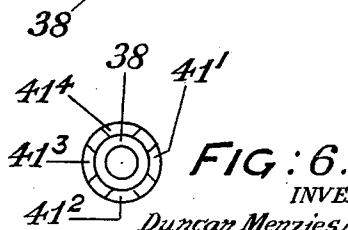


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2 SHEETS--SHEET 1



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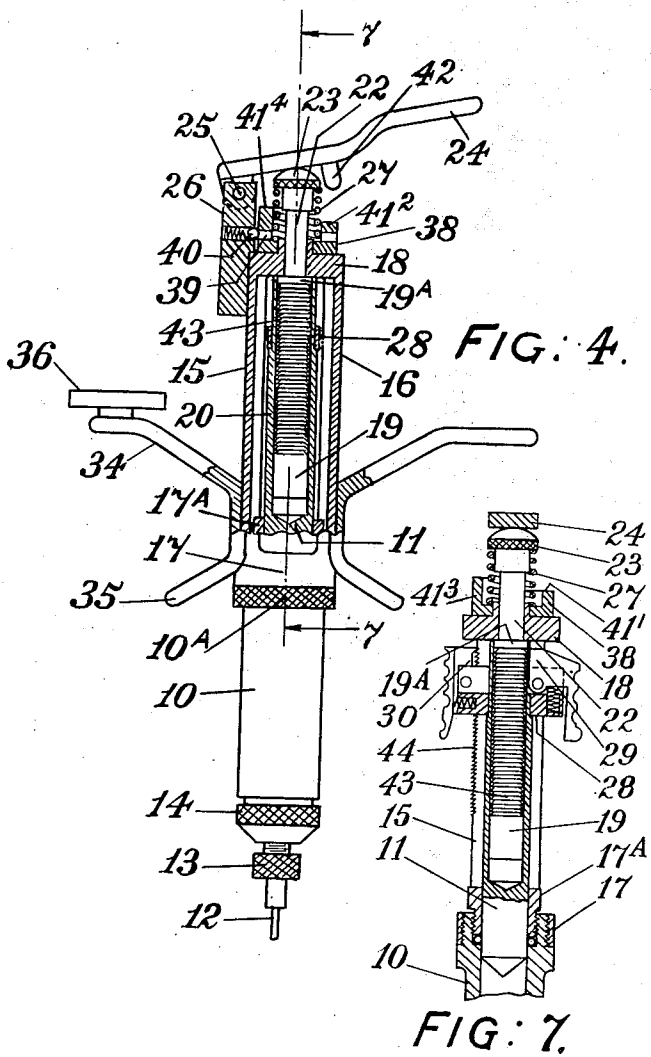
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2,585,815

INJECTION SYRINGE

Filed Feb. 25, 1948

2 SHEETS—SHEET 2



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2,585,815

INJECTION SYRINGE

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Application February 25, 1948, Serial No. 10,682
In Great Britain January 16, 1947Section 1, Public Law 690, August 8, 1946
Patent expires January 16, 1967

10 Claims. (Cl. 128—218)

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This invention relates to injection syringes, namely intradermic or hypodermic syringes, of the type comprising a cylinder forming a receptacle for a fluid to be injected into or under the skin of a body and a plunger in the cylinder, the plunger extending from the cylinder and being adapted to be pressed into the cylinder in order to eject therefrom a dose of the fluid.

The invention is especially although not exclusively concerned with injection syringes used by veterinary surgeons, for example to give injections to cattle. These syringes are frequently used under conditions which call for what might be termed rough and ready handling; for example, when a veterinary surgeon is using a syringe to give injections to cattle in bad light, as is the case in many cowsheds. Thus, it is often impracticable to ensure that a syringe will be treated with care between injections. Errors in judgment on the part of the surgeon may lead to seriously wrong dosage of the cattle.

An object of this invention is to provide a syringe of the type stated which will be capable of use with precision and reliability under even the worst conditions met with in a veterinary surgeon's practice, a feature of the invention being an improved mechanism whereby the action of depressing the plunger to eject a dose from the cylinder automatically sets the syringe in readiness for the next dose.

