Feb. 16, 1960 E. R. ZIEGLER ET AL 2,924,880

AIR AND WATER SUPPLY SYSTEM FOR DENTAL UNITS

Filed March 14, 1956 3 Sheets-Sheet 1

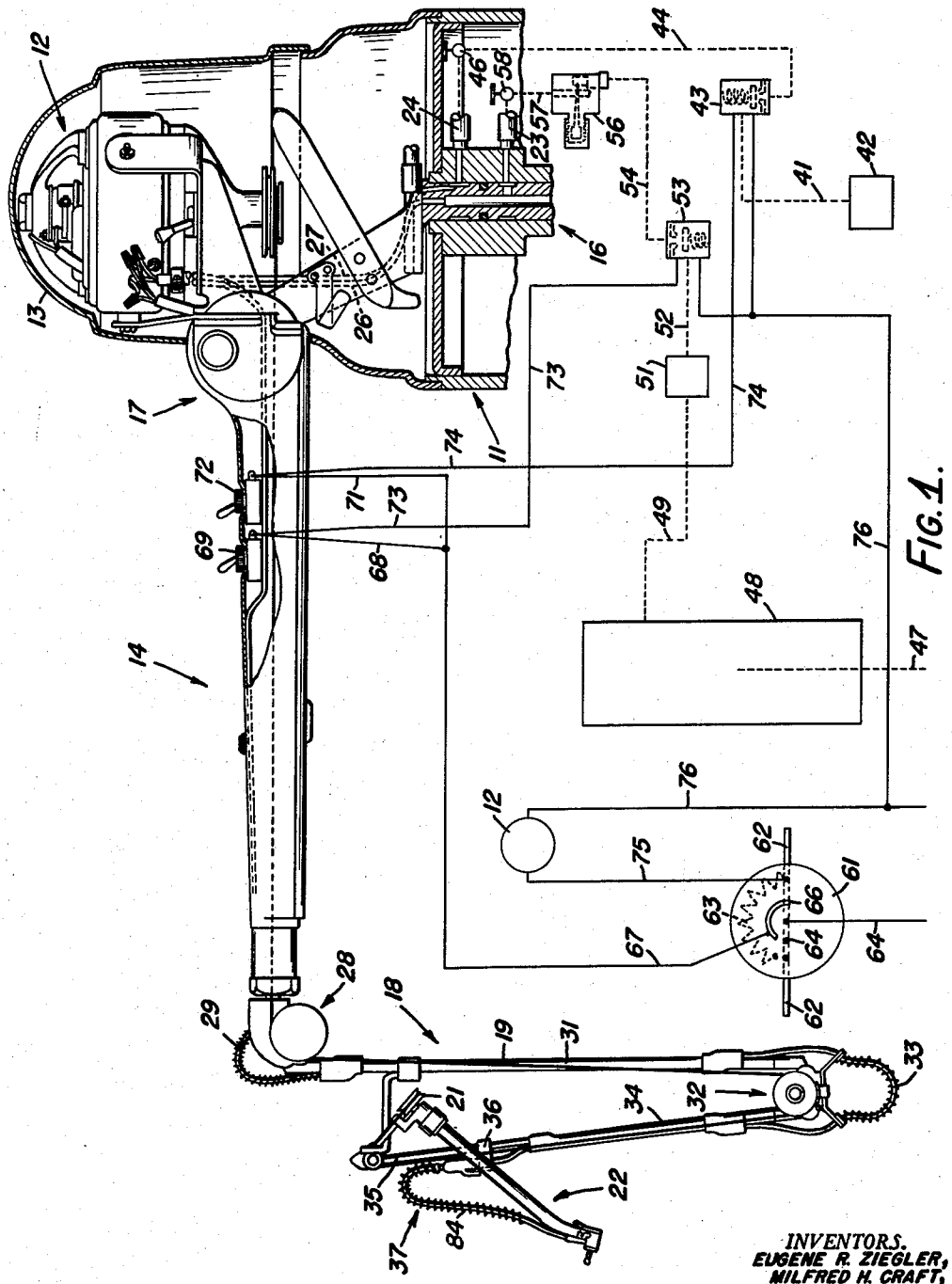


FIG. 1.

