

June 27, 1933.

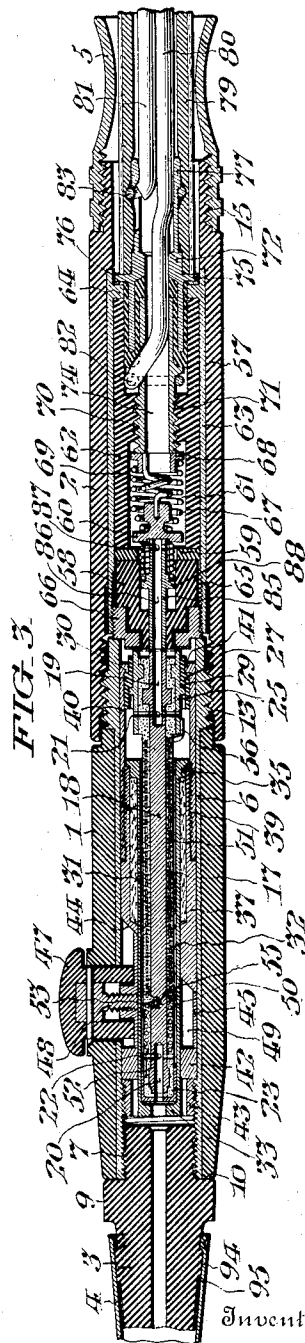
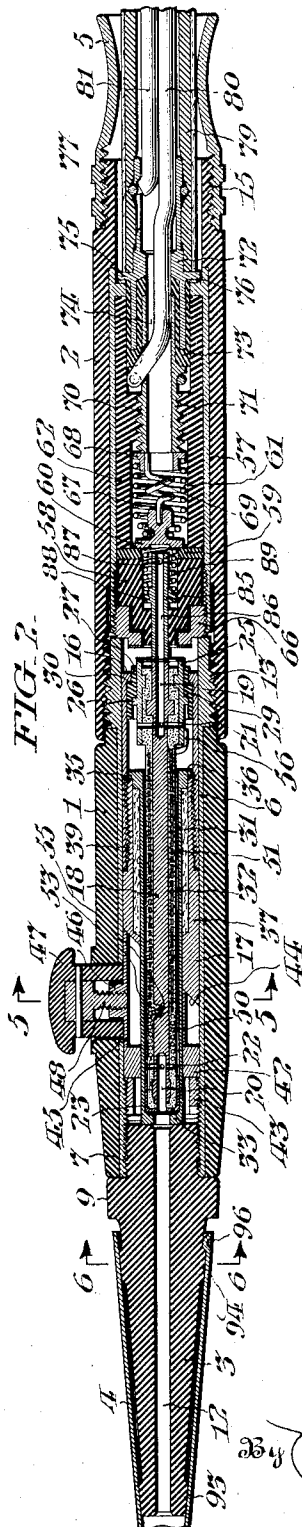
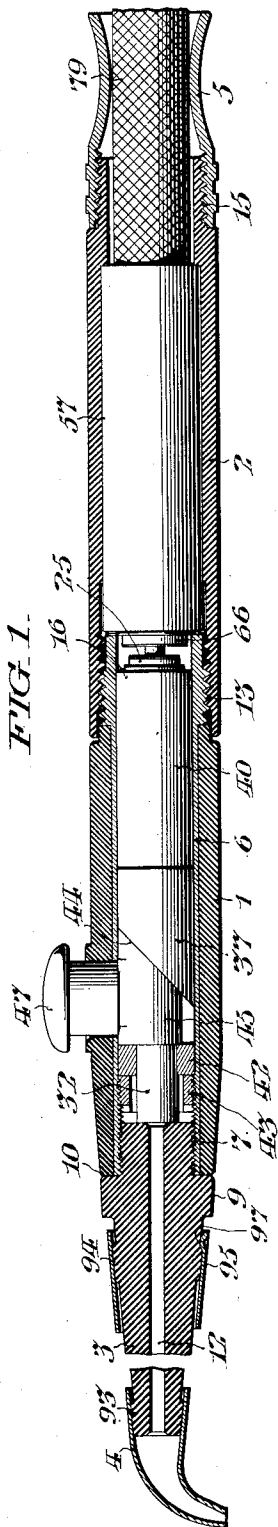
R. C. ANGELL

1,915,351

WARM AIR SYRINGE

Filed Nov. 26, 1928

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG. 4.

