United States Patent [19]

Gardella et al.

[11] **3,778,903**

[45] **Dec. 18, 1973**

[54] **DENTAL UNIT**

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[22] Filed: **Mar. 23, 1971**

[21] Appl. No.: **127,098**

[52] **U.S. Cl.** **32/22**

[51] **Int. Cl.** **A61c 19/02**

[58] **Field of Search** 248/124; 32/22, 23

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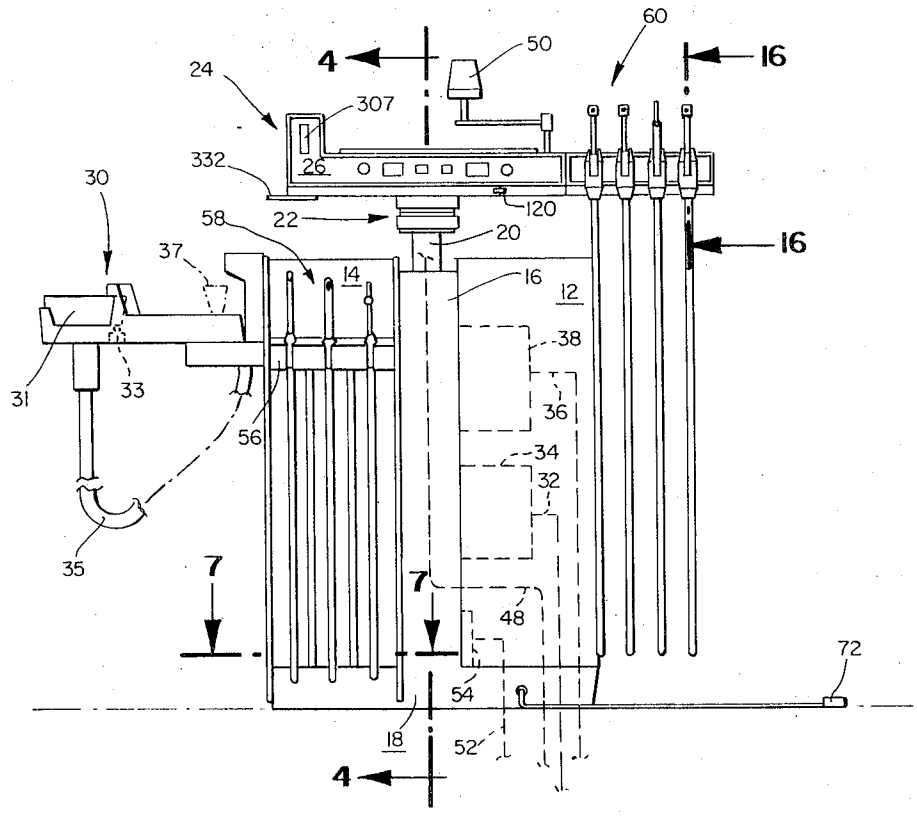
[57] **ABSTRACT**

A dental unit includes an inverted generally T-shaped frame with a supply section located on one side of the upright portion of the frame, and an evacuation section on the other side thereof; the evacuation section includes an evacuation instrument removably supported on a front side thereof, this section being rotatably mounted to the horizontal portion of the frame so that the front side thereof may be rotated to face in any one of an infinite number of positions located within a 180° arc as measured in a horizontal plane. A vertical post is supported within and extends upwardly above the upright portion of the frame, and also above the above mentioned sections. A horizontally extending arm assembly is rotatably mounted at one end thereof to the upper end of the post, and supports a tray assembly at the other end thereof, the tray assembly having a plurality of dental drills removably supported thereon; the arm and tray assemblies may be retracted to a position over the above mentioned sections. The unit includes an outlet into which a prophylaxis unit plug can be inserted so that a single foot control unit can be used for operating both the dental drills and the prophylaxis unit. Upon removing a drill from its associated hanger the supply system is programmed to actuate the selected drill upon actuation of the foot control unit, unless upon removal of the drill, its associated hanger is latched in its lowermost position.

23 Claims, 30 Drawing Figures



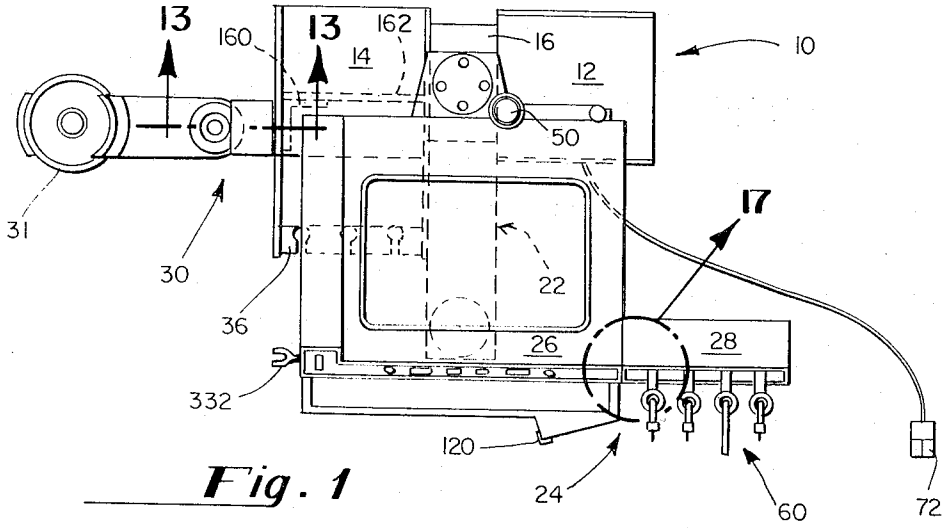


Fig. 1

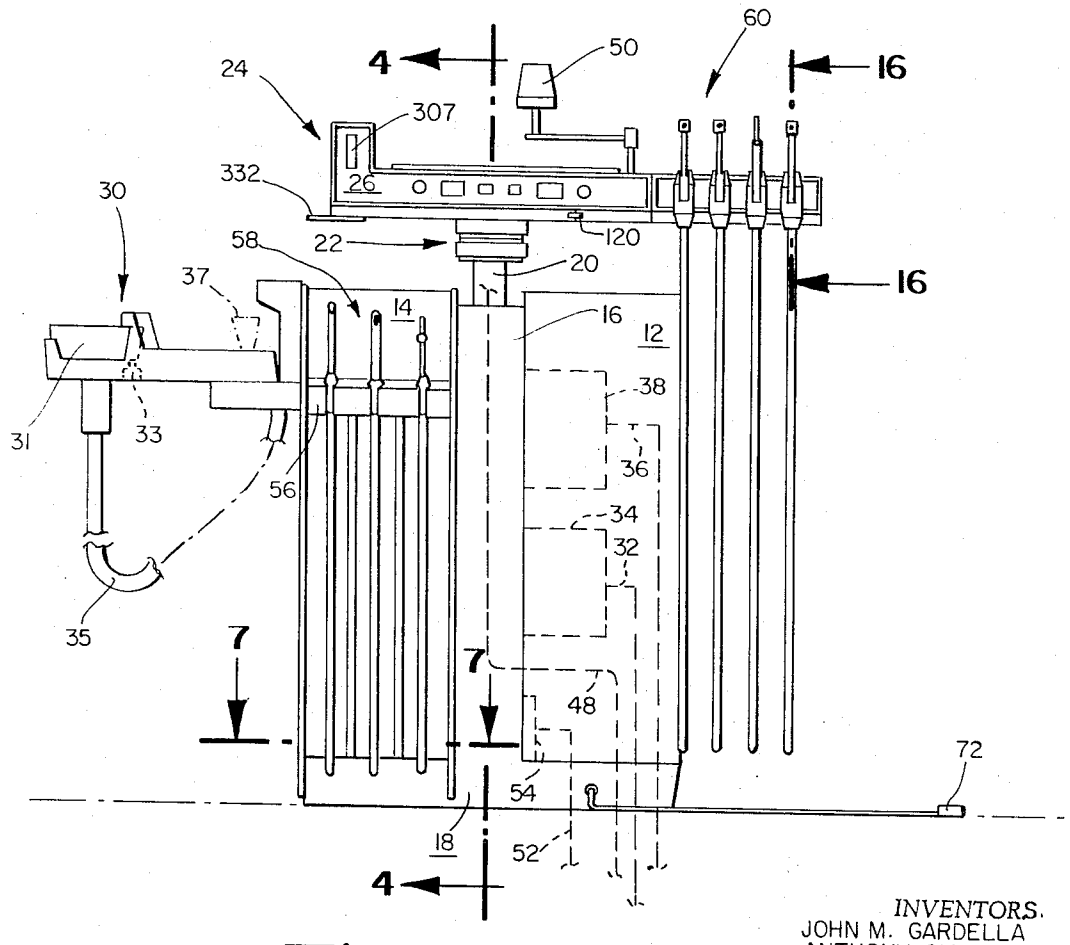


Fig. 2

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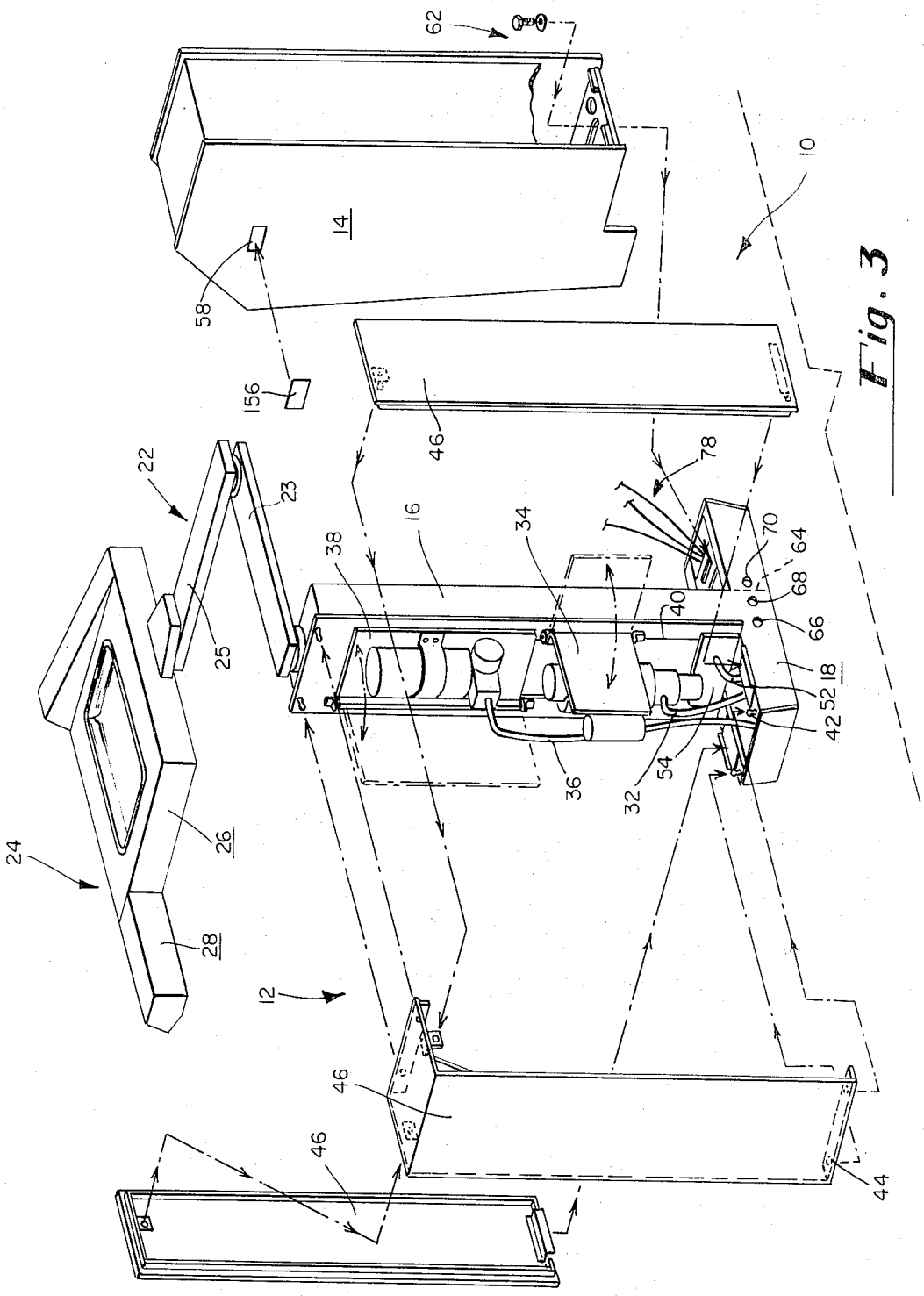

Fig. 3

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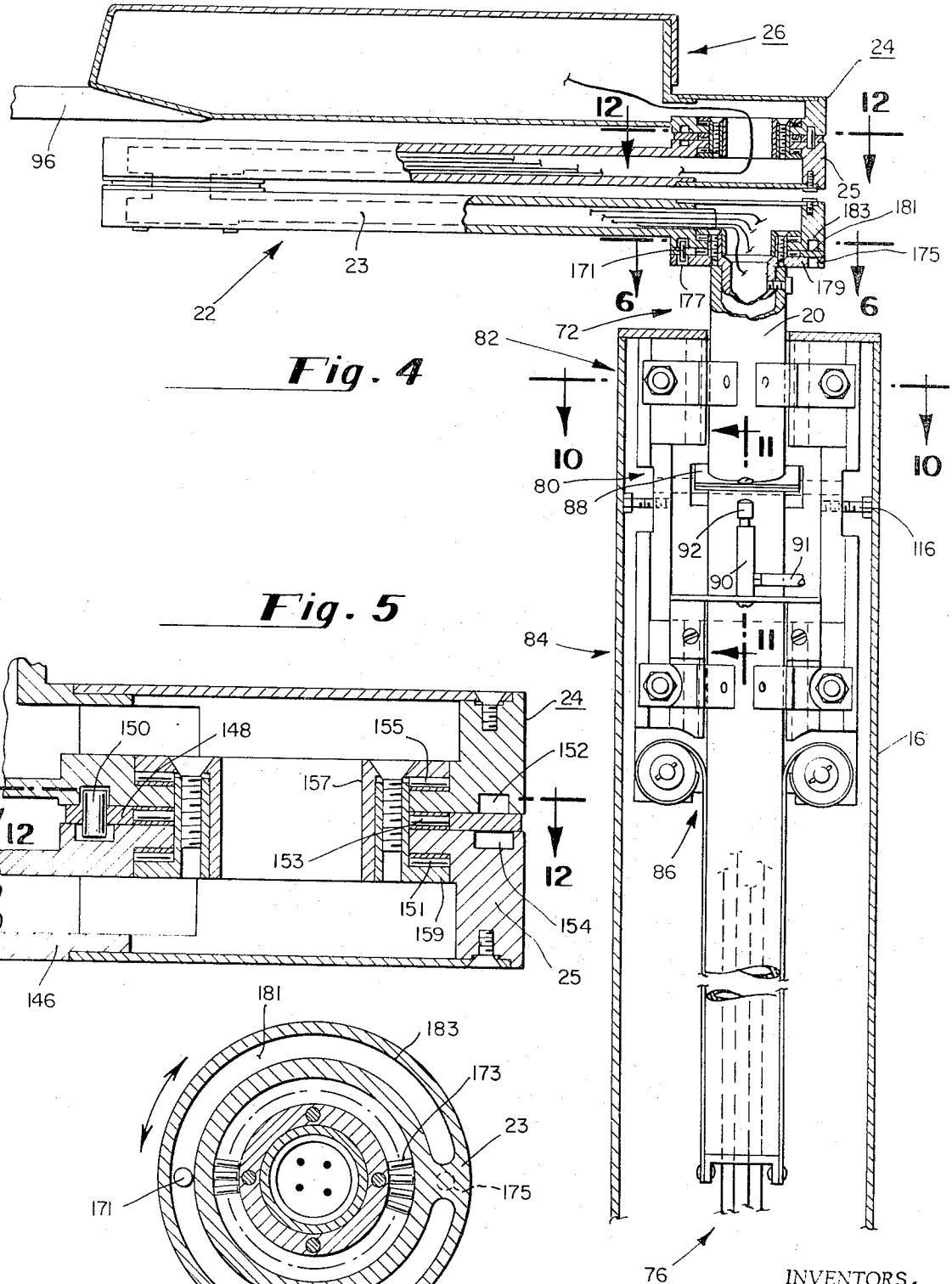

