

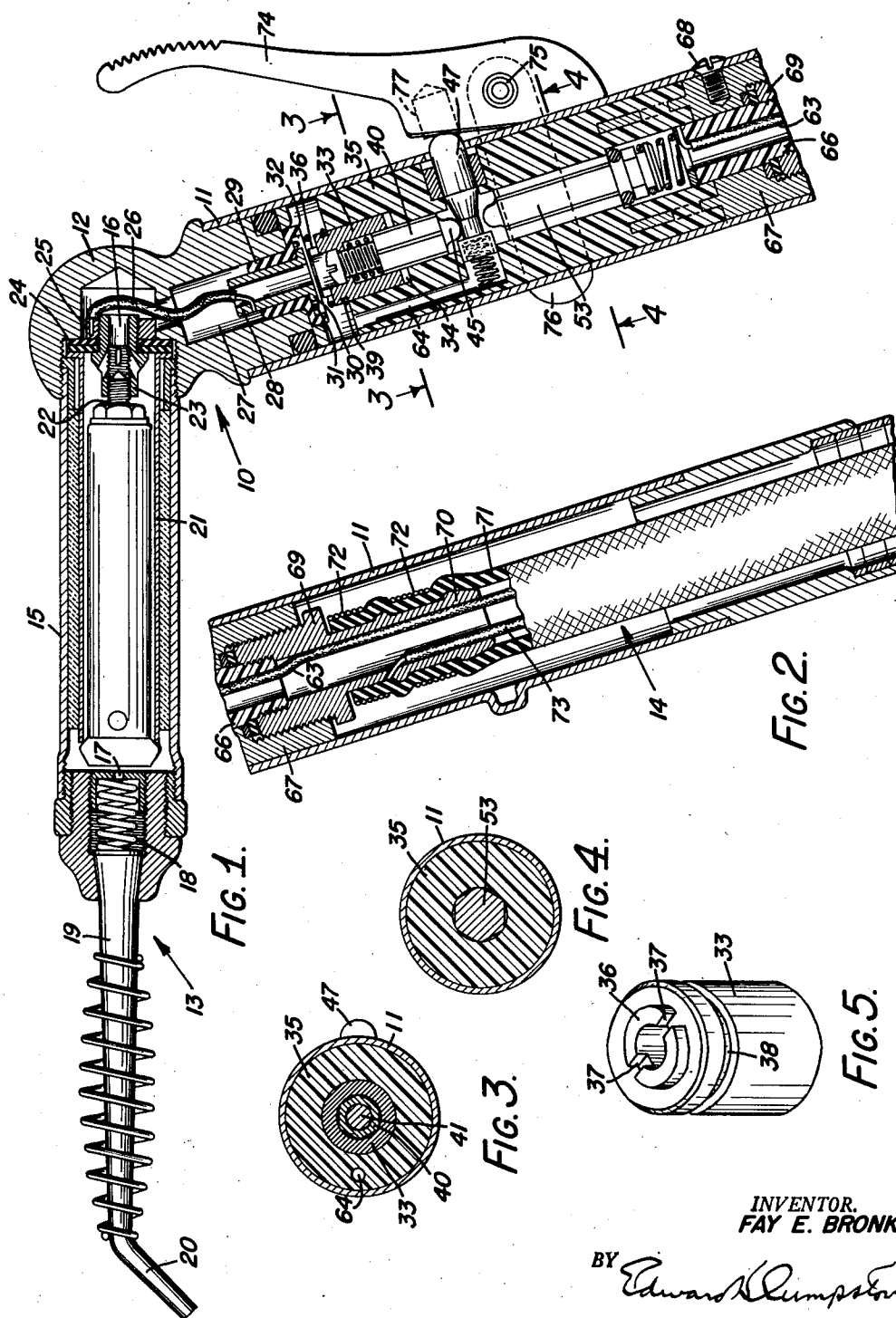
June 15, 1954

F. E. BRONK
SYRINGE

2,681,408

Filed April 8, 1952

2 Sheets-Sheet 1



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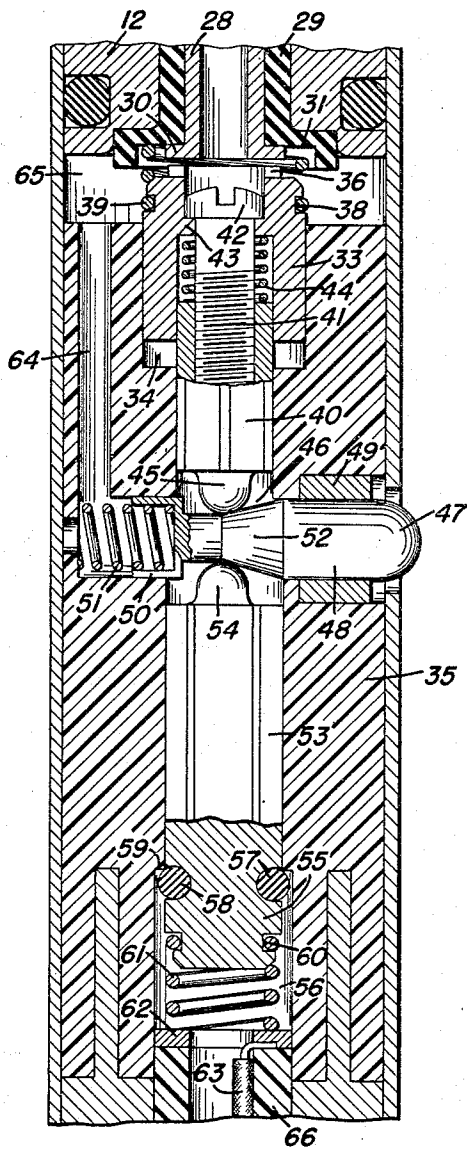


FIG. 6.

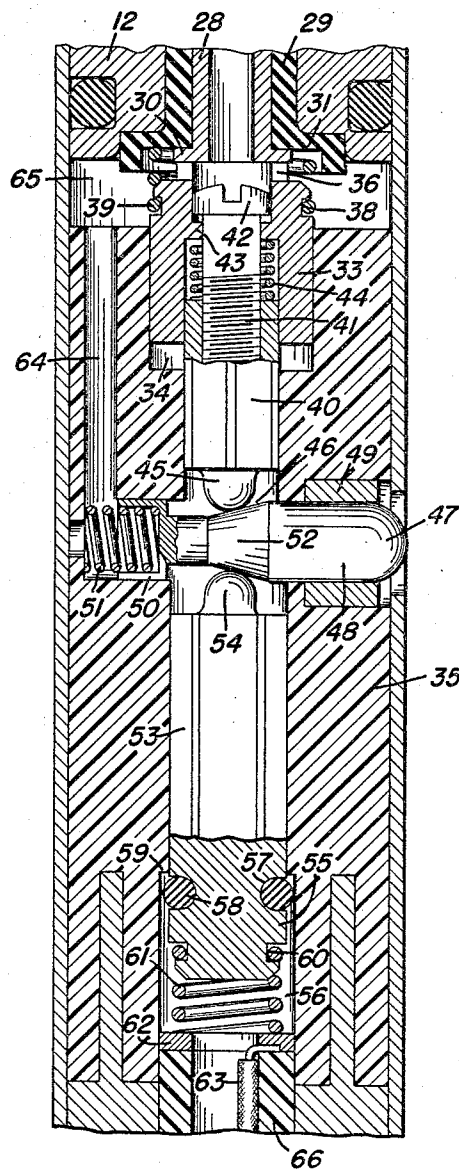


FIG. 7.

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SYRINGE

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This invention relates to the art of syringes, and more particularly, to syringes of the type including means for heating a fluid to be projected in a mist or spray, such as the warm air syringes employed in dental and other medical practices, the chief object of the invention being to provide a syringe of such character having a more simple and practical type of construction capable of operating in a more reliable and convenient manner.