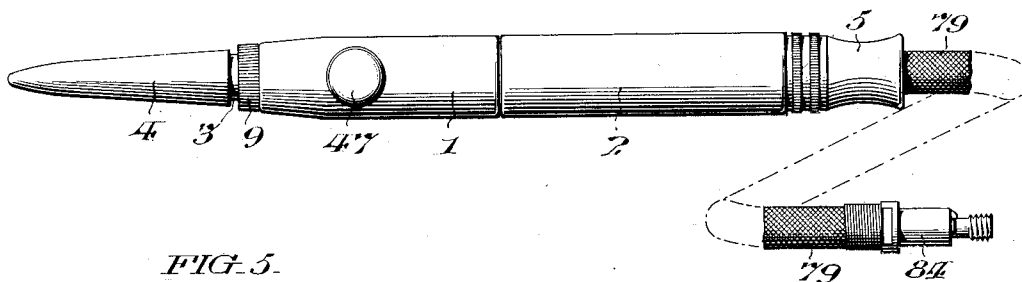


FIG. 5.

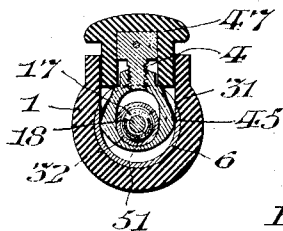


FIG. 6.

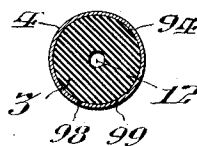


FIG. 7.

FIG. 8.

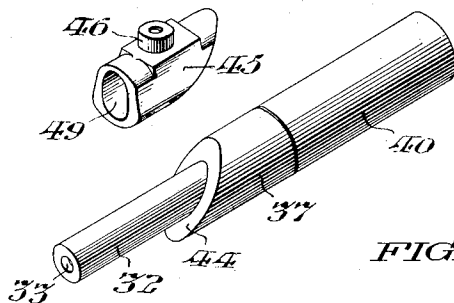
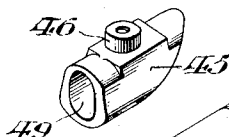


FIG. 9.

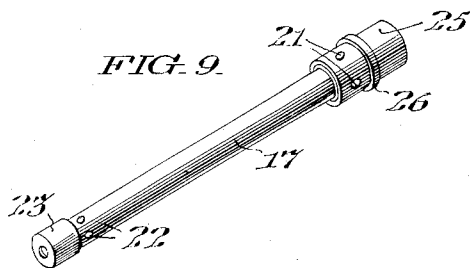


FIG. 10.

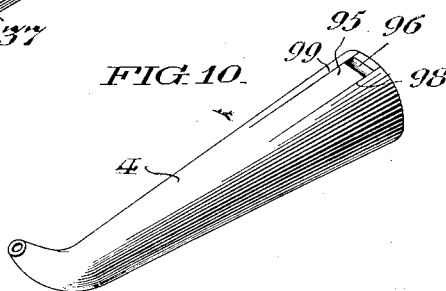


FIG. 11.

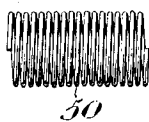


FIG. 12.



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UNITED STATES PATENT OFFICE

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WARM-AIR SYRINGE

Application filed November 26, 1928. Serial No. 322,047.

My invention relates particularly to that class of air-heating devices in which the flowing air is directed therethrough in such proximity to electrical heating elements disposed therein that said air may be ejected therefrom at the increased temperature desired, and is especially applicable to such devices as are employed in dentistry and are commonly known as hot-air or warm-air syringes.

The principal objects of my invention are to provide a warm-air syringe that will so generate a supply of warm air when not in actual use, as to insure a continuous flow of warm air from the instant that said syringe is actuated to effect ejection of air from its nozzle, and to maintain such flow of warm air at a substantially uniform temperature.

Other objects of my invention are to provide a warm-air syringe with a heating unit preferably having heating elements of relative heat intensity arranged for independent control, but capable of being actuated simultaneously, and to provide such a heating unit that may be readily removed and replaced or substituted for units of greater or less heating capacity, as may be desired.