Fig. 4

Fig. 5

Fig. 6

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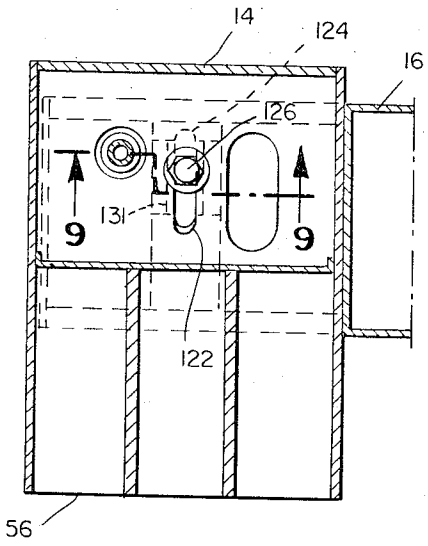
Fig. 7



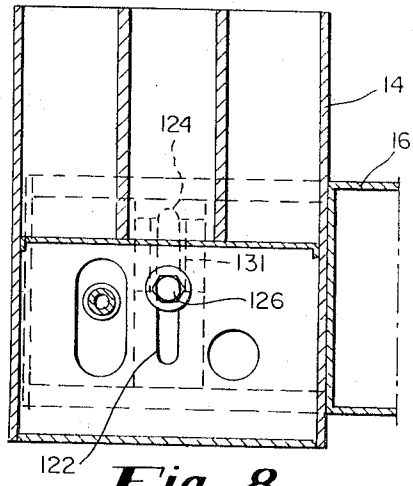


Fig. 8

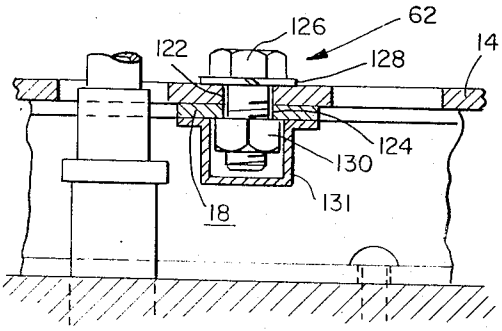


Fig. 9

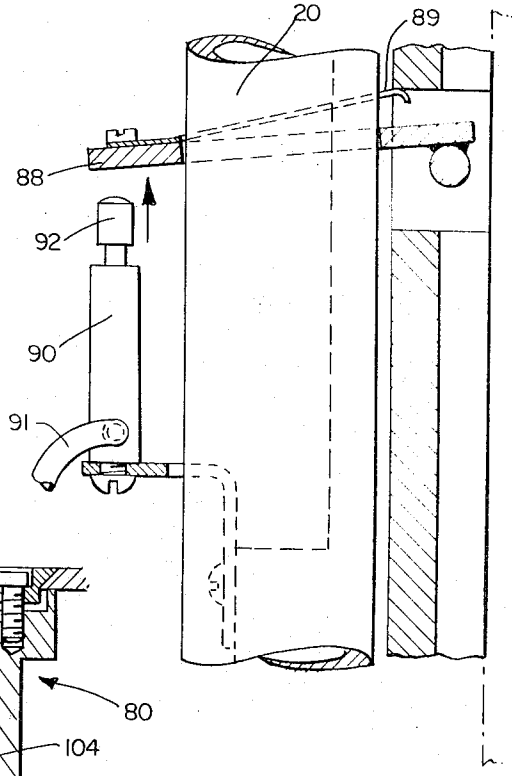


Fig. 11

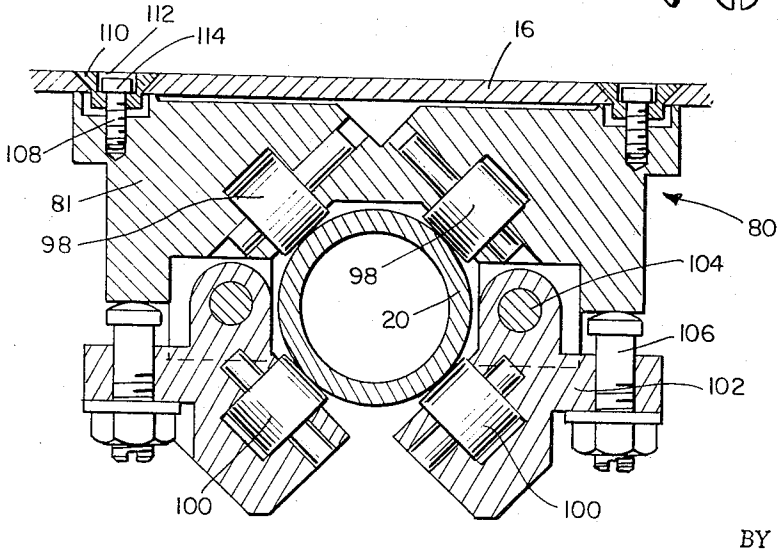


Fig. 10

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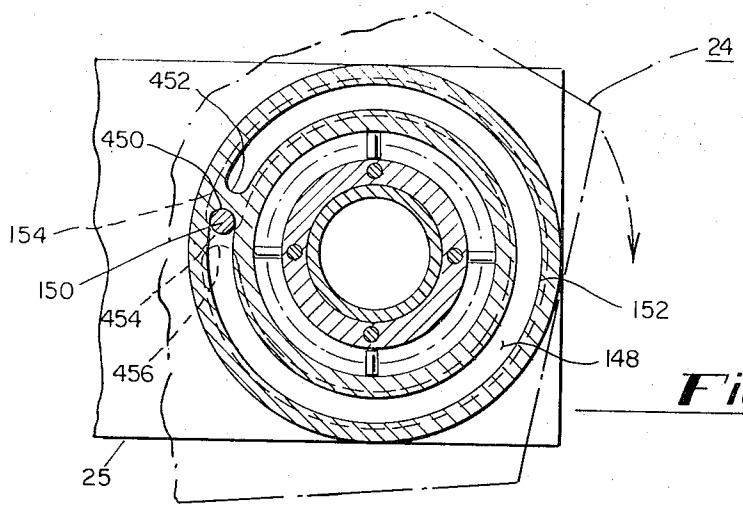

Fig. 12a

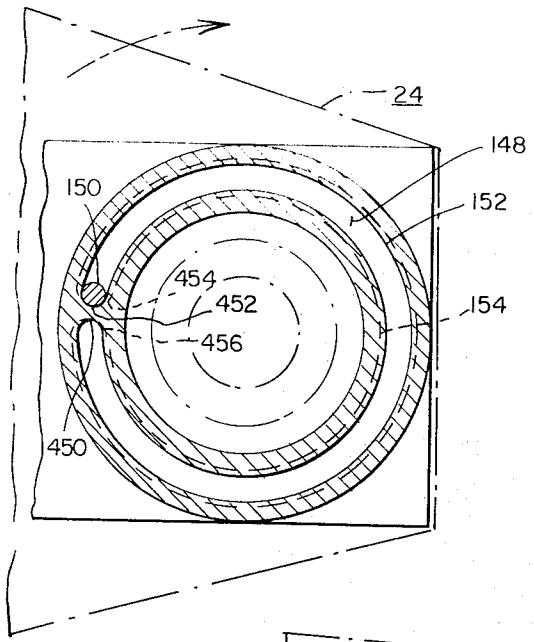

Fig. 12c

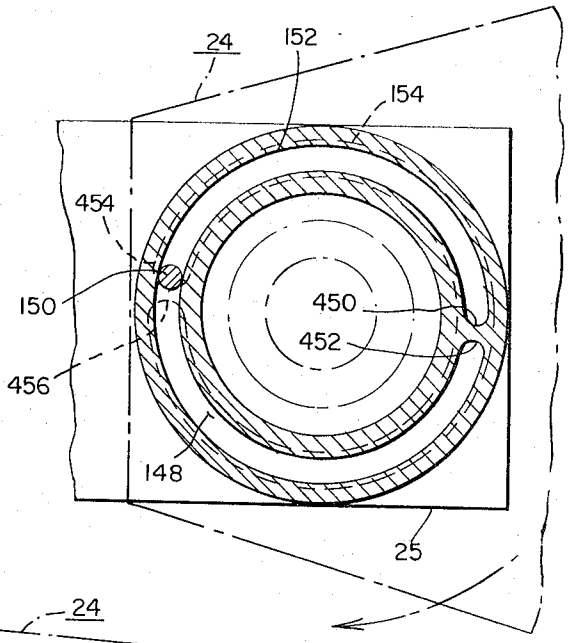

Fig. 12b

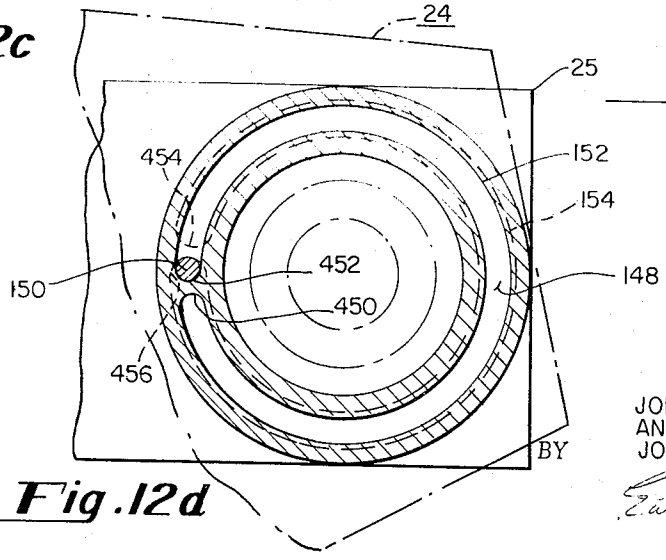

Fig. 12d

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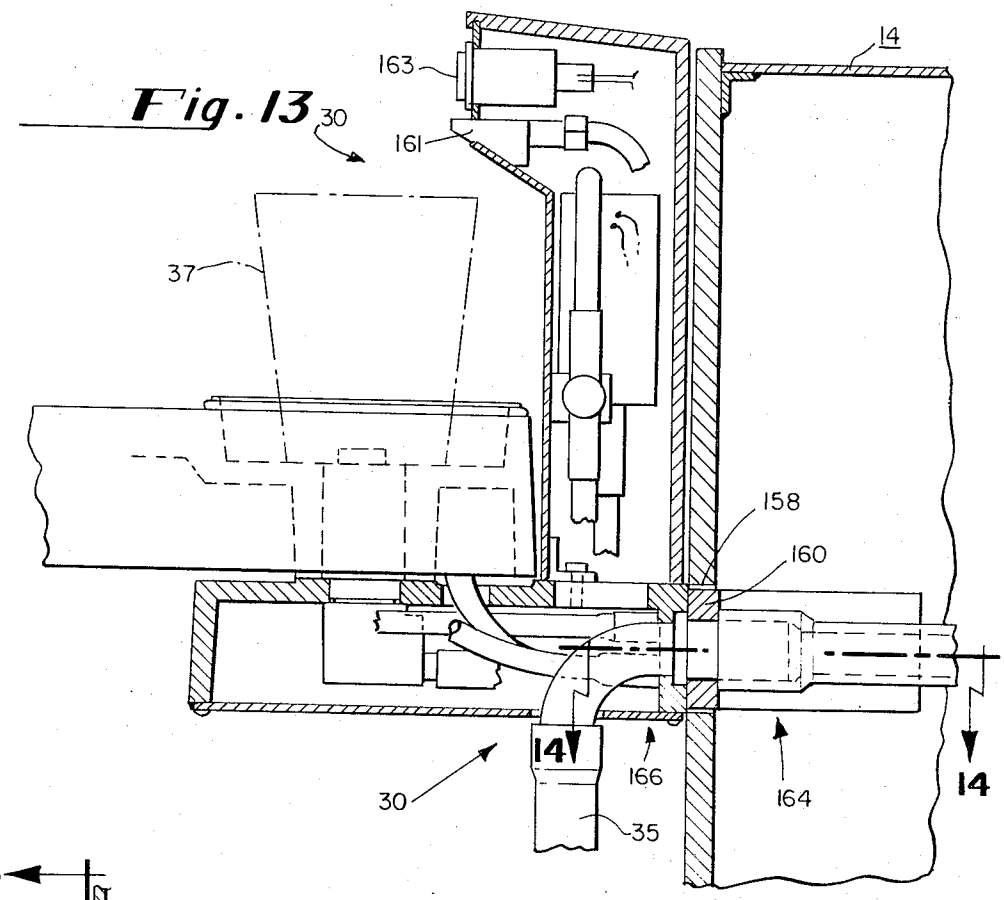
Fig. 13



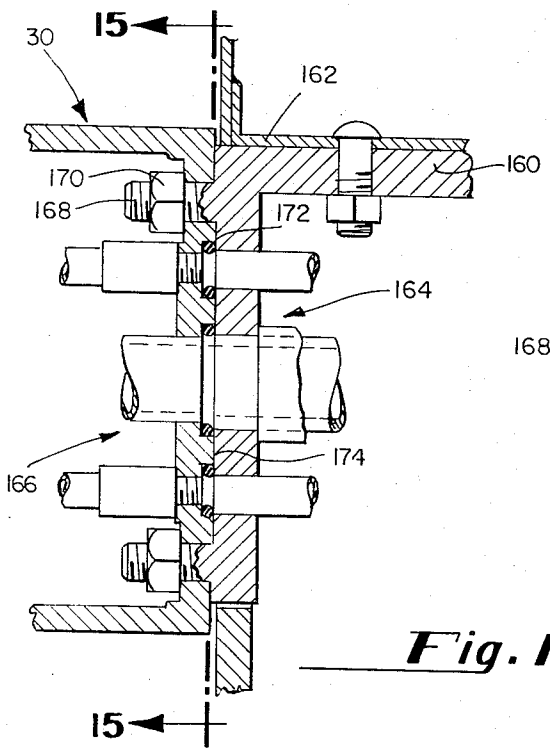


Fig. 14

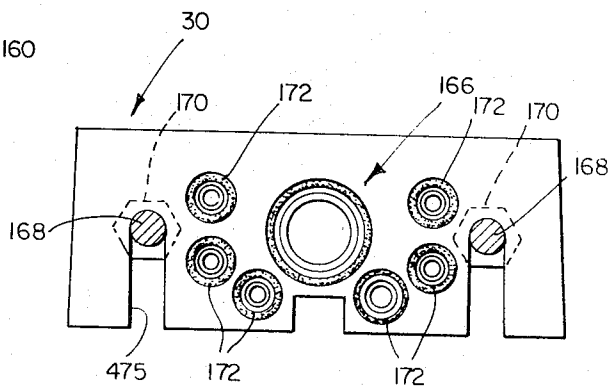


Fig. 15

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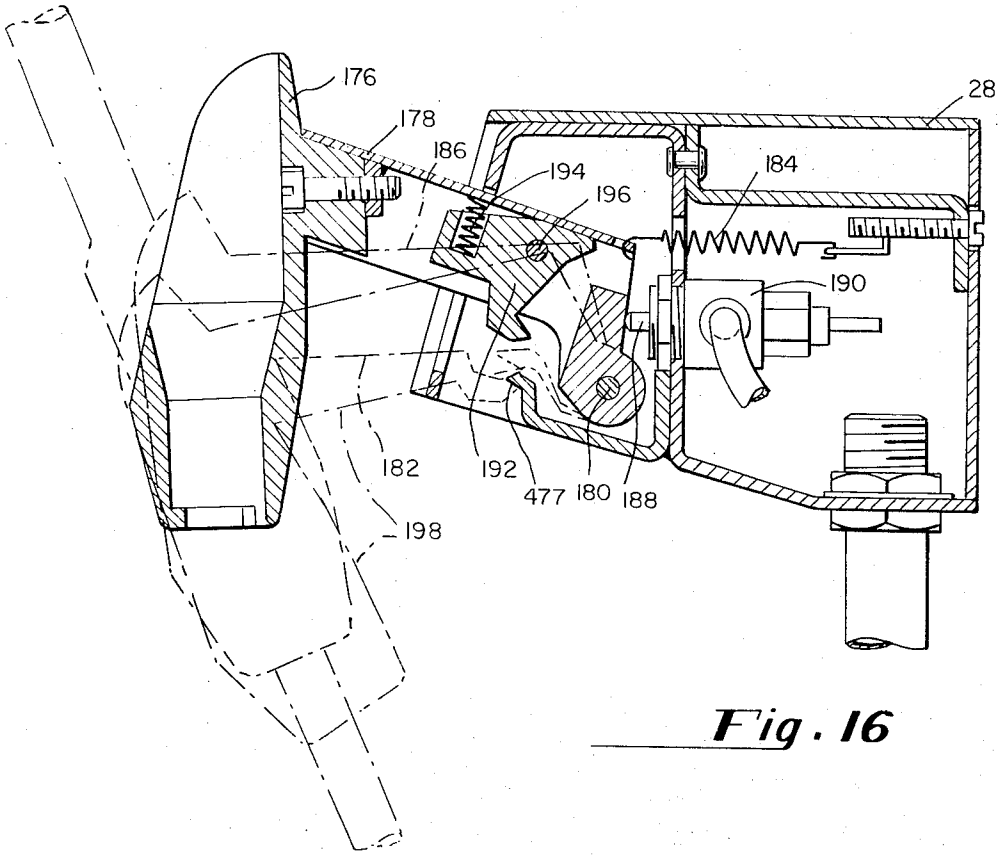

