July 7, 1970 O. H. BANKER 3,518,990

GUN TYPE INOCULATOR

Filed May 2, 1968 2 Sheets-Sheet 1

FIG. 1

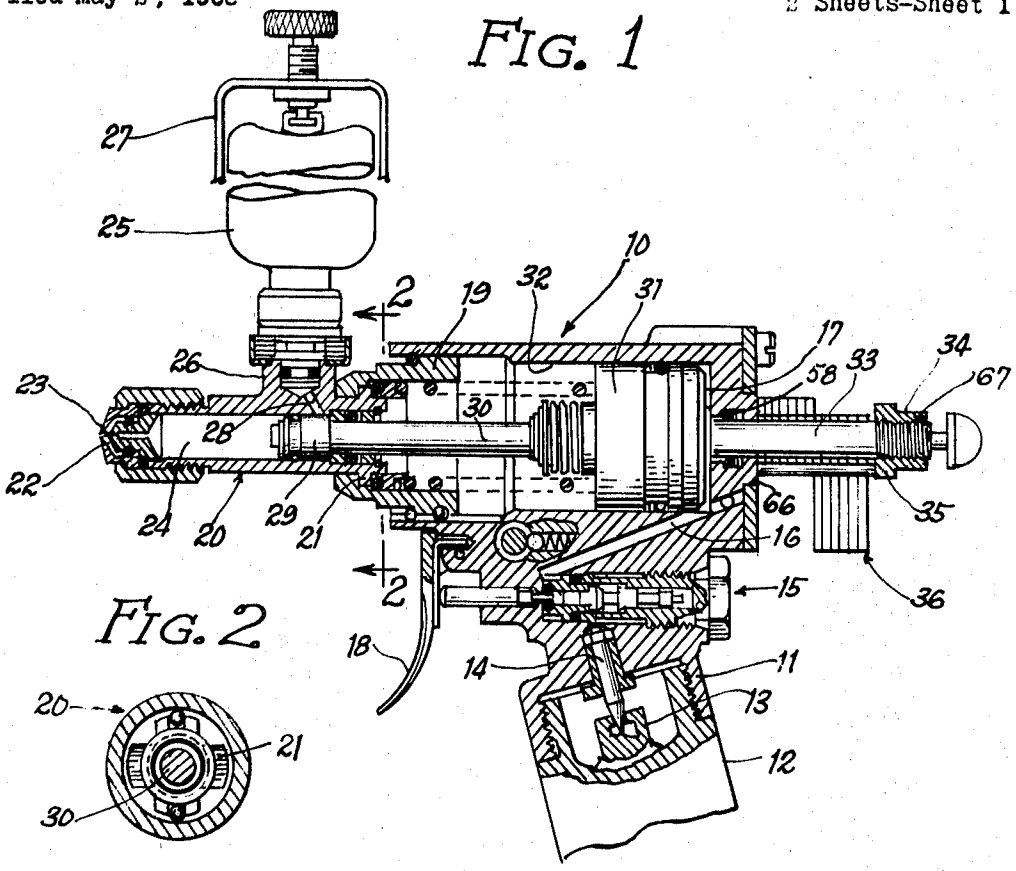


FIG. 2

FIG. 3

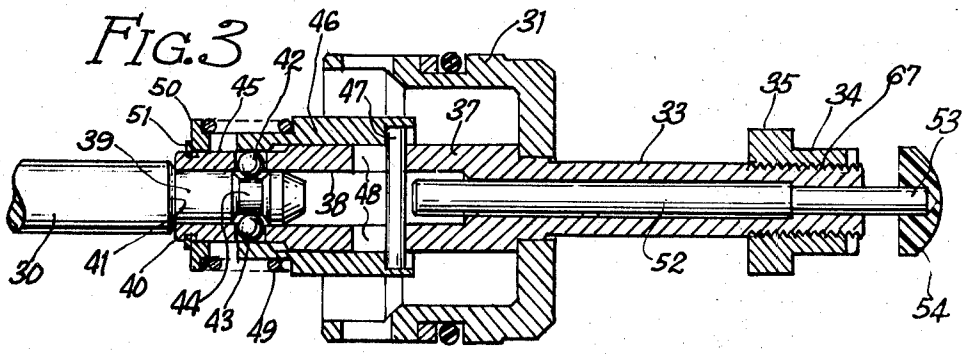
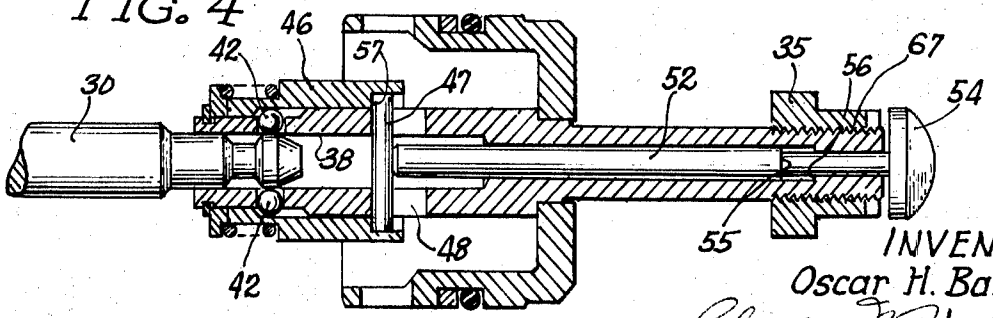


