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Pond

(10) **Patent No.: US 6,390,815 B1**
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(54) **MULTIPLE SOLUTION DENTAL IRRIGATOR**

(76) Inventor: **Gary J. Pond**, 2816 N. Main St., Racine, WI (US) 53402

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/538,255**

(22) Filed: **Mar. 30, 2000**

Related U.S. Application Data

(63) Continuation-in-part of application No. 09/468,524, filed on Dec. 21, 1999.

(51) **Int. Cl.**[7] **A61C 17/00**

(52) **U.S. Cl.** **433/80**; 433/100

(58) **Field of Search** 433/80, 84, 85, 433/99, 100, 32, 98, 27

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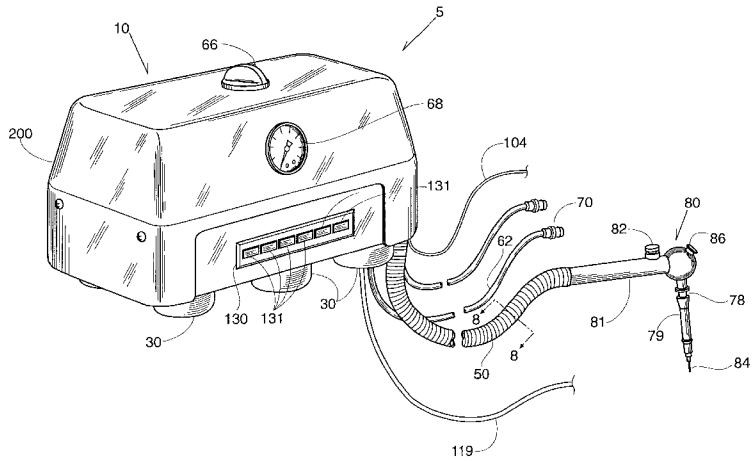
Primary Examiner—Cary E. O'Connor
(74) *Attorney, Agent, or Firm*—Ryan Kromholz & Manion, S.C.

(57) **ABSTRACT**

A fluid dispensing assembly that may be used to supply fluid for use in dental instrumentation including irrigation, application, and aeration for treating a patient's mouth. The fluid dispensing assembly includes a fluid supply system that conveys fluid by pressurized air, and also includes a handpiece to allow flow between the fluid supply system and the patient's mouth. The fluid dispensing assembly further includes a separate handpiece for the delivery of only air into a patient's mouth.

29 Claims, 15 Drawing Sheets



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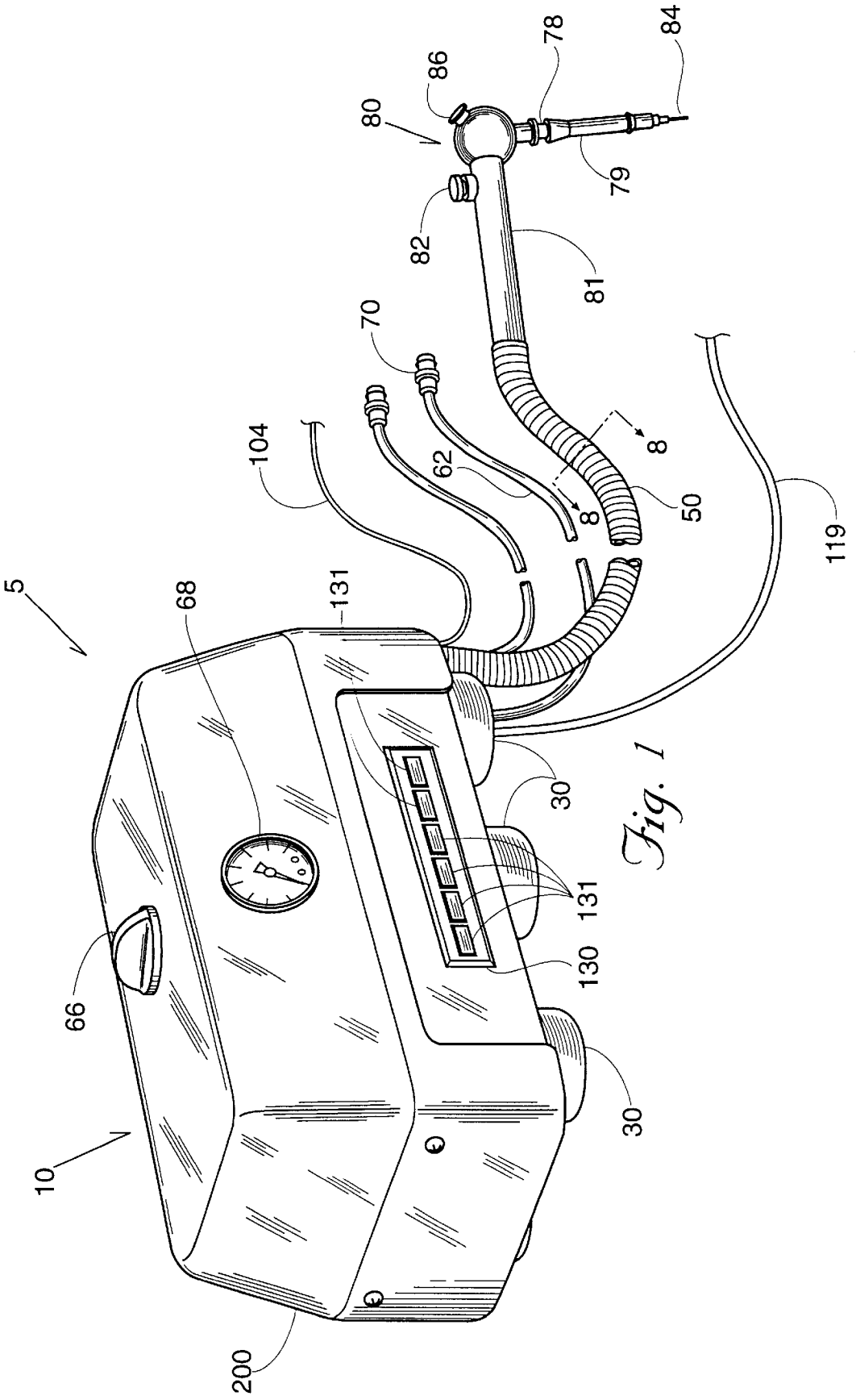
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Fig. 1

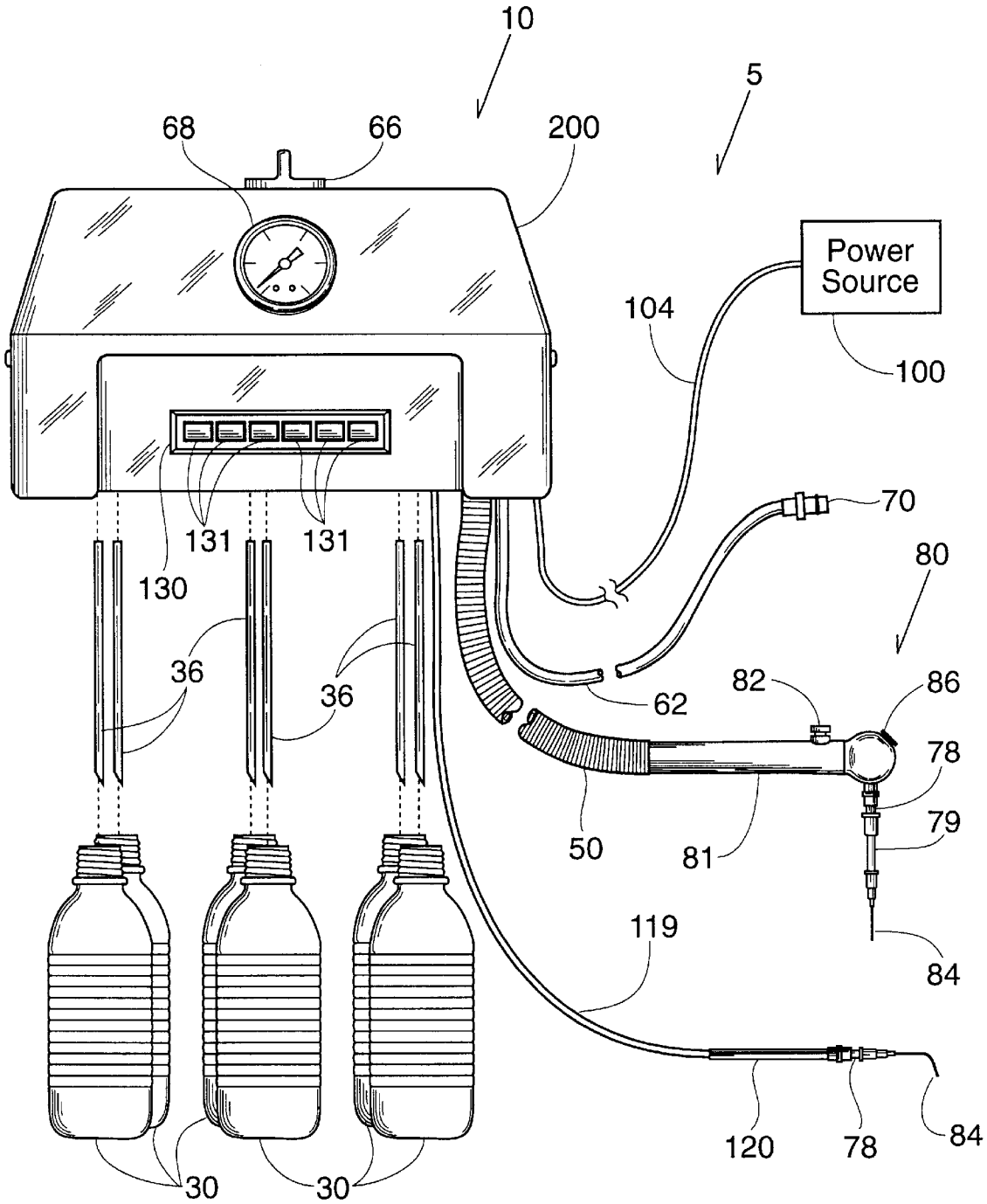
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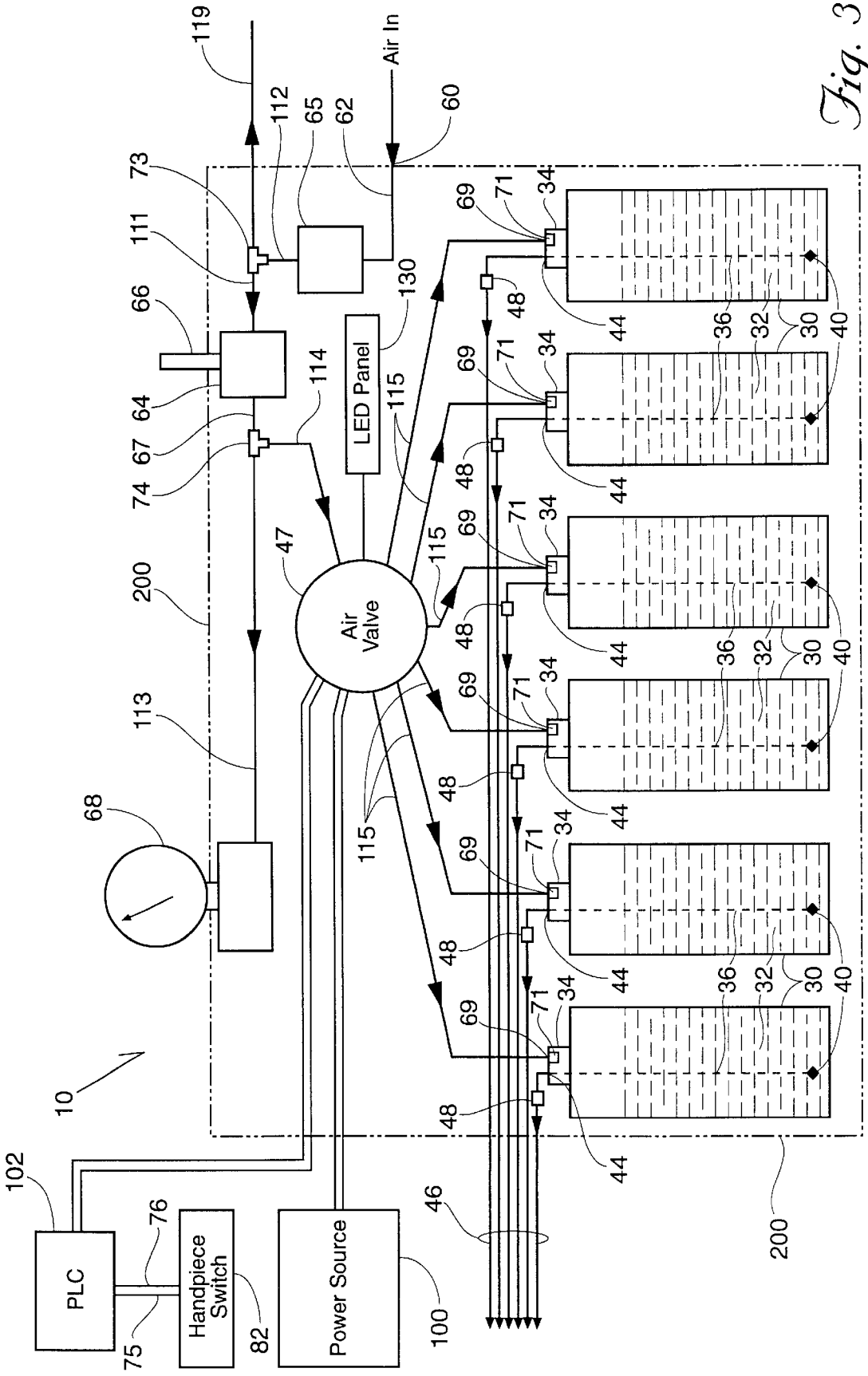
Fig. 2