Another object of the invention is to provide an injection syringe of the type stated in which the plunger is associated with a manually depressible member in telescopic relation with the plunger and in which means on the frame of the syringe guide said member and limit it to depressive and return axial movements of definite size, corresponding to a dose.

Another object is to provide a plunger that is hollow, the manually depressible member to be formed as a ratchet-toothed rod extending with a sliding fit into the plunger.

Examples of injection syringes embodying the invention will now be described with reference to the accompanying drawings.

Fig. 1 is a side elevation of an injection syringe. Fig. 2 is a sectional elevation, the section being on the line 2—2 of Fig. 1. Fig. 3 is a sectional plan, the section being on the line 3—3 of Fig. 1.

Fig. 4 is a fragmentary sectional side elevation showing a modification. Fig. 5 is an elevation and Fig. 6 is a plan of a part incorporated in the modification. Fig. 7 is a section on the line 7—7 of Fig. 4.

Referring to Figs. 1 to 3, the injection syringe

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comprises a cylinder 10 forming a receptacle for the fluid to be injected and a plunger 11 extending slidably from the interior of the cylinder. The injector of the syringe as usual is a fine-bore tubular needle 12 (Fig. 1 only) which in the example is secured by a nut 13 to a fine-bore cap 14 screwed into the bottom end of the cylinder 10. The cylinder forms a part of the syringe's frame, another part of which is a support in the form of an open cylindrical casing consisting of side limbs 15 and 16 and two end pieces 17 and 18. The bottom end piece 17 is internally screw-threaded, being screwed upon the head 10A of the cylinder 10. A gland 17A is screwed into the cylinder head 10A. The open casing and plunger are fitted with ratchet-and-pawl mechanism that permits the plunger to be depressed step-by-step, each step corresponding to a dose of the fluid to be injected.

In the example, the plunger 11 is hollow and has its upper end open to receive a component of the ratchet-and-pawl mechanism. The component is in effect the ratchet; it is a rod 19 which is in telescopic relation with the plunger, being a neat sliding fit in the hollow portion 20 of the plunger, and which has ratchet-teeth 21 in the form of a series of circular ridges with intermediate grooves. Each ridge has the form of a downwardly directed tooth. The ratchet-rod 19 is supported at its upper end 22 by a bearing in the top end piece 18 of the open casing, the bearing serving as a guide for the rod 19. The ratchet-rod 19 is slidable up and down in said bearing to a short extent, the top and bottom limits of its sliding movement being defined by a stop collar 19A on the rod 19 and a stop 18A upstanding from the bearing piece 18. The stop 18A is engageable by a cap 23 at the top of the ratchet-rod 19. The cap 23 bears against a small hand lever 24 which is fulcrumed at 25 to a bracket 26 at the top of the partly open casing and which is movable up and down, the upper limit of its movement being defined by the point of engagement between the butt 24A of the lever and the bracket 26. A return spring 27 is interposed between the bearing piece 18 and the cap 23 of the ratchet-rod. The arrangement is such that the hand lever 24 can be depressed to slide the ratchet-rod 19 a short but definite step downwards and that when the hand lever is released the ratchet-rod will be returned with the hand lever by the spring action.

The pawl component of the mechanism includes a block 28 forming the plunger head. On this head, at opposite sides, two spring-pressed

pawls 29 and 30 are pivotally mounted. One of these, namely the pawl 29, is the pawl proper or driver of the mechanism, being engaged by the ratchet teeth 21 through a recess 31 in the plunger head 28. The arrangement is such that when the ratchet-rod is depressed, the pawl 29 and the plunger 11 are forced to move a step downwards. The other pawl 30 is a detent, or stop-pawl; it cooperates with a series of teeth 32 on the limb 15 of the open casing and serves to maintain the plunger 11 in position after each depression, so that when the ratchet-rod 19 returns upwards after making each step, the plunger does not return. That is to say, in the operation of the syringe, the plunger 11 moves step-by-step downwards from the internal ratchet-rod 19. The two pawls 29 and 30 are formed with finger grips 33 by which they can be simultaneously pressed from the associated teeth 21 and 32, thus enabling the user of the syringe to use the pawls as a handgrip in order to withdraw the plunger to the start of its range of movement.