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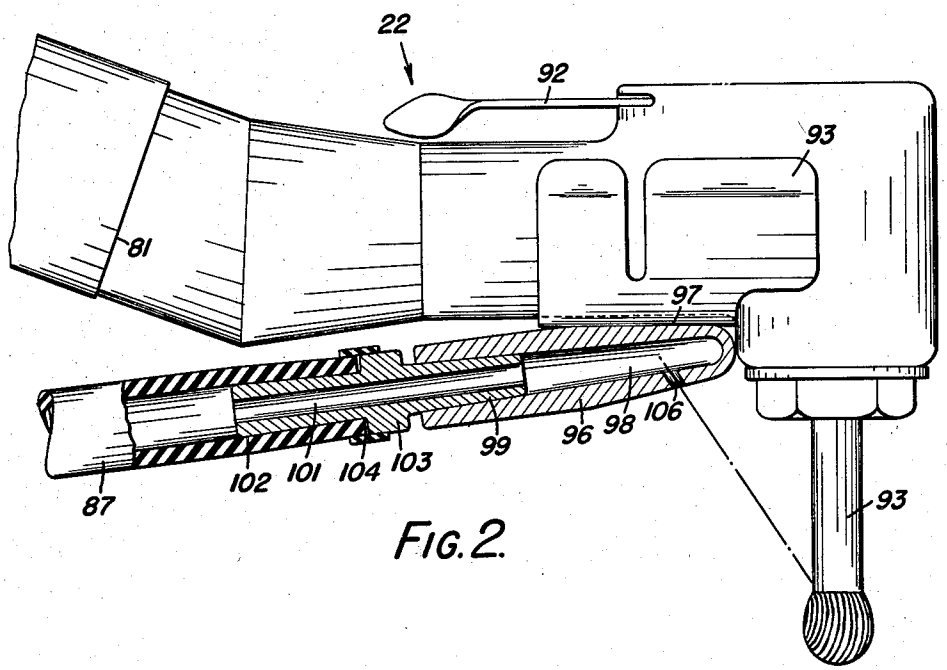


FIG. 2.

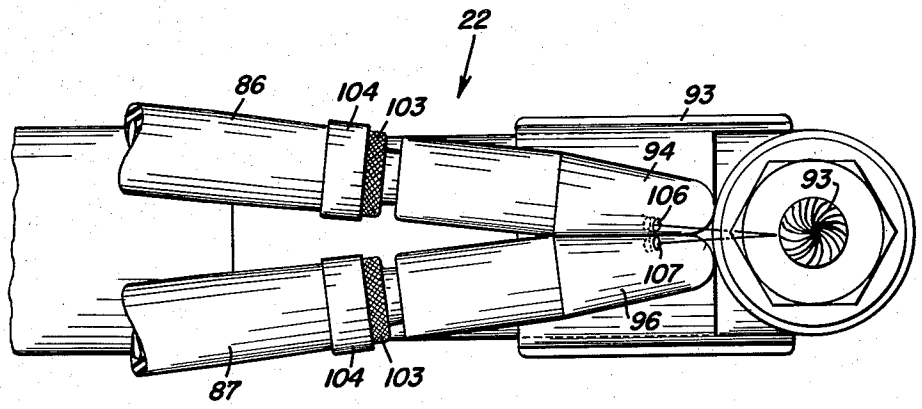


FIG. 3.

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AIR AND WATER SUPPLY SYSTEM FOR DENTAL UNITS

Filed March 14, 1956 3 Sheets-Sheet 3

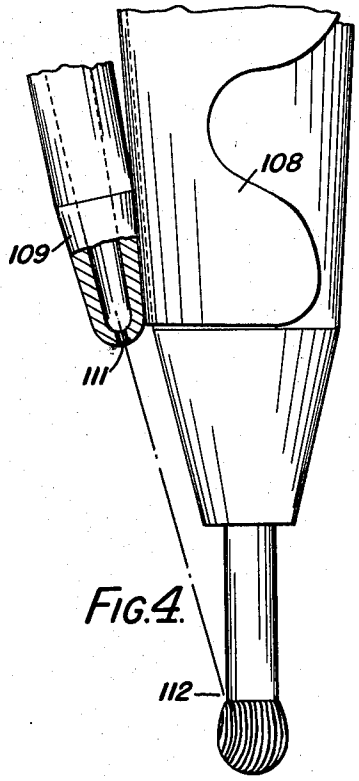


FIG. 4.