Air In
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Air Valve
PLC
Handpiece Switch
Power Source

Fig. 3

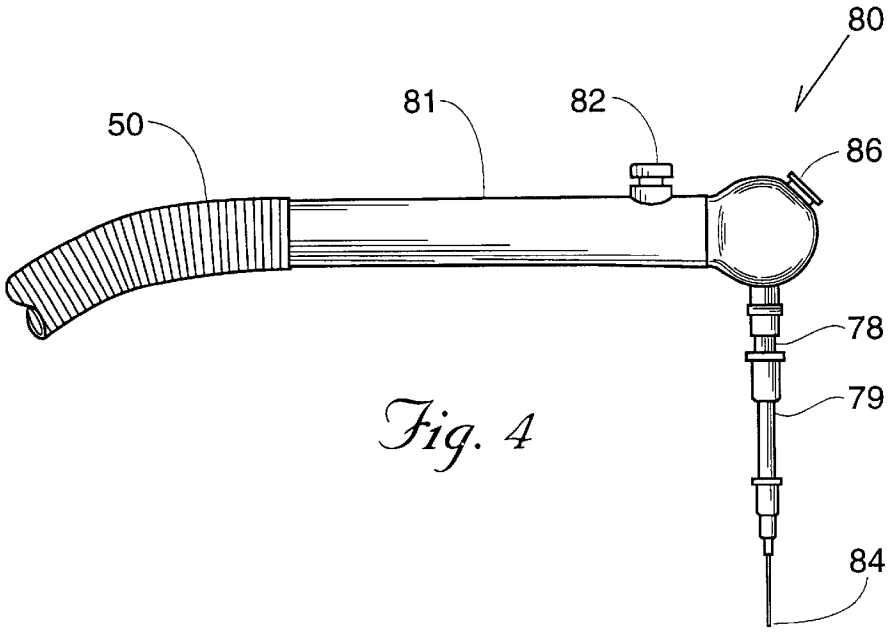


Fig. 4

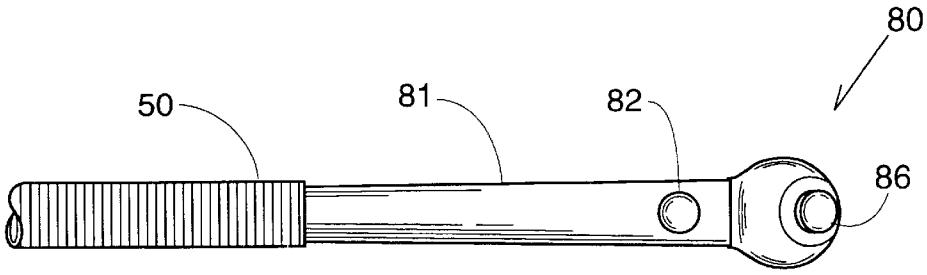


Fig. 5

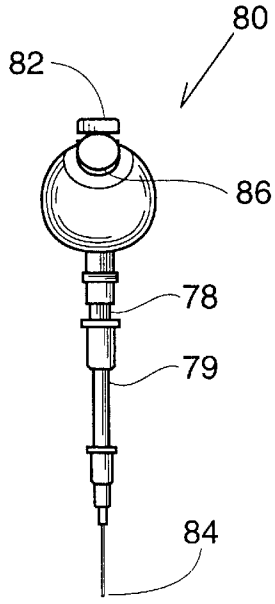


Fig. 6

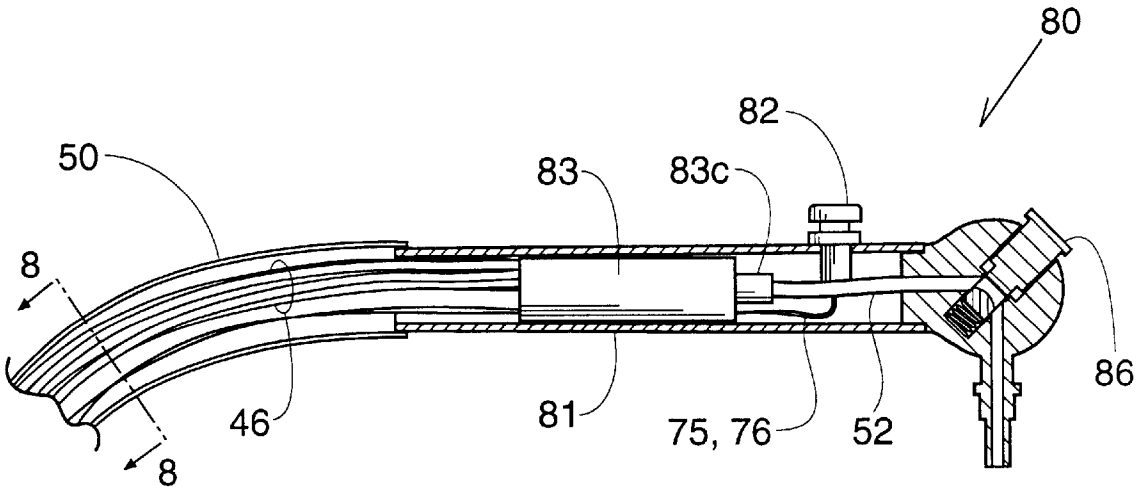
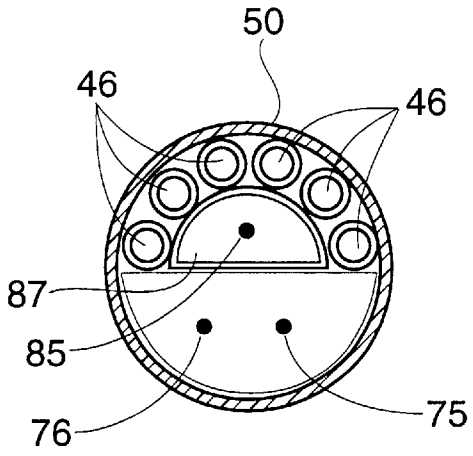


Fig. 7



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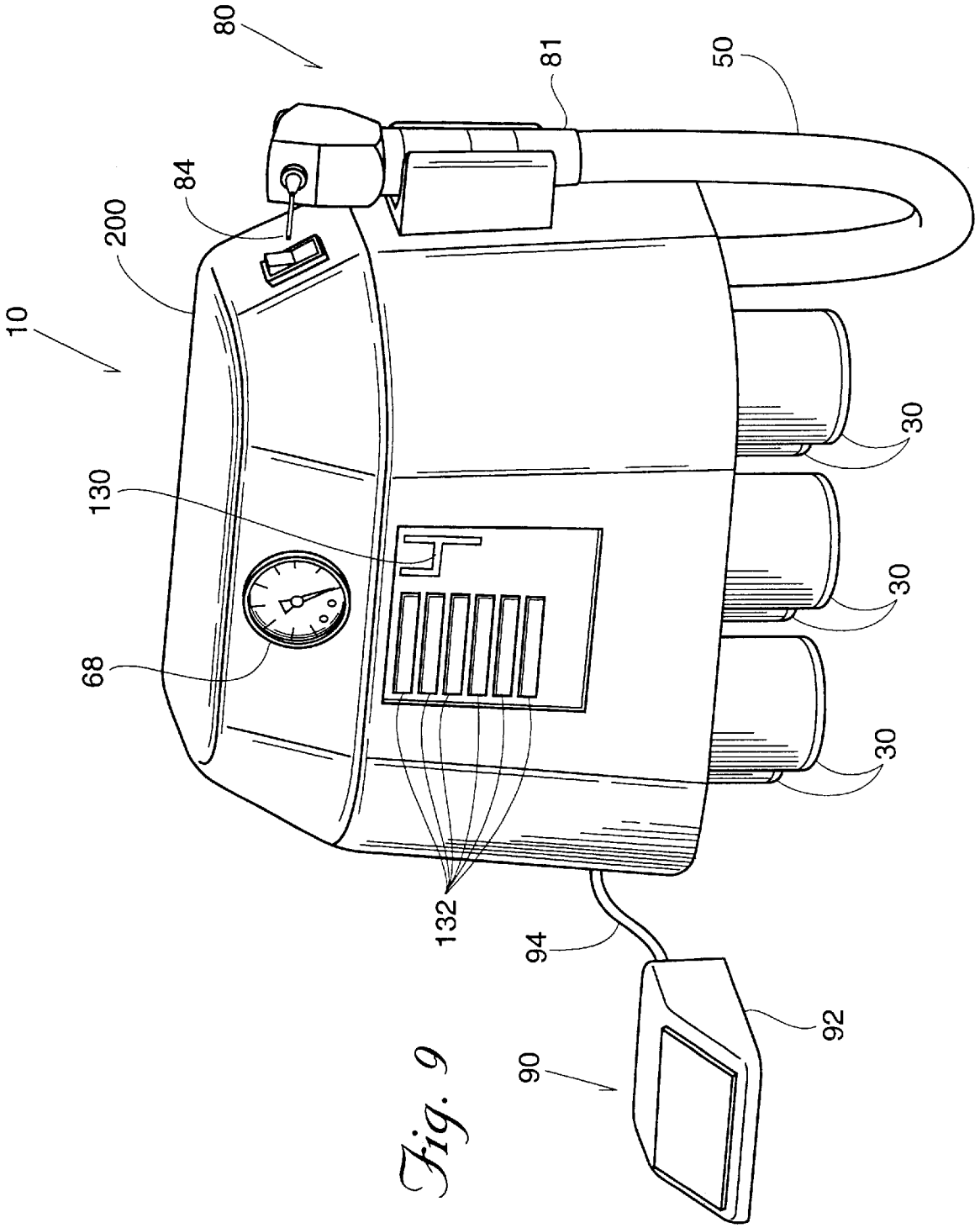