Fig. 16

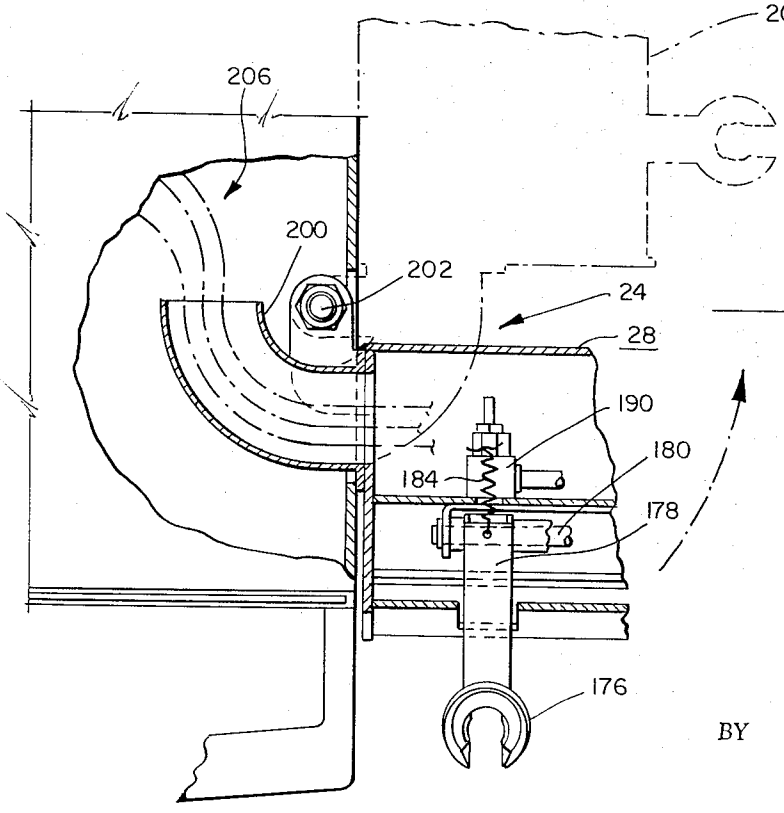

Fig. 17

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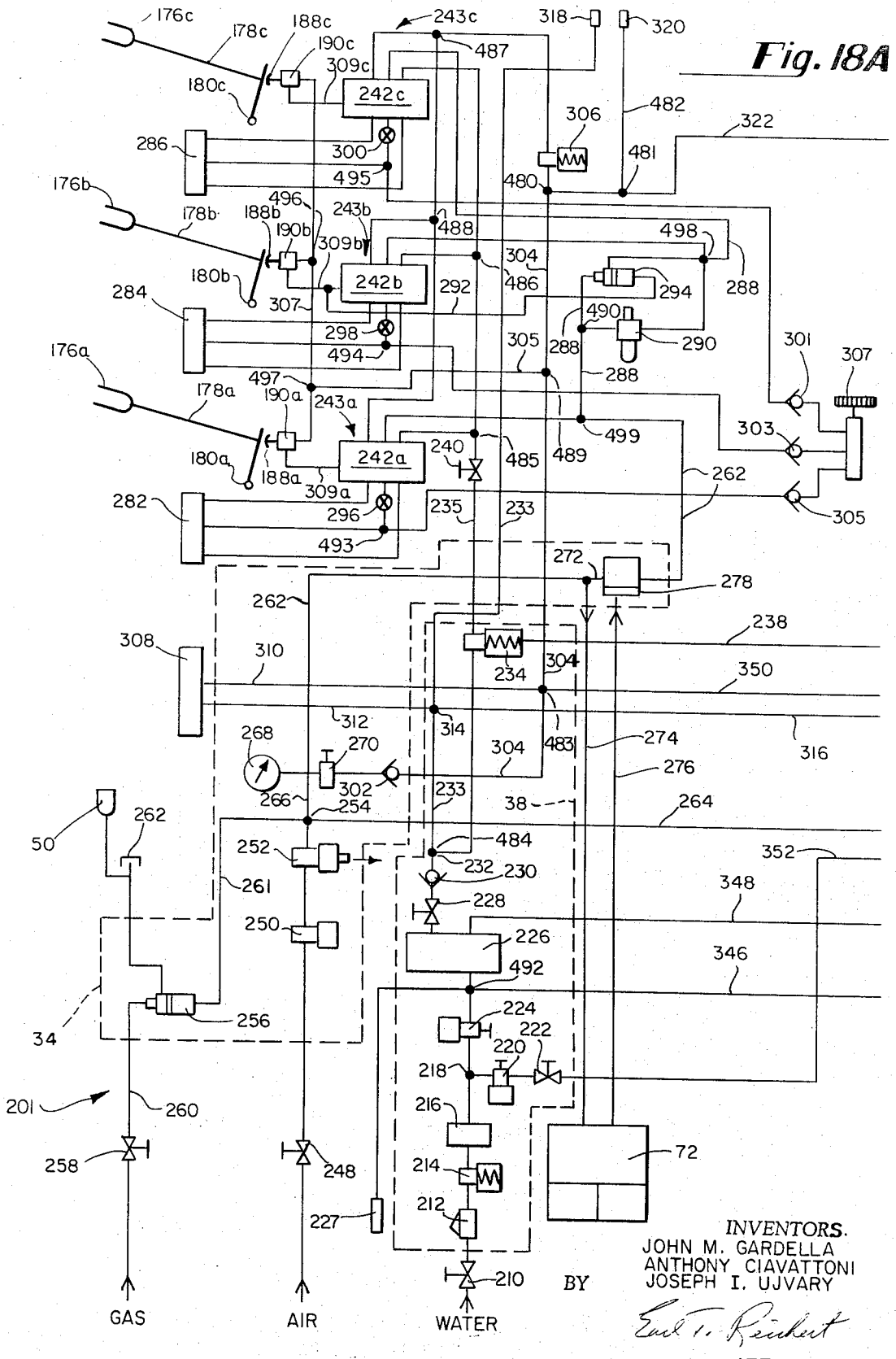

Fig. 18A

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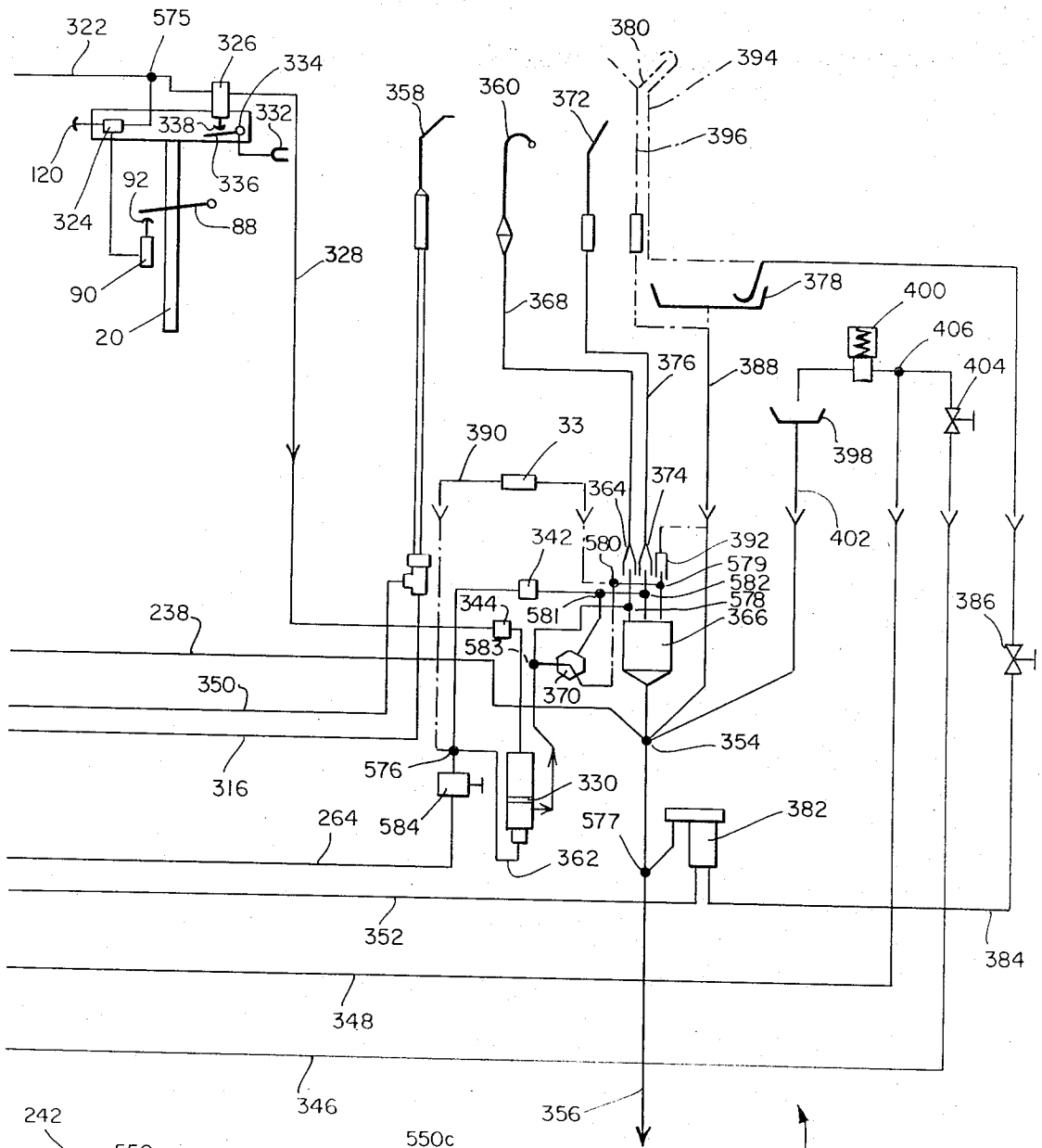
Fig. 18B



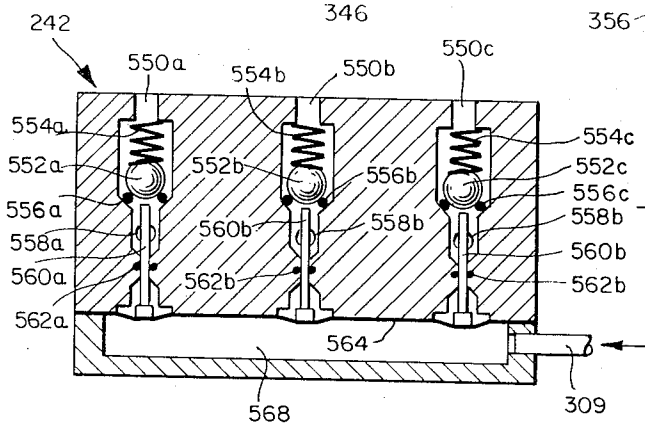


Fig. 18C

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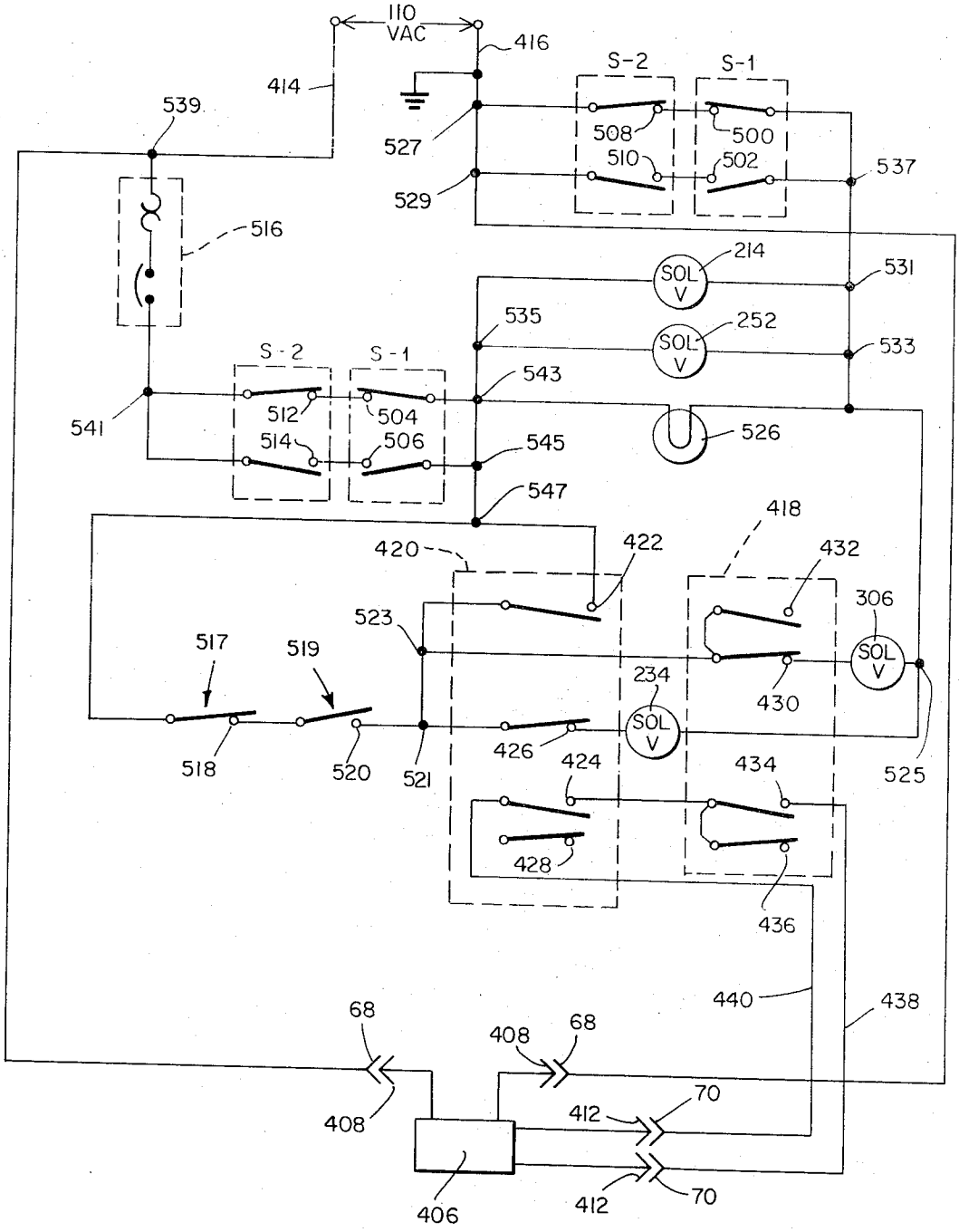

