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AUTOMATIC INJECTION HYPODERMIC SYRINGE

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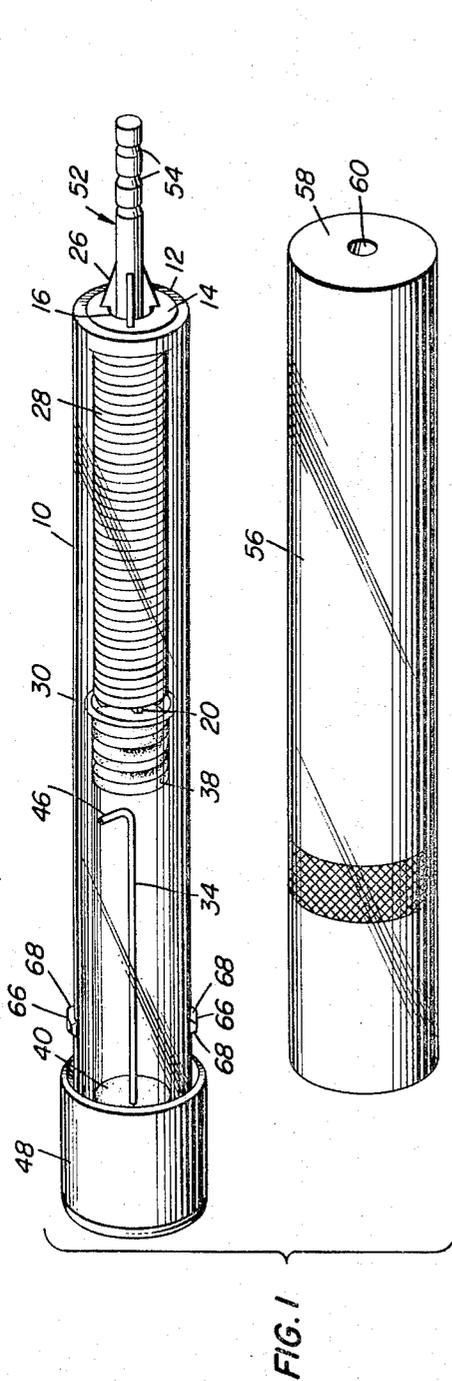
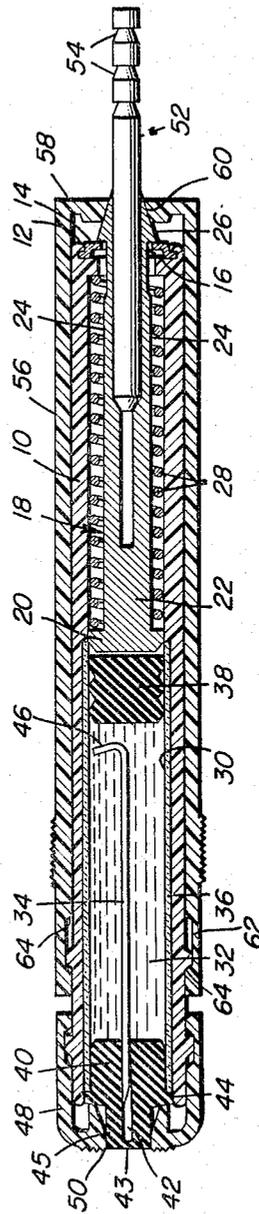


FIG. 2



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**AUTOMATIC INJECTION HYPODERMIC
 SYRINGE**

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This invention relates to hypodermic syringes of the automatic injection type, that is, of the type wherein a needle is ejected from a holder under substantial speed and force to an unsheathed position with simultaneous ejection of fluid therethrough.

Specifically, this invention is an improvement on the hypodermic syringe disclosed in the patent to Sarnoff et al., 2,832,339.

Since injector type hypodermic syringes are in use in very great numbers, any improvement thereon which would enable them to be simplified and be produced at less cost is an obvious desired goal. It is an object of this invention, therefore, to provide a syringe which will meet this goal in that the syringe of the invention requires the use of fewer parts.

Other objects will become apparent after consideration of the specification and the accompanying drawings in which

FIG. 1 is a perspective view of the syringe with a manipulating sleeve shown apart from the remainder of the syringe, and

FIG. 2 is a cross section of the devices of FIGURE 1 shown in assembled relation.

