United States Patent

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[54] **APPARATUS FOR UNITING A PLUNGER AND A PISTON OF A FULLY ASSEMBLED HYPODERMIC NEEDLE SYRINGE**
9 Claims, 7 Drawing Figs.

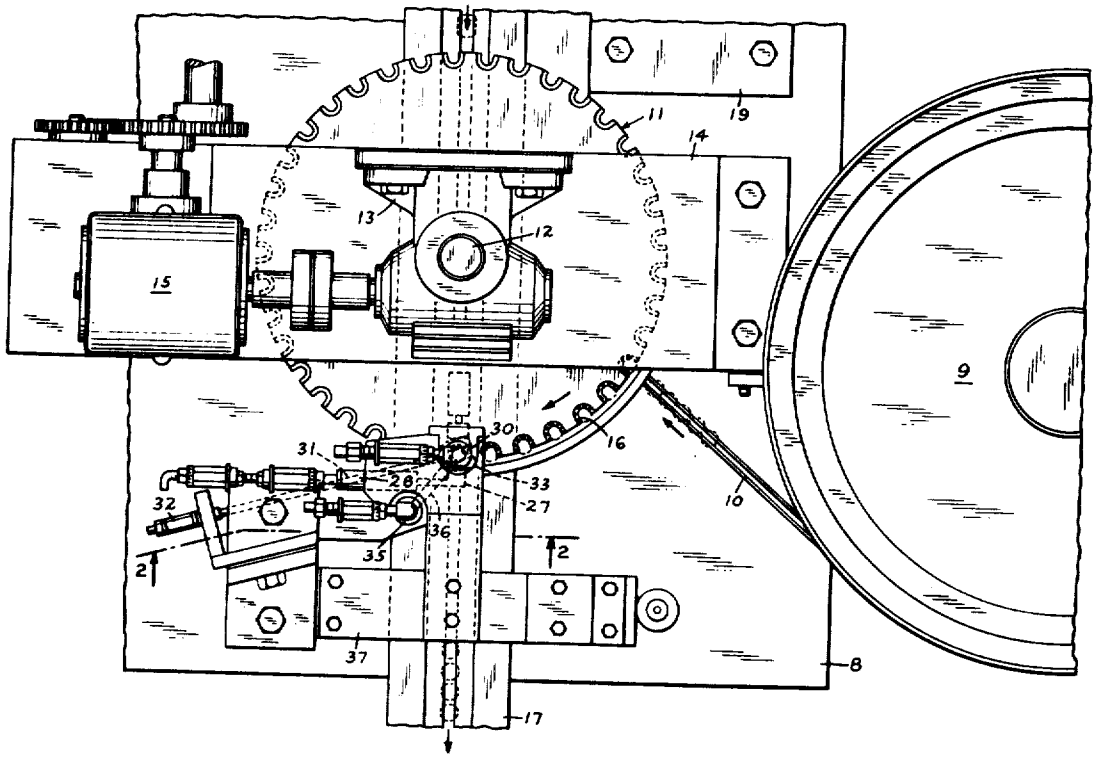
[52] U.S. Cl. ..... 29/208 B, 29/211, 29/240
[51] Int. Cl. B23p 19/04, B23g 7/10
[50] Field of Search ..... 29/208 B, 211, 240, 208 E, 208 C, 208 I, 211 C

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ABSTRACT: A plunger to actuate the piston of a fully assembled hypodermic needle syringe is united to said piston by moving the syringe longitudinally toward a stationary plunger to engage the piston with the plunger and rotating the syringe to unite the piston with the plunger. After the piston is united with the plunger, the syringe is lowered and removed from the apparatus.