FIG. 4



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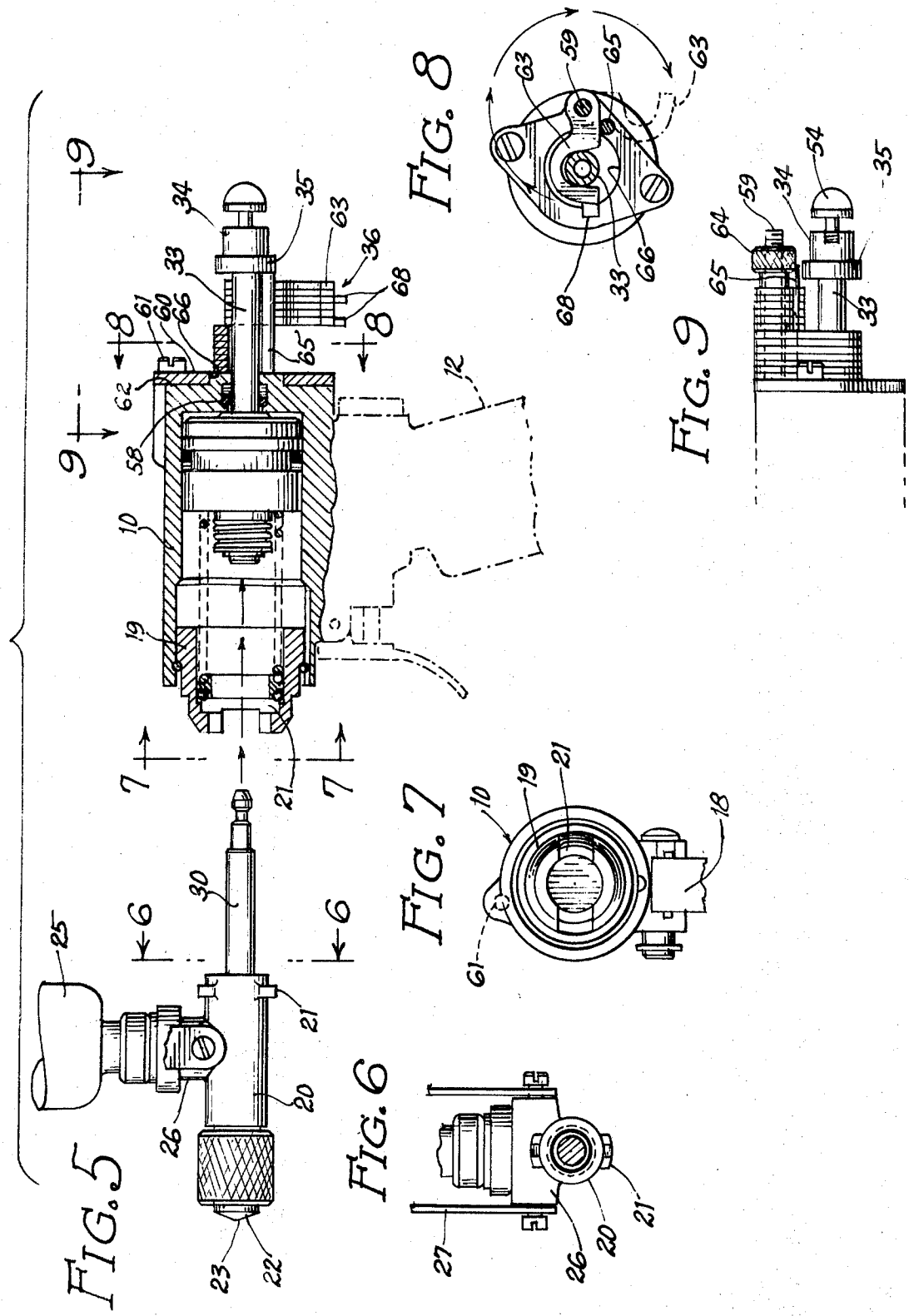
GUN TYPE INOCULATOR