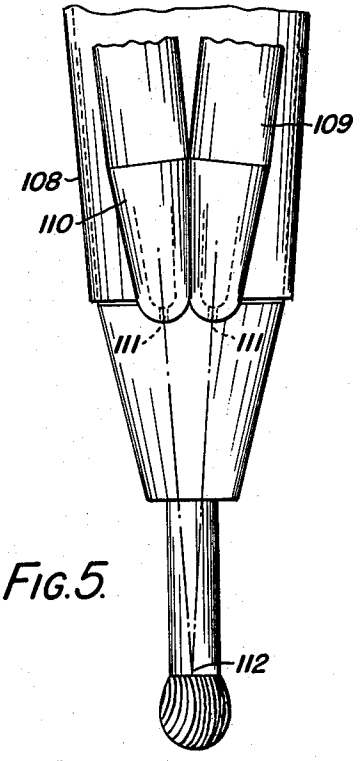


FIG. 5.

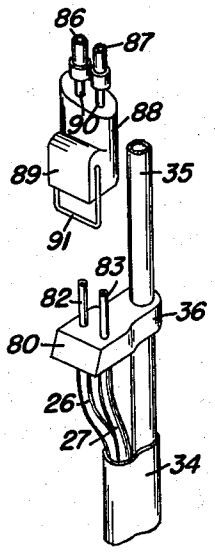


FIG. 7.

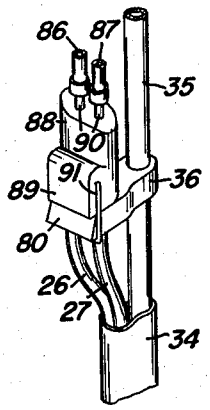


FIG. 6.

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United States Patent Office 2,924,880 Patented Feb. 16, 1960

2,924,880

AIR AND WATER SUPPLY SYSTEM FOR DENTAL UNITS

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Application March 14, 1956, Serial No. 571,565

9 Claims. (Cl. 32—28)

This invention relates to dental apparatus and more particularly to a system for bringing air and water to the hand piece and directing such coolant toward the drill or other tooth cutting device carried by the hand piece and driven by the dental engine.

In the practice of dentistry, many authorities in the field have been advocating higher drilling or cutting speed for many years. Higher cutting speeds, however, produce greater heat during the drilling or cutting operation and require some method of dissipating the heat thus generated. Higher drilling speeds have led to the development of various systems for supplying a coolant to the cutting tool. In some systems air only is supplied to the cutting tool; in other systems only water; and in still other systems air or water or a mixture of air and water may be supplied to the cutting tool.

These latter systems, that is, those which enable the dentist to select the coolant medium most suitable for the operating being carried out have comparatively recently come to the fore because of their versatility not only because various dentists have preferences in the type of coolant to be employed but also because a particular operation being performed may require for best operating conditions air alone, water alone or an air-water spray. For example, in some operations the major problem of the dentist may be the rapid removal from the drilling area of tooth debris, amalgam chips, blood, saliva and pumice. Under such conditions a water stream which will rapidly wash away the debris would probably be the most desirable form of coolant. In fact, some dentists are now working with a vacuum producing apparatus which will pull water and debris away from the tooth as rapidly as the water is supplied thereto and the debris accumulates. In other operations, the dentist may wish to maintain the tooth in a substantially dry condition during the operation, while at the same time removing debris from the drilling area. Under such conditions an air stream alone may be the most desirable coolant. Aside from special considerations which make either air or water the most desirable form of coolant, for general purposes, most dentists appear to prefer an air-water stream and more particularly an air-water spray.

One of the important considerations is the versatility of the system. That is the ability to switch rapidly from one form of coolant to another. For example, the dentist may be using an air-water spray which may cause fogging of the mirror used by the dentist to provide visibility of the work being performed. Under such conditions the dentist may wish to switch rapidly from the air-water spray to air alone to dry the mirror surface while the operation is in progress.

The above considerations have led to many problems which insofar as we are aware have not been fully solved. Among these problems might be mentioned that the versatility of the system must be accompanied by means enabling the selection of the type of coolant desired with a minimum of effort on the part of the dentist. The switch

from one coolant to another must be accomplished rapidly and with almost no conscious effort on the part of the dentist. Another problem lies in securing a proper air-water spray so that the spray is supplied to the cutting tool in almost a mist. The solution of this problem requires accurate control of the volume and pressure of water supplied to the hand piece. Moreover, it requires proper mixing of the two streams at or adjacent the cutting tool. Still another problem encountered is the prevention of water drip from the hand piece when its use is discontinued and without the necessity of employing shut off valves on the hand piece. Shut off valves on the hand piece not only make the hand piece more bulky and cumbersome to use but also such valves frequently fail or become damaged in use.

