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SYRINGE

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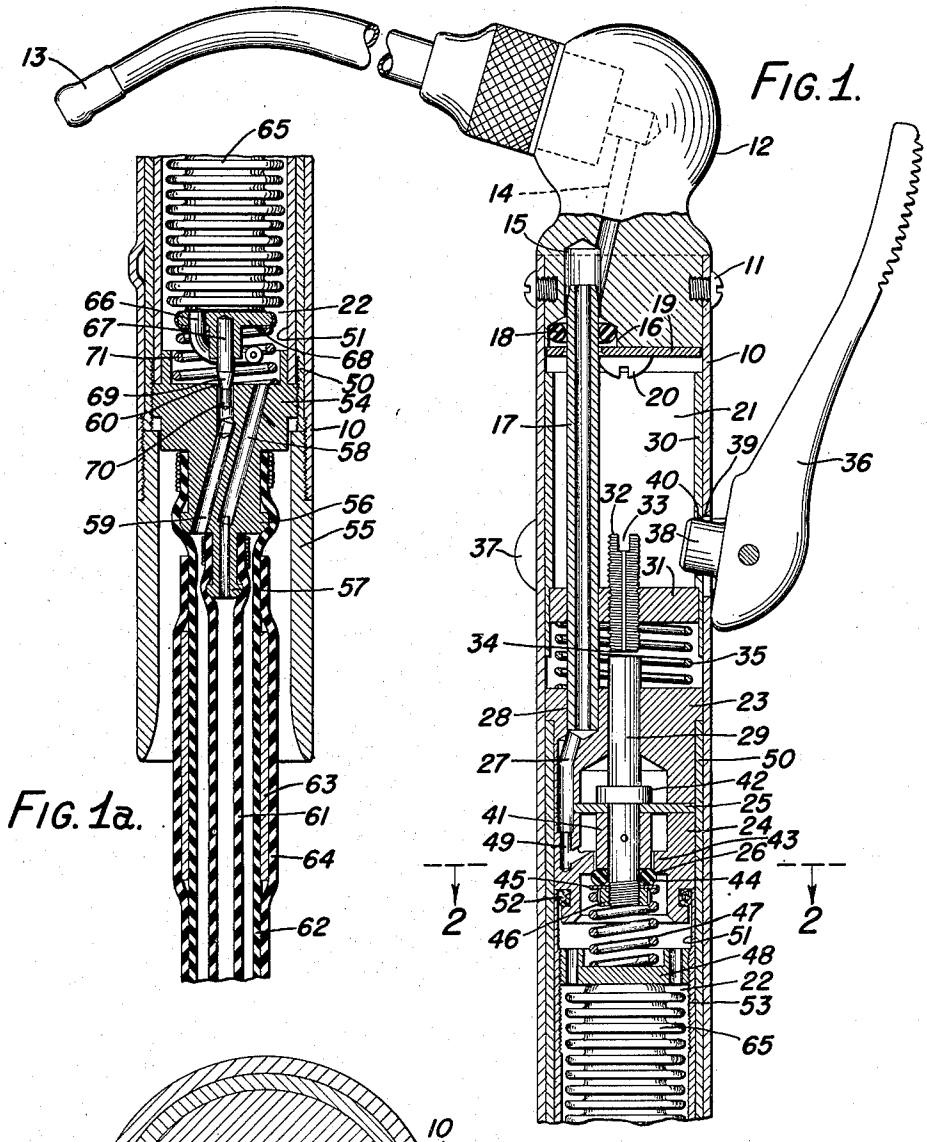

FIG. 1a.

FIG. 1.

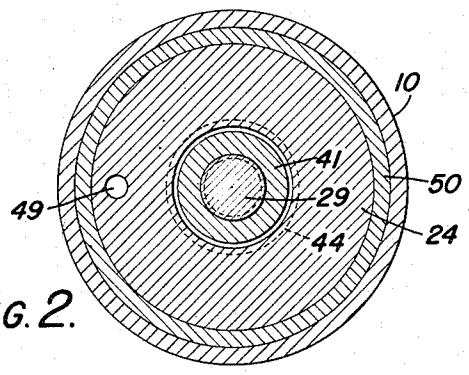

FIG. 2.