Referring to the drawings in greater detail, the reference character 10 represents an inner cylinder of transparent material, as glass or plastic material, open at the lower or left hand end and closed at the upper or right hand end, the closed end forming a base 12. The closure may be effected in any conventional manner as by fusing over the end of the cylinder, or by inserting and fusing in a glass button or, as is shown in the drawing, by fusing in a metallic washer 14. The base of the cylinder is provided with a circular opening, axially therethrough. In the preferred form, the washer 14 is an annular metallic member having a central aperture 16 with its periphery fused into the end of the cylinder. This washer affords a firm support for the conical head of a plunger, designated unitarily as 18. The plunger comprises a seat 20 at the lower end of a shank 22, the upper end of the shank terminating in resilient tines 24, here shown as four in number, the diameter of the tines at the aperture in the washer being smaller than that of said aperture. Each tine carries a portion of a frusto-conical head 26, the base portion of the head being normally of greater diameter than that of the group of tines and greater than the diameter of the aperture in said washer, and normally bearing against the upper surface of the washer. When the portions of the frusto-conical head are forced together, the diameter of the base portion is less than the diameter of the opening in the washer so that the plunger may be permitted to move downwardly of the inner cylinder. Compressed between the seat 20 and the inner or under surface of the washer is a stiff spring 28 coiled about the plunger.

Within the lower end of the inner cylinder is a vial 30 of transparent material, as glass, containing medication 32 and a hollow needle 34. The vial comprises a cylinder 36 open at both ends, with a piston 38 of rubber at the upper end and a stopper 40 preferably of resilient material, as rubber, at the lower end. The stopper is provided with a duct 42 snugly resiliently and slidably receiving the lower end of the needle, the end of which is bevelled as is usual in the art. A lower integument of rubber 43 closes off the duct and is adapted to be

penetrated by the needle when the plunger is released to the action of the spring, as will be explained. Preferably, the stopper is provided with a flange portion 44 engaging the lower edge of the vial cylinder and with an axial prolongation 45, part of which is the integument.

The needle at its upper end is provided with a bent end 46 at an acute angle to the needle axis, said bent end functioning both as an abutment means to be engaged by the piston when the piston is thrust toward the stopper and as a means to prevent withdrawal of the needle from the stopper after projection of the main portion of the needle through the stopper.

About the stopper end of the inner cylinder is a cap 48 suitably snapped or otherwise secured to the inner cylinder and provided with a central perforation 50 axially aligned with the duct in the stopper and surrounding the axial prolongation 49. If desired, the under face of the cap may be provided with concentric circular ridges or other roughened areas to prevent lateral slippage of the syringe when it is applied to the body of the user.

In order to prevent accidental use of the device there is provided a headless cylindrical pin 52 snugly fitting in between the tines and parts of the frusto-conical head whereby, when it is in place, it is not possible to compress the head parts toward each other to free the plunger. When the pin is withdrawn, it is possible to do so. To facilitate withdrawing of the pin by the fingers of an operator, the upper end thereof is provided with corrugations, as indicated at 54.

Cooperating with the assembly thus far described is an operating outer cylinder 56 which may be of glass or plastic material and which may be transparent, this cylinder being open at its lower end and closed off by an annular ring member 58 at its upper end. Extending to within the cylinder at the ringed upper end of this outer cylinder is a longitudinally tapered opening 60 of a size to fit freely over the cylindrical pin 52 and whose smallest internal diameter is sufficient to compress the parts of the head 26 toward each other, with the pin removed, sufficient to allow the head 26 to move through the opening in the washer and the spring 28 to drive the plunger downwardly through the inner cylinder. The outer cylinder is of a size to freely telescope over the inner cylinder and fit about the inner cylinder with no lateral play. At its lower end, the outer cylinder is provided with an annular recess 62, bevelled on the opposing faces, as indicated at 64, to be readily separably sprung over ridge sections 66 on the inner cylinder, bevelled on both upper and lower faces as indicated at 68, for ready assembly and separation of parts, the materials being sufficiently resilient to enable such coupling and decoupling of cylinders.

It is contemplated in the sale of the device that a kit of parts be sold including a number of the inner cylinder assemblies and with a lesser number, as one, outer cylinder.