Filed May 2, 1968 2 Sheets-Sheet 2



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GUN TYPE INOCULATOR

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Int. Cl. A61m 11/00
U.S. Cl. 128—173 11 Claims

ABSTRACT OF THE DISCLOSURE

In a gun type inoculator for giving mass injections wherein a removable inoculant pump is provided which is permanently connected to a source of inoculant, means are provided for quickly releasing the pump and its connected source of inoculant from the gun to remove it for quickly changing from one drug to another and includes a remotely controlled ball-type coupling between the piston rod of the pump and the piston rod of the gun. Shim means is provided for simply and accurately regulating the stroke of the pump piston end therefor the dose injected by each operation of the inoculator.

This invention relates to gun type inoculators for giving mass inoculations.

In my prior Pat. No. 3,292,622, granted Dec. 20, 1966, for Power Operated Inoculator, there is disclosed an inoculator gun having a fluid-operated piston which is connected to the rod of a smaller piston forming part of an inoculant pump. The latter has a small orifice through which the inoculant is ejected, and has further a suction chamber connected to a vial of the inoculant secured to the pump. The pump and its attached vial are removable as a unit, so that the physician or nurse can change inoculants. Of necessity, for preventing exposure of the interior of the pump to atmosphere, the piston of the inoculant pump and its rod must remain with the pump and hence, when the pump is removed, the rod must be disconnected from the fluid-operated piston by which it is operated.

In my said prior patent, the rod is disclosed as being connected to the fluid-operated piston by being threaded into an extension of the said piston. To remove the inoculant pump or "head" as it is sometimes called, the rod must be unscrewed from the fluid-operated piston, which is a somewhat awkward operation in view of the (unsymmetrical) shapes of both the head and gun, and besides, the unscrewing operation is slower than desired.

It is accordingly an object of this invention to provide a quick-disconnect coupling between the rod of the inoculant pump piston and the fluid-operated piston of an inoculator by which the pump and its piston can be quickly disconnected from the gun for removal therefrom.

In my aforesaid patent there is also disclosed a dosage-gauging device which is movable with the fluid-operated piston and the coupling device for the pump piston. Said dosage-gauging device is in the form of cylindrical spacers which encircle a portion of the coupling device so that when it is desired to change the dosage, it is necessary partially to disassemble the pump, remove the gauging device, replace it with the desired one and then reassemble the pump.

A further object of this invention is the provision of an improved dosage-gauging device for the foregoing inoculator which remains with the inoculator gun, but is nevertheless quickly adjustable to vary the dosage produced by the pump.

These and other objects and features of this invention will become apparent from the following detailed description of a preferred embodiment of the invention

when taken together with the accompanying drawings in which:

FIG. 1 is a fragmentary side elevational view partly in section of the invention as applied to an inoculator gun;

FIG. 2 is a section through a portion of the coupling device taken along line 2—2 of FIG. 1 and looking in the direction of the arrows at the ends of said line;

FIG. 3 is an enlarged elevation in section of the coupling means for the pump in its normal operating condition;

FIG. 4 is a view corresponding to FIG. 3 showing the coupling in its disengaged condition;

FIG. 5 is an exploded view of the gun of FIG. 1 showing the pump and its piston rod disconnected from the gun itself;

FIG. 6 is a section taken through the pump of FIG. 5 along line 6—6 thereof and looking toward the left in that figure;

FIG. 7 is an end elevational view of the gun of FIG. 5 from the position of line 7—7 thereof and looking in the direction of the arrows at the end of said line;

FIG. 8 is an end elevational view in section of the gun of FIG. 5 taken along line 8—8 and looking in the direction of the arrows at the end thereof; and

FIG. 9 is a plan view of the gauge portion of the gun of FIG. 5 taken from the position of line 9—9 in FIG. 5.