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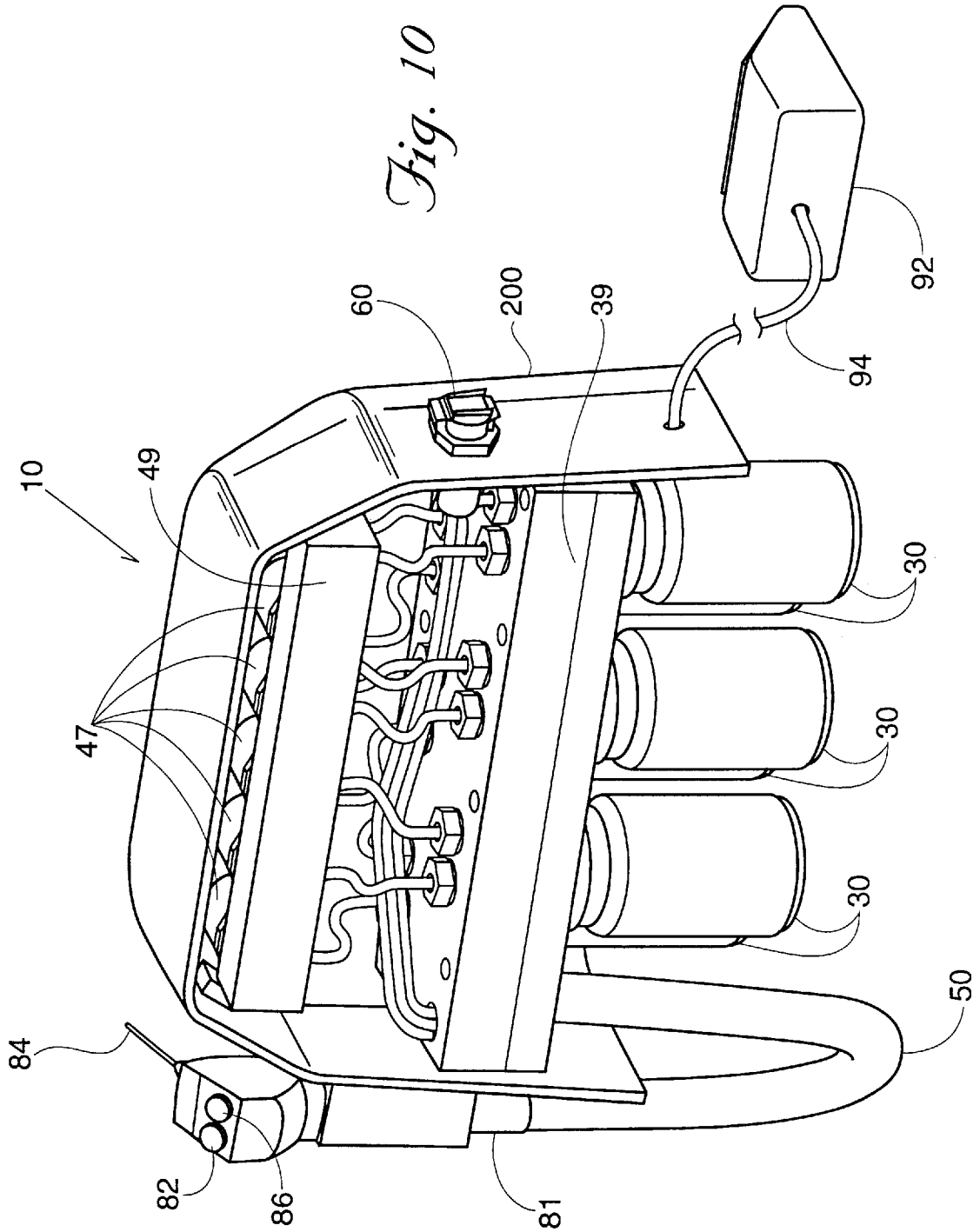