To these and other ends the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings:

Fig. 1 is a fragmentary sectional elevation of a syringe embodying the present invention;

Fig. 2 is a similar view showing portions of the syringe broken away in Fig. 1;

Fig. 3 is a transverse sectional view on the line 3—3 in Fig. 1;

Fig. 4 is a transverse sectional view on the line 4—4 in Fig. 1;

Fig. 5 is a perspective view of a movable contact shown in Fig. 1;

Fig. 6 is an enlarged sectional view of portion of the syringe shown in Fig. 1 but with the switch and valve actuating means partly moved toward operating position, and

Fig. 7 is a view similar to Fig. 6 but showing the valve open and the contact closed as in normal operation.

The embodiment of the invention herein disclosed, by way of illustration, comprises, preferably, an elongated body indicated generally at 10, including the tubular handle portion or sleeve 11 containing operating parts as hereafter described. One end of sleeve 11 has fixed therein a head 12 carrying a nozzle indicated generally at 13, to which the fluid is supplied through passageways through the syringe body 10. The other end of the body is provided with conducting means, indicated generally at 14, adapted for connection with a source of air under pressure and with a source of electrical current for operating the heating means in the nozzle.

The nozzle comprises an outer tubular casing 15 threadedly secured in a socket in the syringe head 12 and containing electrical resistance heating means of any known or suitable variety, the particular construction of which forms no part of the present invention. Air is supplied to this heating means or unit through a passageway 16 therein communicating with a passageway in the syringe body, and is discharged through an open-

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ing 17 adjacent the opposite end of the heater into a chamber 18 communicating with the inner end of a nozzle tube 19 having a discharge tip 20, the inner end of the tube 19 being detachably secured to the casing 15 by any known or suitable means, as well understood in the art. One terminal of the resistance element of this heating unit is connected with its metal sleeve 21 which extends into the socket in head 12 and is electrically connected through associated parts with the head and with handle sleeve 11. The other terminal of the resistance element is connected with a metal post 22 extending from the inner end of the unit and carrying a hollow metal screw cap 23 through which the air passageway 16 is formed. The heating unit is seated in the socket of the head against a pair of washers 24 of insulating material bottomed in the end of the socket, as shown, and these washers are secured to the cap 23 by a threaded nut 25. Fixed in electrical contact with nut 25 is one end of a conductor 26 passing downwardly through a longitudinal passageway 27 in the head and electrically connected to one end of a sleeve 28 which is supported in and insulated by a sleeve 29 of insulating material fitted into the end of passageway 27 in the head. Sleeve 28 forms one of the contacts of the switch controlling the heating unit which will now be described.

The switch controlling the circuit of the heating unit comprises preferably the sleeve 28, stationarily positioned in the syringe body as already described and a cooperating contact movable into and out of engagement with it as hereafter described. Sleeve 28 has at its inner end an outwardly turned narrow flange 30 seated on an outwardly turned flange 31 of the insulating sleeve 29. Flange 31 has retaining rim 32 spaced from the flange 30 of sleeve 28 for a purpose hereafter described.

The movable switch contact is preferably provided by a metal sleeve 33 (Figs. 1, 6 and 7) sliding in a bearing recess 34 in a tubular plug 35 of insulating material fixed in position in the handle sleeve 11 as hereafter described. Sleeve 33 has a longitudinally projecting rim 36 positioned for engagement with flange 30 of sleeve 28 as sleeve 33 is slid longitudinally of the body in its bearing 34. This rim of sleeve 33 is formed with notches 37 (Fig. 5) for the passage of air through the body while the switch is closed as hereafter described. The adjacent end of sleeve 33 is formed with a circumferential groove 38 for receiving and holding one end of a coiled com-

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pression spring 39 having its other end in engagement with flange 31 of sleeve 29 in spaced insulated relation with the flange 30 of sleeve 28, in which position the spring end is retained by the rim 31 of the insulating sleeve. Spring 39 tends to press the movable contact sleeve 33 out of engagement with the stationary contact sleeve 28 and thus normally open the switch to break the heater circuit.