One of the limbs 15 and 16 of the open casing may be marked with a graduated scale to indicate the number of doses contained in the cylinder. In the example, the syringe is designed to hold twenty doses, and the ratchet-and-pawl mechanism is designed to impart twenty steps to the plunger, the teeth 21 and 32 being all spaced apart to an extent corresponding to a single dose. Therefore, an appropriate scale to indicate the number of doses ejected, if any, comprises the numbers "0," "5," "10," "15" and "20" marked on the limb 16 in line with the teeth 32 cooperating with the detent 36. There may be an extra scale on the limb 15 marked in reverse order "20," "15," "10," "5" and "0" to indicate the number of doses still contained in the syringe.

In use of the syringe, assuming that it is filled, in order to make an injection of a dose of liquid the user inserts the needle 12 into or through the skin of the user and depresses the hand lever 24, which returns under the spring action leaving the syringe automatically set for injection of the next dose.

The syringe according to the example, by virtue of the features of construction herein described, has certain advantages namely:

The plunger being encased within the frame parts 15 to 18 is safeguarded even when fully withdrawn against lateral pressure so that there is no risk that the plunger may become bent, or skewed, in the cylinder, a happening which would lead to slackness in the fit of the plunger and excessive friction; and such slackening of the plunger fit is highly undesirable in an instrument required to give precise doses. Moreover, slackening of the plunger fit and excessive friction are avoided by the manner in which the force due to depression of the hand lever 24 is transmitted to the plunger, namely, through the ratchet-rod 19 which is a component separate from the plunger and which is independently guided axially of the plunger by the bearing 18 and which gives axial guidance and support to the plunger. Moreover, slackening of the plunger fit and excessive friction are avoided by having the line of action of the lever 24 and also the centre of the action of the stop 18A in the axis of the plunger; it will be manifest that if the lever acted at an inclination on the plunger or if the stop were offset from the plunger axis,

distortion of the instrument when heavy pressure was applied would result.

There is no practical risk that the plunger will be inadvertently depressed with resultant loss of fluid and reduction of the size of the next dose. That is to say, the plunger itself is safeguarded by the frame parts 15 to 18 from inadvertent pressure, and depression of the lever 24 is opposed by the spring 27. At the worst, inadvertent depression of the lever 24 would lead to the loss of a single dose. Thus, the instrument is distinguished from any previously known syringe whose plunger is exposed and can by pressure inadvertently be applied to it be depressed throughout the entire length of the cylinder.

The arrangement of the hand lever is such that, without adding to the overall width of the instrument, it gives a substantial mechanical advantage to the person making an injection; in the example, the advantage is about 3 to 1.

The syringe according to the example has various other features, namely:

To facilitate a steady hold of the syringe, it is provided with the usual wings 34 (lugs projecting laterally from opposite limbs 15 and 16 of the casing) and these wings are extended downwards along the casing and outturned with tails 35 at their lower ends, so that they provide a grip which, in combination with the hand lever 24, enables the user to grip the syringe firmly by his fingers, to exert a push-pull action and operate the syringe easily and steadily simply by exerting pressure at the root of his thumb on the hand lever. In addition, one of the wings 34 has a thumb-piece 36 to facilitate manipulation of the syringe. It is of considerable importance to the work of injecting cattle, because of the toughness of the skin into the structure of which the injection must be made and because the pressure to be exerted is often considerable, that the veterinary surgeon should be able with ease and firmness to manipulate the syringe and also exert the necessary push. He is enabled to do so by virtue of the combined hand lever 24 and holding means 34, 35 and 36 provided in the syringe according to the example.

To ensure a satisfactory sliding fit of the plunger 11 in the cylinder 10, including complete sealing against leakage, the cylinder head 10A is formed with an annular packing recess into the top of which the gland 17A is screwed. A packing ring 37 is held in the recess by this gland. The packing ring is circular in cross-section. The arrangement is such that the plunger 11 can be entirely withdrawn from the cylinder 10 and reinserted with ease and without injuring the packing.