An object of the invention is to provide a versatile coolant system for the cutting tool of a dental unit wherein the dentist may selectively control the supply of an air stream, a water stream or an air-water spray to the cutting tool and the area being operated upon.

Another object of the invention is to provide a versatile system wherein valves on the hand piece are eliminated; wherein selection of the type of coolant desired may be accomplished quickly and conveniently; and wherein, after selection, the desired coolant is supplied automatically when the dental engine is started.

Another object of our invention is to provide a versatile system for supplying coolant to the cutting tool of the dental engine which enables the use of municipal water supply for the water coolant as distinguished from a water reservoir which must be replenished at frequent intervals.

Another object of our invention is to provide a versatile system for supplying air, water or a mixture of air and water to the hand piece wherein quickly detachable means are provided for attachment to the conduits which bring the air and water to a position adjacent the hand piece enabling the dentist to change rapidly from a straight hand piece to a contra angle hand piece or vice versa.

A further and one of the most important objects of our invention lies in a pressure-volume control system for the water supply to enable the supply of water to the hand piece in a thin stream or almost in droplets in order to produce a finely divided air-water spray or almost a mist of air and water.

Another object of our invention lies in directing the air and water streams at an angle to each other with the water being supplied in a thin stream or almost droplets whereby the air stream breaks up the water stream just prior to or at the drill to the end that a finely divided air-water spray is supplied which encompasses not only the drill but also the area being operated upon to the end that the drill and the area being operated upon are cooled and debris is removed from the cutting area with a minimum amount of water being supplied to thereby minimize the use of a saliva ejector and reduce interruption of the dentist in his work by reason of accumulation of liquid in the patient's mouth.

More specifically our invention contemplates the provision of a versatile coalant system in which the air, water or air-water spray are positively controlled by shut off valves; the supply of water is metered and so controlled as to substantially eliminate dripping of water at the hand piece when use of the system is discontinued without the use of shut off valves on the hand piece.

Other objects and advantages of our invention will be clear from the following description, when taken in connection with the accompanying drawings, in which:

Fig. 1 is a view partly in section showing the dental arm, its jointed appendages, the hand piece and drill, the dental engine and the air and water conduits for con-

ducting coalant to the hand piece, the view also including a diagrammatic showing of the system for controlling selectively the supply of air, the supply of water or the supply and air-water spray to the hand piece;

Fig. 2 is a side elevation, partly in section, showing a contra angle hand piece, showing the discharge end of one of the coolant conduits and illustrating how, when an air-water spray is desired, the air breaks up the water into a finely divided spray or mist which envelopes the cutting element and the area being operated upon;

Fig. 3 is a bottom view of Fig. 2 illustrating the angular relationship of discharge of the air and water streams so that when the water is supplied in a thin, metered pressure controlled stream, almost in the form of a drizzle, the air will pick up the water, break up the stream and supply a finely divided air-water spray;

Fig. 4 is a view similar to Fig. 2 showing the coolant supply system of our invention in use with a straight drill;

Fig. 5 is a plan view of Fig. 4;

Fig. 6 is a perspective view showing the detachable connection between the air and water conduits from the dental unit and the conduits partly carried by the hand piece; and

Fig. 7 is a perspective view similar to Fig. 6 showing the hand piece conduits disconnected from the dental unit conduits.

In Fig. 1 we have shown one form of dental drilling unit in which our coolant supply system may be embodied. It will be understood, however, that this is merely for purposes of illustration and that the system of our invention may be embodied in other types of drilling units. The particular dental drilling unit shown comprises an equipment stand only partly shown and generally indicated by the numeral **11**, a dental engine **12** which may be enclosed by a readily removable hood or cover **13**, a dental arm, generally indicated by the numeral **14**, and pivot means generally indicated by the numerals **16** and **17** by which the dental arm may be swung in a horizontal plane and a vertical plane.

Depending from the outboard end of the dental arm are appendages, generally indicated by the numeral **18**, which include articulated members which carry the pulleys for the drive belt **19** for rotating the pulley **21** carried by the hand piece generally indicated by the numeral **22**.

Water is supplied to the hand piece from a connection **23** and air from a connection **24**. Water is supplied from the connection **23** to a water conduit **26** and air from the connection **24** to an air conduit **27**. The conduits **26** and **27** are for the most part of flexible, plastic materials and extend through the dental arm **14** around the articulated joint, generally indicated by the numeral **28** and as illustrated at **29**, through the arm **31**, around the articulated joint **32**, as illustrated at **33**, through the articulated arm **34** to a connecting block **36** carried by a support arm **35**. At the connecting or mounting block **36**, the air and water conduits are connected to a detachable air and water conduit partly carried by the hand piece and generally indicated by the numeral **37**. The detachable hand piece conduits and their support will be described in more detail later. For our present purposes all that is essential is an understanding that water and air are supplied respectively from the connections **23** and **24** to the mounting block **36**.

