Sept. 18, 1962 E. J. FRANWICK ET AL 3,054,402

DENTAL SYRINGE

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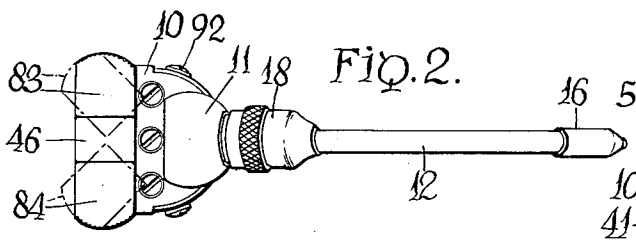

Fig. 2.

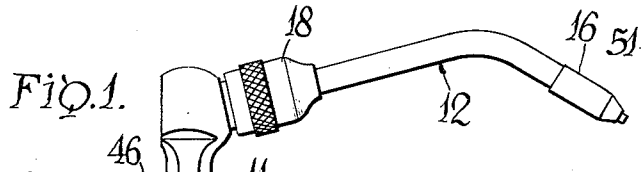

Fig. 1.

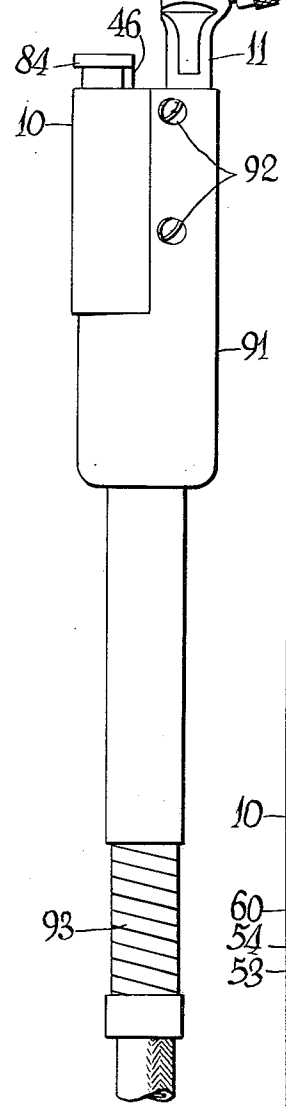

Fig. 9.

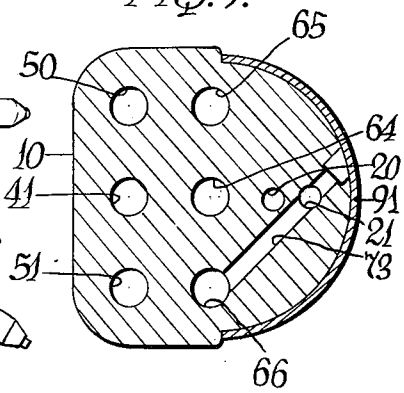

Fig. 4.

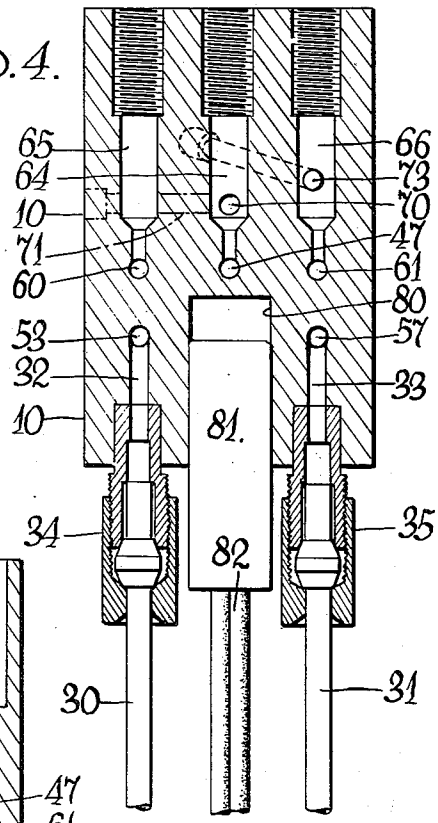

Fig. 5.