Further objects of my invention are to provide a warm-air syringe having its working parts so correlated that the temperature of the air ejected from the syringe nozzle may be varied at will by a greater or less pressure of the thumb of the operator upon the air-controlling mechanism.

My invention comprises a warm-air syringe having such a simplified form of controlling mechanism as to facilitate compactness of the working parts of the syringe as a whole, and affords such smallness of structure that it not only presents a pleasing appearance but it may be efficiently handled with a feeling of utmost comfort.

My invention includes a nozzle having a removable tip-fitting that may be readily removed, sterilized and replaced, and that embodies a novel form of retention not only insuring it against accidental displacement, but permitting it to be easily detached.

Specifically stated, the form of my invention as hereinafter described comprehends a tubular casing formed of conveniently sepa-

rable sections, within the bore of which are removably housed the heating unit and its associated controlling mechanism, and the air-valve unit and its associated controlling mechanism. The heating unit comprises a bar of refractory material in which is preferably embedded distinctly separate heating elements of relative heat intensity, one being connected through the casing with the leading-in conductors and arranged to be controlled at the source or any desired location, and the other being arranged to be controlled by controlling mechanism local to the syringe, which serves to control both said heating element and the air inlet valve.

My invention also includes all of the various novel features of construction and arrangement as hereinafter more definitely specified.

In the accompanying drawings, Figure 1 is an enlarged central vertical longitudinal sectional view of a warm-air syringe constructed in accordance with my invention, the section being taken through the housing and nozzle thereof, the removable heating and valve elements being shown in elevation for convenience of illustration; Fig. 2 is an enlarged central vertical longitudinal sectional view of the syringe including all of its parts, which are shown in position to close the air passageways therethrough; Fig. 3 is an enlarged sectional view of said syringe similar to that shown in Fig. 2, but showing the parts shifted to open the air passageways therethrough and to effect electric energization of the heating unit; Fig. 4 is a side elevational view of the syringe showing the flexible connector attached thereto and its attaching terminal fitting; Fig. 5 is a transverse vertical sectional view of said syringe taken on the line 5—5 in Fig. 2; Fig. 6 is a transverse vertical sectional view of said syringe taken on the line 6—6 in Fig. 2; Fig. 7 is a perspective view of the thumb-actuated push-block which cooperates with the heating unit to effect actuation of the valve and to make and break the electric circuit; Fig. 8 is a perspective view of the heating unit per se; Fig. 9 is a perspective view of the refractory bar; Fig. 10 is a perspective view of the nozzle tip-fitting, show-

ing its attaching spring tang; Fig. 11 is a side elevational view of the primary heating element of the heating unit; and Fig. 12 is a side elevational view of the secondary heating element of said heating unit.

In said figures, the syringe comprises the handle formed of the housing sections 1 and 2, the nozzle 3 having the removable nozzle tip-fitting 4, and the ferrule 5 which is preferably waisted as shown. The housing sections 1 and 2, and the nozzle 3 may preferably be formed of hard rubber, bakelite or other non-heat-conveying and electrical resisting materials. The forward housing section 1 is preferably provided with a metallic tubular lining or bushing 6, which serves as an electrical conductor and which is provided with the internal threads 7 at its forward end to which the nozzle 3 is attached in threaded engagement, said nozzle being provided with the knurled flange 9 forming an abutment shoulder 10, which abuts against the forward end of the forward housing section 1, and also being provided with the air passageway 12 extending axially therethrough.

The innermost end of said tubular bushing 6 extends beyond the inner end of the housing section 1 and is provided with the external screw threads 13 with which the forward end of the housing section 2 is threadedly engaged to complete the handle structure when thus assembled. The innermost end of the inner housing section 2 is provided with the external screw threads 15 with which the ferrule 5 is threadedly engaged.