In Fig. 1 we have diagrammatically illustrated the system for controlling the supply of air and water respectively to the connections **23** and **24**. First considering the air supply the dotted line **41** illustrates an air line connected to a source of air under pressure illustrated at **42**. Such air supply systems are usually available in a dental office and include an air compressor and a storage tank together with means for controlling the pressure of air carried in the tank. The air line extends to a solenoid valve **43** which may be of conventional construction. When the solenoid valve is open the air flows through a line **44** through a hand control valve **46** to the air connection **24**. The hand air control valve **46** may be placed at any convenient point in the line from the source of air under pressure and is preferably located so that the dentist has access to it. Adjustment of this valve need be made only infrequently, if at all, since once it has been set for a particular air pressure and assuming the pressure of air from the source is substantially a constant, it is seldom necessary to adjust the air pressure.

The water supply has been indicated by the numeral **47** which is a connection to the municipal water supply. From the municipal water supply the water flows to heating unit or tank **48**. One of the important aspects of our invention lies in the fact that the control system employed, as will presently appear, enables the use of water from the municipal supply as distinguished from a supply tank which must be frequently replenished. The water heating unit **48** may be of the resistance or any other suitable type, the wiring connections not having been shown. It is sufficient to state that the water should be supplied to the teeth at a controlled temperature well above the usual municipal water supply temperature for reasons which are well known in dental art.

From the heated water tank **48**, the water flows through a line **49**, through a pressure regulator **51**, a line **52**, a solenoid valve **53** similar to the solenoid valve **43**, a line **54**, a metering valve **56**, a line **57**, a hand control valve **58** to the water connection **23**.

The pressure regulator may be of conventional construction and includes the usual hand operated control by which the regulator pressure may be set. The metering valve **56** may take the form of a needle valve which may be hand regulated to control the volume of flow to the water connection **23**. The hand control valve **58** may may be placed in any location convenient to the dentist. It will be understood that all of the elements previously enumerated are located and housed within or on the dental stand, generally indicated by the numeral **11**.

A motor controller, generally indicated by the numeral **61**, has been illustrated only diagrammatically but it will be understood that it includes suitable foot actuated controls **62**, a resistance **63**, a contact arm **64** adapted to sweep over the resistance **63** upon actuation of the foot controls **62**, a line connection **64** and a segment **66** to which electrical conduit **67** is connected. The operation of foot controllers for dental units is well understood in the art and further description of them is unnecessary.

The conductor **67** is connected through a lead **68** to a switch **69** and through a lead **71** to a switch **72**. The other side of the switch **69** is connected through a lead **73** to the solenoid valve **53** while the other side of the switch **72** is connected through a lead **74** to the solenoid **43**. The motor **12** is connected through a lead **75** to the foot controller **61**, the other side of the motor being connected through a lead **76** to the line. The lead **76** connects with the solenoids **43** and **53**.

It will now be apparent that with both switches **69** and **72** in the off position upon actuation of the foot controller to start the motor **12** neither air or water are supplied to the hand piece. This is desirable under certain conditions of operation particularly when the drill is to operate at low speed. With the water switch **69** on, when the foot controller is operated to start the motor, the solenoid valve **53** is opened to supply water through the metering valve to the hand piece. When both the water switch **69** and the air switch **72** are on, both solenoid valves **43** and **53** are actuated and a mixture of air and water are supplied to the hand piece when the foot controller is actuated to start the motor **12**. When the water switch **69** is in the off position and the air switch **72** is in the on position, only the solenoid valve **43** is operated when the foot controller **61** is actuated and only air is supplied to the hand piece.

One of the problems encountered in supplying coolant fluids to the hand piece is the proper control of the flow through the air and water conduits. In the past control of flow through the conduits has, for the most part been by means of valves located on the hand piece. Usually these valves have been of the type requiring pinching, pressing or otherwise deforming flexible conduits. The use of valves on the hand piece make the hand piece more bulky thereby interfering with the convenient use thereof by the dentist. Moreover, repeated pinching of the flexible tubing causes wear and frequently results in rupture of the tubing. In addition such valves are not always positive in their action and may fail to close fully against leakage. In our system as previously described we employ solenoid actuated valves which may be located in the dental unit and are rapid and positive in their action. The controls for the solenoid actuated valves may be located in any convenient position within easy reach of the dentist. One convenient position for the control switches **69** and **72** is on the dental arm. By using control switches for the solenoid actuated valves conveniently located for use by the dentist and placing these control switches in circuit with the foot controller, reliance on valves such as those which pinch flexible tubes or depend upon manual operation is eliminated.