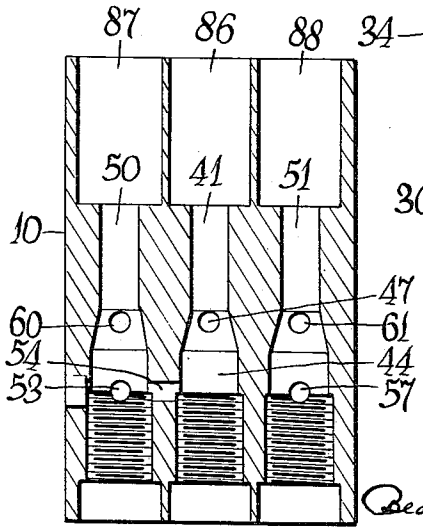

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Fig. 3.

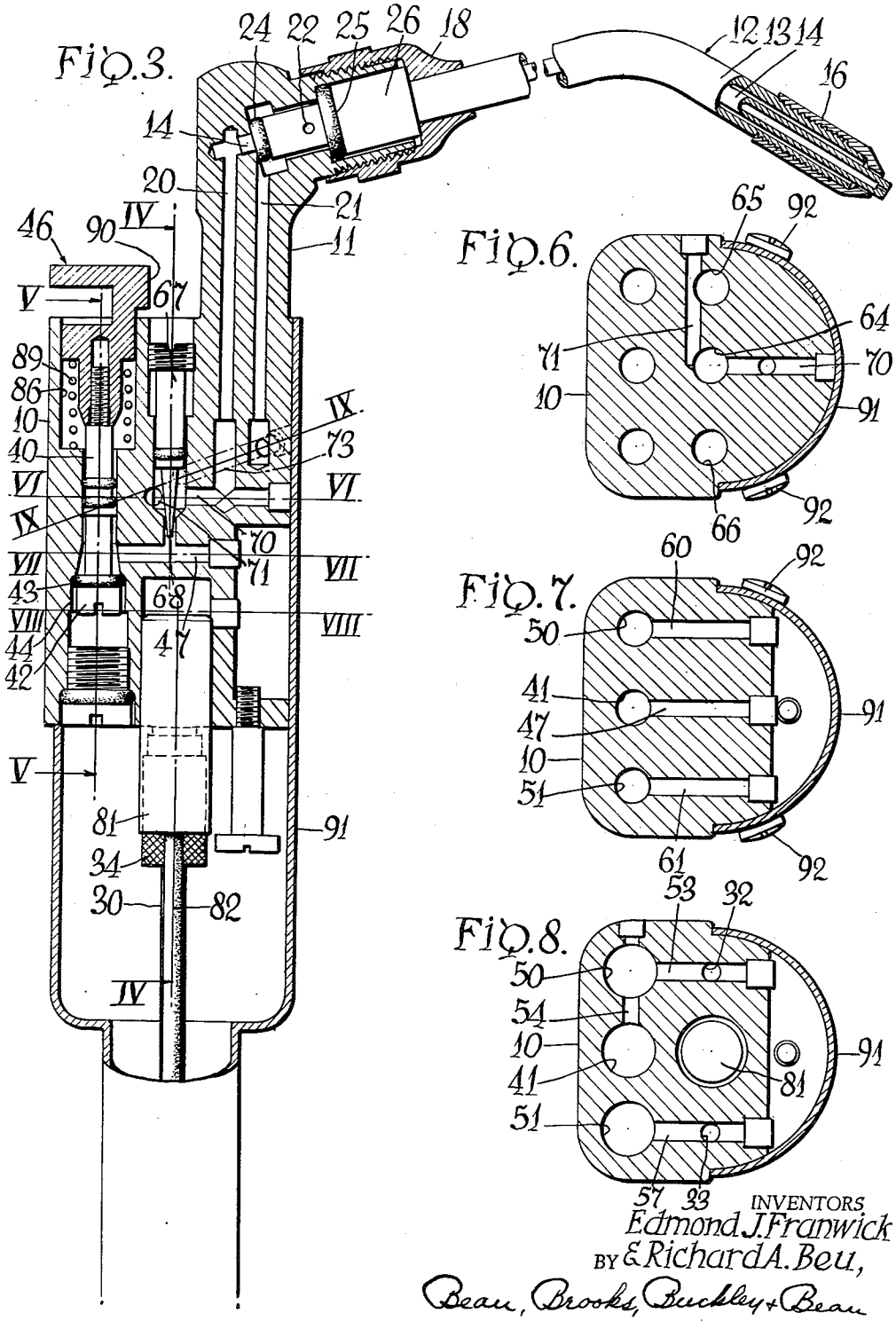

Fig. 6.