Within the forward housing section 1, is removably disposed the heating unit 16 comprising the bar 17 of refractory material, having the metallic core 18 which conveniently serves as an electrical conductor, and which has the terminally disposed bores 19 and 20 affording air passageways provided with lateral vents 21 and 22 respectively. The refractory bar 17 is provided at its forward end with the cup-shaped shoe 23 affording a terminal cap, and at its innermost end with the terminal ferrule 25 projecting slightly beyond the inner end of said refractory bar 17 and affording a switch contact terminal, said ferrule 25 being provided with a flange 26 externally disposed intermediate of its length. An annular collar 27, formed of insulating material, embraces said ferrule 25, and is provided with an internal shoulder 29 arranged to abut against the flange 26, and is also provided with an external shoulder 30, the purpose of which will be hereinafter described.

Said refractory bar 17 is provided with a loosely fitting flanged sleeve 32 affording an annular air passageway 31 for directing air around said bar and connecting the terminally disposed air passageway bores 19 and 20 through the respective lateral vents 21 and 22, and said sleeve 32 is provided at its forward end with the inturned flange 33 serving as an

electrical contact abutment for the shoe 23, and at its inner end is provided with the outwardly extended flange 35 affording a shoulder 36 against which the inner end of the forward casing section 37 of the heating unit 70 abuts.

The forward casing section 37 is provided with the external screw threads 39 in threaded engagement with the correspondingly threaded rearward casing section 40 of the heating unit, said rearward casing section 40 being provided at its innermost end with an inturned flange arranged to engage the shoulder 30 on the insulating collar 27, so, as may be readily seen, the relative rotation of the forward and rearward casing sections 37 and 40 of the heating unit, tends to force the refractory bar 17 with its shoe 23 into the sleeve 32 to form a rigid integral heating unit structure that may be readily removed from and replaced into the tubular bushing 6 of the forward housing section 1.

As best shown in Figures 2 and 3, the forward end of the sleeve 32 of the heating unit structure is arranged to be thrust through and supported in axial alinement with the housing by the annular collar 42, which is disposed within the tubular bushing 6 and is arranged to be adjusted axially therein by the annular nut 43, which is in threaded engagement with the internal threads at the forward end of said tubular bushing 6.

The heating unit 16 as a whole is arranged for axial operative movement within said bushing 6, and the forward end 44 of its forward casing section 37 is inclined at a substantial slipping angle to the axis of said heating unit and is arranged to cooperate with actuating mechanism comprising the wedge-block 45 which is arranged for linear movement transverse to the axis of the heating unit 16, and which has its forward end abutted against the collar 42 and its rearward end inclined and arranged to slide on the inclined end 44 of the casing section 37. Said wedge-block 45 is provided with the boss 46 to which the thumb-actuated push-button 47 is attached by the screw 48.

As best shown in Fig. 5, the push-block 47 embraces the sleeve 32, and has the vertically elongated or oval bore 49 through which said sleeve 32 extends, the minor axis of said bore 49 being substantially equal to the axis of the sleeve 32 so that the push-block 47 is guided thereby in its linear movement to effect longitudinal movement of the heating unit 16.

It will be obvious that when the thumb-actuated button 47 is forced inwardly, the heating unit 16 is caused to move back axially in opposition to spring pressure tending to return said unit to its forward normal position when said thumb-actuated button 47 is released, as will be hereinafter described.

In order to insure a supply of warm air which may be ejected from the syringe continuously from the instant that air is permitted to flow therefrom, the heating unit is provided with separate heating elements, which may for convenience be respectively termed the primary heating element 50 and the secondary heating element 51, preferably embedded in the refractory bar 17, the primary heating element comprising a coil of wire having one end electrically connected at 52 with the cup-shaped shoe 23 and the other end connected at 53 with the metallic core 18 of said refractory bar. The secondary heating element 51 may preferably be formed of flat strip material helically coiled and embedded in said refractory bar 17, and having one end connected at 55 with said metallic core 18 and the other end connected at 56 with the terminal ferrule 25, which is formed of metal and insulated by the refractory bar from its core and also insulated by the annular collar 27 from the tubular lining or bushing 6 of said heating unit.

Within the hollow housing section 2 of the syringe handle, the valve unit 57 is removably disposed and comprises the valve body 58, preferably formed of non-conducting material, and having the valve seat 59 upon which the valve 60 normally rests within the valve chamber 61 formed by the valve casing 62, preferably composed of non-conducting material.