The movable contact sleeve 33 contains a part or plunger 40 slidable longitudinally therein and provided with a screw 41 having a head 42 arranged to seat against a constricted or shoulder portion 43 on the inside of the sleeve 33. Coiled in the sleeve about the screw is a compression spring 44 bearing against the plunger 40 and the shoulder 43 and tending to project the part or plunger 40 from the sleeve 33 until the screw head 42 seats upon the shoulder 43. It is evident that by turning and adjusting the position of the screw in the plunger, the extent to which the other end of the plunger is projected may be adjusted as required, for suitable contact with switch actuating means hereafter described. Spring 44 is preferably somewhat stiffer than spring 39 so that upward actuation of plunger 40 serves to raise sleeve 33 until its rim 36 engages the stationary contact rim 30 of sleeve 28, after which spring 44 yields resiliently while maintaining contact between the switch parts. The opposite end of plunger 40 is formed with a rounded nub 45 arranged to extend into a recess 46 in the insulating and supporting plug 35, as shown, for engagement with the switch actuating means. Plunger 40 thus acts as a cushioning means and spacer for the switch actuating parts.

The switch actuating means preferably comprises also a plunger 47 slidable transversely of the syringe body through the recess 46 in the plug 35. The plunger has at one end a cylindrical portion 48 slidably supported in a metal bearing ring 49 supported and insulated in the plug 35, this end of the plunger being extended outwardly through an opening in sleeve 11 and rounded for engagement by actuating means on the sleeve hereafter described. The other end of the plunger is formed with an enlarged cup-shaped portion 50 containing one end of a coiled compression spring 51 having its other end bearing against a portion of plug 35. This cup-shaped portion is formed with one or more notches (Fig. 6 and 7) to transmit air pressure as hereafter described. The intermediate portion 52 of plunger 47 is tapered, or cone shaped, as shown for camming engagement with the nub 45 of the movable switch contact to actuate the same longitudinally of the syringe body as plunger 47 is moved transversely of the body. The outer end of the plunger 47 is spaced and thereby insulated from the edges of the opening sleeve 11 through which it slides, as shown.

The valve means for controlling the supply of aid comprises preferably a valve stem 53 of hexagonal shape in cross section and slidable longitudinally in a cylindrical bore in the plug 35 (Fig. 4) so as to leave air passageways through the plug bore around the stem. The upper end of the stem is formed with a rounded bearing nub 54 (Figs. 6 and 7) for engagement with the tapered surface of plunger 47. The lower end 55 of the stem projects into a valve chamber 56 in plug 35 and is formed with a circumferential groove 57 in which is seated an O-ring 58 of natural or synthetic rubber or the like for

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engagement with the end 59 of the valve chamber around the valve stem bore, thus forming a valve and valve seat controlling the flow of air from the valve chamber 56 along the valve stem into the chamber 46 of the plug 35 through which the plunger 47 is movable. The valve head 55 is formed with a circumferential groove 60 for retaining engagement with one end of a compression spring 61 positioned in the valve chamber and bearing at its opposite end against a metallic washer 62 seated in the lower end of the chamber. This washer is connected electrically with one end of a wire 63 forming a part of the circuit for the heater. It is evident from the above description that inward movement plunger 47 brings its conically tapered surface 52 into engagement with nub 54 of the valve stem 53 so as to force the valve stem and valve downwardly away from seat 59 and thus open the passageway for the flow of air from the valve chamber 56 into the remainder of the passageway and to the heating unit, as hereafter described.

When the valve is opened as described, the air flows from the chamber 56 along valve stem 53 into chamber 46 and thence through the notches in the cup-shaped end 50 of the plunger 48 and upwardly through a passageway 64 formed in the insulating plug 35. At the upper end of the latter the air enters a chamber 65 from which it passes through the notches 37 in the rim 36 of sleeve 33 while the latter is in electrical contact with the stationary contact sleeve 28. From the latter the air passes into the inner end of chamber 27 and thence through a passageway into the inner end of the heater socket in the head 12 from which it passes through the passageway 16 into the heater.