Fig. 10

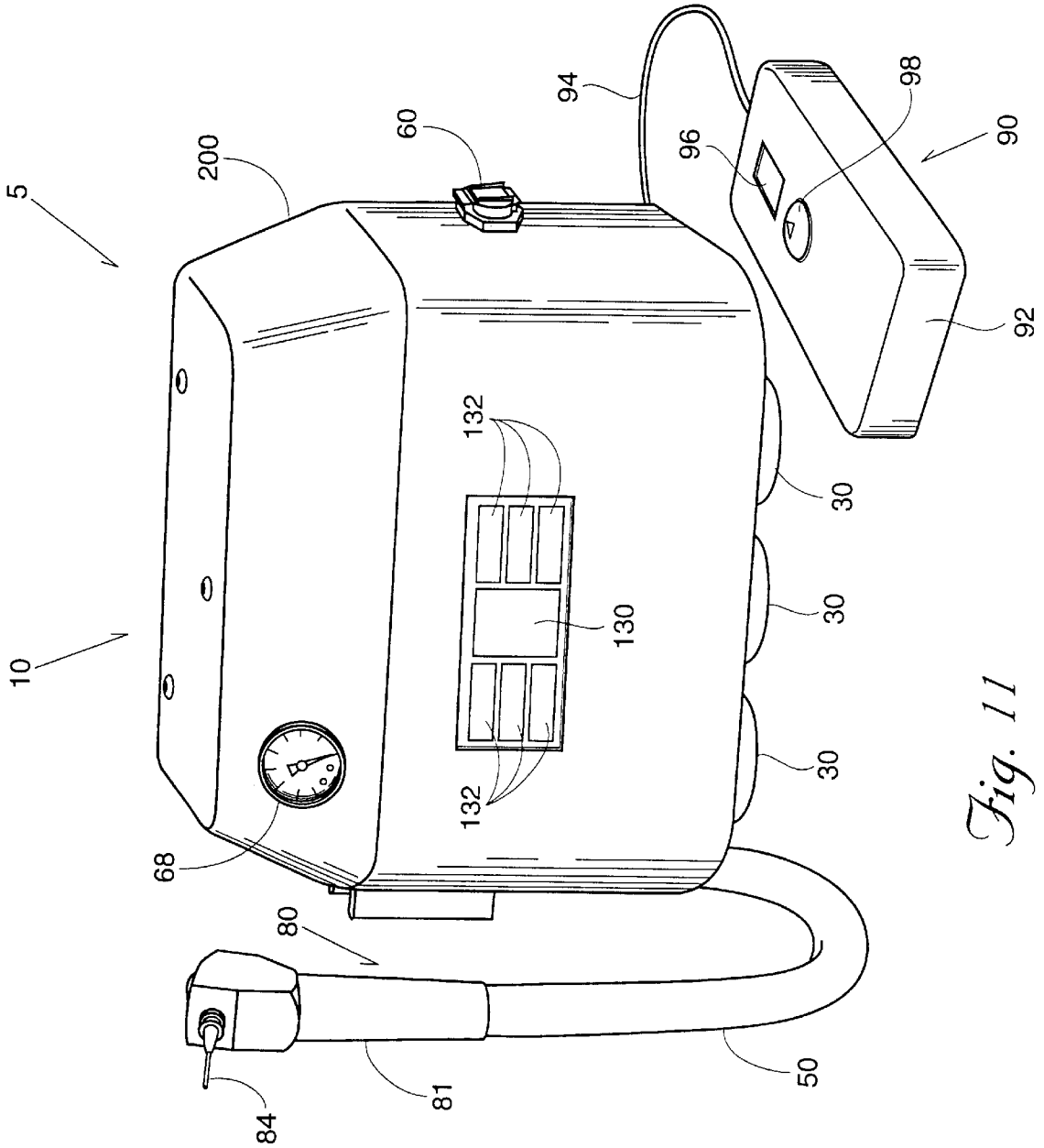

Fig. 11

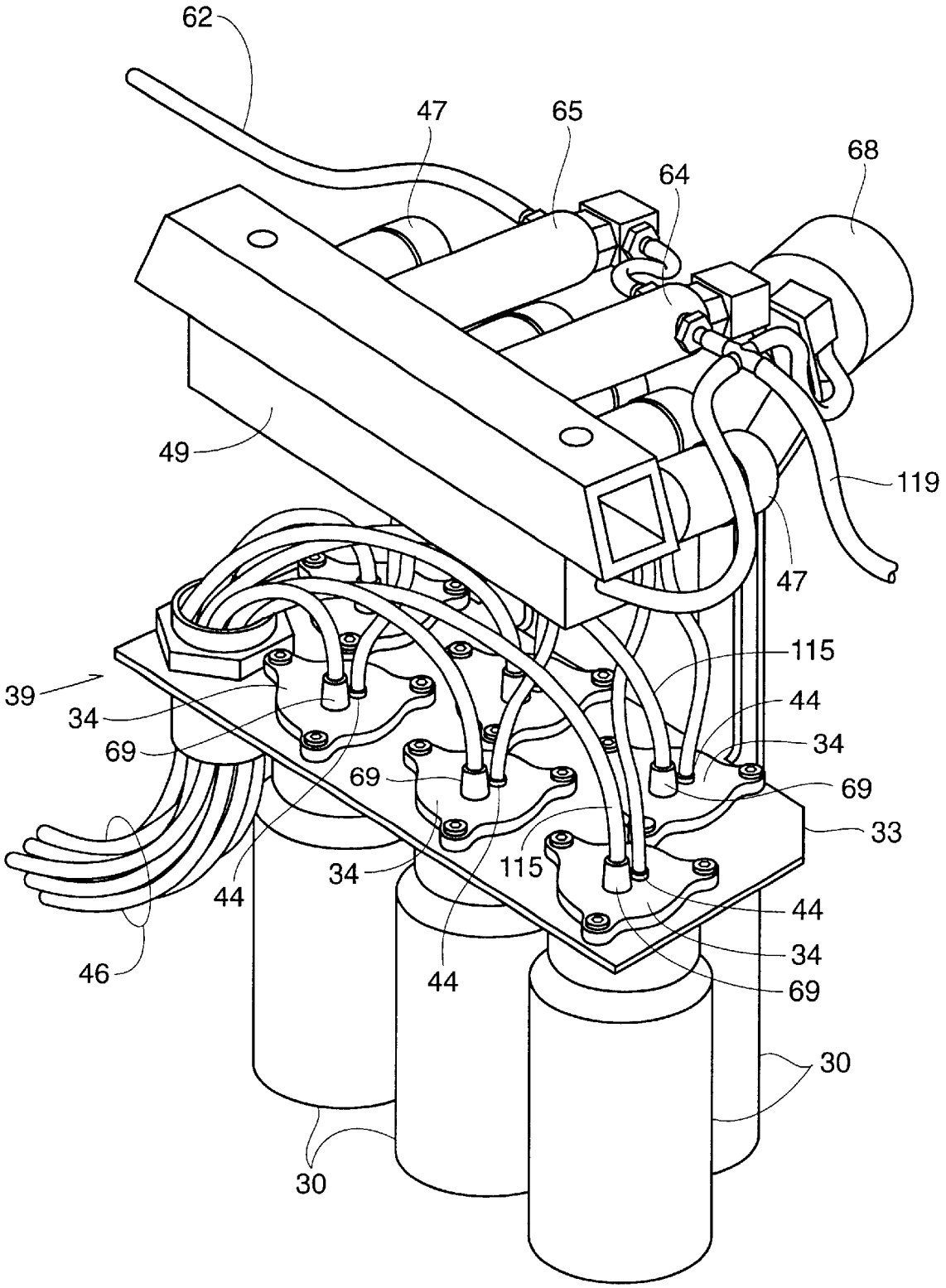
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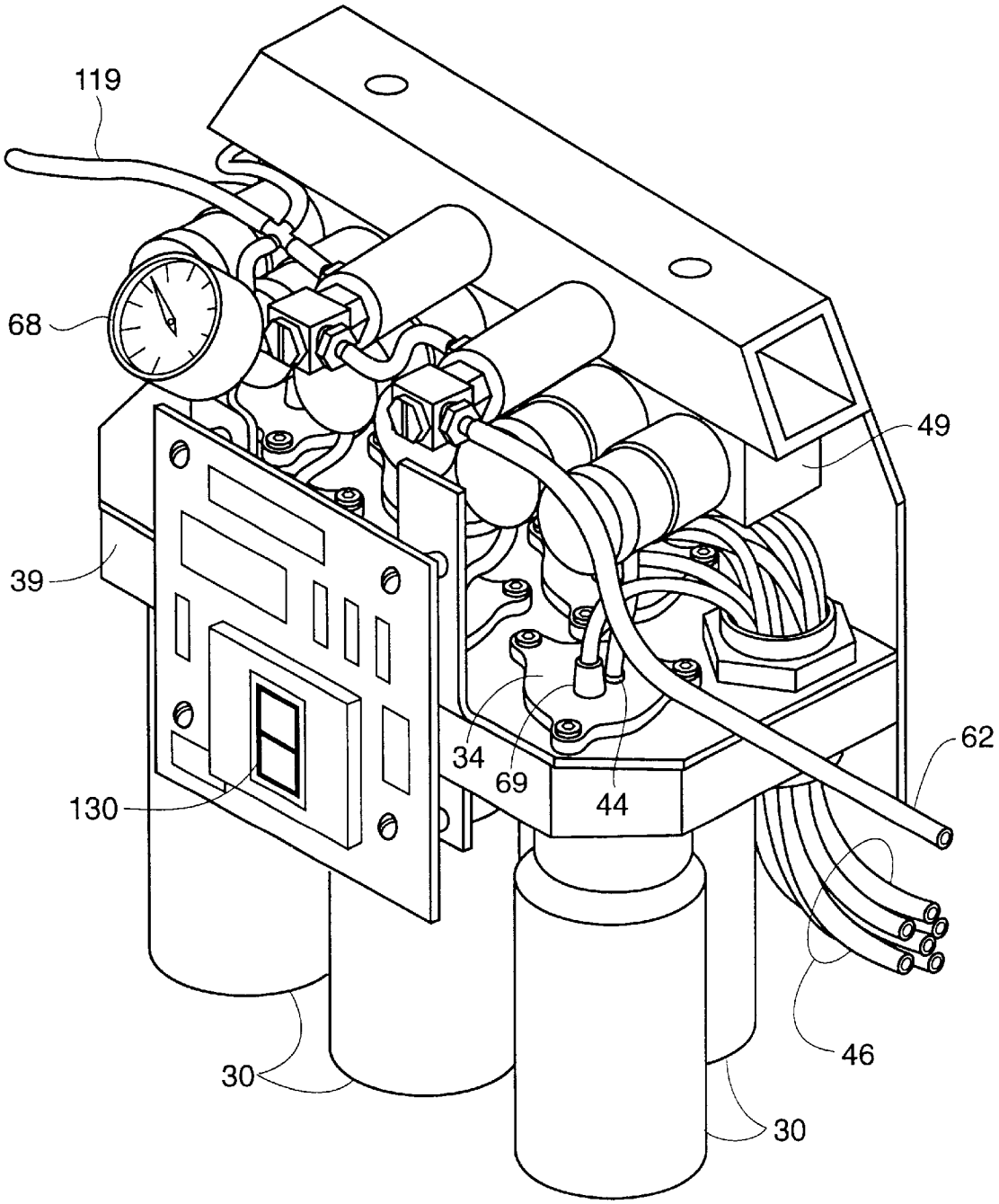
Fig. 12



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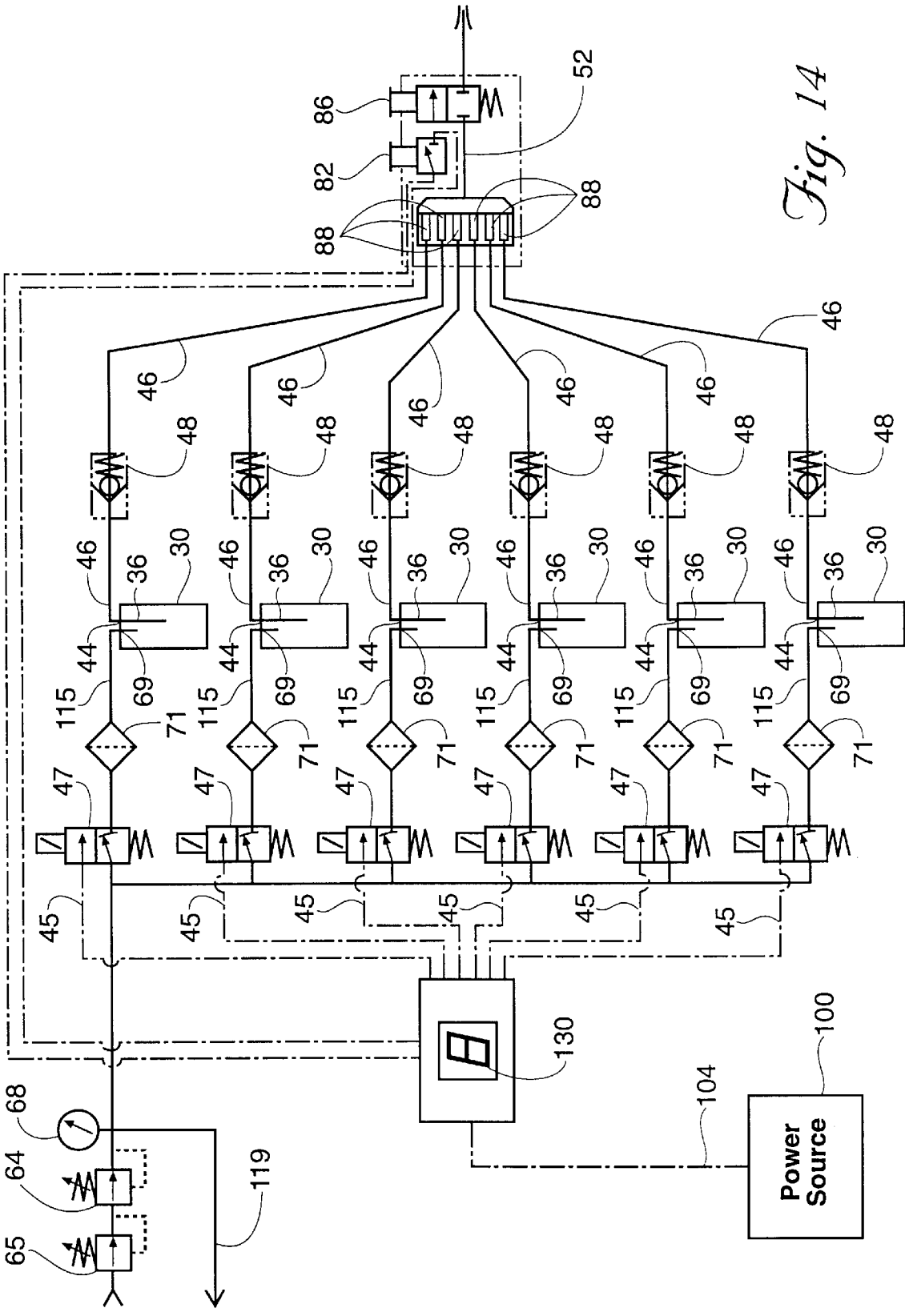
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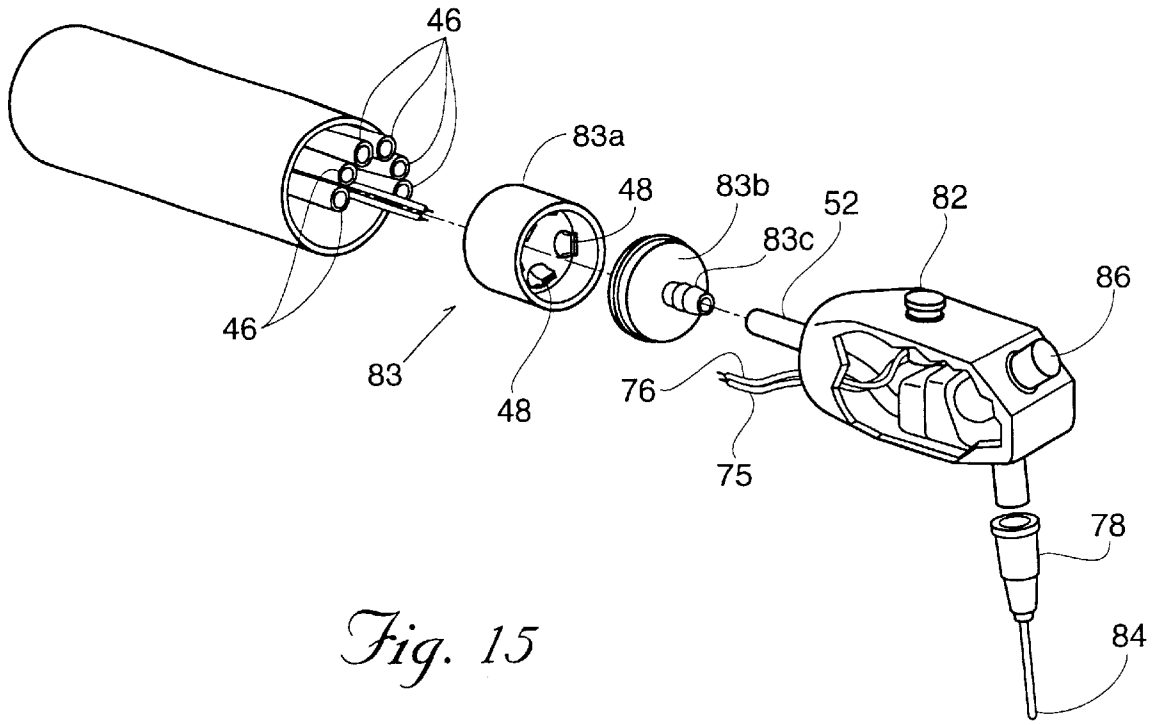
Fig. 14