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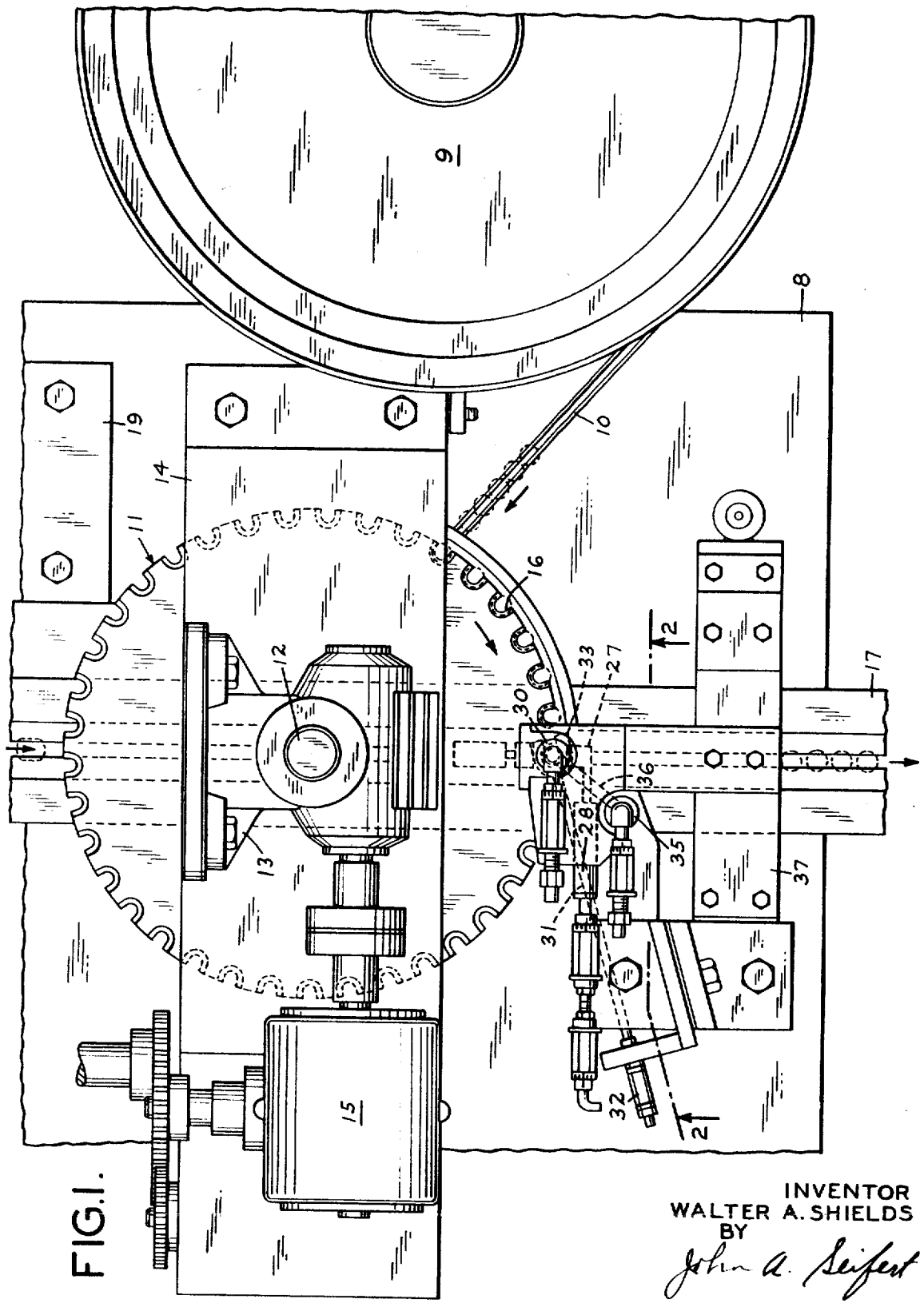
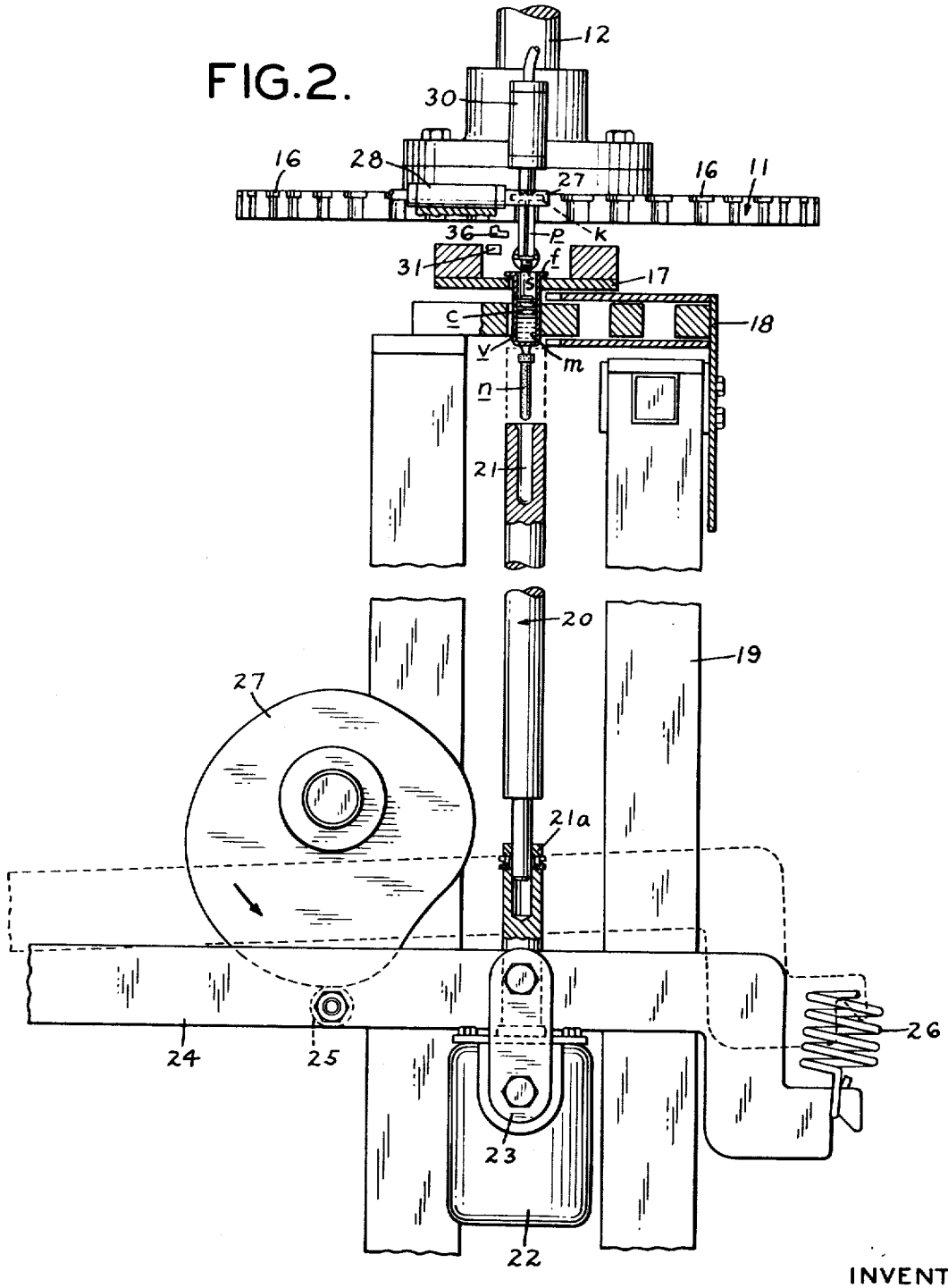