In the modification according to Figs. 4, 5, 6 and 7, a syringe has an adjustment device by virtue of which the size of the doses can be varied to any of a range of sizes. In the device as illustrated, there are four sizes, for any selected one of which the device can be set.

The adjustment device comprises a castellated collar 38 which rests upon the bearing piece 18 of the open casing and which provides a seat for the spring 27 that presses upon the cap 23 of the ratchet-rod 19, the upper end 22 of which is slidable through the bearing piece. The collar 38 is rotatable by hand into any one of four available positions, 90° apart. Each of these positions is defined by one of four holes 39 in the collar which are engageable one at a time by a spring-pressed ball 40 in the bracket 26 to which the hand lever 24 is fulcrumed at 25.

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There are four castellations 41¹, 41², 41³ and 41⁴ of progressively different heights, and the lever 24 has a foot 42 which abuts against one of these castellations whenever the hand lever 24 is fully depressed. The ratchet rod 19 has much finer teeth 43 than in the syringe according to Figs. 1 to 3, the teeth 43 being so spaced that four of them correspond to the maximum size dose to be had when the collar 38 is set so that the lowest castellation 41¹ will be contacted by the foot 42. In Fig. 4, the collar 38 is set for the second largest dose, the castellation 41² being in the contact position. Thus it will be seen that each castellation, when appropriately positioned, functions as a stop that determines the extent that the plunger can be pressed into the cylinder of the syringe in order to inject a dose of the fluid.

In Figs. 7, the teeth 44 with which the detent 30 cooperates on the limb 15 are finely spaced similarly to the teeth 43. In other respects, the syringe is the same as shown in Figs. 1 to 3, and corresponding parts are indicated by the same reference characters.

I claim:

1. An injection syringe comprising a cylinder to receive a fluid, an injector on the cylinder, a support on the cylinder, a guide on said support, a hollow plunger in the cylinder and extending therefrom in association with said support, wings on the support formed with out-turned tails, the wings and tails being engageable by the fingers of the user of the instrument to effect push-pull action, a rod member extending through said guide and into the hollow plunger, ratchet-teeth on said rod member, a spring-pressed pawl on said plunger engaged by said ratchet-teeth, a hand-operable lever member fulcrumed on said support, being depressible by the hand of the user and being arranged to depress said rod member, pawl and plunger to cause ejection of a dose of fluid from said cylinder and through said injector, a spring interposed between said support and said rod member to return the rod member and lever member following each depression thereof, corresponding ratchet-teeth on said support, a spring-pressed detent on said plunger engaging said corresponding ratchet-teeth and thus holding the plunger and pawl against return with the rod member, an adjustable stop device interposed between said support and said lever member, said device presenting at different levels a plurality of stops individually contactable by one of said lever and rod members and serving to determine the size of each dose, and means for holding said device in its position of adjustment.

2. An injection syringe comprising a cylinder to receive a fluid, an injector on the cylinder, a plunger extending from the cylinder and being adapted when depressed to eject therefrom through the injector a dose of the fluid, means on the cylinder for depressing the plunger, ratchet-and-pawl mechanism applied to the plunger to limit the depression thereof to definite steps, an adjustable stop device on the cylinder, said device presenting at different levels a plurality of stops individually contactable by said depressing means and serving to determine the size of each dose, and means for holding said device in its position of adjustment.

3. An injection syringe comprising a frame, a cylinder connected with the frame to receive a fluid, an injector on the cylinder, a plunger extending from the cylinder and being adapted

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when depressed to eject therefrom through the injector a dose of the fluid, manually depressible means on the frame for depressing the plunger, ratchet-and-pawl mechanism interposed between said depressible means and the frame on the one hand and the plunger on the other hand to transmit successive depressions of said means to said plunger as steps, each step representing one dose, an adjustable stop device on said frame, said device presenting at different levels a plurality of stops individually contactable by said depressible means and serving to determine the size of each of said steps, and means for holding said device in its position of adjustment.