The valve structure thus described is integrally assembled and enclosed in the outer sleeve or shell 63, which is arranged to hold the valve parts together and is provided with the inwardly disposed flange 64, against which the inner end of the valve casing 62 is abutted. The forward end of said sleeve or shell 63 is provided with internal screw threads 65 with which the metallic ring or cap 66 is threadedly engaged to force the valve body 58 against the valve casing 62 and the latter into engagement with the flange 64 of the shell 63 to form a rigid integral valve unit structure, which may, as a whole, be removed from or replaced in the housing section 2 of the handle when the housing sections 1 and 2 are separated by relative rotation.

The valve 60 is normally pressed against its seat by the spring 67 which is conveniently seated on the metallic flanged ring 68, which latter is electrically connected with the valve 60 by the coiled connector 69, the respective ends of which may be preferably soldered to said valve and ring, as shown. The valve casing 62 is provided with the internal screw threads 70, with which the metallic air conduit 71 is threadedly engaged, and said air conduit projects into the valve chamber 61 and serves as an electrical contacting seat for the flanged ring 68.

The air conduit 71 is provided with an air

conduit extension 72, the forward end portion of which telescopically embraces the innermost or rearward portion of said air conduit 71, but is electrically insulated therefrom by the bushing 73 of insulation material which extends both within and without the forward end portion of the conduit extension 72, said air conduit 71 and its extension 72 affording the air inlet passageway 74. Said conduit extension 72 is provided with the outwardly extending flange 75 which is electrically connected with the flange 64 on the shell 63 by the contact ring or washer 76, and said conduit extension 72 affords the nipple 77 for convenient attachment of the flexible air conveyer tube 79, through which the electric leading-in wires 80 and 81 extend to carry electric current from the source of supply, the wire 80 being connected at 82 with the air conduit 71 and the wire 81 being connected at 83 with the conduit extension 72. As shown in Fig. 4, the flexible tubing 79 and the wires 80 and 81 terminate in the terminal connector 84, which is arranged to be connected with sources of air and electric current supply.

The valve body 58 is provided with the tubular plunger 85 having the bore 86 provided with lateral vents 87, and has the medially disposed outwardly extending flange 88 between which and the valve 60 is disposed the spiral spring 89 tending to force said plunger forwardly into abutted relation with the inner end of the metallic core 18, so as to form a continuous passageway for air through the bore 86 in the plunger 85 and the terminally disposed bore 19 and its vents 21 in said core.

As best shown in Fig. 2, the nozzle 3 is tapered and provided with the raised bands 93 and 94 serving as spaced bearings for the nozzle tip-fitting 4, which may be readily engaged with and removed from said nozzle for sterilization, and which is provided with the tang 95 having the transverse indentation 96 forming the inwardly projecting ridge 97 arranged to engage said raised band 94, and said tang thereby affords a retaining latch arranged to hold said nozzle tip-fitting on said nozzle. Said tang 95 is preferably formed by providing longitudinal parallel slits 98 and 99 in the wall of said nozzle tip-fitting, so that said tang may be conveniently sprung outwardly to disengage the nozzle tip-fitting from said nozzle.

From the foregoing description, it will be obvious that when the controlling parts of the syringe are disposed in the position shown in Fig. 2 of the drawings, air cannot pass through the syringe by reason of the valve 60 being seated to close the passage through the valve body 58. When, however, the thumb-actuated button 47 is forced inwardly by the thumb of the operator, the inclined inner end of the wedge-block 45 is caused to slide upon the inclined forward end of the forward

casing section 37 of the heating unit, to effect axial rearward movement of said unit and thereby force the tubular plunger 85 backward to force the valve 60 from its seat 59, thus permitting compressed air which is conveyed through the flexible air conveyor tube 79 to enter the air passageway 74 in the air conduit 71 and its extension 72, and be directed thereby into the valve chamber 61, from where it passes through the chamber in the valve body 58, the vent 87, the bore 86, the terminally disposed air passageway 19 and its lateral vents 21 and through the annular air passageway 31, lateral vents 22, into terminally disposed air passageway 20 at the forward end of the heating unit, and into the air passageway 12 of the nozzle 3 where it is ejected from the nozzle tip-fitting 4.