Fig. 7.

Fig. 8.

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DENTAL SYRINGE

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This invention relates to apparatus for use in the practice of dentistry or allied arts and more particularly to a hand device for ejecting streams of water or air or an air-water spray into the mouth of a patient or for related purposes.

In the practice of dentistry it is the usual practice to eject a stream of water into the mouth of the patient to cleanse an area where work has been or is being performed or for other purposes. In some instances a solid stream of water is most effective and in other an air-water spray may be more desirable. It is also common to direct an air stream against certain areas to dry the same preparatory to performing certain dental operations.

In conventional dental apparatus the dental unit is provided with two entirely separate devices, a water springe and an air jet device. It is a primary object of the present invention to provide a single hand-held device which performs all of the above functions at will and is capable of certain combined functions or operations not attainable with either of the foregoing conventional devices.

Certain modern high speed dental handpieces for dental drilling are provided with air or water connections, primarily for cooling a drill, bur or like tool and for preventing overheating of the tooth being drilled. These special purpose accessories do not perform the same function as the cleansing and drying devices referred to above, they do not replace the same in the dentist's array of equipment, and are not usable in place of syringes of the general type contemplated herein.

For general purpose rinsing or cleansing and drying the dentist must employ a device or devices apart from the usual drilling hand piece. Water or air discharge devices associated with drilling hand pieces direct their fluid streams primarily at the handpiece bearings or against the drill or burr and only incidentally exhaust these fluids into the patient's mouth after they have performed their primary function of cooling the handpiece bearings or cooling and clearing the drill or burr.

On the other hand, the separate water stream and drying air devices which are currently employed by dentists are very commonly used conjointly or in close succession, so that a single unit which may be used either for liquid cleansing or air drying at will and instantaneously interchangeably is of inestimable value to the dentist. To perform these combined functions in a professionally satisfactory manner the apparatus must be substantially as compact and convenient to use and handle as either of the separate devices of the prior art and should not require selection or adjustment operations remote from the handheld device itself.

The present invention provides a multiple purpose device of this kind which operates in a safe, convenient and foolproof manner and which may be instantaneously employed by the dentist to perform the two basic functions, water cleansing and air drying, and novel additional combined functions, the chief of which is the emission of a water-air spray for additional cleansing or clearing operations.

The utility and versatility of the dental tool of the present invention will be explained more fully in connection with a detailed description of an exemplary form of such tool which is illustrated in the accompanying drawings and described in detail in the following specification. However, it is to be understood that such embodiment is set forth primarily to illustrate and exemplify the principles of the invention and that the scope of the latter is not limited to the precise form thus disclosed, nor otherwise than as defined in the appended claims.

While the device of the present invention is designed and intended primarily for use by dentists and dental technicians for oral cleansing and drying operations and the foregoing discussion is directed particularly to its use for such purposes, it is to be understood that the device may find analogous uses in other surgical or therapeutic fields.

Certain variations and possibilities in the mode of use of the device of the present invention which may be attained and practiced by various flow adjustments and various manipulations of the device will be better understood after an understanding of the mechanism of the exemplary form set forth herein. For this reason a further discussion of such various adjustments and modes of use is set forth at the end of this specification following the detailed description of the form of the device illustrated in the drawings by way of example.

In the drawings:

FIG. 1 is an elevational view of one form of the syringe or fluid ejecting device of the present invention;

FIG. 2 is a top plan view thereof;

FIG. 3 is a central vertical cross-sectional view through the device of FIGS. 1 and 2 viewed as in FIG. 1 but on a larger scale and with portions thereof broken away;

FIG. 4 is a fragmentary vertical cross-sectional view on the line IV—IV of FIG. 3;

FIG. 5 is a fragmentary vertical cross-sectional view on the line V—V of FIG. 3;

FIG. 6 is a horizontal cross-sectional view on the line VI—VI of FIG. 3;

FIG. 7 is a horizontal cross-sectional view on the line VII—VII of FIG. 3;

FIG. 8 is a horizontal cross-sectional view on the line VIII—VIII of FIG. 3; and

FIG. 9 is an oblique cross-sectional view on the line IX—IX of FIG. 3.