The coupling and gauging means of this invention may be applied to various forms of inoculators and the one hereinafter to be described therefore is to be taken merely as illustrative of the manner in which the invention may be used. Thus the inoculator selected to illustrate this invention is comprised of a main hollow body 10 in the form of a horizontal cylinder from which depends a flange 11 into which is threaded a handle 12. Within handle 12 may be disposed a source of gas under pressure in the form of a small bottle 13 connected by a tube 14 to a control valve 15 from which the compressed gas is conducted through a passage 16 to the interior 17 of the main body 10. An appropriate trigger mechanism 18 is used to operate the control valve 15.

The interior 17 of body 10 constitutes a cylinder the front end of which is closed by a sleeve 19 into which projects the inoculant pump 20. A bayonet type joint 21 serves to removably lock the pump 20 in sleeve 19 (FIG. 2).

Pump 20 has a nozzle 22 at one end thereof through the orifice 23 of which inoculant is ejected from the interior 24 of the pump. The inoculant is introduced into pump 20 from an inverted vial 25 appropriately clamped to a hollow boss 26 on pump 20 by a U-shaped strap 27 (shown turned 90° from its normal position in FIG. 1). Hollow boss 26 communicates with pump interior 24 through a passage 28 connecting the two. Ejection of inoculant is effected by the reciprocation of a pump piston 29 in the interior 24 of the pump past the passage 28, the reciprocation producing a suction stroke during which the inoculant is transferred from the vial to the interior of the pump and a pressure stroke during which the inoculant is ejected through orifice 23. It may be apparent that the length of the stroke of piston 29 determines the volume of inoculant ejected. As shown in detail in my aforesaid patent, piston 29 has a valve which cooperates with piston rod 30 to allow the inoculant to flow between the piston 29 and piston rod 30 during the suction stroke of the rod and to prevent such passage of inoculant during the pressure stroke thereof. Thus piston 29 is actually a form of sleeve which is spaced from rod 30 and is appropriately sealed with respect thereto during the pressure stroke, but is separated therefrom by the suction stroke.

The piston rod 30 is connected to a larger piston 31 which may be called the "operating" piston and which

reciprocates in the cylinder **32** formed in the interior of main body **10**. Said operating piston **31** is in turn secured to a hollow rod **33** which extends outwardly from body **10** to the right, as viewed in FIG. 1, through an opening therein in which is a seal ring **58**, and has secured to the free end thereof a sleeve **34** on which is a radially extending flange **35**. The novel dosage gauging device **36** of this invention, to be hereinafter described in detail, is retained between flange **35** and body **10**.

It may be observed from the description thus far given that to maintain the interior of the inoculant pump **20** in a sterile condition at all times, it is necessary that piston **29** and rod **30** be retained with the pump whenever the pump and its vial **25** are removed from the gun body **10**. Such removal may be necessitated, for example, when the inoculant is to be changed to a different kind, in which event it is simpler to remove the pump **20** and its vial **25** and replace the pump and vial with a second pump in which a vial containing the desired inoculant is already clamped. It is desirable to have a quick-release connection between the piston rod **30** and the operating piston **31**.

Referring now to FIGS. 3 and 4, the operating piston **31**, the piston rod **30**, and the connection therebetween, are shown on an enlarged scale and in section. In these figures hollow rod **33** is shown to have an enlarged end **37** against which operating piston **31** abuts, said enlarged end **37** having a counterbore **38** in which is received the reduced end **39** of piston rod **30**. The end **40** of hollow rod **33** abuts upon the shoulder **41** formed by the reduced end **39** of piston rod **30**.

The coupling between piston rod **30** and hollow rod **33** is comprised of one or more balls **42** which are received in round openings **43** disposed near the left hand end as viewed in FIGS. 3 and 4 of the hollow rod **33**. The radial thickness of said end region is less than the diameter of the balls **42**, but said balls are adapted to be received in a peripheral groove **44** in the reduced end **39** of rod **30**, so that when the balls are retracted radially inwardly into groove **44** the outside surfaces of said balls do not extend beyond the outer surface **45** of the hollow rod **33**.

The possible positions of ball **42** are determined by a control sleeve **46** which surrounds the enlarged end **37** of rod **33**, as well as the portion thereof in which the balls are disposed. Said control sleeve **46** is made to embrace and bear axially against the ends of a radially disposed pin **47** which passes through axially oriented slots **48** in enlarged end **37** and through the counterbore **38**. The means by which control sleeve **46** is made to bear against the ends of pin **47** comprises a compression spring **49** which abuts upon sleeve **46** and upon a washer **50** held against axial movement to the left as viewed in FIGS. 3 and 4 by a snap ring **51**.