In the use of the device, the outer cylinder 56 is slipped over the inner cylinder assembly and sprung over the ridges 66 while the safety pin 52 is still in place. The parts are then coupled together for use when desired. When intended to be used, the pin is withdrawn, the cap 48 is placed against the portion of the body into which an injection is to be made and the outer cylinder thrust down, telescoping the two cylinders. Since the pin is withdrawn, the conical surface 60 on the outer cylinder is enabled to press together the parts of the conical head 26, and the spring 28 then functions to drive the plunger downwardly which in turn drives the piston 38 downward toward the stopper 40. In doing so, the piston engages the upper end of the hollow needle 34 causing its bevelled end to advance and pierce the integument 43 and the needle to enter the body and also causing the contents of the

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vial 30 to be expelled through the needle and into the body. The spent inner assembly can then be discarded but the outer cylinder is saved and can be used again with another inner cylinder assembly.

Having thus described the invention, what is claimed is:

1. In a hypodermic syringe, an inner cylinder having an annular flange forming an axial opening in one end thereof, a plunger slidable in the inner cylinder, said plunger having a seat, a spring under compression between the seat of the plunger and the annular flange, said plunger having a group of resilient tines and a multi-part conical head larger in diameter at the base than the axial opening, one part on the end of each tine, the base portions of the parts of the head bearing against the exterior of the annular flange, a medicament containing vial in said inner cylinder, a piston at the end of the vial adjacent the plunger and movable longitudinally of the vial, a stopper at the other end of the vial, and a hollow needle held in the vial in position to penetrate the stopper, the needle having a stopper penetrating end, the upper end of the hollow needle being adapted to be driven by the piston when the piston is thrust through the vial toward the stopper, and a removable headless locking pin engaged snugly between the parts of the conical head and of a substantially uniform diameter throughout its length to prevent the freeing of the plunger by attempted movement of the parts of the head toward each other.

2. In a hypodermic syringe, an inner cylinder having an annular flange forming an axial opening in one end thereof, a plunger slidable in the inner cylinder, said plunger having a seat, a spring under compression between the seat of the plunger and the annular flange, said plunger having a group of resilient tines and a multi-part conical head larger in diameter at the base than the axial opening, one part on the end of each tine, the base portions of the parts of the head bearing against the exterior of the annular flange, a medicament containing vial in said inner cylinder, a piston at the end of the vial adjacent the plunger and movable longitudinally of the vial, a stopper at the other end of the vial, and a hollow needle held in the vial in position to penetrate the stopper, the needle having a stopper penetrating end, the upper end of the hollow needle being adapted to be driven by the piston when the piston is thrust through the vial toward the stopper, and a removable headless locking pin engaged snugly between the parts of the conical head to prevent the freeing of the plunger by attempted movement of the parts of the head toward each other, an outer cylinder having a base wall and an aperture in said base wall, the diameter of the locking pin throughout its length being no larger than the diameter of the opening in the base wall, said outer cylinder having an annular recess bevelled on the lower face of the recessed portion and said inner cylinder having ridges on the outer surface adapted to be engaged in and disengaged from said recess, said ridges having top and bottom bevelled surfaces to facilitate such engagement.

3. In a hypodermic syringe, an inner cylinder having an annular flange forming an axial opening in one end thereof, a plunger slidable in the inner cylinder, said plunger having a seat, a spring under compression between the seat of the plunger and the annular flange, said plunger having a group of resilient tines and a multi-part conical head larger in diameter at the base than the axial opening, one part on the end of each tine, the base portions of the parts of the head bearing against the exterior of the annular flange, a medicament containing vial in said inner cylinder, a piston at the end of the vial adjacent the plunger and movable longitudinally of the vial, a stopper at the other end of the vial, said stopper having a longitudinal duct extending partially therethrough and said duct terminating short of the outer end of the stopper, a hollow needle held in the duct of said stopper, the needle having a stopper penetrating end normally within the duct of the stopper, the upper end of the hollow needle

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being adapted to be engaged by the piston when the piston is thrust through the vial toward the stopper and an outer cylinder telescopically slidable on said inner cylinder, said outer cylinder having a base portion provided with a longitudinally tapered opening, the walls of said opening being adapted, when engaged with the parts of the frusto-conical head by telescopic collapsing motion of the cylinders, to draw said parts and the tines toward each other thereby to allow the plunger to be unlatched from the end of the inner cylinder and to enable the spring to release the plunger for driving the piston along the axial length of the vial in order to expel its contents through the needle and to cause the piston to engage the upper end of the needle and drive the needle through the material of the stopper, and a removable headless locking pin of a diameter no larger than the smallest diameter of the tapered opening in the outer cylinder engaged snugly between the parts of the conical head to prevent the freeing of the plunger.