FIG. 1.

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FIG.2.



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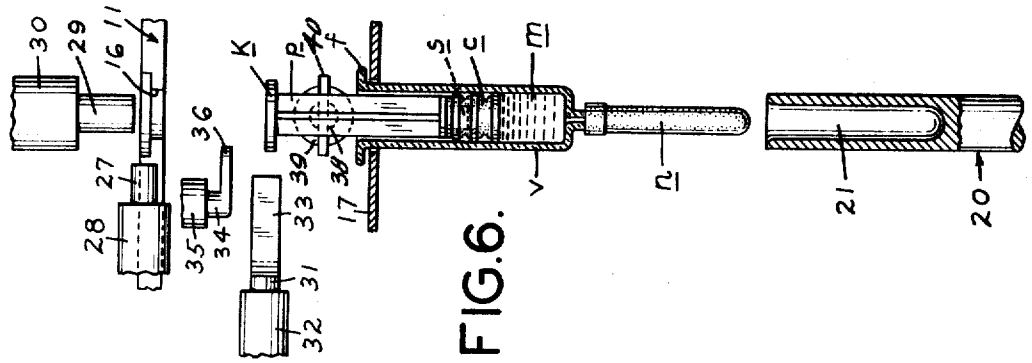


FIG.6.

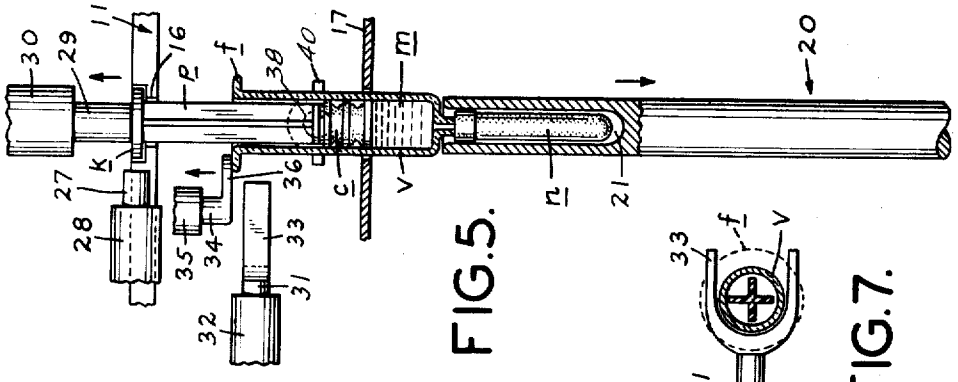


FIG.5.

FIG.7.

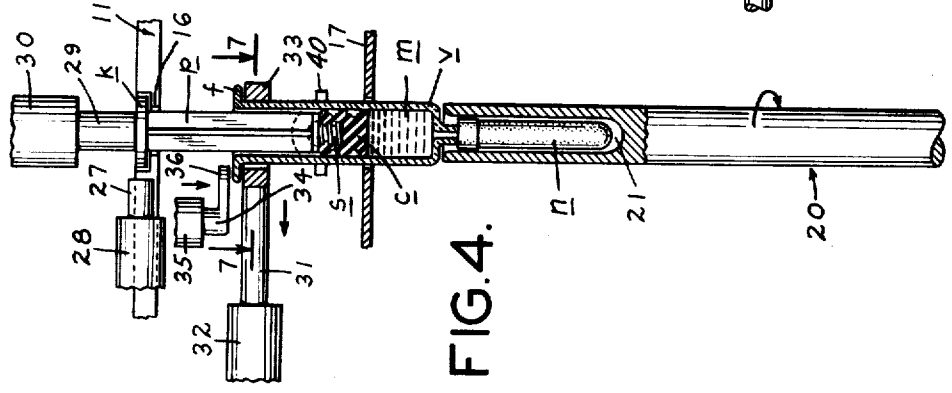


FIG.4.

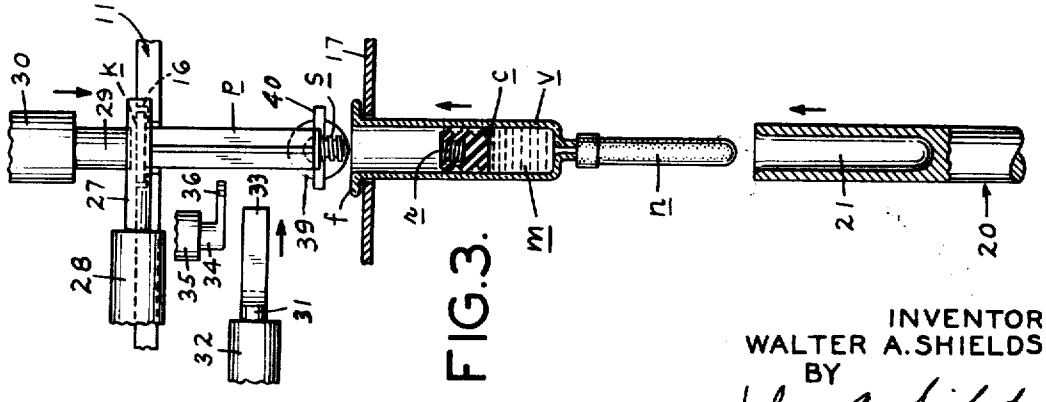


FIG.3.