The air is supplied to valve chamber 66 through a sleeve 66 (Figs. 1 and 2) of insulating material fitted and supported in an opening in a conducting metal sleeve 67 which is fixed in the handle sleeve 11 as by means of one or more screws 68. The lower end of sleeve 66 is threadedly secured in the upper end of an opening in a conducting metal sleeve 69 having at its lower end a nipple 70 of reduced diameter for receiving the upper end of a flexible hollow cord or hose 71 secured to the nipple as by means of suitable wrapping 72. The other or outer end of the hose is adapted for attachment in any known and suitable manner to a source of air under pressure for supplying the same to the valve chamber 56 and upwardly through the syringe valve and passageways and heater as described above.

The electrical circuit wire 63 is led through the cord 71 from one terminal of a source of electrical current of suitable voltage. The other terminal of the source is connected through the hose by a wire 73 having its upper end secured to and electrically connected with the metal sleeve 69 to which the hose is attached. From sleeve 69 the current passes through metal sleeve 67 to the metal handle sleeve 11. From the upper end of the latter the current passes to the head 12 and thence to one terminal of the heating unit as described above. From the other terminal of the heating unit the current returns, as described, through the wire 26 to sleeve 28 of the stationary switch contact. When the latter is engaged by the movable contact, in the closed position of the switch, the circuit continues through sleeve 33, switch plunger 40, the switch actuating plunger 47, valve stem 53 and spring 61 to the

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washer 62 connected with the other terminal 63, to complete the circuit.

The means for moving the actuating plunger 48 comprises preferably a thumb lever 74 (Fig. 1) pivotally mounted at 75 on a collar 76 suitably fixed to the handle sleeve 44. Lever 74 carries a block of insulating plastic material 77 in position for engagement with the outer end of the actuating plunger 47, so that depression of lever 74, by the thumb of the hand holding the instrument, serves to force the plunger inwardly against its spring 51 and thus open the air valve and close the heater switch. The screw 42 of switch plunger 40 is preferably adjusted in its threaded opening to so position the nub 45 of the switch plunger that the switch is closed shortly after the air valve is opened to prevent overheating of the heating unit.

It is evident from the above description that the air valve and switch are operated by plungers slidable in opposite directions in the insulating plug 35 of the handle, by means of the single actuating plunger 48 and the thumb lever 74. The desired relative timing of the actuation of valve and switch is readily adjusted by turning the screw 42 in the switch plunger. The movements of the parts of the movable switch contact are controlled in part by simple and inexpensive spring means adapted to space the parts and maintain connection with the actuating plunger 48, as well as to yield on engagement of the switch contacts to prevent interference with continuing movement of the thumb lever 74 and avoid injury to one of the parts. The parts generally employ a practical sleeve and plunger rod type of construction and operate by simple straight line sliding movements. The construction thus requires relatively few parts of simple and practical construction capable of being readily and economically manufactured and assembled and of operating in a reliable and durable manner, with a minimum of maintenance trouble and expense.

It will thus be seen that the invention accomplishes its objects and while it has been herein disclosed by reference to the details of a preferred embodiment, it is to be understood that such disclosure is intended in an illustrative, rather than a limiting sense, as it is contemplated that various modifications in the construction and arrangement of the parts will readily occur to those skilled in the art, within the spirit of the invention and the scope of the appended claims.

I claim:

1. A syringe comprising an elongated body having a nozzle at one end thereof and a fluid passageway therethrough provided with means at the other end of said body for connection with a source of fluid, electrical means for heating fluid in said passageway, circuit means for said heating means including a pair of contacts one of which is movable toward and from engagement with the other longitudinally of said body, a valve seat in said passageway, a valve movable longitudinally of said body for cooperation with said seat, said valve being movable in the direction opposite the movement of said movable contact for opening and closing said valve concomitantly with the closing and opening, respectively, of said electrical circuit means and manually operable means comprising a plunger slidable transversely in said body for concomitantly actuating said movable contact and said valve for supplying heated fluid for discharge through said nozzle.

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2. A syringe comprising an elongated body having a nozzle at one end thereof and a fluid passageway therethrough provided with means at the other end of said body for connection with a source of fluid, electrical means for heating fluid in said passageway, circuit means for said heating means including a pair of contacts one of which is movable toward and from engagement with the other longitudinally of said body, a valve seat in said passageway, a valve movable longitudinally of said body for cooperation with said seat, said valve being movable in the direction opposite the movement of said movable contact for opening and closing said valve concomitantly with the closing and opening, respectively, of said electrical circuit means and manually operable means comprising a plunger slidable transversely in said body, and having a longitudinally tapered shape for wedging coaction with said movable contact and valve to concomitantly actuate the same to supply heated fluid for discharge through said nozzle.