A further problem encountered in supplying water to the hand piece is adequate control of the pressure and volume of water supplied. In many of the systems heretofore employed, a separate supply tank requiring frequent filling was used primarily because of the problem encountered in connecting up such systems to a municipal water supply. It will be appreciated that the pressure of municipal water supply systems varies from approximately 30 lbs. to 50 lbs. and greater variations are not uncommon. We have found however that if the pressure is maintained at from 5 to 10 lbs. this degree of fluctuation at the lowered pressure provides adequate pressures for the dentist's use without causing faulty operation due to excessive pressures. Accordingly we provide a pressure regulator **51** which is arranged to step down the pressure normally available in municipal supply systems to approximately 5 to 10 lbs. the exact pressure drop depending upon the pressure in the municipal water supply. The pressure regulator **51** may be of any conventional construction and since such pressure regulators are well known in the art, its construction need not be described.

A further problem in connection with a system for supplying water to the hand piece lies in securing adequate control of the volume of water supplied. This is particularly true when it is desired to use an air-water spray or mist. In the systems of the prior art with which we are familiar because no means was provided for regulating the volume of water a proper air-water spray for most efficient use could not be secured. When an air-water spray is desired, the water should be supplied in a very limited flow almost to the point where it constitutes a drizzle at the issuing nozzle which will be presently described. We have found that by using a metering valve **56** proper regulation of the volume of water may be secured so that when the air and water are properly mixed at the discharge thereof located in the hand piece a spray of air and water is delivered which for most purposes encountered in the practice of dentistry is the proper form of coolant. As indicated diagrammatically, the metering valve **56** is of the needle type but this is optional as other forms of metering valves may be employed. Such metering valves including those of the needle type are well known in the art and need not be further described.

One of the reasons why, in accordance with our understanding, shut off valves have been located for the most part on the hand piece in systems of the type with which we are concerned is that it was thought necessary to locate the water shut off valve adjacent the discharge outlet. The purpose of this was to avoid a long conduit between the valve and the discharge outlet so that the device would not drip water when the hand piece shut off valve was closed. Dripping is not only a source of annoyance to the dentist but also the water is likely to drip on a patient's dress possibly resulting in damage thereto. We have found that by using solenoid shut off valves which close tightly and are rapid in their action, drip is minimized.

We have further found that in the water system of our invention in which a pressure regulating valve and a metering valve are employed that the metering valve should be located on the down stream side of the pressure regulating valve. When the position of these valves is reversed, the pressure regulating valve acts as a resrvoir so that some drip will occur. We have found, when the needle valve **56** is located on the down stream side of the pressure regulator, the resistance introduced in the line by the needle valve and the resistance of the relatively small diameter water tubing, coupled with the fact that when the solenoid valve is closed a vacuum is created on the down stream side of the solenoid valve tending to hold water in the tubing, that dripping of water is reduced to a minimum. This is particularly true since the use of a pressure regulating valve and a needle valve reduce the water stream to a relatively low-pressure, small-volume flow. At the low-pressure, small-volume flow we contemplate the resistance to flow on the discharge side of solenoid valve substantially precluded dripping.

In Figs. 2 and 3, we have illustrated a hand piece equipped with a so called contra angle cutting unit and in Figs. 4 and 5 have shown a hand piece equipped with a straight or in line cutting tool. It will be understood that these cutting tools may be selectively connected to the hand piece at **81** through a connection not shown. In Figs. 6 and 7 we have illustrated how the air-water unit mounted on the hand piece is disconnected from the block **36.**

The block **36** receives the water and air conduits **26** and **27** respectively and has preferably metal tubes **82** and **83** extending thereto which the flexible conduits **26** and **27** are connected.