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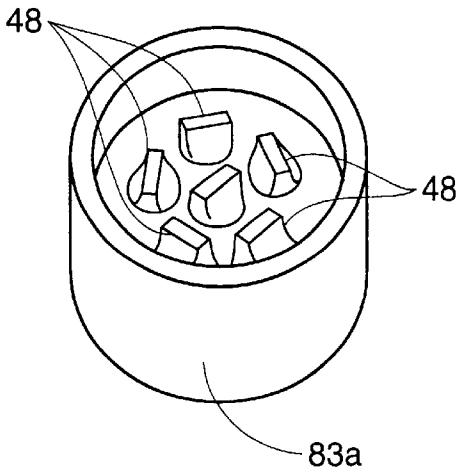


Fig. 16

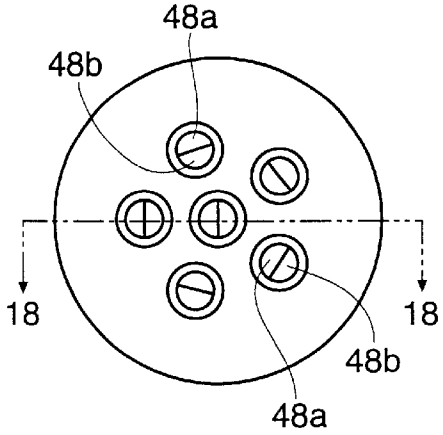


Fig. 17

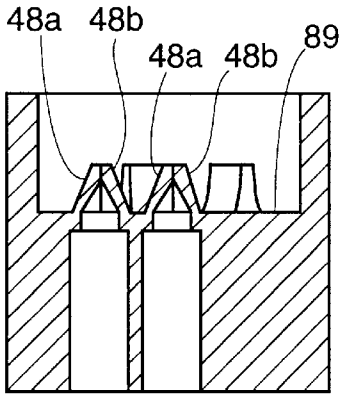


Fig. 18

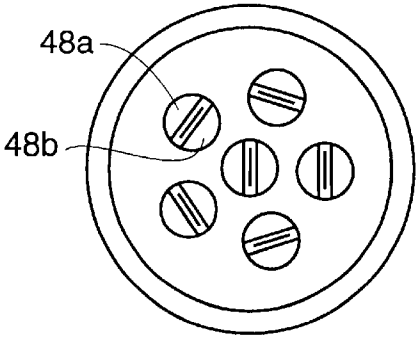


Fig. 19

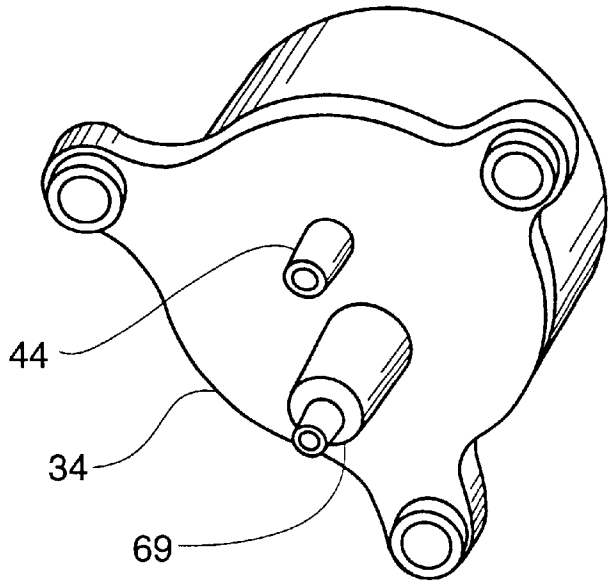


Fig. 20

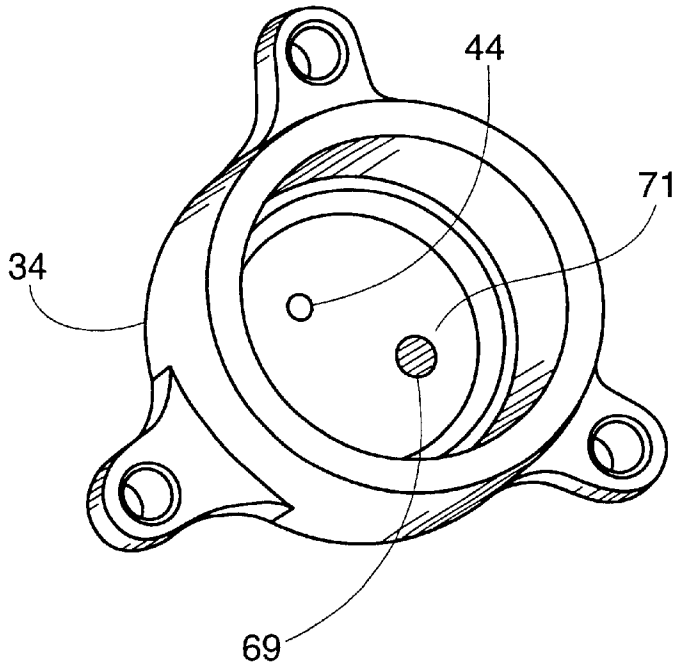


Fig. 21

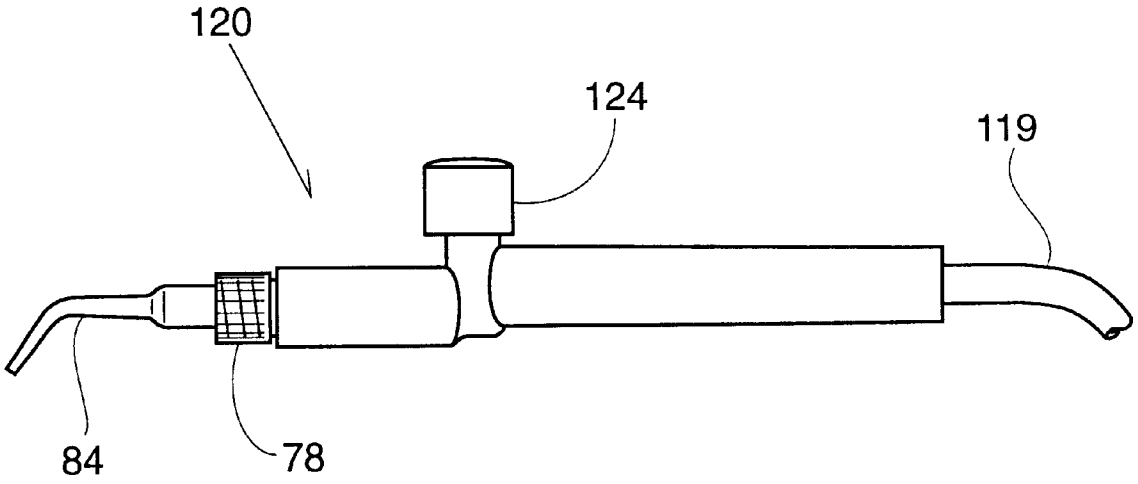


Fig. 22

MULTIPLE SOLUTION DENTAL IRRIGATOR

This application is a continuation-in-part of U.S. application Ser. No. 09/468,524 filed Dec. 21, 1999, pending.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to systems and methods and methods for systems for providing fluid to a hand tool and associated supply lines.

2. Description of Related Art

As a patient sits in a dental chair in a dentist's office, the dentist or a hygienist ordinarily cleans the patient's teeth with a variety of picks and brushes. Next, the dentist or a hygienist uses a hand held tool to supply rinse water or a variety of other medicament fluids from supply lines to a patient's mouth. Also, during many endodontic procedures, the dentist or dentist's assistant may be required to apply multiple medicaments to the operative site during a single procedure. U.S. patent application Ser. No. 09/468,524, filed on Dec. 21, 1999, commonly assigned to the assignee hereof, discloses a similar design, but it will be appreciated by those skilled in the art that the present invention includes numerous improvements.

A single air supply is commonly utilized in each dental operatory. The air supply pressure in a particular dental office is unique to that office because some dentists may operate more or fewer air operated devices than other dentists operate from a single air supply.

Some dental handpieces are able to supply a plurality of fluids to a patient's mouth. One such example is U.S. Pat. No. 4,215,476 to Armstrong. However, such handpieces often involve complex solenoid valves and more expensive electrical controls to toggle between fluid sources. Further, such handpieces often physically toggle fluid sources at the fluid source, controlled by a toggling at the handpiece. It has been found that toggling fluid sources at the handpiece itself, rather than at the more remote fluid source, requires a much lesser volume of fluid to be purged through the lines after fluid changes. Toggling at the handpiece itself results in less fluid waste, and reduces the risks that fluids may interact within a common fluid line and lead to undesirable chemical reactions.

The temperature of the fluids supplied by handpieces such as in the above-referenced Armstrong patent is generally equal to room temperature. Depending upon the time of year and geographical climate, actual room temperature may vary somewhat and thus affect the temperature of the fluids supplied by such handpieces. It has been found that by heating the fluids supplied by the handpiece, the benefits are two-fold. First, the patient's comfort is increased when the fluids supplied to the patient's mouth have been warmed to a comfortable temperature. Second, the efficacy of many of the fluids is increased when the fluids are heated above ambient temperature.

SUMMARY OF THE INVENTION

To overcome the above-identified concerns, the present invention provides an inexpensive apparatus and method for a fluid supply system that is capable of supplying a selected one of a plurality of fluid sources to a patient's mouth.

The various components may be made using conventional molding and extrusion techniques from inexpensive materials, both relatively rigid and also very flexible when needed or required.

