and movement of the drive washer, a releasable stop consisting of a split washer engaging the push rod and a compression spring arranged to prevent proximal movement of the push rod, means to disengage the split washer from the push rod, and a plurality of adjustable stops consisting of a plurality of pins of different lengths mounted parallel to the push rod on a rotatable disc surrounding the push rod and arranged to be brought one at a time into the path of the drive washer on rotation of the disc.

8. In a multiple-dose injection syringe as defined in claim 7, the further improvement which consists of a cup-shaped guide shell affixed to the rotatable disc surrounding the push rod, said guide shell having a rim projecting from the disc in the same direction as the pins and surrounding the pins and push rod, the rim being provided with alternate notches and lands, the notches being radially aligned with the pins and the lands serving to prevent distal movement of the drive means when out of alinement with a pin.

No references cited.