Like characters of reference denote like parts throughout the various figures of the drawings and the numeral 10 designates a body member having a reduced upward extension 11. For convenience of manufacture the upward extension 11 is separately fabricated and set into the body member 10 but this detail is of no importance insofar as the principles of the present invention are concerned and accordingly the drawings illustrate the body member 10 and the upward extension 11 as a unitary member.

Furthermore, for feasibility of manufacture many of the drilled passages of the body member 10 and extension 11 are drilled from a given surface thereof and then the outer ends of the openings are plugged. This is merely a necessary and conventional manufacturing expedient and for simplicity of description these openings will be described only as to their useful or functional extent, without reference to the aforesaid plugs.

At its upper end the extension 11 is fitted with a combined water-ejecting, air-ejecting, and air-water spray emitting nozzle assembly designated generally by the numeral 12. Referring to FIG. 3, the nozzle 12 comprises an outer conduit member 13 and an inner conduit member 14, the walls of the two conduits being radially spaced to provide an intervening annular air passage. At the outer end of the nozzle the water conduit 14 preferably extends beyond the outer end of the outer conduit member 13 and a threaded ferrule 16 defines the end of outer conduit member 13 and may be adjusted axially to modify the characteristics of the air-water spray.

The conduit members 13 and 14 are fitted into the upper end of extension 11 of body member 10 as clearly shown in FIG. 3 and are held in place by a gland type of retaining nut 18. Extension 11 is provided with a vertical water passage bore 20 and a vertical air passage bore 21, the former communicating with the interior of inner conduit 14, and the latter communicating with the annular space between the outer and inner conduits 13 and 14 as by way of radial openings 22 in the outer conduit 13. The ends of the conduits within the extension 11 are sealed to provide fluid-tight passages for water and air as by O-ring washers 24 and 25 and it will be noted that nut 18 engages an enlargement 26 of conduit 13 to urge the washers 24 and 25 against their respective seats in the upward extension 11.

Referring particularly to FIG. 4, a flexible water supply conduit 30 and a flexible air pressure supply conduit 31 are associated with the lower end of body member 10 and communicate respectively with a water inlet bore 32 and an air pressure inlet bore 33 formed in the lower end of body member 10. The flexible conduits 30 and 31 are attached to the body member 10 by conventional nipple and gland nut connection devices designated generally by the reference numerals 34 and 35, respectively, in FIG. 4.

Speaking generally, the air conduit 31 and air pressure inlet bore 33 connect with the air passage bore 21 which lead to the annular air passage through nozzle 12 by way of air passages leading through the body member 10 in a manner which will presently be described. The water conduit 30 and water inlet bore 32 are connected with water passage bore 20 of the upward extension 11 by a pair of more or less parallel water passages which extend upwardly through body member 10 in a manner and for purposes which will likewise presently appear.

Each of the aforesaid three passages through the body member 10, that is the air passage and the two water passages, are provided with independent manual control valves and each of the three passages is also preferably provided with a regulatable needle valve which controls the effective flow orifice of the passage in each case to establish an independently adjustable maximum flow capacity in each of these three passages.

The manual valves and the metering needle valves of the three aforesaid passages are the same in mechanical construction and in general arrangement and only one of each of these valves is illustrated in detail and will now be described, it being understood that these valves are each three in number and identified by like reference numerals to conform with the detailed illustration of the control valve and the needle valve found in FIG. 3. Only the manual operating buttons of the three control valves and their valve chambers or bores are designated by separate reference numerals. FIG. 3 is a central vertical cross-sectional view and accordingly shows the central manual valve and the central needle valve which both serve to control and regulate one of the aforesaid generally parallel water passages through the body member 10.

Referring to FIGS. 3 and 5, the numeral 40 designates a valve member which comprises a stem movable vertically in a valve bore 41. FIG. 5 shows the control valve bores with the movable valve parts omitted. The lower end of valve member 40 has an enlarged head 42 and an O-ring packing 43 associated therewith slides in an enlarged portion 44 of bore 41. Upon downward movement of a manual control button designated generally by the numeral 46 and attached to the upper end of valve member 40 packing 43 moves downwardly to the lower end of enlarged portion 44 of bore 41 and in so doing connects inlet water from the bore 32 to a cross port 47 leading horizontally from bore 41. The manner in which inlet water reaches the valve chamber 44 from the water inlet bore 32 will presently appear.