It will also be obvious that the primary heating element 50 is continuously energized irrespective of the position of the parts of the syringe which are locally controlled by the thumb-actuated button 47, by connection with the source of electric current supply through the leading-in wire 80, air conduit 71, flanged ring 68, connector 69, valve 60, spiral spring 89, plunger 85, core 18, heating element 50, shoe 23, sleeve 32, casing section 37, bushing 6, ring or cap 66, sleeve or shell 63, contact ring or washer 76, air conduit extension 72 and the leading in wire 81.

The secondary heating element 51 of the heating unit 16 may be energized only when the thumb-actuated button 47 is depressed, as shown in Fig. 3, to first effect opening of the valve 60, and then closing the switch members comprising the ferrule 25 and the ring or cap 66 into electrical contact, which permits electric current to pass from the leading-in wire 80 through the air conduit 71, flanged ring 68, connector 69, valve 60, plunger 85, core 18, through the secondary heating element 51, from where it passes through the ferrule 25 forming one pole of the controlling switch, the ring or cap 66 forming the other pole of the controlling switch, the sleeve or shell 63, contact ring 76, air conduit extension 72 and the wire 81.

By the arrangement of the parts thus described, a substantially continuous uniform flow of warm air may be ejected from the nozzle tip. However, if it is found desirable to reduce the temperature of the air being ejected, the thumb-actuated button 47 may be slightly released by the thumb of the operator to such an intermediate position that the switch controlling members, comprising the ferrule 25 and the ring 66, may be slightly separated to open or break the circuit through the secondary heating element without wholly closing the valve 60, whereby, as will be readily observed, air may be permitted to pass through said valve while the switch contacts controlling the second-

ary heating element are separated and consequently open. This, however, does not affect the continuous actuation of the primary heating element 50, which is wholly independent of the switch actuated mechanism local to said syringe, but may be controlled at the source of current supply or otherwise remote from the syringe.

I do not desire to limit my invention to the precise details of construction and arrangement as herein set forth, as it is obvious that various modifications may be made therein without departing from the essential features of my invention as defined in the appended claims.

Having thus described my invention, I claim:

1. A warm-air syringe having means for controlling the flow of air therethrough, and a removable heating unit comprising separate independently controlled heating elements, one being capable of actuation irrespective of the air flow, and the other being actuated by means for controlling the flow of air.

2. A warm-air syringe having a valve for controlling the flow of air therethrough, a heating unit comprising distinctly separate heating elements, one being capable of actuation independently of said valve and the actuation of the other depending upon the open position of said valve.

3. A warm-air syringe having a valve for controlling the flow of air therethrough, a heating unit comprising distinctly separate heating elements, one being arranged for continuous actuation irrespective of the flow of air through said syringe, and the other being so connected with the valve that its actuation is effected only when said valve is open to permit flow of air through said syringe, and means local to the syringe arranged to effect actuation of said valve and its associated heating element.

4. A warm-air syringe comprising a tubular casing having a bore, an air-control valve disposed within said casing, an electrical heating unit mounted to slide in said bore and comprising a heating element arranged to be controlled in accordance with the position of said valve, a heating element arranged to be controlled independently of said valve, and thumb-actuated means arranged to effect the movement of said heating unit to actuate said valve and its associated heating element.

5. A warm-air syringe comprising a hollow handle forming a tubular housing having a bore, an air-control valve unit including a valve, a seat for said valve, and yielding means tending to hold said valve on its seat to prevent passage of air therethrough, a heating unit including independently actuated heating elements, one being arranged to be energized irrespective of the position of

said valve and the other being arranged to be energized only when said valve is opened to permit flow of air therethrough, and means arranged to unseat said valve.

5 6. A warm-air syringe comprising a hollow handle forming a tubular housing having a bore, an air-control valve unit removably disposed in said bore and including a valve seat, a valve cooperative with said seat
10 to control the flow of air therethrough, yielding means tending to maintain said valve seated, a removable heating unit having separately controlled independent heating elements, and means on said handle arranged
15 to effect contemporaneous actuation of one of said heating elements and the opening movement of said valve.

7. A warm-air syringe comprising a hollow handle forming a tubular casing having
20 a bore, an air inlet unit removably disposed in said bore and including a valve seat, an air valve cooperative with said seat to control the flow of air, a tubular plunger arranged to force said valve from its seat and
25 to convey the air thus released, a removable heating unit having a heating element and serving to convey air therethrough from said plunger, and means arranged to produce longitudinal movement of said heating element
30 to effect actuation of said heating element and to force said valve from its seat by the thrust of said plunger.