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SYRINGE

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8 Claims. (Cl. 128—239)

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This invention relates to syringes of the type adapted for use in dental and other medical practises, for supplying a heated fluid at the point of operation, one object of the invention being to provide an improved syringe of the above character having a more simple, practical and efficient construction.

Another object is the provision of a syringe of the character indicated in which the fluid in the instrument and in the conductor connecting it with a source of supply of heated fluid is maintained at a predetermined temperature by an automatically regulated circulation of the fluid from said source through the conductor and instrument to a waste outlet.

Another object is to supply such a syringe having valve means of an improved and more practical character for manually controlling the supply of fluid from the instrument nozzle.

A further object is to provide a syringe of the above nature having simple and efficient thermostatic means for automatically regulating the circulation of heated fluid through the instrument to maintain its temperature ready for instant use.

Still a further object is to provide an instrument having the above advantages in a form of construction which is relatively inexpensive to manufacture and reliable in operation.

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 an enlarged elevation of a portion of a syringe embodying the present invention, with parts in central, longitudinal section;

Fig. 1ª is a central, longitudinal section of the remaining portion of the syringe shown in Fig. 1, and

Fig. 2 is an enlarged, sectional view on the line 2—2 in Fig. 1.

The invention is embodied in the present instance, by way of illustration, in a syringe having a tubular handle comprising an outer sleeve 10 extending throughout the major length thereof and having fixed in its upper end, as by means of screws 11, a head 12 to which is attached the usual or any suitable nozzle 13. The head is formed with a fluid passageway 14 leading to the nozzle from a socket 15 in the head having an enlargement 16 at its lower end opening through the lower end of the head. A tube 17 has its upper end inserted in the socket and forms part

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of a fluid passageway through the handle leading to the nozzle. The end of the tube is sealed in the socket by means of a ring packing 18, of rubber or other similar material, positioned in the socket enlargement 16 and retained therein by means of a plate 19 secured to the lower end of the head by a screw 20.

The handle sleeve 10 is divided into upper and lower chambers, 21 and 22, by partition means comprising a pair of upper and lower heads, 23 and 24, supporting between them a flexible partition disk 25, of rubber or like material. These heads are supported by means hereafter described and the lower head 24 is formed with a seat 26 for valve means controlling communication between the lower chamber 22 and a passageway 27 leading through the upper head 23 to the tube 17 which has its lower end seated in a socket 28 in the head, as shown. The valve means comprises a stem 29 sliding in a bore in the upper head 23 and projecting above the upper end of the head for coöperation with the said valve actuating means, which will now be described.

The means for actuating such valve means, for controlling the supply of fluid to the nozzle, is manually operated and located in the upper chamber 21, comprising an inner sleeve 30 having a close sliding fit within the outer or handle sleeve 10. Sleeve 30 has fixed therein near its lower end a partition 31 formed centrally with a tapped bore in which a threaded stud 32 is adjustably mounted. The upper end of the stud is formed with a slot 33 for engagement by a tool to adjustably screw it through the head and the lower end of the stud projects below the head to provide an abutment 34 for engaging the end of the valve stem 29 to open the valve for supplying fluid to the nozzle. A coiled compression spring 35 is interposed between the heads 23 and 31 for normally raising the head 31 and the stud to release the valve.

Such valve actuating means is preferably operated by a lever 36, pivotally mounted at its lower end in a band 37 clamped around the handle sleeve 10 by any suitable means (not shown). Lever 36 has a spur 38 extending loosely through an opening 39 in the handle sleeve 10 and fitting closely in an opening 40 in sleeve 30. Lever 36 is normally operated by engaging its upper end by the thumb of the operator's hand holding the syringe, to press the free end of the lever toward the handle and swing the lever spur 38 downwardly. Such movement of the spur slides sleeve 30 downwardly and moves its stud 32 to engage the valve stem and open the valve means as long

as the pressure of the thumb is maintained on the lever 36.