Referring particularly to FIG. 5, duplicate valve bores 50 and 51 lie at opposite sides of the valve bore 41, the left-hand bore 50 comprising a companion water control valve chamber and the right-hand bore 51 comprising an air control valve chamber. Each of these valve bores is enlarged at its lower portion as in the case of valve bore 41 and each contains a valve member identical to the valve member 40.

Water is introduced to the lower end of valve bore 50 by a cross port 53 leading from the inlet water bore 32, see also FIG. 8, and this water source is applied jointly to the valve bores 50 and 41 by virtue of a cross port 54 which continuously connects the lower ends of the valve bores 50 and 41. Air pressure is introduced to the lower end of valve bore 51 by way of a cross bore 57 which leads thereto from the air pressure inlet bore 33.

The outlet from the valve bore 41 is shown in FIGS. 3 and 5 and has been designated by the reference numeral 47. Similar horizontal outlets from the valve bores 50 and 51 are designated 60 and 61, respectively, and are shown in FIGS. 5 and 7.

Each of the manual valve outlet passages 47, 60 and 61 leads to one of the aforesaid metering needle valves, in a manner which will presently appear. In FIG. 4 the three needle valve chambers are designated 64, 65 and 66 corresponding, respectively, to the manual valve outlet ports 47, 60 and 61 and communicating therewith. The central needle valve of needle valve chamber 64 is shown in detail in FIG. 3 and it is to be understood that the other two needle valves of the needle valve chambers 65 and 66 are identical and are referred to herein by the same reference numeral.

Referring to FIG. 3, each needle valve 67 has a main body or shank portion, an enlarged threaded upper end portion and a tapered lower needle valve portion. The upper ends of each of the needle valve chambers 64, 65 and 66 are threaded to receive the threaded upper ends of the needle valves 67 so that the needle valve portions thereof may be selectively adjusted relative to beveled seat portions which form the lower ends of the needle valve chambers 64, 65 and 66.

Referring particularly to FIG. 3, the outlet cross port 47 from the manual control valve bore 41 communicates with a vertical port 68 which leads upwardly into needle valve chamber 64 and is controlled by the needle valve 67 of chamber 64. The outlet from needle valve chamber 64 is designated 70 and leads horizontally to the lower end of the vertical water passage bore 20 in upward extension 11 of body member 10, as clearly shown in FIG. 3.

The outlet passage 70 leading from needle valve chamber 64 is also illustrated in FIG. 6. A horizontal outlet port from needle valve chamber 65 is designated 71 and leads to the outlet portion of needle valve chamber 64, as shown in FIGS. 4 and 6. Thus the outlets from the two water needle valve chambers 64 and 65 discharge jointly through port 70 into the vertical water passage bore 20 of upward extension 11.

The outlet from air needle valve chamber 66 is designated 73 and leads obliquely upwardly to the vertical air passage bore 21 of upward extension 11, as shown in FIGS. 3 and 9.

In the form of the present invention illustrated herein means are provided for electrically heating the incoming water and for this purpose a chamber 80 is formed in the bottom of body member 10 and has inserted therein an electrical heating element 81 energized by electrical conductors 82. The heat from the heating element 81 is transmitted to the water in the passages of body member 10 by conduction from the heating element through the body member itself.

The manual control button for the middle valve 40 has previously been designated 46. The corresponding valves 40 of the valve bores 50 and 51 are provided with manual control buttons designated 83 and 84, respectively, such control buttons being illustrated particularly in FIG. 2.

Referring particularly to FIG. 3, each of the manual push buttons 46, 83 and 84 has a circular lower portion which is vertically slidable in a counterbore at the upper end of each of the valve bores 41, 50 and 51, these counterbores being designated, respectively, 86, 87 and 88 in FIG. 5. A compression coil spring, one of which is designated 89 in FIG. 3, acts between the lower end of each counterbore and the lower end of the aforesaid circular portion of each of the manual push buttons, urging the latter upwardly and consequently urging the O-ring sealing member 43 of each valve 40 to closed position.