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APPARATUS FOR UNITING A PLUNGER AND A PISTON OF A FULLY ASSEMBLED HYPODERMIC NEEDLE SYRINGE

The apparatus comprises means to intermittently convey spaced fully assembled hypodermic needle syringes below means to intermittently convey spaced plungers. The paths of conveyance of the syringes and the plungers intersect each other and at said point of intersection, a first member is reciprocally mounted below a syringe and actuated to engage the hypodermic needle end portion of the syringe and lift the syringe from the syringe conveying means to engage the piston of said syringe with a plunger suspended from the plunger conveying means. During the engagement of the piston with the plunger, said first member is continuously rotated to rotate the syringe and unite the piston and the plunger. During the rotation, the syringe is held against downward movement by a second member reciprocated in a horizontal plane between the conveying means to engage the syringe below a flanged open end of said syringe. A third member is reciprocated in a plane of travel of the plunger-conveying means and actuated to position the plunger in vertical alignment with the syringe on the syringe-conveying means prior to the engagement of said syringe by the first member. A fourth member is reciprocally mounted above the plunger in vertical alignment with the first member and actuated to engage and hold the plunger against upward movement during the rotation of the syringe. After the piston and plunger are united, a finger reciprocally mounted above the flanged end of the syringe is actuated to engage said flanged end and relieve internal pressure in the syringe. Subsequent to the engagement of the finger with the flanged end of the syringe, all the members and the finger are actuated out of their performing positions and the plunger is removed from its conveying means by a fifth member reciprocated in a horizontal plane to engage the syringe in its elevated position just prior to the return of the syringe with its attached plunger to the syringe conveying means to be removed from the point of intersection of the conveying means.

In the drawings:

FIG. 1 is a top plan view of the apparatus;

FIG. 2 is a sectional view taken on the line 2–2 of FIG. 1 looking in the direction of the arrows;

FIG. 3 is a fragmentary elevational view of the syringe and the plunger on their conveying means at the point of intersection and showing the plunger being positioned by the third member;

FIG. 4 is a view similar to FIG. 3 and showing the syringe being lifted and rotated by the first member and being engaged by the second member with the third member removed from the plunger and the fourth member engaging the plunger;

FIG. 5 is a view similar to FIGS. 3 and 4 and showing the finger engaging the flanged end of the syringe and the second and third members out of their operating positions;

FIG. 6 is a view similar to FIGS. 3 to 5, inclusive, and showing all members and the finger out of their operating positions and the syringe and its attached plunger supported relative to the syringe conveying means; and

FIG. 7 is a sectional view taken on the line 7–7 of FIG. 4 looking in the direction of the arrows to show the formation of the second member.

The operating parts of the invention are supported by a table 8, as shown in FIG. 1.

Plungers *p* having a manipulating knob *k* at one end and a screw-threaded plug *s* at the opposite end are delivered from a hopper 9, FIG. 1, by a chute 10 to conveying means comprising a turret 11 secured on a shaft 12 rotatably supported by a bracket 13 on a bridge 14 supported by the table 8 and spanning the turret 11. The shaft 12 is intermittently rotated by a conventional pawl and ratchet mechanism, not shown, mounted below the table 8 and actuating transmission gear mechanism indicated at 15 in FIG. 1 and supported by the bridge 14.

The periphery of the turret 11 is provided with equidistantly spaced recesses 16 arranged to support the manipulating knob *k* of the plungers with the screw-threaded plug *s* suspended below the table 11, as shown in FIGS. 2 to 5, inclusive.