Outer surface **45** of enlarged end **37** represents a reduced diameter portion of the hollow rod **33** with reference to the diameter of the portion **37**. Since counterbore **38** is of constant diameter and extends into the portion **37**, the latter has a greater radial dimension than the portion in which the balls are retained. The radial dimension of this enlarged portion is made slightly larger than the diameter of the balls **42**. The interior of sleeve **46** is stepped so that when said control sleeve **46** is moved to the left, as viewed in FIGS. 3 and 4, to bring the portion of said sleeve of greater internal diameter in alignment with balls **42**, the latter may be moved radially outwardly so as not to extend into counterbore **38**. Thus it is apparent that by changing the axial position of control sleeve **46**, the balls **42** may be moved radially into groove **44** to lock piston rod **30** to the hollow rod **33** as shown in FIG. 3, or released to allow the balls to move radially outwardly to free the piston rod **30**, as shown in FIG. 4, and to allow said rod to be slid axially out of the counterbore **38**.

The position of control sleeve **46** is determined by a push rod **52** which passes through a portion of hollow rod **33** and into the counterbore **38** in proximity to pin **47**.

Push rod **52** also extends outwardly to the right, as shown in FIGS. 3 and 4, out of hollow rod **33** where its free end **53** is capped by a button **54**. Push rod **52** is retained in the hollow rod **33** by a shoulder **55** formed in push rod **52** and adapted to abut upon a shoulder **56** formed in hollow rod **33**. Other forms of stop for push rod **52** may suggest themselves to those skilled in the art.

Thus sleeve **46** may be moved to the left, as viewed in FIGS. 3 and 4, by pushing button **54** and its associated push rod **52** in the same direction relative to hollow rod **33** whereby the end of push rod **52** contacts pin **47** and moves said pin in its slots **48** toward the left in said FIGS. 3 and 4. The ends of pin **47** are received in a counterbore **57** in the control sleeve so that said sleeve is constrained to move with the pin against the action of compression spring **49**. The counterbore **57** also serves to retain pin **47** in control sleeve **46** in appropriately centered relation in the slots **48**. To move sleeve **46** to the right, as viewed in FIGS. 3 and 4, button **54** is released and spring **49** then is free to move the sleeve as well as the pin **47** and push rod **52** to the right, as viewed in FIGS. 3 and 4, to the position shown in FIG. 3. In the latter position, the balls **42** are retained in the peripheral groove **44** in piston rod **30** and serve to lock the latter to hollow rod **33**. When the balls **42** are moved outwardly, as in FIG. 4, pump **20** may be removed from body **10** by rotating the pump until the bayonet joint **21** is free, whereupon the pump and its piston rod **30** may be drawn axially out of body **10**. The withdrawn pump **20**, its vial **25** and piston rod **30**, are shown in FIG. 5.

The dosage gauge **36** is shown in greater detail in FIGS. 5, 8 and 9. It is comprised of a pin **59** which is secured to a plate **60** fastened by screws **61** or the like to the end **62** of body **10**. Pin **59** extends axially from plate **60** and is radially offset from hollow rod **33**. A plurality of hook-shaped shims **63** are threaded over pin **59** and are adapted to be clamped against plate **60** by a thumb nut **64**. The shims **63**, when loose, may be swung from a position wherein they are hooked over the hollow rod **33**, as shown in FIG. 8, to a position shown in dotted outline in that figure in which they are free of said rod. In both positions they abut against a second pin **65** which acts as a stop pin and prevents the shims from striking and marring rod **33**.

The thickness of each shim **63** and the number of shims may be so selected as to divide the stroke of the pump piston **29** into metric units of volume. Thus each shim **63** may represent a volume of one-tenth of a cubic centimeter, so that if the desired injection is one cubic centimeter, ten shims will be swung away from hollow rod **33** to the position shown in dotted outline in FIG. 8. The counting of the shims begins from the flange **35** and the shims not rotated to the dotted position shown in FIG. 8 constitute abutments in the path of movement of flange **35** which arrest the movement of the flange and its associated rod **33**. This, in turn, arrests the movement of the pump piston rod **30** and the pump piston **29** at a position to displace the desired amount of inoculant from the pump **20**. To simplify counting the shims, every shim representing a unit dosage may be provided with a tab **68**.