Fig. 19

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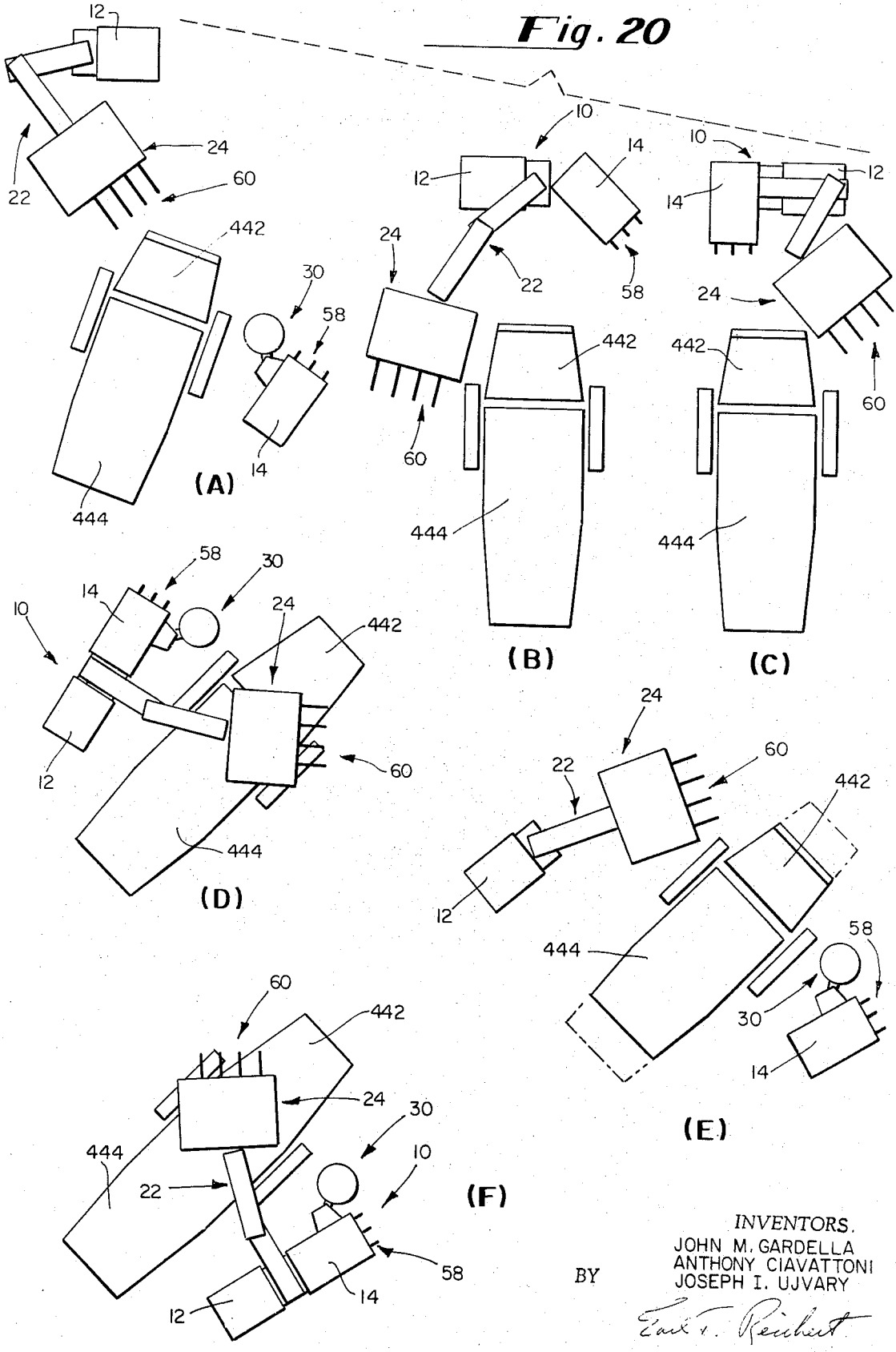
Fig. 20



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DENTAL UNIT

BACKGROUND OF THE INVENTION

This invention relates to dental units; more particularly, it relates to dental units of the fixed or stationary type, i.e., a dental unit which is customarily mounted to the floor of a dental office and which contains a plurality of dental devices utilized by a dentist or his assistant.

For the past several years, various types of stationary dental units have been used in which a plurality of dental handpieces used by the dentist in performing operations upon dental patients are mounted upon a tray assembly, the tray assembly being supported by a horizontal or horizontally extending arm assembly, the arm assembly being mounted to the frame of the dental unit. While the dental handpieces are removably supported on the tray assembly, various evacuation devices or instruments may be mounted upon another portion of the dental unit near the point of connection of the arm assembly to the frame of the dental unit. Thus, if a dentist is utilizing an assistant, the assistant may work from the side of the chair on which a dental unit is mounted, while the tray and arm assemblies are positioned across the body of the patient to allow the dentist to work from the opposite side of the dental chair. However, due to the construction of these dental units the desired flexibility is not always obtained. In some cases the arm and tray assemblies are rotatably supported in such a manner that the degree of rotation is limited because of interference with the cabinet structure of the unit. In other cases, the arm assembly for supporting the tray and the dental handpieces is of the parallel arm type construction in which the individual arm members rotate about a substantially horizontal axis with respect to each other the raising and lowering of the tray assembly. Because of this particular construction, the weight of the arm and tray assemblies tends to make the setup unstable. This is especially true if the tray assembly contains additional tools, etc., which add to the total weight which must be supported. In all of these dental units, the tray and arm assemblies cannot be retracted to a position in which the assemblies are positioned over the cabinet structure of the dental unit to provide a compact arrangement when the unit is not in use so as to occupy the least amount of space possible within a dentist office.

Also, while most of the present dental units perform reliably most of the time, servicing problems do arise from time to time. When these servicing problems do arise, it is necessary in many cases to dismantle a large portion of a unit in order to satisfactorily and properly make any necessary repairs or adjustments. In many units, a substantial portion of the supply system utilized for operating the unit is electrical, and a large number of solenoid valves may be utilized for controlling the flow of air, water, and gas throughout the unit. Due to their nature as the number of solenoid valves utilized within the dental unit is increased, so also are the servicing problems. The utilization of a large number of solenoid valves not only contributes to additional servicing problems, but also decreases the overall dependability of the dental unit.

Another disadvantage associated with present dental units is that when the dentist desires to utilize a separate prophylaxis unit, this prophylaxis unit is supplied with a separate foot control for operating the same which means that the dentist is burdened with the necessity of having two foot controls, one for the dental handpieces located upon the dental unit, and a second foot control for operation of the prophylaxis unit.

While foot controllers or foot control units are utilized for actuating dental handpieces upon removal from their hangers, in the event that two handpieces are simultaneously removed from their hangers, actuation of the foot control unit would operate both handpieces simultaneously in present dental units. Manual means may be provided to shut off the supply of fluids to one of the handpieces while it is removed from its hanger, but this has the disadvantage of adding an extra step which must not be forgotten when simultaneously removing two handpieces from their hangers. This may occur in the event that the dentist wishes his assistant to change a bur in one of the removed handpieces, while the dentist simultaneously utilizes a second dental handpiece for operating on the patient's teeth.

Another problem associated with many dental units of the stationary type is that they do not have the flexibility necessary to permit an individual dentist to locate the unit within his office according to his preferred mode of operation. For example, one dentist may prefer utilizing an assistant most of the time, while another dentist may operate alone. In the event that an assistant is used the dentist may prefer the assistant to work from one side of the chair while he works from the opposite side. Also, whether the dentist is right-handed or left-handed will be a factor in determining the location of the dental unit with respect to the dental chair. Many dentists will prefer to locate the dental unit on one side or the other of the chair, while many others prefer to locate the unit behind the dental chair out of the sight of the patient while seated. Any one or a combination of these factors may be present in determining the exact location of a dental unit within the office of an individual dentist. Present dental units do not provide the flexibility needed to permit the many alternate positions which may be desired by a dentist.

SUMMARY OF THE INVENTION

The present invention relates to a dental unit of the fixed or stationary type which is mounted to the floor of a dental office, and due to the flexibility and construction of the unit may be mounted along either side of the chair, in back of the dental chair, or in numerous other positions as desired by a particular dentist. Basically, the dental unit includes a base frame which is in the form of an inverted substantially T-shaped member. Located on one side of the upright portion of the inverted generally T-shaped member is a supply section which houses the incoming supply lines for delivering air, gas, water, and electricity of the dental unit. Located on the opposite side of the upright portion of the frame is an evacuation section having at least one dental evacuation instrument removably supported on a front side of this section. This evacuation section houses the evacuation system utilized for removing various fluids from the dental unit and/or patient's mouth. The evacuation section is rotatably mounted to the horizontal portion of the frame so that the front side of the evacuation section which contains or supports the evacuation instrument can be rotated to face in any one of an infinite number of positions located within a 180° arc as measured in a horizontal plane. Mounted on a

second side of the evacuation section is a cup filler/cuspidor assembly which is easily and quickly removable so that the latter may be placed upon the opposing side of the evacuation section if desired. This may be necessary, for example, when rotating the evacuation section from one extreme position to the other extreme position located 180° away. This cup filler/cuspidor assembly may include either a fixed cuspidor bowl, or a flushing funnel which is removably mounted in a holder, and which may be held by the hand of a patient or a dental assistant.

Mounted within the upright portion of the frame is a vertical post. This post is telescopically disposed within the upright portion so that it may be raised and lowered but in any event the upper end of the post is located above each of the above mentioned sections and also above the upright portion. The upright portion of the frame has an open area disposed therein, the open area being disposed within the supply section; hingedly mounted over the open area are two supply modules, each of which contains a plurality of supply system components. Upon removing the cabinet structure defining the supply section, these modules may be swung away from the open area over which they are located to provide easy access to the vertical post and its telescopic mounting means. This not only enables easy servicing or adjustment of the vertical post and its telescopic mounting means, but also permits easy access to the supply system components mounted on the individual supply modules.

Rotatably mounted to the upper end of the vertical post is a horizontally extending arm assembly which includes two individual arm members which are connected so as to allow the individual arm members to rotate about a vertical axis with respect to each other. At the outer extreme end of the horizontally extending arm assembly a tray assembly is rotatably connected so as to rotate about a vertical axis, the tray assembly removably supporting a plurality of dental handpieces or drills to be utilized by the dentist. By rotatably mounting the arm and tray assemblies in this manner, the tray assembly and consequently the dental handpieces supported thereon may be moved in an infinite number of arcs with the center line of the vertical post forming the axis of rotation, or with the axis of rotation being the vertical axis extending through one of the other rotary connections between the individual arm members, or between the outer arm member and the tray assembly. Construction of the arm and tray assemblies in this manner also permits a substantial portion of each of the assemblies to be retracted to a position over the supply and evacuation sections, thus allowing the dental unit to be compactly arranged when not in use.

Another feature of the present invention is the provision of a separate instrument or handpiece holder which is swingably connected to one side of the tray, the tray and instrument holder combined forming the above mentioned tray assembly. The instrument holder may be swung from a position alongside the tray to a position substantially 90° away wherein the dental handpieces which are removably supported on the front side of the instrument holder are substantially in line with the front of the tray proper. This allows the dentist to position the tray so that the front thereof is facing a patient as he is seated in the dental chair, while positioning the instrument holder so that the dental handpieces face the side of the chair from which the dentist is working. This allows the dentist more flexibility in removing and replacing dental handpieces from and into their respective hangers.

The dental handpieces are removably supported in individual hangers, and upon lifting a selected handpiece from its respective hanger, the supply system is programmed so that upon actuation of a foot control unit, the appropriate fluids will be delivered to the handpiece. However, in the event that it is desired to simultaneously remove two handpieces from their individual hnagers without actuating both handpieces upon actuation of the foot control unit, one of the hangers is manually moved to a lowermost position in which it is held by a latched mechanism, thus preventing any fluids from being delivered to that particular handpiece upon actuation of the foot control unit. As stated above, this situation may arise when a dentist wishes his assistant to change or insert a bur in one dental handpiece while the dentist is simultaneously utilizing a second handpiece.

Another aspect of the present invention is that the dental unit is provided with an outlet, which outlet is electrically connected to the foot control unit utilized for controlling the operation of the individual dental handpieces. This outlet cooperates with a corresponding plug connected to a prophylaxis unit. When the plug is inserted into the outlet, the prophylaxis unit may be operated with the same foot control unit utilized for operating the dental handpieces. This is accomplished by moving a selector switch located on the dental unit to the appropriate position. This enables a dentist to utilize a separate prophylaxis unit without the necessity of having a separate foot control unit for operating the same as was heretofore the case.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a top view of the dental unit showing the tray assembly in retracted position.

FIG. 2 is a front view of the dental unit, illustrating the base frame which comprises an inverted generally T-shaped member with a supply section on one end of the frame, and an evacuation section on the other end thereof.

FIG. 3 is an exploded view of the dental unit showing the snap-away panel construction, and swing-away supply modules containing supply system components.

FIG. 4 is a cross-sectional view taken through line 4—4 of FIG. 2 showing the vertical post on which the horizontally extending arm assembly, and tray assembly are supported.

FIG. 5 is an enlarged view of the means for rotatably connecting the arm and tray assemblies.

FIG. 6 is a cross-sectional view taken through line 6—6 of FIG. 4, and illustrating the means for rotatably mounting the horizontally extending arm assembly to the vertical post.

FIG. 7 is a cross-sectional view taken through line 7—7 of FIG. 2, and illustrating the means by which the evacuation section may be rotated to any one of an infinite number of positions within a 180° arc on the inverted T-shaped member, the evacuation section being in one extreme position.

FIG. 8 is a cross-sectional view similar to FIG. 7 showing the evacuation section rotated to the other extreme position 180° removed from the position illustrated in FIG. 7.

FIG. 9 is a cross-sectional view taken through 9—9 of FIG. 7.

FIG. 10 is a cross-sectional view taken through line 10—10 of FIG. 4 showing adjustable bearings utilized for supporting and guiding the vertical lifting post.

FIG. 11 is a cross-sectional view taken through line 11—11 of FIG. 4 showing a detent plate mechanism for retaining the vertical lifting post in a desired vertical position, and a means for releasing the detent plate.

FIGS. 12*a*, 12*b*, 12*c* and 12*d* are cross-sectional views taken through lihe 12—12 of FIG. 4, and showing successive positions of the pin and grooves in the connection located between the tray assembly and the arm assembly upon rotating the tray assembly in a clock-wise direction with respect to the horizontal arm assembly.

FIG. 13 is a cross-sectional view taken through line 13—13 of FIG. 1 showing the cup/cuspidor assembly, and a means for quick-connecting/disconnecting the assembly to the assistant section.

FIG. 14 is a cross-sectional view taken through line 14—14 of FIG. 13 showing an L-shaped manifold utilized for connecting a cup/cuspidor assembly to one side of the evacuation section.

FIG. 15 is a cross-sectional view taken through line 15—15 of FIG. 14 showing the slots on the cup/cuspidor assembly which are utilized for supporting the assembly on the L-shaped manifold illustrated in FIG. 14, and also showing various fluid openings in the assembly which register with corresponding openings in the manifold.

FIG. 16 is a cross-sectional view taken through line 16—16 of the instrument holder shown in FIG. 2, and illustrating the means for locking each individual handpiece hanger in its lowermost position when the dental handpiece is removed, and also showing a three way pilot valve which is normally actuated upon removing a dental handpiece from its associated hanger.

FIG. 17 is an enlarged view of the area encircled in FIG. 1 showing the particular arrangement for swingably connecting the instrument holder to one side of the tray proper.

FIGS. 18A through 18C illustrate the fluid flow system for the present dental unit.

FIG. 19 is a schematic drawing illustrating the electrical system for enabling a prophylaxis unit to be operated by the same foot control unit utilized for controlling the dental handpieces.