The supply valve means preferably comprises a sleeve 41, fixed to the valve stem 29 below the flexible partition 25, and the stem has an enlargement 42 engaging the upper side of the partition, so that the stem and partition move together by flexing the partition in recesses provided in the adjacent ends of the heads 23 and 24. The lower head has a constricted portion 43 formed with an opening of larger diameter than the stem sleeve 41, so that the sleeve moves up and down with sufficient clearance in the opening to permit free passage of the fluid therethrough. The valve body is formed by a ring 44, of rubber or like material, closely surrounding the lower end of the valve stem in position to engage the valve seat 26 and to be engaged and moved away from the seat by the lower end of the valve stem sleeve 41. A washer 45, secured by a nut 46 on the lower end of the stem, serves to hold the valve ring on the stem. A coiled compression spring 47 bears at its upper end against the washer and at its lower end against a head 48, hereafter described, so as to yieldably press the valve ring 44 against its seat 26. The opening through the valve seat leads through the opening in the constriction of the lower head 24 into the recess at its upper end which communicates by means of a passage 49 in the head with the lower end of the tube 17.

The head 23 has an enlarged upper end fitting the interior of the handle sleeve 10 and supported on the upper end of an intermediate sleeve 50 which is adjustable in the sleeve 10 by means hereafter described. The head 24 is adjustably slidable in the sleeve 50 and has adjacent its lower end a shoulder by which it is supported on the upper end of an inner sleeve 51 which is adjustably slidable in sleeve 50, as hereafter described, the heads 23 and 24 being adjustably supported to suitably position the sleeve seat 26 and to maintain the heads in close contact with the opposite sides of the flexible disk 25.

The lower chamber 22 of the handle is located in the innermost sleeve 51, the upper end of which has a sealed connection with the head 24 by a ring packing 52 supported in a recess in the lower end of the head, as shown. The upper end of sleeve 51 is internally threaded, as at 53, to receive the above mentioned head 48 which is thus adjustably screwed into the head through its upper end. The purpose of the head 48, with bellows attached, is to provide temperature adjustment. By this adjustment, pressure and travel of the bellows 65 and return spring 71 can be varied. For instance, by reducing the pressure on the bellows more travel is necessary to close the valve 69 resulting in higher temperature in the syringe handle as linear travel of the bellows is directly proportional to the temperature applied to it. The lower end of the innermost sleeve 51 rests on a bottom head 54 (Fig. 1a) adjustably threaded in the lower end of the intermediate sleeve 50, while the lower end of this intermediate sleeve rests on the top of a guard sleeve 55 adjustably threaded in the lower end of the outer or handle sleeve 10. Adjustment of sleeve 55 serves to adjust the intermediate sleeve longitudinally of the handle, while adjustment of the head 54 serves to adjust the innermost sleeve 51, for the purposes described above.

The lower head 54 is formed at its lower end with concentric upper and lower nipples, 56 and 57. The lower nipple communicates through a passage 58 with the adjacent end of the lower chamber 22, while the upper nipple 56 communicates through a passage 59 with a valve opening 60 at the center of the head and leading into the lower chamber. These nipples are connected by flexible inner and outer tubes, 61 and 62, respectively, with the equipment stand on which the syringe is extensibly supported, as well understood in the art, tube 61 being adapted for connection with a source of supply of heated water or other fluid, of known or suitable construction, carried by the stand, while the outer tube 62 forms a waste outlet from the syringe leading to a suitable discharge conductor in the stand. A stiffening sleeve 63 is secured around the tubes under the cover 64 thereof, so as to extend above and below the lower end of the guard sleeve 55 and prevent excessively sharp bending and injury of the tubes at the lower end of the guard.