Mounting block **36** has an angularly extending face **80** for a purpose which will later appear. The air and water conduits **37** carried by the hand piece are flexible and are protected by a coiled spring **84** (Fig. 1) wrapped around them which maintains them in a position such that they are not likely to be cut by the drive cord or belt and the dentist may extend his hand or fingers at least partway through the loop caused by the spring (see Fig. 1). The water and air conduits **37** numbered individually **86** and **87** which may be of rubber or flexible plastic material are connected to metal tubes carried in a plug **88** (Figs. 6 and 7) which may be of moulded rubber. The metal tubes are indicated by the numeral **90** and have knurled or roughened portions, slightly enlarged, adapted to receive a flexible sleeve which may be slipped partly over the knurled part to assist in holding the flexible tubes **86** and **87** on the tubes **90.** The plug **88** has moulded therein tubular sockets which are adapted to receive the metal connecting tubes **82** and **83** so that the plug **88** may be disconnected from the metal tubes **82** and **83** and connected thereto as shown in Fig. 6.

Plug **88** has a boss **89** which carries a resiliently mounted bail **91.** When the plug is applied to the metal tubes **82** and **83** the bail slides over the angularly extending face **80** so that the loop end of the bail is lodged over the lip of the mounting block **36** as shown in Fig. 6. The purpose of the bail is to insure that the water and air connections **86** and **87** will be connected to the water and air connections **82** and **83** respectively. This is not of major importance in the particular system shown

herein but some manufacturers put out hand pieces requiring definite air and water connections.

Referring now to Fig. 2 the handpiece generally indicated by the numeral **22** has the usual means **92** for releasing and locking a cutting tool such as a burr **93** in a chuck located in the hand piece. A spring clip **93** of any suitable shape and form is provided which clips on over the hand piece and is held in position by the spring of the metal. A pair of nozzles, one for air and one for water such as nozzles **94** and **96** are soldered or otherwise secured as indicated at **97** to the spring clip. It would be possible to eliminate the clip and attach the nozzles directly to the hand piece. Each of the nozzles **94** and **96** has an internal longitudinally extending opening **98** which is slightly tapered inward from its open end and adapted to receive the correspondingly tapered end of a fitting **99**. The fittings each have a through opening **101** and preferably are of metal with the opposite end of each somewhat enlarged at its outer diameter, as at **102**, to receive the flexible tubes **86** and **87**. The purpose of the outward taper at the outer end is to hold the flexible tubing more securely after the tubing has been positioned. The fitting **99** has an enlarged part **103** which is knurled or otherwise roughened on its outer surface to receive a flexible sleeve **104** which may be shifted along the flexible tube **86** to overlap part of the knurling so as to hold the parts securely together.

Each of the nozzles **94** and **96** has a nozzle opening **106** which in the case of the contra angle hand piece extends outwardly and at an angle to the axis of the nozzle as illustrated in Fig. 2. In Fig. 3 the water nozzle opening has been indicated at **106** and the air nozzle opening at **107**. Figs. 2 to 5 inclusive are several times normal size but it will be apparent from an examination of the nozzle openings of Fig. 3 and the dotted extensions thereof through the walls of the nozzles that the openings are directed toward each other and that their axes cross at or adjacent to the burr **93**.

It will be appreciated, since Figs. 2 and 3 are several times normal size, that the openings **106** and **107** are extremely small. Thus the water will issue from the nozzle **106** in an extremely fine stream which, when only water is to be applied to the drill and the tooth being drilled, is adequate for cooling and washing debris away from the cutting area. However, when the air is turned on the stream of water is sufficiently fine that due to the intersection of the streams of air and water the air stream breaks up the water stream into a fine air-water spray. The air stream picks up the water stream so rapidly that to some extent it appears to break it up into droplets adjacent the nozzle opening before dispersing it into a spray adapted to envelope the burr and the area being operated upon. The breaking up of the water into a fine air-spray provides maximum cooling effect for the amount of water supplied. In addition an important consideration is accomplished, namely, a reduction of the volume of water supplied to thereby minimize the necessity of the patient interrupting the dentist to clear his mouth of water.

In Figs. 4 and 5 we have illustrated a straight or in-line hand piece which has a spring clip **108** and water and air nozzles **109** and **110** respectively. The nozzle openings **111** are in-line with the axes of the nozzles, as will be apparent from an examination of Fig. 5 but the nozzles are mounted so that their axes, extended, cross at **112** at or adjacent the burr for the purposes previously described in connection with the contra angle mounting of the nozzzles.