FIG. 20 is composed of views (A), (B), (C), (D), (E) and (F) showing various alternate positions in which the present dental unit may be placed with respect to the dental chair, and alternate positions for the evacuation section with respect to the remainder of the dental unit.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIGS. 1 & 2, a top view of the dental unit 10 is illustrated showing a supply section 12, and an evacuation section 14, these sections being located on opposite sides of a vertical or upright portion 16 of a base frame comprised of an inverted generally T-shaped member 18. Telescopically supported within the upright portion 16 is a vertical lifting post 20, this post being utilized for supporting a horizontally extending arm assembly 22, which arm assembly in turn supports a tray assembly 24; this tray assembly is comprised of a tray proper 26, and an instrument holder 28 having a plurality of individual instrument hangers extending from a front side thereof, the hangers removably supporting a plurality of dental handpieces (instruments). Instrument holder 28 is swingably connected to one side of the tray 26 to permit the holder to be moved from the position shown in FIG. 1 wherein the dental handpieces 60 are substantially aligned with the front side of the tray 26 to a position substantially 90° away in a counter clock-wise direction. By swingably mounting or connecting the holder 28 to one side of the tray 26 in this fashion the tray may be positioned in front of the patient so that the front side thereof faces the patient as he is sitting in the chair while the holder 28 is rotated approximately 90° so that the handpieces 60 face the dentist who may be working from one side of the dental chair. The dental handpieces are actuated by operation of a foot control unit 72; upon lifting a selected handpiece from its respective hanger, the supply system is programmed so that upon actuation of the foot control unit 72, the selected handpiece is actuated. Mounted to one side of the evacuation section 14 is a cuspidor assembly 30 which includes a removably mounted funnel 31, which when removed actuates the evacuation system through a two way valve 33 to remove debris from the funnel through a discharge line 35. While in the present case a removably mounted funnel is shown, a fixed bowl arrangement may also be utilized. The cuspidor assembly 30 also includes an automatic cup filler for filling a cup 37 with water.

The supply section 12 houses the incoming supply system for supplying air, water, gas, and electrical power to the dental unit. Referring to FIGS. 2 and 3, the various sub-systems are illustrated in more detail. The main air supply line is identified by the dotted line 32 which connects with a first supply module 34 which is swingably or hingedly mounted to the upright portion 16 of the frame. The main water supply line is identified by the numeral 36 which leads into a second supply module 38, also hingedly mounted to the upright portion 16. The main gas supply line 48 is utilized for delivering gas to a gas burner 50 located on the tray 26. The main electrical supply line is identified by the numeral 52 which leads into a terminal board 54 mounted to the lower portion of the upright portion 16 of the frame. As can be seen more clearly in FIG. 3, the upright portion 16 has disposed therein an open area 40, each of the supply modules being hingedly mounted to the upright portion 16 so that they can be swung away from the open area to expose a vertical lifting post and its telescopic mounting means which are located within the upright portion 16. This not only permits easy access to the vertical lifting post and its mounting means, but also allows easy access to the supply system components which are mounted upon each of the supply modules 34 and 38. Attention is also directed to the nipple-like studs 42, and the apertured brackets 44 for securing the individual panels 46 of the supply section to the frame 18. The cabinet structure defining the supply and evacuation sections are preferably constructed in this manner so that the unit may be easily and quickly dismantled for any necessary servicing or adjustments. The term "rapid connecting means" is used herein to define the nipple 42, bracket 44 arrangement, and includes any means for rapidly connecting and disconnecting the cabinet structure to and from the frame 18 without the assistance of tools.

The evacuation section 14 houses the evacuation system utilized for removing various fluids and debris from

the dental unit to a point of discharge. Mounted on a first side or front **56** of the evacuation section is a plurality of dental evacuation instruments **58**, e.g., a saliva ejector, a syringe, and an oral evacuator for high volume removal of debris and waste fluid from the oral cavity. Located on a second side of the evacuation section is an opening **158** having a removably mounted closure **156** for closing this opening. This arrangement is also provided on the opposite or third side of the evacuation section, and these openings are utilized for mounting the cuspidor assembly **30** to either the second or third side of the evacuation section depending upon the position of the section with respect to the remainder of the dental unit **10.** This will be described in more detail in subsequent figures.

Referring to FIGS. **1** through **3,** it is noted that the present dental unit has the evacuation instruments **58** mounted or removably supported on the cabinet structure of the dental unit, while the dental handpieces (which includes both dental drills and syringes) are removably supported on the tray assembly; in FIG. **3** it can be seen that the horizontally extending arm assembly **22** includes a first arm **23** and a second arm **25** rotatably connected to each other so as to rotate about a vertical axis which allows the tray assembly to be pulled across the patient while seated in a dental chair which allows the dentist to work from one side of the dental chair while the dental assistant (if one is used) works from the opposite side of the chair. The flexibility provided by the present dental unit is one of the important aspects of the present invention, but will be discussed in greater detail in subsequent figures. But, briefly speaking at this point, it is noted that the dentist may position the present dental unit in numerous alternate positions within the dental office to conform with his particular mode of operation. For example, the dental unit can be placed on either side of the dental chair by appropriately rotating the evacuation section **14** by means of a bolt-washer-slot-nut arrangement designated generally by the numeral **62.** The horizontal portion of the frame **18** upon which the evacuation section **14** is mounted may also be removably connected as indicated at **64** to the remainder of the unit **10.**

Before leaving FIG. **3,** it is noted that the incoming supply lines of the supply system are connected with one of the supply modules **34** or **38** upon which the supply system components are mounted, or to the terminal board **54.** From either the supply modules or the terminal board the supply lines branch out to various parts of the dental unit; for example, air, water, gas, and electricity must all be supplied to the tray assembly **24** as indicated by the numeral **76** (FIG. **4**), while only air, water, and electricity need be supplied to the evacuation section **14** as indicated by the numeral **78** (see FIG. **3**). Located within the lower portion of the frame **18** are three outlets numbered **66, 68,** and **70** for supplying water, electricity, and an electrical connection with the foot control unit **72** respectively. While the details will be supplied in subsequent figures, these outlets are provided for the purpose of utilizing a separate prophylaxis unit without the necessity of a separate foot control unit for operating the prophylaxis unit. Generally, a dentist utilizing a prophylaxis unit, utilizes a separate foot control unit supplied with the prophylaxis unit for operating the same; however, with the present dental unit means are provided with which the foot control unit **72** which is utilized for operation or actuation of the dental handpieces **60** can also be utilized for actuating the prophylaxis unit.

Referring to FIG. **4,** the telescopic mounting means for supporting the vertical lifting post **20** within the upright portion **16** of the frame is more clearly illustrated. The vertical lifting post **20** is hollow and of circular cross section so that the supply lines can be passed through the post and into the horizontally extending arm assembly **22,** and into the tray assembly **24.** The post **20** is supported within the upright portion **16** of the frame by a bearing unit **80** which includes a plurality of roller bearings in rolling contact with the circular surface of the post **20.** An upper set **82** and a lower set **84** of these roller bearings provide firm support for the post, and lend themselves to easy adjustments for firm and smooth rolling contact with the post. Provision is made for adjusting the bearing unit, and consequently the cant of the post **20** by including adjustable screw means **116** which are threadably connected into opposite sides of the bearing unit **80,** the outer or extreme ends of each of the screw means contacting the inner surface of the upright portion **16.** Each of the sets of roller bearings includes at least one bearing which in addition to being rotatable about a horizontal axis is also rotatable about a vertical axis for adjustment purposes. This will be discussed in more detail when referring to FIG. **10** below.

The mechanism for permitting the lowering of post **20** and consequently the tray assembly **24** includes a spring assembly **86,** a detent plate **88,** a piston and cylinder arrangement **90,** and a plunger **92** which is adapted to contact the detent plate for releasing the same. Spring assembly **86,** which is connected between the upright portion **16** and the bottom of the post **20,** acts in opposition to the weight of the post and tray assembly mounted thereon. A handle grip **96** is provided on the tray assembly to permit manual moving of the tray assembly to a desired position. A release button **120** (see FIG. **1**) is provided by which air may be delivered to the piston-cylinder **90** for releasing the detent plate **88** in order to lower the tray assembly **24.** This also will be described in greater detail in subsequent figures.

Referring to the horizontally extending arm assembly **22,** it is noted that the arm assembly includes a first arm **23** and a second arm **25** (see FIG. **3**) these arms being connected so as to be rotatable about a vertical axis with respect to each other. FIG. **5** is an enlarged view of the means for rotatably connecting each of the arms **23** and **25** of the arm assembly **22,** and also for rotatably connecting the tray assembly **24** to the arm **25.** More accurately, while FIG. **5** actually represents an enlarged view of the means for rotatably connecting the tray assembly **24** to the arm **25,** it is also representative of the means for rotatably connecting the arm member **23** to the arm member **25.** Disposed on the underside of the tray assembly **24** is an annular groove **152** which extends approximately 350° or slightly less than one complete revolution. Disposed on the upper side of the arm **25** is a similar annular groove **154,** and located between the tray assembly and arm **25** is an annular member or plate **148** having a pin **150** extending therethrough. The upper and lower ends of the pin **150** cooperate with each of the annular grooves **152** and **154** so as to allow relative rotation between the tray assembly and arm **25** about a vertical axis of more than 360°, but slightly less than two complete revolutions or

720°. As can be seen, three sets of annular roller bearings **155, 153,** and **151** are disposed between relatively movable members, the sets of roller bearings being confined by a two-piece bushing which includes members **157** and **159** secured together by screw means (not numbered). The operation of this connecting means will be described in greater detail when discussing FIG. **12** which follows.

Referring to FIG. **6,** a cross-sectional view taken through line **6—6** of FIG. **4** illustrates the means for rotatably mounting the horizontally extending arm assembly **22** to the post **20.** As can be seen in FIGS. **4** or **6,** a locator member **179** is rigidly mounted to the upper end of the post, the locator member having two holes **175** and **177** disposed therein and spaced 180° apart. Disposed above the member **179** is an annular plate **181** having a pin **171** extending therethrough. The lower end of the pin **171** is adapted to cooperate with one of the holes **175** or **177** in the member **179.** Formed on the underside of the arm **23** is an annular groove **183** which extends approximately 350° or slightly less than one complete revolution. The upper end of the pin **171** cooperates with this annular groove **183** to limit the extreme travel or rotation of the arm **23** about its rotational axis. As can be seen from FIG. **6,** the arm **23** may be rotated 175° in either direction before one end or the other of the groove **183** abuts this pin. Thus, as is apparent from this figure, i.e., FIG. **6,** the extreme limits of travel of the arm **23** can be varied 180° merely by rotating the annular plate **181** 180° so that the lower end of the pin **171** registers with the hole **175** as opposed to the hole **177.** This change would be made, for example, when rotating the evacuation section **14** 180° from the position shown in FIG. **1,** in a clock-wise direction as viewed from the top of the dental unit, to its other extreme position. As will be more apparent later, this change is made when it is desired to reverse the location of the dental unit **10** and locate the same on the opposite side of the dental chair.

FIGS. **7** through **9** illustrate a cross-sectional view of the evacuation section **14** in each of its extreme positions, and the means **62** (see FIG. **3** also) for rotatably mounting the evacuation section of the frame **18.** A bolt **126** extends through a washer **128** and extends through a nut **130,** the latter being contained within a channel **131** dimensioned so that the nut **130** cannot rotate therein. While FIGS. **7** and **8** show the extreme positions of the evacuation section **14,** it is apparent that the evacuation section may be rotated to any one of an infinite number of positions within this 180° arc as measured in a horizontal plane. A slot **122** is disposed within the bottom of the evacuation section **14,** and a cooperating slot **124** is disposed in the base frame **18.** By loosening the bolt **126,** the evacuation section **14** can be rotated to a desired position after which the bolt **126** is again tightened, and the evacuation section locked into place.

FIG. **10** more clearly illustrates the construction of the upper set of roller bearings **82** which were briefly described with reference to FIG. **4.** Because the upper and lower sets of roller bearings are identical in construction only the construction of the upper set will be described herein. This set of bearings contains two non-adjustable bearings **98,** and two adjustable bearings **100;** the four individual roller bearings each rotate about a horizontal axis as the post **20** is moved into or out of the upright portion **16** of the frame. The bearings are supported within a mounting block **81** which is connected to the upright portion **16** by means of screws **108** which extend through washers **110** having a depression **112** formed therein, the head of each of the screws **108** being slightly smaller than the diameter of the depression **112.** The hole and the washer **110** through which the screw **108** extends is also slightly larger than the threaded portion or shank of the screw, thus allowing a slight lateral movement of the screw upon loosening the same. Therefore, when it is desired to vary the cant of the post **20,** each of the screws **108** is loosened thus permitting a slight lateral movement of the mounting block **81** to either the right or left as viewed in FIG. **10.** When the desired position is reached, the screw means **116** (see FIG. **4**) are moved into or out of the mounting block **81** until contacting the inner surfaces of the upright portion **16;** after this is done the screws **108** are again tightened by screwing the same into the mounting block **81,** securely locking the bearing unit in place within the frame. This assures that the horizontally extending arm assembly **22** and tray assembly **24** are level at all times.

Referring to FIG. **11,** the mechanism for holding the vertical post **20** in a desired vertical position is more clearly illustrated. As stated previously, when it is desired to raise the tray assembly **24,** this is accomplished by manual force applied to the hand grip **96** on the front of the tray assembly. Because the detent plate **88** is biased in a downward direction by a spring **89** the post **20** can be raised against plate **88** without moving the plunger **92** against the plate for release. The post remains in a selected vertical position due to the frictional force between the apertured detent plate **88** and the post **20.** To move the tray assembly to a lower position, a release button **120** (see FIG. **1**) is pressed to deliver a supply of air through the conduit **91** to the piston-cylinder arrangement **90** to move the plunger **92** upwardly against the detent plate **88;** once the detent plate is released, the post and tray assembly may be manually moved to any desired lower position. It is here noted (see FIG. **2**) that even in its lowermost position the upper end of the post **20** is disposed above the upright portion **16** and the supply section and evacuation section. This allows the tray assembly to be retracted to a position in which both it and the horizontally extending arm assembly **22** are located above the latter mentioned sections. This permits the dental unit to be compactly arranged when the tray assembly is not being utilized.

Another of the important features of the present invention is the flexibility afforded the dentist in manipulating or moving tray assembly **24** to any desired position, depending upon the mode of operation of the dentist. This is due to the unique construction of, a method of mounting the arm and tray assemblies to the frame of the dental unit. Referring to FIGS. **2** and **3,** it is noted that because the arm assembly **22** is connected to post **20** at the upper end of the latter, which is located above the upright portion **16,** and the supply and evacuation sections, it is possible to rotate the arm **23** about the post **20** almost one complete revolution. As stated above, with reference to FIG. **6,** the means for rotatably mounting the arm **23** to the post **20** includes an annular groove **183** which allows rotation of the arm about the post **20** approximately 175° in either direction from its midpoint position which is illustrated in FIG. **6.** If the evacuation section **14** is rotated 180°

from the position indicated in FIGS. 1 and 3, it is necessary to also rotate the locator member 181 180° so that the pin 171 is aligned with the other hole 175 located in the locator member 179. This might be done for example when reversing the location of the dental unit 10 with respect to the dental chair, i.e., when removing the dental unit from one side of the chair and relocating the same on the opposite side of the chair. This would then permit the arm 23 to stop in the proper place upon rotation due to the reversed position of the dental unit.

While the construction illustrated in FIG. 5 is an enlarged view of, and that illustrated in FIGS. 12*a* through 12*d* is a cross-sectional view of, the means for rotatably connecting the tray assembly 24 to the arm 25, this construction is also identical to that which is used for rotatably connecting the arm 23 to the arm 25. In each case approximately 700° of rotation, or slightly less than two complete revolutions, is permitted between the rotatably connected members or assemblies. This construction combined with the means for rotatably mounting the horizontal arm assembly 22 to the post 20 permits the dentist to move the tray assembly 24 within an infinite number of arcs located within the maximum arc which would be generated by rotating the tray assembly about the post 20 with the arm assembly 22 fully extended. Thus, maximum flexibility is afforded the dentist without the danger of undue twisting of the supply line contained within the arm assembly 22, and the tray assembly 24.