It is evident from the above construction that heated fluid from a source in the equipment stand is supplied through the inner tube 61 and the passageway 58 of the lower head 54 to the lower chamber of the handle and through the latter to the supply valve means in the head 24. On operation of the manual lever 36, the supply valve is opened and the heated fluid is supplied through the passageways 49 and 27 and the tube 17 to the syringe head and nozzle. When the syringe has been standing for any substantial period, such fluid tends to become cooled in the tube 61 and in the lower chamber and passageway through the instrument, and the invention comprises thermostatic means for maintaining a continuous circulation of heated fluid at a low rate through the tube 61 and the lower chamber of the instrument to maintain the temperature of the fluid in these parts and of the instrument as a whole, so that a supply of suitably heated fluid is quickly available on operation of the lever 36.

Such means for maintaining the temperature of the fluid and of the instrument comprises a thermostatic element, preferably a temperature-responsive, expansible bellows 65, of any known or suitable construction, located in the chamber 22, in spaced relation with the inner wall of the innermost sleeve 51, as shown, with its upper end bearing against and preferably fixed to the lower face of the head 48. The bellows is filled with a liquid, such as acetone, which expands with increase in temperature, as well understood in the art, the bellows being filled through an inlet tube 66 at its lower end and the tube being thereafter sealed to prevent the escape of the liquid. The lower end of the bellows is provided with means for actuating the valve cooperating with the valve seat 60 leading to the waste outlet.

Such outlet valve is preferably in the form of a rod 67 fixed in a socket in the lower head 68 of the bellows and the projecting lower end of the rod is formed with a portion 69 tapered inwardly toward the free end of the rod, for cooperation with the valve seat, beyond which the rod has an end 70 of uniform reduced diameter. A coiled compression spring 71, seated in the recess in the lower head 54, bears at its upper end against the lower head 68 of the bellows to press it upwardly and withdraw the tapered portion of the valve rod from the seat, to increase the escape of fluid from the chamber to the waste outlet.

It is further evident from this construction that when the syringe is brought into condition for use by the supply of heated fluid through the tube 61, such fluid circulates in the lower chamber

22 around the thermostatic bellows, causing its expansion and the progressive throttling of the escape of fluid through the valve to the waste outlet. While the instrument and the fluid in it are relatively cold, the bellows is collapsed, withdrawing the valve rod from its seat and permitting a substantial flow of the heated fluid through the lower chamber around the bellows. As the temperature of the instrument and its contained fluid is thus raised, the bellows expands to partially close the outlet valve and reduce the circulation. When the parts are fully heated, the outlet valve is closed to an extent which permits only the small circulation which is necessary to maintain the parts at the desired temperature.

The invention thus provides a syringe in which the nozzle head occupies a fixed position in the instrument handle and the actuating means for the supply valve are located wholly outside the fluid passageway, such actuating parts being readily accessible for any necessary adjustments by removal of the nozzle head from the handle. The temperature of the instrument and the fluid therein and in its supply line are automatically maintained by a regulated circulation of the heated fluid controlled by a simple and effective arrangement of waste outlet valve and thermostatic actuating means therefor, located in one portion of the instrument handle, thus obviating the more complicated electrical heating units and circuit connections heretofore commonly employed for this purpose. These advantages are afforded by a relatively simple and practical type of construction which is relatively inexpensive to manufacture and reliable in operation.

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.

We claim:

1. A syringe comprising a handle provided with a nozzle and with a fluid supply passageway leading therethrough to said nozzle, fluid conducting means connected with said handle passageway and adapted for connection with a source of heated fluid, a waste outlet from said passageway, a valve controlling said outlet, and thermostatic means associated with said handle for actuating said outlet valve to automtically regulate the circulation and temperature of fluid in said passageway.

2. A syringe comprising a handle provided with a nozzle and with a fluid supply passageway leading therethrough to said nozzle, fluid conducting means connected with said handle passageway and adapted for connection with a source of heated fluid, a valve controlling the supply of fluid through said passageway, manually operable means for actuating said supply valve, a waste outlet from said passageway, a valve controlling said outlet, and thermostatic means in said passageway for actuating said outlet valve to automatically regulate the circulation and temperature of fluid in said passageway.