A fluid dispensing assembly for dispensing a plurality of fluids is disclosed, the fluid dispensing assembly comprising a remote touch pad, a handpiece, a fluid discharge tip disposed on the handpiece, a manifold disposed within the handpiece, and a control mechanism disposed on the handpiece. The control mechanism includes a pinch valve for dispensing fluid from the fluid discharge tip. Preferably, both the handpiece and the remote touch pad include a momentary operated switch which actuates a remotely located air valve for selectively pressurizing one of a plurality of reservoirs. Further, the remote touch pad may include a digital or similar visual display. The handpiece manifold comprises a plurality of fluid inlets and a single fluid outlet. The handpiece further comprises a detachable coupling enabling the operator to detach the handpiece from the fluid supply system so that the handpiece may be autoclaved. The fluid dispensing assembly further comprises a fluid supply system, a plurality of fluid outlet lines, the fluid outlet lines preferably surrounding a heating element, and the fluid outlet lines communicatively coupled between the fluid supply system and the fluid inlets.

The fluid supply system comprises a plurality of reservoirs, a volume of fluid contained within each reservoir, and a reservoir head detachably coupled to each reservoir. A source of pressurized air is used to pressurize each reservoir and, in turn, force fluid from each reservoir to the fluid inlet on the handpiece. An air pressure regulator can be used to adjust air pressure, and thus adjust fluid flow from the handpiece. As the fluid is forced from a reservoir, it may be heated by the previously mentioned optional heating element.

The fluid dispensing assembly further comprises a single-fluid dental handpiece for delivering a dedicated fluid, such as air, to a patient's mouth. The single-fluid handpiece may include a control mechanism in the form of a valve for actuating between fluid discharge and no discharge.

Further, the invention comprises a fluid dispensing assembly whereby the dentist can supply pre-selected fluids to irrigate the field of operation within a patient's mouth. In addition, the invention includes a pressurized air supply and a single—fluid handpiece by which the dentist may deliver only a single fluid, such as pressurized dry air, to the patient's mouth.

A method for dispensing a selected fluid from a handpiece is also disclosed, the method comprising attaching a plurality of fluid-containing reservoirs to respective reservoir heads, coupling a plurality of fluid outlet lines between the fluid containing reservoirs and a handpiece, depressing a momentary switch disposed on the handpiece or disposed on a touch pad housing in order to select the desired fluid, the momentary switch being operable to select a particular fluid from among a plurality of fluids, air pressure being supplied to the selected fluid-containing reservoir, the pressurized air forcing the fluid from the selected fluid-containing reservoir through the respective fluid outlet line to the handpiece, and actuating a control mechanism to allow the fluid to pass from the selected fluid outlet line through the handpiece and ultimately the tip.

The foregoing is considered as illustrative only of the principles of the invention. Furthermore, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described. While the preferred embodiment has been described, the details may be changed without departing from the invention, which is defined by the claims.

Accordingly, it is an object of the present invention to provide a system that minimizes or substantially eliminates the corrosive effects of fluids, such as sodium hypochlorite, on the components of the fluid supply system.

It is another object of the present invention to provide a system including check valve means for minimizing cross contamination of fluids.

It is a further object of the present invention to provide means for minimizing cross-contamination of fluids in the event that the fluid dispensing assembly is jostled or tipped from its upright position.

It is yet another object of the present invention to provide fluid heating means for both patient comfort and for increasing the efficacy of fluids delivered by the fluid supply system.

It is yet a further object of the present invention to provide a separate handpiece for the delivery of a single fluid, such as dry air, to the patient's mouth.

These and other objects will become apparent in the following detailed description and the drawings take in conjunction therewith.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a partial perspective view of a fluid dispensing assembly.

FIG. **2** is a front elevational view of the fluid dispensing assembly of FIG. **1**, with certain of the components being shown in exploded relationship.

FIG. **3** is a schematic view of a fluid supply system having application in the fluid dispensing assembly of FIGS. **1** and **2**.

FIG. **4** is a fragmentary, side elevational view of a handpiece used with the fluid dispensing assembly.

FIG. **5** is a fragmentary, top elevational view of the handpiece used with the fluid dispensing assembly.

FIG. **6** is a front elevational view of the handpiece of FIGS. **4** and **5**.

FIG. **7** is a longitudinal, sectional view of the handpiece of FIGS. **4–6**, inclusive.

FIG. **8** is a cross-sectional view taken along lines **8—8** of FIG. **7**.

FIG. **9** is a perspective view of a modified fluid dispensing assembly, including a light emitting diode display and a touch pad assembly used in connection with the fluid dispensing assembly.

FIG. **10** is a rearward perspective view of the fluid dispensing assembly of FIG. **9**.

FIG. **11** is a perspective view of the modified fluid dispensing assembly, including an alternate display and touch pad assembly.

FIG. **12** is a rearward perspective view of the components of the fluid dispensing assembly with the housing removed.

FIG. **13** is a frontal perspective view of the components of the fluid dispensing assembly with the housing removed.

FIG. **14** is an alternate schematic view of the components of another embodiment of the fluid dispensing assembly of this invention.

FIG. **15** is an exploded perspective view of a modified handpiece of the fluid dispensing assembly.

FIG. **16** is a perspective view of a portion of a manifold arranged to be located within the handpiece of the fluid dispensing assembly.

FIG. **17** is a top plan view of the manifold of FIG. **16**, showing the normally closed position of individual check valves located in the manifold.

FIG. **18** is a longitudinal sectional view taken along lines **18—18** of FIG. **17**.

FIG. **19** is a top plan view similar to the view of FIG. **17**, but showing the individual check valves in open operating position.

FIG. **20** is a top perspective view of a reservoir head.

FIG. **21** is a bottom perspective view of the reservoir head of FIG. **20**.

FIG. **22** is a side elevational view of an air-only handpiece of the present invention.

DETAILED DESCRIPTION

Although the disclosure hereof is detailed and exact to enable those skilled in the art to practice the invention, the physical embodiments herein disclosed merely exemplify the invention which may be embodied in other specific structure. While the preferred embodiment has been described, the details may be changed without departing from the invention, which is defined by the claims.

It is to be noted that like elements of the drawings are designated by like reference numbering.

The term "fluid," as used herein, shall be defined as a gas including air, a liquid, a substance which flows, or a substance which differs from a solid in that it can offer no permanent resistance to change of shape. It shall further include mixtures of gases, mixtures of liquids, and mixtures of gases and liquids.

The invention includes a housing, at least one fluid reservoir, a fluid reservoir manifold, at least one handpiece, and a fluid pressurizing mechanism. The fluid pressurizing mechanism in one embodiment comprises at least one pressure regulator, at least one air valve, and a momentary switching means to pressurize at least one selected fluid reservoir. The fluid pressurizing mechanism in the preferred embodiment comprises at least one pressure regulator, a plurality of air valves, each air valve being in communication with a respective fluid reservoir, and a momentary switching means to control each air valve.

In one embodiment of the present invention, reference is made to the views of FIGS. **1–8**, inclusive. Referring in particular to FIGS. **1** and **2**, there is shown a fluid dispensing assembly, indicated generally by the reference numeral **5**, capable of supplying irrigation from a fluid supply system, indicated generally by the reference numeral **10** to a dental handpiece **80**. Delivery of dry air for aeration purposes or another fluid is preferably supplied from a supply line **119** to a single—fluid dental handpiece **120**.

The fluid dispensing assembly **5** includes at least one reservoir **30** capable of containing fluid **32** (see FIG. **3**). The reservoir **30** is carried by a housing **200**. While it is apparent that any number of reservoirs could be utilized, the preferred embodiment has six. The reservoir **30** can come in many forms, including, for example, a bottle, a canister, a dual-compartment bottle or canister; and can range greatly in size. Preferably, however, the reservoir **30** is an inexpensive clear plastic bottle with an engageable neck **31**, similar to a common water bottle with the cap removed. Reservoirs of this type are readily available from a variety of sources and manufacturers, and are most commonly available in a 10–20 fluid ounce capacity size. The clear bottle allows for a determination of the amount of fluid **32** remaining in the reservoir **30**, and a reservoir of this type is capable of withstanding internal pressure, though typically the resistance to pressure for this type of reservoir is limited to approximately 50 pounds per square inch (psi). Although a

stronger reservoir is capable of use with the fluid supply system, such as a high density polyethylene reservoir, the polyethylene terephthalate elastomer (PETE) construction common to plastic soda and water bottles provides sufficient rigidity, is easily available, and is inexpensive.

Referring now to FIG. **3**, the reservoir **30** is detachably coupled to a reservoir head **34** (hidden from view in FIG. **2**). The reservoir head **34** is designed to provide the reservoir **30** with an air-tight seal capable of containing pressures up to 50 psi, but higher pressures are capable with different reservoir embodiments. The detachable coupling may be provided by a threaded neck **31** on the reservoir **30** and a female thread on the reservoir head **34**. However, it is to be understood that a variety of means for removably coupling each reservoir to the reservoir head may be employed. The detachable coupling allows for quick and simple reservoir changes, should refills or different fluids be desired for use with the fluid dispensing assembly **5**.

The reservoir head **34** has two fluid passageways or two communicative conduits **44** and **69** indicated schematically on FIG. **3**, between the reservoir **30** and the remainder of the fluid dispensing assembly **5** and fluid supply system **10**. The first communicative conduit provides a pathway to the interior of the reservoir **30** for pressurized air through an air inlet fitting **69**. The second communicative conduit is a fluid outlet fitting **44**, providing a fluid passage for fluid to leave the reservoir **30**.

It is conventional to supply sodium hypochlorite during certain dental procedures to either irrigate, debride and disinfect the mouth of a patient, or to destroy bacteria present in the dental unit water line. The components of the fluid supply system **10** that come into contact with the sodium hypochlorite are preferably constructed of material capable of withstanding the corrosive effects of the sodium hypochlorite. These components, as shown in FIGS. **1–7**, inclusive, include a check valve **48**, an air valve **47**, a fluid draw line **36**, a fluid outlet line **46**, the fluid outlet fitting **44**, the reservoir **30**, the reservoir head **34**, and the handpiece **80**, and are preferably constructed of sodium hypochlorite resistant material. Because sodium hypochlorite is particularly corrosive with respect to metal, non-metal components are preferred. Plastic is a preferred construction material because of its resistance to sodium hypochlorite corrosion. The fluid outlet lines **46** preferably have an inner layer and an outer layer, the inner layer preferably being constructed of polyethylene (PE) and the outer layer preferably being constructed of polyvinyl chloride (PVC).

Dental offices are often unique with respect to the air pressure in the air system. Dental offices operate at higher or lower pressures based on operator preference, the output of the air compressor, the number of components in the office using air, and the number of components in use at any one time. For this reason, the fluid supply system **10** is supplied with an adjustable air pressure regulator **64** and a fixed air pressure regulator **65**. Adjustable air pressure regulator **64** is coupled with an air supply line **62** and the air valve **47** between an air inlet **60** and the reservoir **30**, as is best shown in FIG. **3**. This arrangement avoids erratic and uncontrollable fluid flow from the fluid supply system **10** and ultimately the handpiece. One air pressure regulator that performs suitably is a CLIPPARD MAR-1, 0–27 psi air pressure regulator. Most dentists prefer a setting of approximately 5–10 psi. Preferably, pressure in the fixed air pressure regulator **65** is fixed at 20 psi. Preferably, pressure in the adjustable air pressure regulator **64** is adjustable by operation of an air pressure regulator adjuster **66**, according to the operator's preference, to an air pressure from 5 psi to 10 psi. The operator of the fluid supply system **10** thus has the capability to alter the air pressure to provide a consistent output of fluid.