4. An injection syringe comprising a cylinder to receive a fluid, an injector on the cylinder, a support on the cylinder, a guide on said support, a hollow plunger in the cylinder and extending therefrom in association with said support, wings on the support formed with out-turned tails, the wings and tails being engageable by the fingers of the user of the instrument to effect push-pull action, a rod member extending through said guide and into the hollow plunger, ratchet-teeth on said rod member, a spring-pressed pawl on said plunger engaged by said ratchet-teeth, a hand-lever member fulcrumed on said support, said lever member being depressible by the hand of the user and being arranged to depress said rod member, pawl and plunger to cause ejection of a dose of fluid from said cylinder and through said injector, a stop on said support for engagement by one of said two members in order to limit the depression of said rod member, a spring interposed between said support and said rod member to return the rod member and lever member following each depression thereof, corresponding ratchet-teeth on said support, and a spring-pressed detent on said plunger engaging said corresponding ratchet-teeth and thus holding the plunger and pawl against return with the rod member.

5. An injection syringe comprising a cylinder assembly including a cylinder to receive a fluid, an injector on the cylinder assembly, a hollow plunger in the cylinder and extending therefrom, a rod extending into the hollow plunger, ratchet-teeth on said rod, a pawl on said plunger engaged by said ratchet-teeth, hand means on said cylinder assembly depressible by the hand of a user of the syringe and being arranged to depress said rod, pawl and plunger to cause ejection of a dose of fluid from said cylinder and through said injector, said hand means, rod, pawl and plunger constituting a depressible assembly, spring means interposed between said support and said rod to return the rod and hand means following each depression thereof, and an adjustable stop device interposed between said two assemblies, said device presenting at different levels a plurality of stops individually contactable by a part of one of said two assemblies and serving to determine the size of each dose.

6. An injection syringe comprising a frame, a cylinder connected with the frame to receive a fluid, an injector on the cylinder, a hollow plunger extending from the cylinder and being adapted when depressed to eject therefrom through the injector a dose of the fluid, an actuating member on the frame for depressing said plunger, ratchet-and-pawl mechanism interposed between the actuating member and frame on the one hand and the plunger on the other hand, said mechanism including a ratchet-toothed member that extends into the plunger and forms a one-way

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operative connection therewith, a stop device on said frame, said device being contactible by one of said two members, namely the actuating member and the ratchet-toothed member, and serving to determine the size of each dose.

7. An injection syringe as claimed by claim 6 in which the ratchet-and-pawl mechanism comprises two pawls mounted on the plunger, one of said pawls being engaged by the ratchet-toothed member that extends into the plunger, and ratchet teeth provided on said frame and engaged by the other of said pawls to prevent retrograde movement of the plunger.

8. An injection syringe comprising a frame that includes a cylinder to receive a fluid, a plunger extending from the cylinder and being adapted when depressed to eject from the cylinder a dose of the fluid, ratchet-and-pawl mechanism applied to the plunger, said mechanism consisting of a manually depressible ratchet-toothed member in telescopic relation with the plunger, a ratchet-toothed rack on the frame and pawls on the plunger engaging the ratchet-teeth of said member and rack, respectively, and means on said frame for guiding said member and plunger, said mechanism serving to transmit recurrent depressive movements from said member to the plunger and to prevent return movement of the plunger.

9. An injection syringe comprising a cylinder to receive a fluid, a support uprising from the cylinder, a spring-return member guided by said support and depressible inside it, a series of down-turned ratchet teeth on said member, another series of down-turned teeth on said support, a hollow plunger extending from said cylinder and being a sliding fit on said ratchet-toothed mem-

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ber, and two pawls on said plunger respectively engaging said two series of teeth, the one pawl serving as a driver between said member and the plunger and the other pawl serving as a detent for the plunger.

10. An injection syringe comprising a cylinder to receive a fluid, a support uprising from the cylinder, a bearing at the top of said support, a spring-return member guided by said bearing and depressible inside said support, a series of down-turned ratchet teeth on said member, another series of down-turned teeth on said support, a hollow plunger extending from said cylinder into said support and being a sliding fit on said ratchet-toothed member, two pawls on said plunger respectively engaging said two series of teeth, the one pawl serving as a driver between said member and the plunger and the other pawl serving as a detent for the plunger, and means on said member contactible with surfaces on said bearing to limit depressive and return movements of said member.

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