3. A syringe comprising a hollow handle divided interiorly into upper and lower chambers, a nozzle on the upper end of said handle, fluid conducting means connected with said lower chamber and adapted for connection with a source of heated fluid, a fluid passageway communicating with said lower chamber and leading through said upper chamber to said nozzle, a valve controlling the supply of fluid through said passageway, means in said upper chamber for actuating said valve having a manually operable part on the exterior of said handle, a waste outlet from said lower chamber, a valve controlling said outlet, and thermostatic means in said lower chamber for actuating said outlet valve to automatically regulate the circulation and temperature of fluid supplied through said passageway.

4. A syringe comprising a tubular handle divided interiorly into upper and lower chambers, a nozzle fixed on the upper end of said handle, fluid conducting means connected with said lower chamber and adapted for connection with a source of heated fluid, a passageway communicating with said lower chamber and leading through said upper chamber to said nozzle, a valve for said passageway having a stem located exteriorly thereof, means movably mounted in said upper chamber having an adjustable abutment for actuating said valve stem and a manual actuating part therefor located exteriorly of said handle, a waste outlet from said lower chamber, a valve controlling said outlet, and thermostatic means in said lower chamber for actuating said outlet valve to automatically regulate the circulation and temperature of fluid in said passageway.

5. A syringe comprising a tubular handle divided interiorly into upper and lower chambers, a nozzle fixed on the upper end of said handle, fluid conducting means connected with said lower chamber and adapted for connection with a source of heated fluid, a passageway communicating with said lower chamber and leading through said upper chamber to said nozzle, a valve for controlling the supply of fluid through said passageway and having a stem located in said chamber exteriorly of said passageway, a sleeve slidably mounted in said upper chamber and having an adjustable abutment for actuating said valve stem, a manually operable member on the exterior of said handle for sliding said sleeve and controlling the supply of fluid to said nozzle, a waste outlet from said lower chamber, a valve controlling said outlet, and thermostatic means in said lower chamber for actuating said outlet valve to automatically regulate the circulation and temperature of fluid in the passageway.

6. A syringe comprising a tubular handle divided interiorly into upper and lower chambers, a nozzle fixed on the upper end of said handle, fluid conducting means connected with said lower chamber and adapted for connection with a source of heated fluid, a passageway communicating with said lower chamber and leading through said upper chamber to said nozzle, a valve for controlling the supply of fluid through said passageway and having a stem located in said upper chamber exteriorly of said passageway, a sleeve slidably mounted in said upper chamber and having therein a partition containing a threaded stud for actuating said valve stem, a manually operable member on the exterior of said handle for moving said sleeve and stud to actuate said valve and control the supply of fluid to said nozzle, a waste outlet from said lower chamber, a valve controlling said outlet, and thermostatic means in said lower chamber for actuating said outlet valve to automatically reg-

ulate the circulation and temperature of fluid in the passageway.

7. A syringe comprising a handle provided with a nozzle and with a fluid supply passageway leading thereto, fluid conducting means connected with said handle passageway and adapted for connection with a source of heated fluid, a valve controlling the supply of fluid through said passageway, manually operable means for actuating said supply valve, a waste outlet from said passageway, valve means adapted to progressively throttle the escape of fluid through said outlet, and a thermostatic element in said passageway and having an actuating connection with said valve means for regulating the circulation and temperature of fluid in said passageway.

8. A syringe comprising a handle provided with a nozzle and with a fluid supply passageway leading therethrough to said nozzle, fluid conducting

means connecting said handle passageway and adapted for connection with a source of heated fluid, a waste outlet from said passageway, a valve controlling said outlet and a temperature-responsive, expansible bellows in said passageway provided with means for actuating said outlet valve to automatically regulate the circulation and temperature of fluid in said passageway.

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