3. A syringe comprising an elongated body having a nozzle at one end thereof and a fluid passageway therethrough provided with means at the other end of said body for connection with a source of fluid, electrical means for heating fluid in said passageway, circuit means for said heating means including a pair of contacts one of which is movable toward and from engagement with the other longitudinally of said body, a valve seat in said passageway, a valve movable longitudinally of said body for cooperation with said seat, said valve being movable in the direction opposite the movement of said movable contact for opening and closing said valve concomitantly with the closing and opening, respectively, of said electrical circuit means, manually movable means comprising a plunger slidable transversely in said body, a spring for moving said plunger in one direction and a thumb lever pivoted on said body for moving said plunger in the other direction to concomitantly actuate said movable contact and valve to supply heated fluid for discharge through said nozzle.

4. A syringe comprising an elongated body having a nozzle at one end thereof and a fluid passageway therethrough provided with means at the other end of said body for connection with a source of fluid, electrical means for heating fluid in said passageway, circuit means for said heating means including a pair of contacts one of which is movable toward and from engagement with the other longitudinally of said body, a valve seat in said passageway, a valve movable longitudinally of said body for cooperation with said seat, said valve being movable in the direction opposite the movement of said movable contact for opening and closing said valve concomitantly with the closing and opening, respectively, of said electrical circuit means, manually operable means comprising a plunger slidable transversely in said body and having a longitudinally tapered shape for concomitantly actuating said movable contact and valve to supply heated fluid for discharge through said nozzle, spring means for moving said plunger in one direction and a thumb lever pivoted on said body for actuating said plunger in the other direction.

5. A syringe comprising an elongated body having a nozzle at one end thereof and a fluid passageway therethrough provided with means at the other end of said body for connection with a source of fluid, electrical means for heating fluid in said passageway, circuit means for said

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heating means including a pair of contacts one of which is movable toward and from engagement with the other longitudinally of said body, one of said contacts having a resiliently yieldable part adapted to yield under actuation after engagement of said contacts, a valve seat in said passageway, a valve movable longitudinally of said body for cooperation with said seat, said valve being movable in the direction opposite the movement of said movable contact for opening and closing said valve concomitantly with the closing and opening, respectively, of said electrical circuit means, manually operable means comprising a plunger slidable transversely in said body and having a longitudinally tapered shape for engagement with said contact part and said valve, spring means for moving said plunger in one direction and a thumb lever pivoted on said body for moving said plunger in the other direction to concomitantly actuate said contact part and valve to supply heated fluid for discharge through said nozzle.

6. A syringe comprising an elongated body having a nozzle at one end thereof and a fluid passageway therethrough provided with means at the other end of said body for connection with a source of fluid, electrical means for heating fluid in said passageway, circuit means for said heating means including a pair of contacts one of which is movable toward and from engagement with the other longitudinally of said body, spring means for disengaging said movable contact, one of said contacts having a spring actuated part adjustably mounted thereon and adapted to yield under actuation after engagement of said contacts, a valve seat in said body, a valve movable longitudinally of said body for cooperation with said seat, said valve being movable in the direction opposite movement of said movable contact for opening and closing said valve concomitantly with the closing and opening, respectively, of said electrical circuit means, spring means for moving said valve to closed position, manually operable means comprising a plunger slidable transversely in said body and having a longitudinally tapered shape for engagement with said contact part and said valve, spring means for moving said plunger in one direction and a thumb lever pivoted on said body for moving said plunger in the other direction to move said valve in one direction and said movable contact in the opposite direction to concomitantly open said fluid passageway and close said electrical circuit means to supply heated fluid for discharge through said nozzle.