It will be understood that in the normal use of the device that in changing from a contra angle to an in-line hand piece, it is merely necessary to remove the contra angle hand piece and slip the nozzles **94** and **96** off the ends of the fittings **99**. Then the in-line drilling unit of Figs. 4 and 5 together with its nozzles **109** and **110** may be substituted for the contra angle, slipping the fittings **99** into the openings in the ends of the nozzles **109** and **110**. If desired and the dentist finds it more convenient, the conduits may be disconnected by disconnecting the plug **88** from the mounting block **36**. In such case a flexible conduit up to and including the plug **88** will be maintained assembled on both the contra angle and the straight or in-line hand piece.

While we have shown and described the preferred form of our invention it will be apparent that various modifications and changes may be made therein particularly in the form and relation of parts without departing from the spirit of our invention as set forth in the appended claims.

I claim:

1. Dental apparatus wherein a tooth cutting tool is actuated by motor means at high speed, comprising, in combination, an air conduit for conducting air under pressure from a source of supply, a water conduit having a pressure controller therein for conducting water under pressure from a source of supply, means for mixing the air and water, means for controlling the flow of air and water comprising a solenoid valve in each of said conduits, switch means for selectively controlling said solenoids, start and stop means for said motor means and means for supplying air, water or a mixture of air and water to said cutting tool depending upon the position of said switch means when said start and stop means is actuated to start the motor means.

2. Dental apparatus in accordance with claim 1 wherein the water conduit has a metering valve operable therein.

3. Dental apparatus in accordance with claim 1 wherein said pressure controller is between the source of supply and the solenoid valve and a metering valve is provided between the pressure controller and the mixing means.

4. Dental apparatus wherein a tooth cutting tool is actuated by motor means at high speed, comprising, in combination, a hand piece, an air conduit for conducting air under pressure from a source of supply to said hand piece, a water conduit for conducting water under pressure from a source of supply to said hand piece, a water nozzle mounted on said hand piece, an air nozzle mounted on said hand piece, said air and water nozzzles being directed angularly with respect to each other whereby the issuing streams cross adjacent said cutting tool, said water conduit having metering means therein between the source of supply and said handpiece enabling the supply of water to said water nozzle to be reduced in volume to an extent such that the air stream will break up the water stream into a fine mist.

5. Dental apparatus in accordance with claim 4 wherein means are provided for controlling the flow of water through said water conduit, said means including a solenoid actuated valve, a pressure controller between the source of supply and the solenoid actuated valve and a metering valve between the pressure control valve and the water nozzle.

6. Dental apparatus wherein a tooth cutting tool is actuated by motor means at high speed comprising, in combination, a hand piece for carrying and directing said cutting tool, a water conduit for conducting water under pressure from a source of supply to said hand piece, means for controlling the flow of water through said conduit comprising a solenoid actuated shutoff valve, a pressure controller between said source of supply and the shutoff valve and a metering valve between said pressure controller and the hand piece.

7. Dental apparatus wherein a tooth cutting tool is actuated by motor means at high speed comprising, in combination, a hand piece for carrying and directing said cutting tool, an air conduit for conducting air under pressure to said hand piece, a water conduit for conducting water under pressure to said hand piece, a solenoid valve in said air conduit between a source of air under pressure and said hand piece for opening and clos-

ing the air conduit to the flow of air, a solenoid valve in said water conduit between a source of water under pressure and said hand piece for opening and closing the water conduit to the flow of water, a pressure controller in said water conduit between the source of water under pressure and said water solenoid valve, a metering valve in said water conduit between the water solenoid valve and said hand piece and circuit means including a foot actuated switch and said solenoids for controlling the flow of air and water to said hand piece.

8. Dental apparatus in accordance with claim 7 wherein portions of both said air and water conduits are flexible and means are provided for detachably attaching said flexible portions to said hand piece.

9. Dental apparatus wherein a tooth cutting tool is actuated by motor means at high speed comprising, in combination, a hand piece for carrying and directing said cutting tool, an air conduit for conducting air under pressure from a source of supply to said hand piece, a water conduit for conducting water under pressure from a source of supply to said hand piece, said hand piece carrying an air nozzle and a water nozzle to which said conduits are connected, said nozzles being directed at an

angle to each other so that the projected streams cross each other adjacent said cutting tool and said water conduit including controllable means for metering the flow of water to a trickle whereby said air stream will break up said water flow into a mist, and means including an electrical circuit for controlling the flow of air and water through said conduits, means in said circuit for controlling the starting and stopping of said motor means, a solenoid actuated shutoff valve in each of said conduits the solenoids of which are included in said circuit, switch means in said circuit for controlling said solenoid valves, said switch means enabling the selection of a flow of air, a flow of water, or a flow of a mixture of air and water to said hand piece whenever said motor means controlling means is actuated.

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