The three push buttons 46, 83 and 84 are non-circular and together they form an oblong push button surface which is aptly illustrated in FIG. 2. When the push buttons are all in raised position they mutually prevent rotative movement of the push buttons and several valves. The center push button 46 has a depending heel portion 90 at its rear part whereby the left-hand push button 83 even when depressed cannot be rotated in a clockwise direction as viewed from above. The reason for this is that normal downward and forward thumb pressure on the push button 83 will tend to rotate the push button 83 in a clockwise direction and the same would otherwise lock under the upper portion of push button 46.

However, it will be noted that the forward portion of push button 46 is undercut so that with push button 83 in depressed position it may, by a special and deliberate rearward manipulation of the operator's thumb, be rotated in a counterclockwise direction to lock the same beneath push button 46, in the undercut forward portion thereof, for continuous opening of the valve 40 which is associated with push button 83, as illustrated in dot and dash lines in FIG. 2.

The heel portion of push button 46 provides the same safety feature against inadvertent counterclockwise rotation of the push button 84 and the latter is also susceptible of the same under-locking operation which may be instituted by clockwise rotation thereof, likewise as illustrated in dot and dash lines in FIG. 2.

It will be seen from the foregoing that when the push button 84 is depressed to lower the valve stem 40 of the valve bore 51, air under pressure from conduit 31 and air inlet bore 33 will flow from cross bore 57 through the valve bore 51 past the valve-forming O-ring 43, transversely through the port 61, thence upwardly into needle valve chamber 66 past the needle valve 67 therein, thence obliquely upwardly through port 73 and upwardly through the vertical air passage bore 21 in the upward extension 11 of body member 10. The rate of flow will obviously be controlled by the setting of the needle valve 67 of needle valve chamber 66.

Flow of water from the water inlet bore 32 of body member 10 to the vertical water passage bore 20 of upward extension 11 is by two alternative paths, depending upon which of the push buttons 46 and 83 is depressed. If push button 83 is depressed flow of water is upward through inlet bore 32, horizontally through cross bore 53 into valve bore 50, upwardly past the O-ring 43 of the valve 40 of this valve bore, thence horizontally through port 60 and upwardly into the needle valve chamber 65 past the needle valve 67 therein and through the transverse port 71 into the outlet portion of needle valve chamber 64, thence horizontally through the port 70 to the lower end of the vertical water passage bore 20 of upward extension 11.

If the manual push button 46 is depressed, flow of water will be from water inlet bore 32, horizontally through port 53 into the lower end of valve bore 50, the valve 40 of which is now closed, thence horizontally through port 54 into the lower end of valve bore 41, thence upwardly past the O-ring 43 of the valve 40 of valve bore 41, thence horizontally through the port 47 and upwardly into the lower end of needle valve chamber 64, past the needle valve 67 therein, and thence through

the horizontal port 70 to the lower end of vertical water passage bore 20 of the upward extension 11.

The reason for the two alternative water passages through body member 10 under separate manual control of the push buttons 46 and 83 is to provide two water passages with substantially different flow capacities by reason of different settings of the needle valves 67 of the needle valve chambers 64 and 65. The operator may thus select as between two different degrees of water flow by using one or the other of the manual buttons 46 and 83. A further variation in use may be practiced by setting both water needle valves 67 for the same setting, in which case the operator can choose between two different degrees of flow by depressing either one of the water control push buttons or both simultaneously.

While a wide variation in mode of use is possible within the limits of the structure provided herein by using various needle valve adjustments and by manipulating the push buttons in various combinations, the most common condition of adjustment and mode of use will now be described.

Generally speaking, a much lower degree of water flow is desired to produce an air water spray than to produce a solid water stream through nozzle 12. Accordingly, the middle needle valve 67 of needle valve chamber 64 will normally be set much closer than the left-hand needle valve 67 of needle valve chamber 65. Accordingly, the left-hand push button 83 will be depressed by the operator to produce a solid water stream through the nozzle, the right-hand push button 84 will be depressed to produce merely a flow of drying air. Each of these push buttons is in a position for ready accessibility and use singly because of their positions at the end of the row of three push buttons.

When it is desired to produce an air-water spray, the operator merely applies thumb or finger pressure to the two adjacent push buttons 46 and 84, thus producing air flow along with a relatively restricted water flow suitable for spray forming purposes. Of course the immediate adjacency and co-planar faces of push buttons 46 and 84 renders their joint depression extremely convenient.