8. A warm-air syringe comprising a heating unit, an air controlling valve unit having
35 a valve body provided with a seat, a valve cooperative with said seat arranged to control the flow of air, yielding means tending to force said valve against said seat, a tubular plunger extended forwardly beyond the body
40 of said valve arranged to be thrust inwardly to unseat said valve, and yielding means tending to force said tubular plunger away from said valve, and thumb-actuated means arranged to energize said heating unit and to
45 contemporaneously thrust said tubular plunger inwardly to open said valve.

9. A warm-air syringe comprising a handle formed of separable sections including a
50 nozzle, a valve unit disposed in said handle and having a controlling valve and a switch contact, a heating unit having an inclined surface disposed in said handle and including a switch contact, thumb-actuated means
55 arranged to slide on said inclined surface to effect longitudinal movement of said heating unit and thereby cause said valve to open and said switch contacts to relatively engage, and a nozzle tip-fitting removably engaged with said nozzle and rotatably adjustable
60 thereon to direct heated air therefrom in relatively different lateral directions.

10. A warm-air syringe comprising a hollow handle having a nozzle provided with a
65 shoulder, a valve unit arranged to control the flow of air, an electric heating unit ar-

ranged to heat said air, means actuated to successively open said valve unit to permit air to pass therethrough and to close the circuit through said heating unit, and a nozzle tip-fitting rotatably engaged with said
70 nozzle and having means comprising a spring tang cooperative with said shoulder arranged to removably engage said fitting with said nozzle.

11. A warm-air syringe comprising a handle having an air passageway extended
75 therethrough, means arranged to control the flow of air therein, means in said handle forming a closed electric circuit and including a heating element, means in said handle
80 forming an open electric circuit including a heating element, and means arranged to open the air controlling means and close said open electric circuit.

12. A warm-air syringe comprising a handle enclosing air controlling means and electrically actuated heating means having an
85 inclined surface movable longitudinally in said handle for actuating said air controlling means and for controlling said electrically actuated heating means, and thumb-actuated means on said handle cooperatively slidable
90 on said inclined surface to effect movement of said longitudinally movable means.

13. A warm-air syringe including a fluid
95 heating unit comprising a bar of refractory material carrying independently controlled heating elements and having a metallic electric conductor core provided with terminal bores having lateral vents, a sleeve loosely
100 fitting the bar and affording an air passageway embracing said bar and connecting said bores, and means arranged to hold said bar and sleeve together to form an integral heating unit structure.
105

14. A warm-air syringe having a fluid heating unit comprising a bar of refractory material in which independently controlled heating elements are embedded, and through
110 which a metallic electric conductor core having terminal air passageways extends, a sleeve loosely fitting said bar and affording an air passage embracing said bar and connecting said terminal air passageways, and means arranged to hold said bar and sleeve
115 together to form an integral unit structure.

15. A warm-air syringe comprising a hollow handle formed of separable sections and affording a tubular casing, an air inlet unit
120 removably disposed in said casing and including a valve seat, an air-controlling valve cooperative with said seat to control the flow of air therethrough, yielding means tending to hold said valve on said seat, a tubular plunger normally forced away from said
125 valve but arranged to be moved longitudinally to unseat said valve and affording an air passageway, a removable heating unit disposed in said casing and comprising a core having air passageways in communica-
130

tion with the air passageway leading through said plunger and affording an electrical conductor for said unit, and thumb-actuated means arranged to force said unit axially in
 5 said casing to open said valve and to cause said heating unit to be energized.