The plungers *p* are successively positioned above and in vertical alignment with successive syringes comprising a vial *v* containing a liquid medicament *m* and having a sheathed hypodermic needle *n* at one end and a flange *f* at the opposite open end with a piston *c* closing the flanged end of the vial *v* and sealing the medicament *m* in said vial. The exposed end of the piston *c* is provided with a screw-threaded recess *r*, FIG. 3, for engagement with the screw-threaded plug *s* to unite the plunger *p* with the piston *c*.

The syringes are intermittently conveyed along a pair of spaced rails 17 supported by the table 8 below and diametrically of the turret 11, as shown in FIGS. 1 and 2. The syringes are conveyed by rack bars 18 slidably supported in brackets 19 on the table 8 and actuated in a circular-reciprocal path by suitable mechanism, not shown. The syringes are suspended from the rails 17 by the flanges *f* engaging the upper surfaces of said rails.

During the periods of rest of the turret 11 and the rack bars 18, successive plungers *p* and syringes are positioned in vertical alignment with each other, and the first step in uniting the plunger and piston is the lifting of the syringe from the rails 17 to position the screw-threaded recess *r* into engagement with the screw-threaded plug *s* and simultaneously rotating the syringe during the lifting movement. This is accomplished by a first member comprising a rod 20 having a recess 21 in one end to accommodate the sheathed hypodermic needle *n*. The opposite end of said rod 20 is pivotally connected to a drive shaft 21*a* of an electric motor 22 pivotally connected by links 23 to a lever 24, as shown in FIG. 2, pivotally supported in a suitable manner, not shown, by the table 8. The motor 22 is continuously energized during the operation of the apparatus. The lever 24 is provided with a roller 25 yieldingly urged by a spring 26 into engagement with a cam disc 27 rotatably supported by the table 8 and continuously rotated by an electric motor, not shown, so that the rod 20 and the motor 22 are simultaneously reciprocated toward and away from the syringe. During the periods of rest of the turret 11 and the rack bars 18, the rod 20 and motor 22 are reciprocated toward the syringe under the influence of the spring 26. The continued upward movement of the rod 20 and the motor 22 will engage the recessed end of the rod 20 with the hypodermic needle end of the syringe with the sheathed hypodermic needle in the recess 21, as shown in FIG. 4.

Before the rod 20 engages the syringe and during the movement of the turret 11 to its rest period, there is provided a third member in the form of a piston 27 in an air cylinder 28 connected to a source of air supply periodically controlled in synchronism with the intermittent actuation of the turret 11 and the rack bars 18, so that when successive plungers *p* approach the point of intersection between the paths of travel of the plungers *p* and the syringes, the piston 27 will be projected from the cylinder 28 to engage the approaching plunger *p* and position said plunger in the recess 16 in vertical alignment with the syringe on the rails 17 in vertical alignment with the rod 20, as shown in FIG. 3.

Simultaneously with the longitudinal movement of the rod 20 toward the syringe, a fourth member is provided comprising a piston 29 actuated by air pressure in a cylinder 30 supporting said piston and connected to a source of supply periodically controlled in synchronism with the intermittent actuation of the turret 11 and the rack bars 18, so that when the roller 25 approaches a low in the cam disc 27 and the rod 20 is moved toward the syringe by the spring 26, the piston 29 will engage the manipulating knob *k* and prevent the upward movement of the plunger *p* out of the turret recess 16 during the uniting of the plunger *p* and the piston *c*, as shown in FIG. 4.

Simultaneously with the engagement of the piston *c* with the plunger plug *s*, the upper portion of the syringe below the flange *f* is engaged by a second member comprising a piston

31 in an air cylinder 32 connected to a source of air supply periodically controlled in synchronism with the intermittent actuation of the turret 11 and the rack bars 18, so that when the syringe is in the position shown in FIG. 4, a forked end 33 of the piston 31 will engage the syringe below the flange *f* and prevent the syringe from dropping or moving in a downward direction during the uniting of the plunger *p* and the piston *c*.