As previously stated and as shown in FIGS. **1** and **2**, the pressurized air is conveyed from a conventional source of pressurized air common in dental offices, through the air supply line **60** coupled with the source of pressurized air by a coupling **70**. The air supply line **60** is ultimately communicatively coupled with the air valve **47** and its respective reservoir head **34**. Each air supply line **115** leads to the air inlet fitting **69** to supply pressurized air to the reservoir **30**.

The pressurized air is supplied to force fluid **32** from the reservoir **30** through a distal end **40** of the fluid draw line **36** through the fluid outlet fitting **44** and through the fluid outlet lines **46**, contained within an outlet line sheath **50**, and ultimately to components of the handpiece **80**.

With reference to FIG. **3**, actuation of the air valve **47** may be accomplished by conventional means, supplied from an electrical power source **100** via power supply line **104**, and controlled by means such as a programmable logic controller (PLC) **102**. As further disclosed in FIG. **3**, a single electrically operated air valve **47** receives pressurized air from the air supply line **62** passing through the adjustable air pressure regulator **64** a to a tee-fitting **74**, where one port supplies air to an air line **114**. The other port of the tee-fitting **74** being in communication with a pressure gauge **68**. The pressurized air is delivered from the air valve **47** through hydrophobic filters **71** and to individual air inlet fittings **69** on the reservoir heads **34**, thus pressurizing the fluid **32** and forcing the same through the fluid draw lines **36** to the fluid outlet lines **46** and through check valves **48**. As will be described later, the fluid outlet lines **46** communicate with the handpiece **80**. The hydrophobic filter **71**, is disclosed schematically in FIG. **3**, and a physical embodiment will be later shown and described.

As shown in FIG. **3**, the present embodiment further contemplates the use of separate common tee-fittings **73** and **74**. Here, the air supply line **62** enters the fluid supply system **10**, and the air supply line **62** is split by a first common tee fitting **73** to split the air passage into two distinct pathways. One pathway **111** leads to the adjustable air pressure regulator **64** from the fixed air pressure regulator **65**. Another pathway **112** for air travel leads to the fixed air pressure regulator **65**. Preferably, the first common tee fitting **73** may be used to split the air flow into two distinct pathways.

Air enters the fixed air pressure regulator **65** through air supply line **62**. Leaving the adjustable air pressure regulator **64**, an air outlet line **67** is split by the second common tee-fitting **74** to split the air passage into two distinct pathways. As shown on FIG. **3**, one pathway **113** leads to the pressure gauge **68**. Another pathway **114** leads to the air valve **47**.

If the first common tee fitting **73** is not utilized, two separate pressurized air supply lines could be used with one air line directed to the air valve **47** and the other pressurized air supply line directed to the air-only handpiece **120**.

Referring to FIGS. **2** and **3**, the fluid draw line **36** is coupled to the apertured fluid outlet fitting **44** located on the underside of reservoir head **34**. The fluid draw line **36** is sized to extend from the top of the reservoir **30** to a point which is near the bottom of the reservoir, so that the fluid supply system **10** can operate until the reservoir **30** is nearly empty of fluid **32**. The fluid outlet line **46** is communicatively coupled with the fluid outlet fitting **44** on the upper side of the reservoir head **34**, extending the pathway for fluid **32** leaving the reservoir **30**. The previously mentioned

hydrophobic filter **71** is seated within a through bore communicating at the underside of reservoir head **34** as shown in FIG. **3**.

Alternatively, the fluid draw line **36** and the fluid outlet line **46** could be integrated into a single line serving the same purpose of providing a conduit for fluid **32** to leave the reservoir **30** and retain pressure within the reservoir **30**, if an air-tight fitting around the line is used as opposed to fluid outlet fitting **44**. However, the use of both the fluid draw line **36** and the fluid outlet line **46** is preferred, mainly because this arrangement provides a better pressure seal than a single line with an air-tight fitting around the line. Each fluid outlet line **46** includes the check valve **48** coupled with the fluid outlet line **46**, in order to prevent fluid **32** from flowing back into the reservoir **30**.

A plurality of fluid outlet lines **46** emerge from the fluid supply system **10**, (see FIG. **3**) and enter a distal end of the outlet line sheath **50** (see FIGS. **1** and **2**). The sheath **50** is preferably flexible, allowing ease of mobility during treatment of the patient, but also rigid enough to withstand penetration, line puncture, and kinking. The sheath **50** may be detachably coupled to a distal end of a handpiece handle **81** by a threaded couple, and the sheath **50** may be detachably coupled to a fluid reservoir manifold **39** by a similar threaded couple. After entering the distal end of the sheath **50**, the fluid outlet lines **46** extend a predetermined distance from the distal end of the sheath and exit a proximal end of the sheath **50**. The length of the sheath **50** and fluid outlet lines **46** is primarily determined by the distance between the fluid supply system **10** and the patient. Subsequently, the fluid outlet lines **46** enter a handpiece manifold **83** disposed within the handpiece handle **81**, and the fluid outlet lines **46** are coupled with a plurality of respective fluid inlets **88** within the handpiece manifold **83**. Also disposed within the handpiece handle **81** is a single fluid discharge line **52**, through which a selected fluid passes into before being delivered into the patient's mouth.

In FIGS. **7** and **8**, the cross-sectional view of FIG. **8** indicates the relationship of the fluid outlet lines **46** with respect to the sheath **50** and handpiece **80**. As will be observed, it is preferable to arrange the fluid outlet lines **46** in a semi-circular pattern around a heating element **87**, heated by at least one resistance wire **85** of substantially the same length as the fluid outlet lines **46**. Thus, the fluid contained in the fluid outlet lines **46** will be pre-heated prior to discharge into the mouth of the patient, the temperature of said fluid being at a temperature that is suitable both for optimal patient comfort and for improving the efficacy of certain selected fluids with respect to the dental procedure being performed on the patient.

Referring to FIGS. **4–7**, in order for the operator to select which fluid **32** to use, a momentary switch **82**, such as a membrane switch, is provided on the handpiece **80**. The switch **82** is connected to the PLC **102** by way of conductors **75**, **76** as shown in FIGS. **3**, **7** and **8**. Pressure is delivered to the particular reservoir **30** containing the selected fluid **32**, allowing the operator to quickly supply the desired fluid following a depression of the momentary switch **82**, as opposed to having to wait for the air supply to re-pressurize the reservoir **30** with each alternation in fluid. In this arrangement, only one reservoir **30** is pressurized at a time.

Referring to FIGS. **1** and **2**, the fluid supply system **10** is supplied with the housing **200**, provided as a hub for simple instrumentation configuration changes, and as a hub for the fluid supply system **10** components. Carried by the housing **200** face is a light emitting diode display **130**, which display utilizes a plurality of individual indicators **131**. The individual indicators **131** indicate the particular fluid selected by the operator. The housing **200** creates an attractive portal for quick connections and flexibility during instrumentation, and also provides an easily accessible outside surface for regulating the air pressure with the air pressure regulator switch **66**.

During instrumentation, an operator can configure the fluid supply system **10** to supply different fluids **32** and finger tip controlled irrigation, and aeration to a patient's mouth. Referring now to FIGS. **4–7**, the dental handpiece **80** has a disposable tip **84**, and the handpiece **80** may also have a disposable extension **79** for ease of accessing the patient's mouth. The extension **79** may be coupled to the handpiece **80** by a conventional LUER-LOK®-type fitting **78**. The tip **84** receives the selected fluid **32** through the fluid discharge line **52** regulated by the pinch valve **86**. The tip **84** is selectively coupled to the handpiece **80** and the tip **84** is then used during instrumentation to direct the deposit of fluids or evacuation target site in a patient's mouth. In this arrangement, only the relatively small amount of fluid **32** contained within the discharge line **52** and the tip **84** need be purged between fluid alternations.

Referring to FIG. **2**, if the operator desires to independently convey dry air to the patient's mouth, an air-only dental handpiece **120** is supplied. The air outlet line **119** is provided between the fluid supply system **10** and the air-only handpiece **120**. Preferably, the air-only handpiece **120** is autoclavable, and has a tip **84**, preferably disposable for use between different patients. The tip **84** receives the dry air through the air outlet line **119** coupled to the fixed air pressure regulator **65**. The handpiece **120** is used during instrumentation to direct a stream of pressurized air in a patient's mouth. A control mechanism **124**, in the form of a valve, may be disposed on the air-only handpiece **120** for actuating between air discharge and no discharge (see FIG. **22**).

Now referring to FIGS. **12** through **14**, in a preferred embodiment there are provided separate air valves **47**. It is preferred to utilize conventional venting air valves because of the immediate release of pressure in the reservoir **30**. However, simple two-way air valves may be substituted and the same result will be achieved. In this embodiment, after the air supply line **62** enters the fluid supply system **10** and passes through the fixed air pressure regulator **65** and through the adjustable air pressure regulator **64**, the pressurized air is then split in three directions. The first directed path leads to the pressure gauge **68**. The second directed path leads to the air-only handpiece **120**. The third directed path leads to a valve manifold **49**. The individual air valves **47** are each controlled by conventional logic circuitry supplying current to electric valve control lines **45**, shown in phantom in FIG. **14**. Hydrophobic filters **71** are also supplied in the schematic circuit as shown.

One hydrophobic filter that performs suitably is Model TA **65**, available from PERFORMANCE SYSTEMATIX INC. of Caledonia, Mich., and which hydrophobic filter **71** consists of a hydrophobic membrane contained within a polyethylene frame. In the event the housing **200** is jostled or is tipped upside down, the hydrophobic filter **71** prevents fluid **32** from escaping the reservoir **30** and entering the air valve **47**. Over time, an accumulation of the escaped fluid in the air valve **47** would lead to corrosion of the air valve **47** and subsequently to contamination of fluid **32** in the reservoir **30** when air is forced through a corroded air valve **47** and into the reservoir **30**. Such an arrangement eliminates a threat of cross-contamination of fluid **32** in the reservoir **30**.

As seen in FIGS. **15–19**, inclusive, preferably the check valves **48** are preferably integrally molded in the handpiece manifold **83**, comprising a cup—like base member **83***a* and an enclosure member **83***b*. The enclosure member **83***b* includes a fluid exit port provided by the bore of a barbed fitting **83***c*, for supplying the selected fluid to the patient's mouth through the fluid discharge line **52**. The check valves **48** protrude from a base surface **89** to provide flexible, normally closed bill-like members, **48***a* and **48***b*. Silicone rubber is a suitable molding material to provide flexibility to oppositely disposed bill-like members **48***a* and **48***b*. Placement of the check valves **48** within the handpiece manifold **83** is preferred due to the ease of cleaning the component members of the handpiece manifold **83**. Further, by placing the check valves **48** within the handpiece manifold **83**, cross contamination of fluid **32** due to a backflow of fluid from the tip **84** is prevented.