16. A warm-air syringe comprising a hollow handle formed of separable sections and provided with a nozzle, an air inlet unit removably disposed within said handle and including a valve seat, an air-releasing valve cooperative with said seat to control the flow of air, a metallic air conduit leading into the valve chamber and forming an electric conductor, yielding means tending to force said valve against its seat, a tubular plunger arranged to force said valve from its seat and to convey air thus released, yielding means tending to force said plunger away
 10 from said valve, a removable heating unit disposed within said handle comprising a bar of refractory material including heating elements, a metallic core for said refractory bar having terminal passageways respectively communicating with said plunger and with said nozzle, a sleeve embracing said bar and affording an annular passageway connecting said terminal passageways, a casing arranged to hold said sleeve and bar together and having an inclined surface, a thumb-actuated push-block loosely embracing said sleeve and arranged to cooperate with said inclined surface to effect the longitudinal movement of said unit to close the electric circuit through said heating element and to open said valve.
 15 20 25 30 35

17. A warm-air syringe having means for controlling the flow of air therethrough, and a removable heating unit comprising independently controlled heating elements, one being included in a closed circuit and the other being included in an open circuit, and a valve arranged to control the flow of air the actuation of which closes said open circuit to actuate its heating element irrespective of the heating element in said closed circuit.
 40 45

18. A warm-air syringe having an air passage therein, means controlling the flow of air through said passage, means independent of said controlling means for heating air in said passage, and means actuated by said air controlling means for augmenting the heat supplied to air in said passage.
 50 55

19. A syringe having independently controlled heating elements of relatively different heat intensity, one being continuously energized to heat the fluid therein, and the other being intermittently energized contemporaneously with the flow of fluid there-through whereby the combined energy of the respective heating elements maintains a substantially even temperature of the fluid flowing therefrom.
 60 65

20. In combination, a syringe comprising

a pair of tubular members mounted for movement one relative to the other, a nozzle carried by one of said members, the other having an inlet for fluid under pressure, a valve for controlling the passage of fluid through said members having a part normally spaced from one of the members arranged to be engaged and operated thereby upon effecting relative movement between said members and means by which said relative movement is effected.
 70 75

21. In combination, a syringe comprising a pair of tubular members mounted for longitudinal movement one upon the other, a nozzle carried by one of said members, a conduit connected with the other for supplying fluid thereto under pressure and a normally closed valve for controlling the flow of fluid through said members, said valve being spaced from one of said members and opened by longitudinal movement thereof into engagement with the valve.
 80 85

22. In combination, a syringe comprising a pair of tubular members mounted for longitudinal movement one relative to the other, a nozzle carried by one of said members, a normally closed valve carried by the other of said members, a conduit connected with the last mentioned member for supplying fluid thereto under pressure, and manually operable means by which to effect said relative movement.
 90 95

23. In combination, a syringe comprising a pair of tubular members mounted for longitudinal movement one relative to the other, one of said members having an outlet and the other having a fluid passage communicating therewith and a self closing valve interposed between the ends of said passage and normally preventing the flow of fluid to said outlet, said valve being automatically opened by one of said members movable relative thereto and relative to the other of said members.
 100 105

24. In combination, a syringe comprising a pair of communicating tubular members mounted for longitudinal movement one relative to the other, one of said members having an outlet provided with a nozzle, a self closing valve interposed between the ends of the other of said members and normally preventing the passage of fluid therethrough, said valve being automatically opened when said members are moved one longitudinally of the other and an operating member movable upon one of the tubular members to effect longitudinal movement of the other.
 110 115 120

25. In combination, a syringe comprising a tubular casing and a nozzle head carried thereby, a tube movable within the casing and arranged to deliver fluid to the nozzle head, a supply conduit connected with the tube, a valve normally preventing the passage of fluid through the tube and arranged to be opened automatically upon effecting
 125 130

relative movement between the casing and said tube and operating means adjustable to effect such movement.

26. In combination, a syringe comprising
5 a pair of telescoped tubes arranged for relative longitudinal movement and having fluid passages therein, a discharge nozzle on the outer tube, a fluid supply conduit connected with the inner tube and a valve for
10 controlling the passage of the fluid through the inner tube to the nozzle arranged to be automatically opened upon effecting relative longitudinal movement between said tubes.

15 27. In combination, a syringe comprising inner and outer tubes mounted for relative longitudinal movement and having communicating passages for the flow of liquid under pressure, a valve arranged to be opened
20 by a longitudinal movement thereof upon effecting relative movement between said tubes whereby to permit the liquid to flow from one to the other, a nozzle carried by the
25 outer tube and means movable upon one of the tubes arranged to effect movement of the other.

In witness whereof, I have hereunto set my hand this 23rd day of November, A. D., 1928.

30 ROBERT C. ANGELL.

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