4. In a hypodermic syringe, an inner cylinder having an annular flange forming an axial opening in one end thereof, a plunger slidable in the inner cylinder, said plunger having a seat, a spring under compression between the seat of the plunger and the annular flange, said plunger having a group of resilient tines and a multi-part conical head larger in diameter at the base than the group of tines, one part on the end of each tine, the base portions of the parts of the head bearing against the exterior of the annular flange, a medicament containing vial in said inner cylinder, a piston at the end of the vial adjacent the plunger and movable longitudinally of the vial, a stopper at the other end of the vial, said stopper having a longitudinal duct extending partially therethrough and said duct terminating short of the outer end of the stopper, a hollow needle snugly but slidably held in the duct of said stopper, the needle having a stopper penetrating end normally within the duct of the stopper, the upper end of the hollow needle being adapted to be engaged by the piston when the piston is thrust through the vial toward the stopper, an outer cylinder telescopically slidable on said inner cylinder, said outer cylinder having a base portion provided with a longitudinally tapered opening, the walls of said opening being adapted, when engaged with the parts of the frusto-conical head by telescopic collapsing motion of the cylinders, to draw said parts and the tines toward each other thereby to allow the plunger to be unlatched from the end of the inner cylinder and to enable the spring to release the plunger for driving the piston along the axial length of the vial in order to expel its contents through the needle and to cause the piston to engage the upper end of the needle and drive the needle through the material of the stopper, and a removable headless locking pin engaged snugly between the parts of the conical head to prevent the freeing of the plunger, said pin having corrugations on its exposed end to enable easy grasping of the pin by the fingers of an operator and of a diameter throughout its length no larger than the smallest diameter of the tapered aperture.

5. In a hypodermic syringe, an inner cylinder having an annular flange forming an axial opening in one end thereof, a plunger slidable in the inner cylinder, said plunger having a seat, a spring under compression between the seat of the plunger and the annular flange, said plunger having a group of resilient tines and a multi-part conical head larger in diameter at the base than the group of tines, one part on the end of each tine, the base portions of the parts of the head bearing against the exterior of the annular flange, a medicament containing vial in said inner cylinder, a piston at the end of the vial adjacent the plunger and movable longitudinally of the vial, a stopper at the other end of the vial, said stopper having a longitudinal duct extending partially therethrough and said duct terminating short of the outer end of the stopper, a hollow needle snugly but slidably

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held in the duct of said stopper, the needle having a stopper penetrating end normally within the duct of the stopper, the upper end of the hollow needle having a bend to be engaged by the piston when the piston is thrust through the vial toward the stopper, an outer cylinder telescopically slidable on said inner cylinder, said outer cylinder having a base portion provided with a longitudinally tapered opening, the walls of said opening being adapted, when engaged with the parts of the frusto-conical head by telescopic collapsing motion of the cylinders, to draw said parts and the tines toward each other thereby to allow the plunger to be unlatched from the end of the inner cylinder and to enable the spring to release the plunger for driving the piston along the axial length of the vial in order to expel its contents through the needle and to cause the piston to engage the bend of the needle and drive the needle through the material of the stopper, and a removable headless locking pin engaged snugly between the parts of the conical head and between the tines to prevent the freeing of the plunger and of a diameter throughout its length no larger than the smallest diameter of the tapered aperture.