Referring to FIGS. 12*a* through 12*d*, the operation of the connection for rotatably connecting tray assembly 24 to the arm 25 will now be described. As stated previously, the means for rotatably connecting tray assembly 24 to arm 25 is identical to the construction for rotatably connecting arm 23 to arm 25; thus, only the former will be described in detail. In FIG. 12*a*, it is noted that at one extreme end of rotation, pin 150 abuts end 450 of groove 152, while abutting end 454 of groove 154. While the width of each of the grooves 152 and 154 are substantially the same, for purposes of clarity, groove 154 which is indicated by the dotted line is shown as being substantially wider. As the tray assembly 24 is rotated in a clock-wise direction, the groove 152 will also move in a clock-wise direction while the pin 150 remains stationary. As the tray assembly 24 continues to rotate in a clock-wise direction, pin 150 is eventually located at the approximate midpoint of groove 152 as shown in FIG. 12*b*. Continuing to rotate the tray assembly 24 in a clock-wise direction, the other end of groove 152, i.e., end 452, eventually contacts pin 150 as shown in FIG. 12*c*. From this point on, continued rotation of tray assembly 24 in a clock-wise direction will move pin 150 and consequently annular member 148 in a clock-wise direction until the pin moves the complete distance within annular groove 154; as can be seen in FIGS. 12*c* and 12*d*, this means that pin 150 will move from end 454 of groove 154 to the opposite end thereof, i.e., end 456. Thus, since each of the annular grooves 152 and 154 extend approximately 350°, the total relative rotation between tray assembly 24 and arm 25 is approximately 700° or slightly less than two complete revolutions. Arms 23 and 25, being rotatably connected in the same manner, are also capable of 700° relative rotation. Thus, with a maximum arc, tray assembly 24 is capable of being rotated in substantially an unlimited number of arcs over the cabinet structure and frame of the dental unit. While the extent of maximum relative rotation between the rotatably connected portion may be varied, it has been found that the supply wires or lines located within the arm assembly 22 and tray assembly 24 will not be damaged by the present construction.

Referring to FIGS. 13 through 15, the cuspidor assembly 30 (which may also be referred to as the cup-cuspidor assembly) is illustrated along with the means for securing the assembly to one or the other of opposite sides of the evacuation section 14. Because the evacuation section may be rotated to any one of an infinite number of positions within a 180° arc as measured in a horizontal plane, it may be necessary to reverse the position of the cuspidor assembly when repositioning the evacuation section. As illustrated in FIG. 3, the evacuation section 14 has disposed on either of opposite sides thereof a removable closure 156 adapted to be secured over an opening 158 located on either of these opposite sides. Thus, depending upon which side of the evacuation section that the cuspidor assembly 30 is mounted, the opposite side of the section will have its opening 158 closed by the closure 156. The cuspidor assembly is adapted to be rapidly connected and disconnected to and from either of these opposite sides of the evacuation section 14, and the means for accomplishing the same is clearly illustrated in FIGS. 13 through 15. An L-shaped manifold 160 is secured to a partition 162 (see FIG. 1 also) extending across the interior of the evacuation section 14. Manifold 160 has a plurality of fluid passageways designated generally by the numeral 164, which passageway register with appropriate passageways or fluid conduits in the cuspidor assembly 30, the latter passageways being designated generally by the numeral 166. As can be seen in FIG. 14, extending from manifold 160 are two threaded studs 168 upon which the cuspidor assembly 30 is mounted via slots 475 (see FIG. 15). The cuspidor assembly 30 is then secured in place by means of two nuts 170 which are threadably secured on two studs 168, thus assuring rapid placement in removal of the cuspidor assembly from either side of the evacuation section. It is noted that since the inner surface 174 of the assembly 30 is flush with the outer surface of manifold 160, means must be provided for sealing between adjacent faces or surfaces to prevent leakage of fluid between cooperating passageways within the manifold and assembly 30; this is accomplished by the installation of O-rings 172 disposed within circular depressions formed in the surface 174 of the cuspidor assembly. Thus, as can be seen, the assembly 30 can be quickly mounted and dismounted to and from either of opposite sides of the evacuation section 14 merely by removing the closure from the respective side and placing the assembly 30 over the studs 168; the passageways disposed within the manifold and the cuspidor assembly are automatically aligned, and upon tightening the nuts 170, the assembly 30 is locked into place and sealed against leakage.

To assure that the supply system is programmed to automatically actuate a selected handpiece upon actuation of the foot control unit 72, the instrument holder 28 is provided with a plurality of hangers 176, each of which is supported at the end of a lever 178 extending from the front side of the holder 28, and pivotedly mounted about an axis 196 so as to pivot about the latter in a vertical plane. When a dental handpiece is removably supported in hanger 176, the hanger and lever

178 will assume the dotted line position indicated by the numeral 182. Upon removing the selected handpiece (a dental drill in this instance), the hanger 176 will be biased to its uppermost position by spring 184, the indicated solid line position being the uppermost position. Upon reaching its uppermost position, an inner surface located on lever 178 will abut plunger 188 of a conventional three-way supply and exhaust valve 190 (pilot valve) to deliver pilot fluid to a selector valve to open the latter. While the details will be discussed more fully with regard to FIG. 18, upon opening the selector valve, the supply system is programmed to deliver the appropriate fluids to the selected dental drill upon actuation of the foot control unit 72. The three-way supply and exhaust valve 190 is a commercially available product which can be obtained from the Clippard Manufacturing Instrument Laboratories. Upon replacing the selected dental drill back into the hanger 176, the hanger assumes the dotted line position indicated by the numeral 182 thus releasing the plunger 188 to exhaust fluid from the pilot chamber of the selector valve, thus closing the latter. It is here noted that each of the hangers utilized for supporting a dental drill contains a latch mechanism 192 which is biased in a counter-clock-wise direction with respect to the pivotal axis 196 so as to allow the latching mechanism to be hooked beneath a protrusion 477 disposed on the casing of the instrument holder 28; this lowermost position of hanger 176 is indicated by the dotted line 198, the hanger 176 being held within this lowermost position by the latching mechanism 192, and protrusion 477. In the event that the dentist desired to simultaneously remove two dental drills without actuating both upon actuation of the foot control unit 72, one of the instrument hangers 176 may be manually moved to its lowermost position as indicated by the dotted line 198, where it is held by the latching mechanism 192. Thus, the plunger 188 of the respective three-way valve 190 will not be depressed, and therefore the respective selector valve for the dental drill will not be opened; consequently upon actuation of the foot control unit 72 only the selected handpiece, i.e., the handpiece associated with the hanger which has reached its uppermost position, will be actuated.

FIG. 17 is an enlarged view of the area encircled in FIG. 1, showing the means for swingably mounting the instrument holder 28 about an upright or vertical axis to one side of the tray 26. As can be seen the holder 28 includes a housing with a hollow, curved, arcuate conduit portion 200 providing an extension of the instrument holder housing which extends into tray 26 when the holder 28 is moved to a position such that the dental handpieces and the front of the instrument housing are aligned with the front of the tray. The instrument holder is pivotally mounted to the tray 26 at a pivot point 202, so that the holder 28 may be swung to a position as indicated by the broken line 204 where the instrument hangers and dental handpieces removably supported therein as well as the front side of the instrument housing, are facing in horizontal direction away from one side of tray 26. The dotted line position indicated by the numeral 204 is approximately 90° from the solid line position in which the dental handpieces are substantially aligned with the front of tray 26. By so arranging the instrument holder 28, a move may move the entire tray assembly so that the tray 26 faces the patient while he is seated in the dental chair, while removing the holder 28 alongside the tray 26 as indicated by broken line 204 so that the dental handpieces are not inconveniently placed immediately in front of the patient while seated in a dental chair. The arcuate portion 200 is designed to house supply lines leading from the tray 26 into the holder 28. Thus, the tray 26 may be positioned so that the front thereof faces the patient while seated in the dental chair, while the instrument holder 28 may be moved to a position alongside the tray 26 so that the dental handpieces may face the dentist who is working from one side of the dental chair. This allows the dentist to easily remove and replace dental handpieces without interfering with the confort of the patient.

Referring to FIGS. 18*a* through 18*c*, the supply system utilized for delivering the appropriate fluids to each of the dental handpieces, and the evacuation system for removing fluids and debris will now be described. A plurality of fluids are necessary including water, air, and gas, the air being utilized to provide drive air for driving or operating each of the dental drills, and to provide chip blow air for blowing chips or debris away from the work site or cavity.

Water enters the supply system at a pressure between 50 and 100 psi. The inflow of water is controlled by a manual shut-off valve 210 which controls the supply of water to the entire dental unit. While this valve is normally open it may be utilized to cut off the flow of water to the entire dental unit when servicing the latter. Large particles of solids or other impurities are removed from the water by a strainer 212. The delivery of water to the dental unit is controlled through a main solenoid valve 214 which in turn is controlled by one or the other of two main switches S-1 or S-2, one of the switches being physically located on the front of the tray 26, while the other is located on the evacuation section 14. A second water filter 216 further cleans the water of any fine particles or impurities which may still be present within the water. The water then reaches junction 218 from where it is diverted into two separate flow paths.

One flow path includes a pressure regulator 220 to regulate the pressure of water passing therethrough, and a manual shut-off valve 222 located downstream of the regulator 220 to cut off the supply of water to the cuspidor assembly 30 in the event it is desired.

The second flow path into which the water is diverted from the junction 218 also includes a pressure regulator 224 to regulate the pressure of the water. A heater is then itilized to adjust the temperature of the water being delivered to the dental handpieces, and also to the cup filler to produce a water temperature that is comfortable to the patient. The water heater 226 also contains a manual shut-off valve 228 which again may be utilized to shut off the water supply to any point located downstream of the valve 228. Valve 228, being normally open, allows the water to pass through a check valve 230 and arrive at a junction 232 at which point the water is again diverted into two separate flow paths.

One of these flow paths will carry the water to a three way solenoid valve 234, the latter being controlled by the foot control unit 72. When the foot control unit 72 is actuated, valve 234 will be opened to allow the water to pass to the dental handpieces. Upon deactivating or deactuating the foot control unit 72, water located downstream of the solenoid valve 234, i.e., in line 235,

will be exhausted via a line 238 to a point of waste. The purpose of exhausting water via line 238 upon deactuation of the foot control unit 72 is to prevent water which may be located downstream of the valve 234 from leaking from the handpieces after they are placed back into their respective hangers.

After passing through valve 234, the water is controlled by a control valve 240 which is physically located on the front of the tray 26 after which the water flows to three selector valves, 242*a*, 242*b*, and 242*c*, there being one selector valve associated with each of the dental handpieces. A detailed construction of each of these selector valves is illustrated in FIG. 18*c* and will be discussed in more detail later. Each of the selector valves is utilized for simultaneously controlling the flow of fluids through a plurality of fluid supply lines connected with each dental handpiece. Thus after passing through the control valve 240, water is delivered to the inlet of each of the selector valves 242*a*, 242*b*, and 242*c*.

Referring now to the air flow system, air enters at approximately 75 to 100 lbs. psi pressure, passing through a manual control valve 248 which controls the flow of air to the entire dental unit. This valve, while normally open, may be closed in the event that it is desired to stop the flow of air to the dental unit 10. An air filter 250 is utilized for filtering out foreign particles contained within the air stream. After passing through filter 250, the air is delivered to a three way solenoid vlave 252 which is also controlled by one of the main switches S-1 or S-2 (FIG. 19), which switches are physically located on the front of the tray 26, and on the evacuation section 14. Upon actuation of one of these main switches, valve 252 is opened and air is allowed to flow through the valve to a junction 254, at which point the air flow is divided into three separate paths.

A first path delivers air to a diaphragm operated valve 256 which controls gas flow to the gas burner 50 (see FIG. 2 also). Upon delivering air to a pilot chamber disposed within the diaphragm operated valve 256, the valve is opened, and a supply of gas passes through a manual shut-off valve 258 located within the gas line 260, and is delivered to the gas burner 50. When the three-way solenoid valve 252 is deactuated, air within the pilot chamber within the diaphragm operated valve 256, and within the line 261 is exhausted to the atmosphere through valve 252, thus closing valve 256 and terminating the flow of gas to the gas burner 50. Not only is the air within line 261 exhausted to the atmosphere, but all of the air contained within the air system downstream of valve 252 is exhausted to atmosphere. Thus, once valve 256 is deactuated, gas flow is cut off, and no further gas is delivered to the gas burner 50. However, to stop the flow of gas from reaching the burner, a manual shut-off valve 262 is provided to trap the gas contained between the valve and the diaphragm operated valve 256. In the event that the dentist does not desire to use the gas burner during operations, the manual shut-off valve 262 may be utilized to terminate the flow of gas to the burner 50 even though the main diaphragm operated valve 256 is open. The primary purpose of the valve 256 is to terminate the flow of gas to the burner upon shutting down of the dental unit at the end of a day.

A second flow path carries the air junction 254 through a line 264 to an evacuation system which will be described in more detail later.

A third path leading from the junction 254 directs air through a line 266 to which a pressure gauge 268 is connected. A pressure regulator 270 regulates the pressure of air being delivered to the chip blow circuit and spray syringe. This pressure regulator 270 reduces the pressure of the incoming air to appropriate levels for the operation of the chip blower disposed on each of the dental drills, and spray syringe. After passing through the pressure regulator 270, the air passes through a check valve 302 and to a line 304 until reaching a solenoid valve 306 which controls the flow of air through line 304. Prior to reaching the solenoid valve 306 a portion of the air is diverted from line 304 into a line 310 to a syringe 308, this syringe being physically located on the tray assembly 24. Syringe 308 also receives a supply of water from the heater 226 via line 233, junction 314 and line 312.

Water and air outlets 318 and 320 respectively are provided on the dental unit. Water being delivered from heater 226 into the line 233 is delivered via the latter to the water outlet 318. Air passing through the line 304 is diverted at junction 480 to a junction 481, and from the latter through a line 482 to the air outlet 320.

Returning to a portion of the air system, air is delivered from junction 254 through line 266, line 262 to a junction 272, and into a line 274 leading to the foot control unit 72. The foot control unit 272 contains a conventional throttle valve for controlling the flow of air through line 274 to a pilot pressure line 276, and back to a pilot operated regulator 278; a small amount of air is utilized to control the pilot operated regulator 278 by varying the foot control unit which varies the throttle valve contained therein. The foot control unit 72 contains a vertical lever for actuating the throttle valve contained therein to control the amount of air passing from line 274 to line 276, the flow of air into line 276 depending upon the extent of movement of the vertical lever which controls the throttle valve therein. The more air that is allowed to pass into line 276, the more air that is passed from line 262 through the pilot operated regulator 278. If the vertical lever on the foot control unit is not depressed, air is precluded from passing through line 262 beyond the pilot operated regulator 278. The vertical lever on the foot control unit 72 is returned to its midpoint or neutral position, the air contained within line 276 is exhausted to the atmosphere, and closes the pilot operated regulator 278. Thus, the throttle valve being controlled by the vertical lever of the foot control unit 72 is actually a three-way valve which not only regulates the flow of air from line 274 to line 276, but also exhausts the air contained within line 276 to the atmosphere upon returning the vertical lever to its neutral position.

Various types of dental drills may be utilized with the present supply system depending upon the preference of the dentist. Illustrated are three drills 282, 284 and 286; dental drill 282 is representative of a commercially available drill utilizing non-lubricated drive air such as the Encore Air Orbit Handpiece available from the Encore Dental Products Co. The two remaining dental drills, i.e., drills 284 and 286 are representative of drills requiring lubricated air for operating the same. An example of a drill requiring lubricated drive air is the Dentsply Silencer Handpiece available from Dentsply International Inc. As illustrated, drill 284 rep-

resents a low speed drill, while drill **286** is representative of a high speed drill.