7. A syringe comprising an elongated body having a nozzle portion at one end thereof and a fluid passageway therethrough provided with means at the other end of said body for connection with a source of fluid, electrical means in said nozzle portion for heating fluid therein, circuit means for said heating means including a pair of contacts, one of which is movable toward and from engagement with the other longitudinally of said body, a valve seat in said passageway, a valve movable longitudinally of said body for cooperation with said seat, said valve being movable in the direction opposite the movement of said movable contact for opening and closing said valve concomitantly with the closing and opening, respectively, of said electrical circuit means, and manually-operable means comprising a plunger slidably transversely in said body for concomitantly actuating said

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movable contact and said valve for supplying heated fluid for discharge through said nozzle.

8. A syringe comprising an elongated body having a detachable nozzle portion at one end thereof and a fluid passageway therethrough provided with means at the other end of said body for connection with a source of fluid, electrical means in said nozzle portion for heating fluid therein, circuit means for said heating means comprising a pair of contacts one of which is movable toward and from engagement with the other longitudinally of said body, a valve seat in said passageway, a valve movable longitudinally of said body for cooperation with said seat, said valve being movable in the direction opposite the movement of said movable contact for opening and closing said fluid passageway concomitantly with the closing and opening, respectively, of said electrical circuit means, and manually-operable means comprising a plunger slidable transversely in said body, and having a longitudinally-tapered shape for wedging coaction with said movable contact and valve to concomitantly actuate the same to supply heated fluid for discharge through said nozzle.

9. A syringe comprising an elongated body having a detachable nozzle portion at one end thereof and a fluid passageway therethrough provided with means at the other end of said body for connection with a source of fluid, electrical means in said nozzle for heating fluid therein, circuit means for said heating means comprising a pair of contacts one of which is movable toward and from engagement with the other longitudinally of said body, a valve seat in said passageway, a valve movable longitudinally of said body for cooperation with said seat, said valve being movable in the direction opposite the movement of said movable contact for opening and closing said valve concomitantly with the closing and opening, respectively, of said electrical circuit means, manually movable means comprising a plunger slidable transversely in said body, a spring for moving said plunger in one direction and a thumb lever pivoted on said body for moving said plunger in the other direction to concomitantly close said electrical circuit means and open said fluid passageway to supply heated fluid for discharge through said nozzle.

10. A syringe comprising an elongated body having a nozzle portion at one end thereof and a fluid passageway therethrough provided with means at the other end of said body for connection with a source of fluid, electrical means in said nozzle for heating fluid therein, circuit means for said heating means comprising a pair of contacts, one which is movable toward and from engagement with the other longitudinally of said body, a valve seat in said passageway, a valve movable longitudinally of said body for cooperation with said seat, said valve being movable in the direction opposite the movement of said movable contact for opening and closing said valve concomitantly with the closing and opening, respectively, of said electrical circuit means, manually-operable means comprising a plunger slidable transversely in said body and having a longitudinally tapered shape for concomitantly actuating said movable contact and valve to supply heated fluid for discharge through said nozzle, spring means for moving said plunger in one direction and a thumb lever pivoted on said body for actuating said plunger in the other direction.

11. A syringe comprising an elongated body

having a nozzle detachably mounted at one end thereof and a fluid passageway therethrough provided with means at the other end of said body for connection with a source of fluid, electrical means in said nozzle for heating fluid as it passes therethrough, circuit means for said heating means comprising a pair of contacts one of which is movable toward and from engagement with the other longitudinally of said body, spring means for disengaging said movable contact, one of said contacts having a spring-actuated part adjustably mounted thereon and adapted to yield under actuation after engagement of said contacts, a valve seat in said body, a valve movable longitudinally of said body for cooperation with said seat, said valve being movable in the direction opposite the movement of said movable contact for opening and closing said valve concomitantly with the closing and opening, respectively, of said electrical circuit means, spring means for

moving said valve to closed position, manually-operable means comprising a plunger slidable transversely in said body and having a longitudinally tapered shape for engagement with said contact part and said valve, spring means moving said plunger in one direction and a thumb lever pivoted on said body for moving said plunger in the other direction to move said valve in one direction and said movable contact in the opposite direction to concomitantly open said fluid passageway and close said electrical circuit means to supply heated fluid for discharge through said nozzle.

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