The foregoing merely sets forth what is believed to be the most common mode of use of the springe of the present invention and it is to be understood that any combination of the various push buttons may be depressed simultaneously or singly for various special purposes, or to suit the desirabilities of different operators and the several needle valves 67 may be adjusted to any desired settings independently of each other to enter into the various combinations of use.

A sheet metal shell or casing 91 is attached to body member 10 as by screws 92 to enclose portions thereof and to cooperate with the body member to form a holding portion which may conveniently be held by an operator. In the illustrated instance casing 91 has depending therefrom a flexible tubular portion 93 which encloses the water and air conduits 30 and 31 and also the electric heater conductors 82.

We claim:

1. In a dental syringe having a pair of fluid passages and normally closed valve means in said passages, a pair of closely adjacent manually depressible non-circular push button elements connected to said valves and adapted to be depressed by the operator to selectively open said valves, one of said push buttons being normally held against rotation by abutment against the other of said push buttons and rotatable in depressed position to engage beneath said other push button for holding the valve controlled by said one push button in an open condition.

2. In a dental syringe having three fluid passages and normally closed valve means in each of said passages, a series of three closely adjacent manually depressible non-circular push button elements connected individually with said valves and adapted to be depressed by the operator

to selectively open said valves, the end push buttons being normally held against rotation by abutment against the middle one of said push buttons and each of said end push buttons being rotatable in depressed position to engage beneath said middle push button for holding the valve controlled by said end push button in an open condition.

3. In a dental syringe having a pair of fluid passages and normally closed valve means in said passages, a pair of adjacent manually depressible non-circular push button elements connected individually with said valves and adapted to be depressed by the operator to selectively open said valves, said push buttons being substantially in abutment edgewise and having coplanar outer faces whereby they may be depressed singly or jointly by thumb or finger pressure, one of said push buttons being normally held against rotation by abutment against the other of said push buttons and rotatable in depressed position to engage beneath said other push button for holding the valve controlled by said one push button in an open condition.

4. In a dental syringe having three fluid passages and normally closed valve means in each of said passages, a series of three closely adjacent manually depressible non-circular push button elements connected individually with said valves and adapted to be depressed by the operator to selectively open said valves, said push buttons being substantially in abutment edgewise and having coplanar outer faces whereby they may be depressed singly or jointly in adjacent pairs by thumb or finger pressure, the end push buttons being normally held against rotation by abutment against the middle one of said push buttons and each of said end push buttons being rotatable in depressed position to engage beneath said middle push button for holding the valve controlled by said end push button in an open condition.

5. In a dental syringe, the combination of an elongate body member adapted to be grasped in the user's hand, a pair of flexible conduits connected to said body member to introduce water and air to said syringe, a discharge nozzle extending from said body member and comprising a pair of separate conduit members, said body member having passage means connecting one of said flexible conduits to one of said conduit members and the other of said flexible conduits to the other of said conduit members, valve means in said body member interposed in said passage means to control fluid flow therethrough, and manually operable valve actuating means mounted on said body and connected to said valve means, said actuating means including a pair of manually depressible non-circular push button elements adapted to be depressed by the operator to selectively open said valve means, one of said push buttons being normally held against rotation by abutment against the other of said push buttons and rotatable in depressed position to engage beneath such other push button for holding the valve means control of said one push button in an open condition.

6. In a dental syringe, an elongate body member adapted to be grasped in the user's hand, a pair of conduits leading to one end of said body member to introduce water and air to said syringe, a discharge nozzle extending from the other end of said body member, a set of three manually operable control elements disposed in side-by-side relation for selective manipulation by the user, said body member having a passage therethrough from said air conduit to said nozzle and a normally closed valve in said passage connected with an end one of said manual control elements for selective opening thereof, said body member having a pair of generally parallel passages therethrough from said flexible water conduit to said nozzle, one of said pair of passages having a relatively large flow capacity and the other having a relatively restricted flow capacity, and a normally closed valve in each of said pair of passages, the other end one of said control elements being connected with said large capacity water passage valve and the middle control element being connected with said restricted flow capacity water passage valve, each of said passages including a first bore receiving a respective one of said normally closed valves and a metering valve bore displaced from the associated first bore, a metering valve in each metering valve bore, said pair of passages merging into a common passage between their respective metering valve bores downstream of the associated metering valves.

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