After passing through the regulator **278**, air is delivered via line **262** to a junction **499**, and from the latter to the selector valve **242***a*; as previously stated upon reaching a selector valve, the air flow is interrupted unless the selector valve is open due to the associated dental drill being removed from its respective hanger.

Air also passes from junction **499** to junction **490** via line **288**. From junction **490** the air is delivered through a lubricator **290**, picking up lubrication as it passes therethrough on the way to selector valve **242***b*. The amount of lubrication picked up by the air in passing through the lubricator **290** is dependent upon the air flow; the higher the air flow, the more lubricant that is assimilated by the air. Because the low speed drill **284** requires less lubricant than the high speed drill **286**, provision must be made so that the drill **284** receives the proper amount of lubricant because lubricator **290** is preset to deliver the maximum amount of lubricant as required by the high speed drill **286**. This is accomplished by providing a conventional two-way pilot operated valve **294** which is identical to the valve **256** previously described with reference to the gas flow line **260**. Upon lifting drill **284** from its associated hanger **176***b*, pilot valve **190***b* is opened to deliver pilot air from line **307**, to line **292**, and into the pilot chamber of valve **294** to open the latter; thus, by opening valve **294**, a portion of the air reaching junction **490** is bypassed through valve **294** to the junction **498**, and from junction **498** to the selector valve **242***b*. By bypassing a portion of the air utilized for operating or driving the drill **284**, a lesser amount of lubricant is picked up within lubricator **290**. It is also here noted that pilot air utilized for operating each of the selector valves **242**, and also valve **294** is air which has been reduced in pressure by the regulator **270**, after which it passes via line **304** to junction **489**, and from the latter through line **305** to junction **497** connected to line **307**. Thus, it can be seen that while lubricator **290** is preset to supply the maximum lubrication required by drill **286**, the same lubricator is utilized for supplying lubricated air to the drill **284** by incorporating valve **294** to bypass a portion of the air around the lubricator and to the selector valve **242***b* upon removal of the drill **284** from its associated hanger.

When operating the high speed drill **286**, the maximum amount of lubrication will be picked up by the air in passing through the lubricator **290** because none of the air will be bypassed in this instance. Because the valve **294** is now closed due to drill **284** being supported in its hanger, all of the air reaching junction **490** will pass through lubricator **290**, to the junction **498**, and from the latter through line **288** to selector valve **242***c*. Thus, as with each of the drills, selector valve **242***c* will be opened upon removing drill **286** from the hanger **176***c*; as with each of the drills, pilot valve **190***c* is opened upon removing drill **286** from its hanger to deliver pilot fluid through line **309***c* to the selector valve to open the latter.

It is noted that each of the selector valves **242** have a plurality of incoming fluid supply lines **243**, each plurality of supply lines being simultaneously controlled by the associated selector valve **242**. Referring to FIG. **18***c*, a cross-sectional view of the selector valve **242** is illustrated. Each of the selector valves, i.e., valve **242***a*, **242***b*, and **242***c* are constructed as shown in FIG. **18***c*. Upon lifting the associated drill from its hanger, pilot valve **190** delivers pilot air via line **309** to the associated selector valve to move the diaphragm **564** upwardly, thus simultaneously actuating each of the valves **552** which are normally biased closed by a spring **554**. Each of the valves **552** seat against an O-ring **556** until lifted therefrom by the plunger **560** when diaphragm **564** is moved upwardly by the pilot air delivered to the pilot chamber **568**. It is also noted that an O-ring **562** also serves to seal around the plunger or rod **560** to prevent incoming fluids which are being delivered through passageway **550** to the outlet **558** from escaping around the rod. Each of the outlets **558** connects the selector valve **242** to the associated dental drill. It is apparent that any number of valves **552** may be disposed within each selector valve **242** depending upon the number of various fluids which must be supplied to the associated drill.

Because each drill requires a different pressure requirement with respect to the drill air utilized for operating the particular drill, a throttle or needle valve is located in the drive air supply line, each of these throttle valves being disposed or located between the selector valve and its associated handpiece. These throttle valves are represented by the numerals **296**, **298**, and **300**. The supply system is preset to deliver air for the drill which requires the highest pressure for its drive air. Each of the throttle valves is then adjusted to regulate the flow of air being delivered to the associated drill, and consequently the pressure of that drive air.

Thus, as stated above with respect to FIG. **16**, one of the important aspects of the present invention is that the supply system **201** of the present invention is automatically programmed upon lifting a selected dental drill from its associated hanger to deliver the appropriate fluids to the handpiece upon actuation of the foot control unit **72**. By lifting the selected handpiece from its hanger **176**, a lever **178** depresses plunger **188** of the three-way pilot valve **190** to deliver pilot fluid to the associated selector valve **242** to open the latter; upon opening the selector valve **242**, the supply system **201** is programmed to deliver the appropriate fluids to the selected handpiece upon actuating the foot control unit **72**. Actuation of the foot control unit **72** will actuate solenoid valve **234** (see FIG. **19**), and will also control regulator **278** to deliver drive air to the selected drill.

Referring to FIG. **18***b*, it can be seen that a portion of the air within line **304** is diverted to line **322** to a junction **575**, and from the latter to a two-way push button actuated air valve **324**, the push button **120** which is utilized for actuating this valve being located on the handle grip of the tray assembly (see FIG. **1**). When it is desired to lower the tray assembly **24**, push button **120** is depressed to open valve **324** and allow air to pass to the piston and cylinder arrangement **90** to raise the plunger **92** (see FIGS. **4** and **11** also), and release the detent plate **88**; after releasing the detent plate, the tray assembly may then be manually moved to a lower position. As previously stated, it is not necessary to release the detent plate **88** in order to raise the tray assembly because the detent plate is biased in a downward direction. Air is also directed from the junction **575** to a three-way valve **326**. When valve **326** is open, air is delivered therethrough and into a line **328** to a diaphragm actuated two-way valve **330** (assuming two-way valve **344** is open), valve **330** being similar to valve **256** and **294** in FIG. **18***a*. Valve **326** is open when

hanger **352** (see FIG. **1** also) is in the position shown. Hanger **332** is an alternate hanger utilized to support a saliva ejector, and when the saliva ejector is placed therein hanger **332** raises lever **336** against a button **338** to close the three-way valve **326**; by closing valve **326** the line **328** is exhausted to atmosphere thus closing the diaphragm operated valve **330**, the valve **330** being utilized to control the flow of air to a centuri to create a suction at the saliva ejector. The evacuation system for producing a vacuum at each of a plurality of dental evacuation instruments will be described in more detail later.

While each of the dental evacuation instruments are normally removably supported upon the evacuation section **14** (see FIG. **2**), in the event that the dentist is working without an assistant and utilizing the saliva ejector, it may not be convenient for him to replace the saliva ejector on the evacuation section **14** as this section may be located on the opposite side of the chair from which the dentist is working. For instance, the dental unit **10** may be mounted on one side of the chair in a dental office and the dentist may be working from the opposite side of the chair with the tray assembly extended across the chair while the patient is seated therein. Therefore, if the dentist desires to remove the saliva ejector from the mouth of the patient, he may conveniently place the saliva ejector on hanger **332** which is located on the tray assembly, without the necessity of having to walk to the opposite side of the chair to replace it in the evacuation section.

Referring back to FIG. **18***a*, it can be seen that upon deactuation of the foot control unit **72**, the three-way solenoid operated valve **234** which is controlled by the foot control unit will be shifted to a position such that water contained within the supply system between valve **234** and the dental drills, or in other words any water located downstream of valve **254**, will be exhausted or drained via line **238** to a junction **354**, the latter being connected with a drain line **356**. As previously stated, the present dental unit utilizes two dental syringes; one of the syringes **308** (FIG. **18***a*) is physically located on the tray assembly **24** for use by the dentist, and a second syringe **358** (FIG. **18***b*) is physically located on the evacuation section **14** for use by a dental assistant, if one is available. Each of these syringes require air and water, both the air and water being controlled by a manual valve located on each of the syringes. Thus, when it is desired to operate syringe **358** for example, a manual valve located on the syringe is depressed, and air is delivered through line **350** from junction **483** while water is delivered through line **316** from the junction **314**. Each of the syringes may be designed such that a single manual control valve will control both the air and water, or a manual control valve may be provided for each of these fluids.

An air saliva ejector **360** is physically located on the evacuation section **14**, and is actuated upon removal from its holder. While the evacuation system utilized to produce a suction at each of the evacuation instruments disposed on the evacuation section **14** are thoroughly described in a co-pending U.S. Pat. application, Ser. No. 62,242, and entitled "Dental Evacuation Apparatus," the system will be briefly described herein. With respect to saliva ejector **360**, upon removal of the same from its holder valve **334** is opened to allow air to flow through line **328** to valve **330** to open the latter; air is then delivered through line **264** to the junction **576**, and from the latter through a line **362** to the diaphragm operated valve **330** from which the air passes to a venturi **364** mounted on top of a separator **366**, to create a vacuum or suction at the saliva ejector, thus extracting debris and water from a patient's mouth through line **368**; the extracted water and debris is delivered to the separator **366** where a separation takes place, the liquids passing into the drain line **356**. Upon replacing saliva ejector **360** back into its holder on the evacuation section **14**, two-way valve **344** is closed, thus terminating the flow of air through line **328** to the valve **330** and thereby terminating the air flow through line **362** and valve **330**. The suction at the saliva ejector **360** may also be terminated by placing the saliva ejector in the hanger **332**, thus terminating the flow of air into line **328** and thereby close the diaphragm actuated valve **330**, this also terminates the flow of air to the venturi **364**.

While each of the evacuation instruments is actuated upon removal from its respective holder in evacuation section **14** by delivering air to its associated venturi located on separator **366**, a portion of this air flow is also diverted via restricted passageways contained within a bias block **370** of each of the remaining venturis located on separators **366**, thus creating a minor suction or vacuum at each of the remaining or unused evacuation instruments. This prevents gases which have been separated within the separator **366** from being released through the unused evacuation instruments into the dental office.

Upon lifting aspirator **372** from its respective holder of the evacuation section **14**, a valve **342** is actuated to deliver the supply of air from line **264**, through the valve **342**, and into a venturi **374** mounted on top of the separator **366** and associated with the aspirator; a vacuum is thus produced at the aspirator, Again, a portion of the air flow being directed to venturi **374** is diverted through a plurality of restricted passageways in bias block **370** to each of the other venturis mounted on top of separator **366**, thus producing a minor suction at the remaining dental evacuation instruments.

A fixed cuspidor bowl **378**, or alternatively, a removable funnel **380** (indicated by the broken lines) is provided on the cuspidor assembly **30** (see FIGS. **1** and **2** also). Assuming that the fixed cuspidor **378** is provided, water is supplied thereto via line **352**, through a commercially available vacuum breaker **382**, and into line **384**; the water is then passed through a manual control valve **386** located in line **384** and into the cuspidor bowl through **78**. From the cuspidor bowl, the water is discharged through line **388** to the junction **354**, the latter being connected to the drain line **356**.

Alternatively, if the removable funnel **380** is supplied, it will actuate a valve **33** (see FIG. **2** also) upon removal from its associated holder on the cuspidor assembly **30**. Upon opening valve **33**, air will be delivered from line **264** to junction **576**, and from the latter through line **390**, through the valve **340**, through junction **580**, and through a venturi **392** mounted on top of separator **366**, thus producing a vacuum at the funnel. Again, a portion of the air flow is diverted at junction **580** to the bias block **370**, and through a plurality of restricted passageways disposed therein to each of the remaining venturis mounted on separator **366** to produce a minor suction at each of the remaining dental evacuation instruments. If the funnel **380** is utilized as an alternative to the cuspidor boel **378**, water will be supplied

to the funnel as indicated by the broken line **394.** Materials will be removed from the funnel **380** via line **396** (indicated by the broken line) and into line **388.**

A cup filler **398** is aso provided for use by the dental patient, the cup filler being disposed on the cuspidor assembly **30** (see FIG. **2**). Placement of a cup in the cup filler **398** will actuate a two-way solenoid valve **400** to permit the flow of both warm and cool water through lines **348** and **346** respectively; the temperature of the water being delivered to the cup placed in the cup filler **398,** is controlled by a manual valve **404** which conrols the flow of cool water through the line **346.** By adjusting the valve **404** the temperature of the mixture at the junction **406** can be accurately controlled. In the event that there is any overflow from the cup which is located in the cup filler **398,** that overflow will be drained through line **402** to the junction **354,** the latter being connected to the drain line.

Provision has also been made in the present dental unit so that the foot control unit **72** (see FIGS. **1, 2,** and **18***a*) utilized for controlling the dental drills **282, 284,** and **286** (FIG. **18***a*) can also be employed for operating a prophylaxis unit. A prophylaxis unit is a unit utilized by the dentist for cleaning patients' teeth, and is generally obtained by the dentist as a separate item; these prophylaxis units are generally supplied with their own separate foot control units which means that the dentist must have at least two foot control units located on the floor of his dental office, one of the units being utilized for controlling the dental drills, the other being utilized for controlling the separate prophylaxis unit. The present invention utilizes a system by which a prophylaxis unit may be operated with the same foot control unit utilized to control the operation of the dental drills. An example of a commercially available prophylaxis unit suitable for use in combination with the present dental unit is the Cavitron Ultrasonic Unit available from the Dentsply International, Inc., of York, Pennsylvania; many other suitable and commercially available ultrasonic prophylaxis units may also be utilized.

Referring to FIG. **19,** an embodiment of the present invention will be described whereby a selector switch physically located on the dental unit **10,** enables the dentist by selective switching to utilize foot control unit **72** for actuating either the dental drills **382, 384,** and **386** (FIG. **18***a*), or a prophylaxis unit **406** (FIG. **19**). As previously stated, a prophylaxis unit may have three lines which need to be connected to appropriate outlets in order to operate the unit; because commercially available units now on the market are generally supplied with their own separate foot control units, there may only be two lines with respect to these units which need to be connected for operation of the unit, these two lines being utilized for supplying water and electrical power to the prophylaxis unit. However, the present invention contemplates severing the line connecting the prophylaxis unit to its foot control unit and installing a plug at the outer end of the severed line, this plug being adapted to cooperate with a corresponding outlet which is physically located on the dental unit, the latter mentioned outlet being electrially connected to foot control unit **72.** These three outlets are illustrated as outlets **66, 68,** and **70** in FIG. **3.**

Referring to FIG. **19,** a commercially available prophylaxis unit **406** is supplied with a plug **408** adapted to correspond with an electrical outlet **68** for supplying electrical power to the unit **406.** As stated, the present invention contemplates severing the line leading from a commercially available prophylaxis unit to its foot control unit and connecting a plug **412** to the severed end of the line, this plug **412** being adapted to cooperate with a corresponding outlet **70** located on the dental unit. Two main switches, S-1 and S-2, are provided on the dental unit, one of the switches being physically located on the tray assembly **24,** while the other is physically located on the evacuation section **14** to allow either the dentist or his assistant to switch on the dental unit. A selector switch **418** is provided by which a dentist may select either the dental drills or the prophylaxis unit **406** for operation by switch **420,** the latter being physically located on foot control unit **72.** Actuation of either of the main switches S-1, or S-2, opens the main water valve **214** and the main air valve **252** to allow flow therethrough. Upon actuation of either of the main switches a pilot light **526** located on the dental unit is lighted to indicate that the unit is set for operation.

Assuming that the main switches S-1 and S-2 are in the positions shown, and the selector switch **418** is in the position shown, upon actuation of the foot control switch **420** a circuit will be completed through line **414,** circuit protector **516,** junction **541,** contacts **512** and **504** of the main switches, junction **543,** junction **547,** contact **422,** junction **523,** contact **430,** thus actuating air solenoid valve **306,** and completing the circuit through contacts **500** and **508** of the main switches. It is also noted that upon actuation of the foot control switch **420** a circuit is completed through contact **422,** junction **521,** contact **426,** through the solenoid valve **234,** through contacts **500** and **508** of the main switches, and line **416.** Therefore, when the selector switch is in the position shown, only the solenoid valves associated with the dental handpieces are opened; thus only the dental drills may be operated when the selector switch is in the position shown.