6. In a hypodermic syringe, a transparent inner cylinder having an annular flange forming an axial opening in one thereof, said flange being provided by an annular metallic washer set into an end of the cylinder, a plunger slidable in the inner cylinder, said plunger having a seat, a spring under compression between the seat of the plunger and the annular flange, said plunger having a group of resilient tines and a multi-part frusto-conical head larger in diameter at the base than the group of tines, one part on the end of each tine, the base portions of the parts of the head bearing against the washer, a transparent medicament containing vial in said inner cylinder, a piston at the end of the vial adjacent the plunger and movable longitudinally of the vial, a resilient stopper at the other end of the vial, said stopper having a longitudinal duct extending partially therethrough and said duct terminating short of the outer end of the stopper, a hollow needle snugly but slidably held in the duct of said stopper, the needle having a stopper penetrating end normally within the duct of the stopper, the upper end of the hollow needle having a bend to be engaged by the piston when the piston is thrust through the vial toward the stopper, a cap about the stopper end of the vial, said cap having a central aperture axially aligned with the duct in the stopper and an outer transparent cylinder telescopically slidable on said inner cylinder, said outer cylinder having a base portion provided with a longitudinally tapered opening, the walls of said opening being adapted when engaged with the parts of the frusto-conical head by telescopic collapsing motion of the cylinders, to draw said parts and the tines toward each other thereby to allow the plunger to be unlatched from the end of the inner cylinder and to enable the spring to release the plunger for driving the piston along the axial length of the vial in order to expel its contents through the needle and to cause the piston to engage the bend of the needle and drive the needle through the material of the stopper, and a removable headless locking pin engaged snugly between the parts of the conical head and between the tines to prevent the freeing of the plunger, said pin having corrugations on its exposed end to enable easy grasping of the pin by the fingers of an operator and of a diameter throughout its length no larger than the smallest diameter of the tapered aperture.

7. In a hypodermic syringe, an inner cylinder having a base provided with a longitudinal opening therethrough extending parallel to the axis of the cylinder, a plunger in said cylinder having a seat at one end, the opposite end

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of said plunger having a group of resilient tines with a conical head, a portion of said head being fixed on each tine, the base of the conical head being larger in diameter than the group of tines, said head in cocked condition of the syringe extending through the opening and having its base pressing against the outer face of the cylinder base, a spring under compression between the seat on the plunger and the base of the inner cylinder, a hollow needle and medicament at the opposite end of the cylinder, a piston engaged by said plunger when released operative to thrust the needle out of the cylinder and expel the medicament through the needle, a headless pin engaged between the portions of the head, and an outer cylinder adapted to be telescopically engaged with the inner cylinder, said outer cylinder having a base provided with a tapered aperture to freely slide over the headless pin in applying the outer cylinder to the remainder of the syringe and adapted when thrust to engage the conical head of the plunger, the tines of said plunger being adapted to move toward each other sufficient to free the plunger of restraint by the conical head to project the needle and expel the medicament there-through only when the headless pin had been removed from between the portions of the head and of a diameter throughout its length no larger than the smallest diameter of the tapered aperture.

8. In a hypodermic syringe, an inner cylinder having a base provided with a longitudinal opening therethrough extending parallel to the axis of the cylinder, said base being in the form of an annular metallic washer, a plunger in said cylinder having a seat at one end, the opposite end of said plunger having a group of resilient tines with a conical head, a portion of said head being fixed on each tine, the base of the conical head being larger in diameter than the group of tines, said head in cocked condition of the syringe extending through the opening and having its base pressing against the outer face of the washer, a spring under compression between the seat on the plunger and the base of the inner cylinder, a hollow needle and medicament at the opposite end of the cylinder, a piston engaged by said plunger when released operative to thrust the needle out of the cylinder and expel the medicament through the needle, a headless pin engaged between the portions of the head, and an outer cylinder adapted to be telescopically engaged with the inner cylinder, said outer cylinder having a base provided with a tapered aperture to freely slide over the headless pin in applying the outer cylinder to the remainder of the syringe and adapted when thrust to engage the conical head of the plunger, the tines of said plunger being adapted to move toward each other sufficient to free the plunger of restraint by the conical head to project the needle and expel the medicament there-through only when the headless pin had been removed from between the portions of the head and of a diameter throughout its length no larger than the smallest diameter of the tapered aperture.

References Cited by the Examiner

UNITED STATES PATENTS

2,489,600	11/1949	Tydings et al.	128—218
2,832,339	4/1958	Sarnoff et al.	128—218
3,115,135	11/1963	Sarnoff	128—218

FOREIGN PATENTS

1,172,205	2/1957	France.
1,081,192	5/1960	Germany.

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