Pressurized fluid forces the normally closed bill—like members **48***a* and **48***b*, as shown in FIG. **17**, to open the flexible bill—like members **48***a* and **48***b* to the position shown in FIG. **19**. Closure of the pinch valve **86** will stop fluid flow and the members **48***a* and **48***b* will be permitted to close to the position shown in FIG. **17**.

With reference to FIG. **12**, it will be observed that the fluid reservoir manifold **39** comprises a plurality of reservoir heads **34** mounted on an apertured reservoir manifold plate **33**. The heads **34** have been previously described to provide a detachable coupling for engaging the threaded neck **31** of each of the reservoirs **30**.

In the preferred embodiment, the housing face **200** carries a light emitting diode display and a plurality of labels **132**. Each label **132** is sequentially numbered and each label **132** corresponds to a different fluid **32** contained within a particular reservoir **30**. When the operator selects a fluid **32** to use, the light emitting diode display **130** displays a number that corresponds to the selected fluid **32**.

Referring now to FIG. **11**, in one embodiment of the present invention, the fluid supply system **10** is equipped with a remote touch pad assembly **90**. The touch pad assembly **90** includes a housing **92**, a cord **94**, a light emitting diode display **96**, and a momentary switch **98**. The touch pad assembly **90** is communicatively coupled to the fluid supply system **10** by the cord **94**. If the touch pad assembly **90** is employed, the momentary switch **82** may not be disposed on the handpiece **80**. The operator selects which fluid to use by depressing the momentary switch **98** on the touch pad assembly **90**. The selected fluid is indicated by the light emitting diode display **96** on the face of the touch pad assembly **90** and/or the light emitting diode display **130** on the housing **200**.

To supply a selected fluid **32** to the handpiece **80**, the user first attaches the plurality of fluid-containing reservoirs **30** to the respective reservoir heads **34**. Next, the user couples the plurality of fluid outlet lines **46** between the fluid containing reservoirs **32** and the handpiece **80**. The user can then depress momentary switch **82** disposed on the handpiece **80** or momentary switch **98** disposed on the touch pad housing **92** in order to select the desired fluid. The momentary switch is operable to select a particular fluid **30** from among a plurality of fluids. After depressing the momentary switch, air pressure is supplied to the selected fluid-containing reservoir **30**, and the pressurized air forces the fluid **32** from the selected fluid-containing reservoir **30** through the respective fluid outlet line **46** to the handpiece **80**. Next, the user actuates the control mechanism **86** to allow the fluid **32** to pass from the selected fluid outlet line **46** through the handpiece **80** and ultimately the tip **84**.

The foregoing is considered as illustrative only of the principles of the invention. Furthermore, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described. While the preferred embodiment has been described, the details may be changed without departing from the invention, which is defined by the claims.

What is claimed is:

1. A fluid dispensing assembly for dispensing a fluid selected from a plurality of fluid sources, the fluid dispensing assembly comprising:

a handpiece;

fluid discharge means disposed on the handpiece;

a handpiece manifold disposed within the handpiece;

said handpiece manifold including a plurality of fluid inlets and at least one fluid outlet;

a first control mechanism disposed on the handpiece, for controlling the amount of fluid flowing from said manifold fluid outlet to said fluid discharge means;

a second control mechanism disposed on the handpiece, said second control mechanism including an electrically operated selector circuit having momentary switching means for selecting a fluid from said plurality of fluids and for directing the selected fluid to one of said manifold fluid inlets.

2. A fluid dispensing assembly in accordance with claim **1**, the fluid dispensing assembly further comprising:

a second handpiece for delivering only air;

an air-only discharge means disposed on the second handpiece; and

a third control mechanism disposed on the second handpiece, for controlling the amount of air flowing through said second handpiece to said air-only discharge means.

3. A fluid dispensing assembly according to claim **1**, wherein the fluid dispensing assembly further comprises:

a fluid supply system;

a housing for the fluid supply system; and

a plurality of fluid outlet lines, the fluid outlet lines being communicatively coupled between the fluid supply system and the fluid inlets of said handpiece manifold.

4. A fluid dispensing assembly according to claim **3**, wherein the fluid supply system comprises:

a plurality of fluid reservoirs;

a reservoir manifold arranged to detachably support said plurality of reservoirs;

a volume of fluid contained within each reservoir; and

a plurality of reservoir heads, each head being coupled to the reservoir manifold and each head being adapted to detachably support and enclose a respective reservoir.

5. A fluid dispensing assembly according to claim **4**, wherein the fluid outlet lines are communicatively coupled with the reservoir heads, and wherein the fluid supply system further comprises:

a fluid draw line contained within each reservoir, each fluid draw line being communicatively coupled with its respective reservoir head.

6. A fluid dispensing assembly according to claim **5**, each fluid outlet line having a proximal end and a distal end, each fluid draw line having a proximal end and a distal end, the fluid supply system further comprising:

a fluid passage disposed through each reservoir head, the fluid passage having an interior end and an exterior end;

the proximal end of each of the fluid draw lines coupled with the interior end of one of the fluid passages, the proximal end of each of the fluid outlet lines coupled with the exterior end of one of the fluid passages, the distal end of each of the fluid outlet lines coupled to one of the handpiece manifold fluid inlets.

7. A fluid dispensing assembly according to claim **6**, wherein the fluid supply system further comprises:

a check valve coupled with at least one fluid outlet line.

8. A check valve according to claim **7**, wherein a respective one of a plurality of said check valves is located within said handpiece manifold and said check valve is in communication with a respective handpiece manifold fluid inlet.

9. The fluid dispensing assembly in accordance with claim **7**, wherein said check valve is formed integrally within the handpiece manifold.

10. The fluid dispensing assembly according to claim **7**, wherein said check valve comprises oppositely disposed, flexible bill-like members in a normally closed relationship, and when said bill-like members are opened under fluid pressure, fluid is permitted to pass therethrough to said fluid discharge means, and when said flexible bill-like members are permitted to return to normally closed relationship, said check valve will block fluid back flow from the fluid discharge means into the fluid supply system.

11. A fluid dispensing assembly according to claim **4**, wherein the fluid supply system further comprises:

a source of pressurized air; and

an air supply line communicatively coupled between the source of pressurized air and each reservoir head, the pressurized air being at a pressure capable of forcing fluid from each reservoir to a respective one of the fluid inlets of the handpiece manifold.

12. A fluid dispensing assembly according to claim **11**, wherein the fluid supply system further comprises:

air pressure regulating means coupled with the air supply line, said means being disposed between the source of pressurized air and each reservoir head.

13. A fluid dispensing assembly according to claim **11**, wherein the fluid supply system additionally comprises:

air pressure regulating means coupled with the air supply line, said means being disposed between the source of pressurized air and each reservoir head; and

a common tee fitting including an air inlet port and first and second outlet ports, said first outlet port being in communication with said air pressure regulating means and said second outlet port being in communication with a second handpiece for delivering only air.

14. A fluid dispensing assembly according to claim **13**, wherein the air pressure regulating means includes an adjustable air pressure regulator.

15. A fluid dispensing assembly according to claim **13**, wherein the air pressure regulating means includes a fixed air pressure regulator.

16. A fluid dispensing assembly according to claim **13**, wherein the air pressure regulating means includes both a fixed air pressure regulator and an adjustable air pressure regulator.

17. A fluid dispensing assembly in accordance with claim **11**, wherein the fluid supply system further comprises:

electrically operated valve means located between the source of pressurized air and the reservoir; and

said electrically operated valve means being controlled by the electrically operated selector circuit.

18. The fluid dispensing assembly in accordance with claim **17**, wherein the electrically operated selector circuit includes a programmable logic controller.

19. A fluid dispensing assembly in accordance with claim **17**, wherein said electrically operated valve means includes a valve manifold;

said valve manifold adapted to support and retain a plurality of said electrically operated valves, a respective one of said plurality of electrically operated valves being in fluid communication with a selected one of said reservoirs.

20. A fluid dispensing assembly in accordance with claim **19**, wherein said electrically operated valve means comprises a single electrically operated valve controlled by the electrically operated selector circuit; and

wherein said electrically operated valve includes a plurality of fluid outlet ports, each of said ports being in fluid communication with a selected one of said reservoirs.

21. A fluid dispensing assembly according to claim **20**, wherein the fluid supply system additionally comprises:

air pressure regulating means coupled with the air supply line, said means being disposed between the source of pressurized air and each reservoir head;

a first common tee fitting including an air inlet port and first and second outlet ports, said first outlet port being in communication with said air pressure regulating means and said second outlet port being in communication with a second handpiece for delivering only air;

an air pressure gauge;

a second common tee fitting including an air inlet port and first and second outlet ports, said air inlet port being in communication with said air pressure regulating means; and

said first air outlet port being in communication with said air pressure gauge; and said second air outlet port being in communication with said single electrically operated valve.

22. A fluid dispensing assembly in accordance with claim **11**, wherein the fluid supply system further comprises a hydrophobic air filter located between the source of pressurized air and the reservoir head.

23. A fluid dispensing assembly in accordance with claim **22**, wherein said hydrophobic air filter is disposed within each reservoir head.

24. A fluid dispensing assembly in accordance with claim **4**, wherein the fluid supply system further includes a light emitting diode display for indication of the fluid flow from a selected reservoir.

25. A fluid dispensing assembly according to claim **3**, wherein the fluid supply system further comprises fluid heating means.

26. The fluid heating means of claim **25**, said fluid heating means being arranged proximate to at least a portion of said fluid outlet lines, and being further adapted to warm a fluid being transported through a respective fluid outlet.

27. A fluid dispensing assembly according to claim **3**, wherein the momentary switching means is disposed on the first handpiece, and said momentary switching means being communicatively coupled to the fluid supply system.

28. A fluid dispensing assembly according to claim **3**, wherein the momentary switching means is disposed on a remote touch pad, said remote touch pad switching means being communicatively coupled to the fluid supply system.

29. A fluid dispensing assembly according to claim **3**, wherein the momentary switching means is disposed both on the first handpiece and on a remote touch pad, said momentary switching means being communicatively coupled to the fluid supply system.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

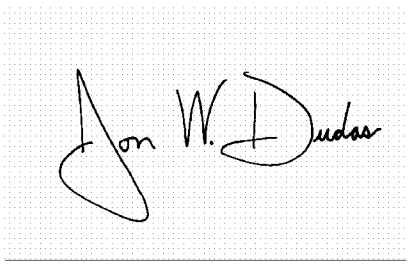
PATENT NO. : 6,390,815 B1
DATED : May 21, 2002
INVENTOR(S) : Gary J. Pond

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title page,
Item [56], **Refernces Cited**, FOREIGN PATENT DOCUMENTS, insert
-- 4,797,098, 01/1989, Kawata --.

Signed and Sealed this

Eighth Day of June, 2004



JON W. DUDAS
Acting Director of the United States Patent and Trademark Office