To compensate for production errors, sleeve **34** is adjustably mounted on rod **33**, preferably by threads **67**, so that its distance of flange **35** relative to the shims **63** may be accurately determined. After it is accurately located on rod **33**, sleeve **34** may be fixed to the rod by any well-known means.

Any selected dosage is fixed by turning thumb nut **64** to clamp the shims **63** against plate **60**. If another gradation of shims is desired, plate **60** is removed by loosening screw **61** and with it are removed shims **63** on their pin **59** and the stop pin **65**. Another plate **60** with its selected shims **63** is then fastened to body **10** by the screw **61**. This replacement of one dosage gauging device with another can be accomplished without disassembling any other part of the gun, inasmuch as plate **60** has an opening

66 therein which is large enough to allow the plate to pass over flange 35. Should the gun be operated inadvertently while a gauging device is removed, flange 35 will strike the body of the gun and prevent damage to the pump 20.

It is understood that shims 63 may be removed completely from pin 59 and replaced with other shims, instead of removing and replacing an entire gauging unit including plate 60. Removing and replacing only the shims may result in inadvertently mixing shims of different sizes which in turn may result in giving incorrect doses of the inoculant, and hence replacing the entire dosage gauging device is preferred.

The quick release coupling of this invention, with its push rod 52 passing through the hollow rod 33, and the quickly adjustable dosage gauge cooperating with the exterior of rod 33 make for a compact, simple and readily usable inoculator gun.

I claim:

1. An inoculator gun having a hollow body, an inoculant pump extending from one end of the hollow body, a reciprocable piston in said pump, a rod extending from the pump piston into the hollow body, said rod being secured to said piston, an operating piston in the hollow body disposed substantially concentrically with respect to the pump piston, a rod on the operating piston extending through the hollow body and outwardly from the opposite end of the hollow body, and disconnectable means for securing the inoculant pump to the hollow body characterized by quick-disconnect coupling means establishing a connection between the pump rod and the operating piston, a control element for the quick-disconnect means, and means extending from the said control element to the exterior of the operating piston rod for operating the said control element.

2. An inoculator gun as described in claim 1, characterized further in that said rod on the operating piston is hollow, and said means extending from said control element to the exterior of the operating piston rod passes through said hollow operating piston rod.

3. An inoculator gun as described in claim 1, characterized further in that said quick-disconnect coupling comprises an end of the pump piston rod telescoped into the operating piston rod, radially movable means interlocking the pump piston rod and the operating piston rod, and said control element comprising an axially slidable sleeve on the operating piston rod and movable from a position in which said radially movable means is held in position to interlock the pump piston rod and the operating piston rod to a position in which said radially movable means is released to move radially out of interlocking position with respect to the pump piston rod.

4. An inoculator gun as described in claim 1, characterized further in that a dosage-gauging device is provided on the hollow body, said dosage-gauging device comprising a pin on the body, a radially outwardly extending abutment on the said operating piston rod on the operating piston disposed outside of the body, and pivoted shims on the pin adapted to be selectively interposed between the abutment on the said operating piston rod and the body to arrest the movement of said operating piston rod into the body.

5. An inoculator gun as described in claim 4, characterized further in that means are provided for removably securing said pin to the body and said pin securing means has an opening therein through which the abutment is adapted to pass, such that said dosage device may be removed from the gun while the said abutment is mounted on the operating piston rod.

6. An inoculator gun as described in claim 4, characterized further in that releasable means are provided on the pin for clamping the shims to the pin.

7. An inoculator gun as described in claim 4, said shims being hook-shaped and adapted to hook around said rod on the operating piston into the path of movement of said abutment.

8. An inoculator as described in claim 4, and a stop pin for the shims supported on the body to limit rotation of said pivoted shims in one direction.

9. An inoculator gun as described in claim 4, and a stop pin located in the path of rotation of said pivoted shims in both directions of rotation thereof, said stop pin being supported on said body.

10. An inoculator gun as described in claim 4, said abutment comprising a sleeve, and means for adjusting the axial position of said sleeve on said operating piston rod.

11. An inoculator gun as described in claim 4, said abutment comprising a sleeve, cooperating threads on the sleeve and operating piston rod for adjusting the axial position of said sleeve on said operating piston rod, and means for fixing the sleeve in an adjusted position on said operating piston rod.

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