To relieve pressure on the medicament *m* subsequent to the uniting of the plunger *p* and the piston *c*, there is provided a finger comprising a piston 34 in an air cylinder 35 connected to a source of air supply periodically controlled in synchronism with the intermittent actuation of the turret 11 and the rack bars 18, so that a lateral extension 36 of the piston 34 will engage the top of the flange *f* and apply a downward pressure on the syringe, as shown in FIG. 5.

The cylinders 28, 30, 32 and 35 are supported from the table 8 by fixtures designated at 37 in FIG. 1.

Subsequent to relieving pressure on the medicament *m* and the actuation of the rod 20 and the pistons 27, 29, 31 and 34 to their inoperative positions, the plunger *p* is removed from the turret recess 16 by a fifth member in the form of a piston 38 in an air cylinder 39 supported to extend in a horizontal plane above the rails 17 and connected to a source of air pressure periodically controlled in synchronism with the intermittent actuation of the turret 11 and the rack bars 18, so that just prior to the intermittent movement of the turret 11 and the feeding movement of the rack bars 18, a head 40 of the piston 38 will engage the vial *v* and remove the plunger *p* from the turret recess 16, as shown in FIG. 5.

Subsequent to the removal of the plunger *p* from the turret recess 16, intermittent movement is imparted to the turret 11 and feeding movement is imparted to the rack bars 18 whereby the empty recess 16 is moved out of vertical alignment with the piston 29 and the syringe having the united plunger and piston is moved out of vertical alignment with the rod 20 and the succeeding plunger and syringe are presented in vertical alignment with the rod 20 and the piston 29 when the steps of uniting said plunger and the piston of said syringe are repeated.

I claim:

1. In apparatus for uniting a plunger and a piston of a fully assembled hypodermic needle syringe, said syringe having an annular flange at the piston end thereof, said plunger having a screw-threaded plug and said piston having a screw-threaded recess for receiving said plunger plug and uniting the plunger and the piston, means to intermittently convey spaced hypodermic needle syringes, said means being provided with a pair of spaced rails to engage the syringe flanges and support the syringes while they are conveyed, means to intermittently convey spaced plungers above and intersecting the path of conveyance of the hypodermic needle syringes, whereby a syringe and a plunger are periodically positioned in vertical alignment with each other, a first member vertically reciprocated into and out of engagement with the hypodermic needle portion of the syringe in vertical alignment with a plunger and arranged to lift said syringe and engage the piston recess with the plunger plug, and motive means connected to said first reciprocating member and arranged to rotate said first member and the syringe and unite the piston and the plunger.

2. In apparatus as claimed in claim 1, a second member having a forked end and reciprocated in a horizontal plane above said syringe supporting rails and actuated to engage the forked end with the syringe below the annular flange during the rotation of said syringe.

3. In apparatus as claimed in claim 1, a finger reciprocated toward and away from the syringe flange and actuated to engage said flange subsequent to the uniting of the piston and the plunger to relieve pressure in the syringe.

4. Apparatus as claimed in claim 1, wherein the plunger conveying means comprises an intermittently rotated turret having an annular series of equidistantly spaced recesses arranged to support the plungers in suspended position, and a third member reciprocated in front of a recess positioned in vertical alignment with the first member and actuated to engage said plunger during the positioning of said plunger in vertical alignment with a syringe.

5. In apparatus as claimed in claim 1, a fourth member reciprocally mounted above the plunger positioned by its conveying means in vertical alignment with the syringe and actuated to engage said plunger during the syringe lifting movement of the first member.

6. In apparatus as claimed in claim 1, a fifth member reciprocally mounted in a horizontal plane between the syringe-conveying means and the plunger conveying means and actuated to engage the syringe and facilitate the removal of the plunger from its conveying means subsequent to the rotation of the syringe by the first member.

7. In apparatus as claimed in claim 6, pneumatic motive means connected to the second, third, fourth and fifth members and arranged to periodically actuate said members during the periods of rest of the syringe and plunger conveying means.

8. Apparatus as claimed in claim 1, wherein the first member comprises a rod having a recess in its upper end to receive the hypodermic needle and the lower end of said rod being connected to the motive means.

9. In apparatus as claimed in claim 1, a lever pivotally supporting the motive means for the first member, and a cam reciprocating said lever.