If it is desired to operate the prophylaxis unit, a selector switch **418** is moved so as to break contact at contacts **430** and **436** and make contact at contacts **432** and **434.** With the selector switch **418** now in its opposite position, actuation of the foot control switch **420** will complete a circuit from outlet **68,** through prophylaxis unit **406,** through plug-outlet **412, 70,** through line **438,** contact **434,** contact **424,** line **440,** and back to the outlet **68.** As indicated, a foot control switch **420** is in its off position, and upon being actuated contact is made at contacts **422** and **424,** and broken at contacts **426** and **428.** Thus, as is apparent, the present invention allows the dentist, by selective switching, to actuate either the dental drills or a separate prophylaxis unit with the same foot control unit.

FIG. **20** illustrates various positions in which the present dental unit may be installed in the dental office with respect to the dental chair. As viewed in this figure, the dental hair includes a back portion **442** and a front portion **444,** the left side of the chair being on the left as viewed from the back of the chair to the front thereof. Thus, in FIG. **20***a*, an arrangement is shown whereby the evacuation of section **14** has been separated from the remainder of the dental unit **10** and placed on the left side of the dental chair, while the remainder of the unit has been positioned to the rear of the chair and slightly to the right thereof. This allows the dentist to work from one side of the chair while allowing the dental assistant to work alongside the chair.

It also permits the dental handpieces **60** to be positioned out of the sight of the dental patient as he is seated in the chair.

FIG. **20***b* illustrates an arrangement wherein the dental unit **10** is positioned directly behind the dental chair with the evacuation section rotated to approximately a 45° angle to permit the assistant to work from the left rear of the chair while the dentist works from the right side of the chair. This again posiions the dental handpieces **60** so that they are substantially out of sight of the dental patient as he is seated in the dental chair.

FIG. **20***c* is a third arrangement in which the dental unit **10** is once again positioned behind the dental chair. However, in this instance, the tray assembly **24** is positioned at the left rear, while the evacuation section **14** is positioned on the right rear of the dental chair.

FIG. **20***d* illustrates an arrangement wherein the dental unit **10** is mounted along the right side of the dental chair with the tray assembly **24** extending across the chair so that the dentist may operate or work from the left side of the chair while the dental assistant works from the right side of the chair. It is here noted that the cuspidor assembly **30** has been placed on the opposite side of the evacuation section **14** from which it is mounted in FIG. **20***a*. This particular arrangement might be very suitable for a left handed dentist.

FIG. **20***e* illustrates an arrangement wherein the dental unit **10** is separated as in FIG. **20***a*. However, in this instance while the evacuation section **14** is again placed on the left side of the dental chair the remainder of the dental unit is not mounted along the right side of the dental chair. This particular arrangement might be highly suited for a right handed dentist who wishes to work from the right side of the dental chair.

FIG. **20***f* illustrates an arrangement wherein the dental unit **10** is mounted along the left side of the dental chair with the tray assembly being extended across the chair so that the dentist may work from the right side of the chair. As is true with respect to FIG. **20***e*, this arrangement is also suitable for a right handed dentist who wishes to work from the right side of the dental chair. However, in this instance the entire dental unit is mounted on the left side of the dental chair. Comparing FIGS. **20***d* and **20***f*, it is noted that upon reversing the position of the dental unit **10**, the cuspidor assembly **30** is removed from one side of the evacuation section **14** and mounted to the opposite side thereof.

Thus, it can be seen that the present dental unit provides a great deal of flexibility to allow a dentist to position the unit within his office in any number of positions, depending upon his particular mode of operation, and whether he is right handed or left handed.

What we claim:

1. A dental unit comprising:

a. A base frame comprising an upright portion and a horizonal portion forming an inverted generally T-shaped member, the horizontal portion of said T-shaped member being adapted to be mounted to the floor of a dental office;

b. cabinet structure removably mounted to said frame and defining a supply section on one side of said upright portion, and an evacuation section on the other side of said upright portion, said evacuation section including at least one dental evacuation instrument removably supported on a first side thereof, said evacuation section being movably mounted to said frame so that it can be moved so that said first side may face in any one of numerous horizontal directions;

c. a supply system for supplying fluids and electrical power to said unit, and an evacuation system for removing fluid and debris from said unit;

d. a post, and means for telescopically mounting said post within said upright portion so that said post can be vertically moved into and out of said upright portion;

e. horizontally extending arm assembly, and means for mounting one end of said arm assembly to the upper end of said post;

f. a tray assembly mounted to the other end of said arm assembly, a plurality of dental drills removably supported on said tray assembly, said arm and tray assemblies being adapted to be retracted to a position so at least a portion of each is simultaneously disposed over said frame and said supply and evacuation sections even when said post is in its lowermost position; and

g. telescopic mounting means for said post comprising a roller bearing unit having a plurality of roller bearings in rolling contact with said post, each said roller bearing being rotatable about a horizontal axis, at least one of said bearings being adjustably mounted within said unit so as to be rotatable about a vertial axis for adjusting the contact between said bearing and said post.

2. A dental unit according to claim **1** and further including means for leveling said arm and tray assemblies by varying the cant of said post which supports said assemblies, said leveling means comprising adjustable screw means extending outwardly from and threadably connected to opposite sides of said bearing unit, the outer end of each of said screw means contacting the inner surface of said upright portion.

3. Dental apparatus according to claim **9** further including:

a plurality of dental drills for operating upon teeth;

means, including a plurality of hangers, for removably supporting each of said drills;

a plurality of fluid supply lins connected to each of said drills;

first control valve means operatively associated with each of said supporting means for simultaneously controlling the flow through the plurality of supply lines respectively associated with its drill;

a pilot valve operatively associated with each hanger and adapted to deliver air to said first control valve means to actuate the latter upon removal of the respective drill from its respective hanger;

means for non-electrically actuating the respective pilot valve upon removal of the associated drill;

third control valve means disposed upstream of said first control valve means, said third control valve being operative to control the flow through at least one of the supply lines associated with each drill; and

a foot control unit operatively connected to said third control valve means for actuating the latter, said dental apparatus being so constructed and arranged that upon removal of a selected drill from its respective hanger, the associated pilot valve is actuated and consequently its associated first control valve means is actuated, and upon actuation of

said foot control unit, said third valve means is opened to deliver fluid sto said selected drill.

4. Dental apparatus according to claim 3 and further including means for preventing actuation of said pilot valve upon removal of the respective drill.

5. Dental apparatus according to claim 3 and further including a throttle valve disposed in one of the plurality of supply lines connected to each of said dental handpieces for controlling the pressure of the fluid being supplied to the respective drill, said throttle valve being disposed in said one line between said drill and aid first valve means.

6. Dental apparatus according to claim 3, and further including a lubricator operatively associated with one of said dental drills, said lubricator being disposed in said one line in which the flow is controlled by said third control valve means said lubricator being located downstream of said third control valve mans and upstream of said one dental drill, a bypass line for bypassing a portion of said flow around said lubricator, a bypass valve located in said bypass line for controlling the flow through said bypass line, said bypass valve being operatively connected to said pilot valve and adapted to be opened by actuation of said pilot valve upon lifting the associated dental drill from its respective hanger.

7. A dental unit comprising:

a. a base frame including a horizontal portion and an upright portion extending upwardly from said horizontal portion, said upright portion being of hollow construction to define a chamber therewithin having an access opening to said chamber at one side thereof;

b. a supply system including lines for pressurized air, pressurized water, and electrical current; also a supply module with component elements connected to said lines, said supply module including a panel supporting said elements and movably mounted on said frame for closing the access opening to said chamber, said panel being movable relative to said frame for opening said access opening;

c. an evacuation system including a line for conducting waste fluid away from said unit;

d. cabinet structure mounted to said frame, including an evacuation section disposed on the side of said upright portion opposite said access opening and housing at least a portion of said evacuation system, said evacuation section being movably mounted on said base frame for facing a side portion thereof in a selected one of a variety of horizontal directions relative to said facing position; said cabinet structure further including a supply section disposed on the side of said upright portion adjacent to said access opening and housing at least a portion of said supply system including said supply module;

e. a vertically elongated post telescopically received within the upright portion of said base frame and supported for movement in vertical directions, the upper end portion of said post being disposed above the level of said cabinet structure and said base frame in all positions of said post, with adjustable bearing structure for said post disposed in said chamber;

f. a tray assembly and a pivot on which said tray assembly is rotatable about a vertical axis;

g. arm structure extending in horizontal direction between the upper end portion of said post and the pivot of said tray assembly, said arm structure being movable about the longitudinal axis of said post;

h. a plurality of air-operated dental instruments removably mounted on the said tray assembly and connectable through said arm assembly to the lines of said supply system;

i. an auxiliary outlet for prophylaxis apparatus connectable to the lines of said supply system;

j. foot control means for controlling flow through said lines;

k. means selectively connecting said lines to either said auxiliary outlet or said dental instruments;

l. normally closed valve structure for each instrument, having a compartment and being responsive to the flow of air to said compartment for opening itself to the flow of air from said supply system therethrough to said instruments;

m. a delivery valve for each one of said instruments, responsive to removal of the weight of said one instrument for delivering air to the compartment of said valve structure for initiating delivery of drive air from said valve structure to said one instrument;

n. latch means optionally employed for holding the other of said delivery valves against response to removal of the weight of said other instrument to prevent delivery of air to the compartment of the valve structure associated with said other instrument;

o. said arm structure comprising first and second horizontally extending arm members, and means connecting one end of said first arm member and one end of said second arm member for relative rotational movement about a vertical pivotal axis, the other end of said first arm member being connected to the upper end portion of said post; and

p. said tray assembly, said pivot, said first arm member, said connecting means for the arm members, said second arm member, and the upper end portion of said post being disposed at levels one above the next in the order named.

8. A dental unit according to claim 7 wherein said connecting means includes a lower plate secured to said second arm and having an arcuate track formed about the pivotal axis with abutment surfaces at the opposite ends of said track, an intermediate plate overlying said lower plate and having a lower pin extending downwardly into said track for movement therein between said abutment surfaces during rotational movement of said intermediate plate about said pivotal axis, said intermediate plate being further provided with an upper pin extending upwardly therefrom, an upper plate overlying said intermediate plate, said upper plate being secured to said first arm and having an arcuate track formed about the pivotal axis to receive the upper pin therein, said upper track having abutment surfaces at opposite ends thereof, the construction and arrangement being such that said first arm is swingable about said pivotal axis for the arc distance that said upper pin travels in said upper track between its abutment surfaces plus the arc distance that said lower pin travels in said lower track between its abutment surfaces.

9. A dental unit comprising:

a. a base frame of inverted T shape including a horizontal portion and an upright portion extending upwardly from said horizontal portion;

b. a supply system including lines for pressurized air, pressurized water, and electrical current, and a supply module with component elements connected to said lines;
c. an evacuation system including a line for conducting waste fluid away from said unit;
d. cabinet structure mounted to said frame;
e. said cabinet structure including a supply section disposed on one side of said upright portion and housing component elements of said supply module;
f. said cabinet structure including an evacuation section disposed on the other side of said upright portion and housing at least a portion of said evacuation system, said evacuation section being adjustably mounted on said base frame in order to face a side portion of the evacuation section in a selected one of a variety of horizontal directions.

10. A dental unit according to claim **9** wherein said upright portion is of hollow construction to define a chamber therein and is provided with an access opening to said chamber at one side thereof; said supply sysem having a panel supporting at least a portion of said component elements of said supply system, said panel being movably mounted on said frame for closing said access opening, at least a portion of the supply section of said cabinet structure being removably mounted to said frame and said panel being movable relative to said frame for opening said access opening to provide access to said chamber; and further including a vertically elongated post telescopically received within the upright portion of said base frame and supported for movement in vertical directions, and adjustable bearing structure for said post disposed in said chamber adjacent said access opening.

11. A dental unit according to claim **9** further including at least one dental unit, an air line connected to the line for pressurized air for delivering pressurized air therethrough, a normally closed valve in said air line movable when actuated to open position, an auxiliary electrical outlet, an electrical line connecting said outlet to said line for electrical current, a normally open switch in said electrical line movable when actuated to closed position to complete a circuit therethrough, a foot control having an actuating means, conditioning means connected between the valve and the actuating means and between the switch and the actuating means, said conditioning means being movable between first and second position operable for moving said valve to open position when in first position and operable for moving said switch to closed position when in second position, whereby said foot control controls the flow of air to said dental drill in said first position of said conditioning means and controls the flow of electrical current to said outlet in said second position of said conditioning means, the construction and arrangement being such that the operation of auxiliary electrical apparatus connected to said outlet may be controlled by the same foot control which is used for controlling the operation of said dental drill.

12. A dental drill unit according to claim **10** wherein the cabinet strucure of at least one of said sections includes rapid connecting means for mounting and dismounting said cabinet structure to and from said frame.

13. A dental unit according to claim **9** wherein said evacuation section has an opening disposed in each of second and third opposing sides thereof, and further including a removable closure for each of said openings, a manifold adapted to be mounted within said evacuation section adjacent to either of said openings, said manifold having a plurality of passageways adapted to be connected to said supply system, and a cuspidor assembly having a plurality of passageways disposed therein which is adapted to be operatively connected to said manifold on either said second or third sides when the respective closure is removed so that corresponding passageways in said manifold and cuspidor assembly are aligned.

14. In combination, a dental unit according to claim **9** and further including a dental drill, a foot control unit for operating said dental drill, an electrical outlet disposed on said dental unit and electrically connected to said foot control unit, with a prophylaxis unit having a plug adapted to cooperate with said outlet so that said foot control may be utilized for operating said prophylaxis unit.

15. In a dental unit, a tray assembly comprising:
a. a tray containing at least one supply line for a dental instrument and having adjacent, horizontally extending front and side portions;
b. a movable support for said tray having means for maintaining said tray generally horizontal in various positions thereof;
c. a horizontally elongated instrument holder supporting at least one dental instrument;
d. means pivotally mounting said instrument holder to said side portion of said tray for movement of up to approximately 90° about an upright axis to a selected position, said instrument holder being movable between a first position wherein the instrument holder extends horizontally in general horizontal alignment with the front portion of said tray and a second position wherein the instrument holder extends horizontally generally along the side portion of said tray in parallel relationship therewith; and
e. means extending adjacent said mounting means connecting said dental instrument to said supply line.

16. A dental unit according to claim **15** further including a conduit arcuately formed about the upright axis of said mounting means, with said supply line extending therethrough.

17. In a dental unit having horizontally extending arm structure for supporting apparatus thereon, said arm structure comprising first and second horizontally extending arm members, and means connecting one end of said first arm member and one end of said second arm member for limited relative rotational movement about a vertical axis, and connecting means including a lower plate secured to said second arm and having an arcuate first track formed about the pivotal axis with abutment surfaces at the opposite ends of said first track, an intermediate plate overlying said lower plate and having a lower pin extending downwardly into said first track for movement therein between said abutment surfaces during rotational movement of said intermediate plate about said pivotal axis, said intermediate plate being further provided with an upper pin extending upwardly therefrom, an upper plate overlying said intermediate plate, said upper plate being secured to said first arm and having an arcuate second track formed about the pivotal axis to receive the upper pin therein, said second track having abutment surfaces at

opposite ends thereof, the construction and arrangement being such that said first arm is swingable about said pivotal axis for the arc distance that said upper pin travels in said first track between its abutment surfaces plus the arc distance that said lower pin travels in said second track between its abutment surfaces.

18. In a dental unit;

a. a frame;

b. cabinet structure mounted to said frame;

c. a supply system including lines for pressurized air, pressurized water, and electical current;

d. a tray assembly and means for mounting said tray assembly to frame;

e. a plurality of air-operated dental instruments carried on said tray assembly and connectable to the lines of said supply system, a delivery valve for each one of said dental instrumnts for controlling delivery of drive air to said one dental instrument, and a master valve for controlling the flow of air to said delivery valves, said master valve being connectable to the pressurized air line of said supply system;

f. an auxiliary electrical outlet for prophylaxis apparatus connectable to the electrical line of said supply system;

g. foot control means responsive to actuation for initiating the connection of said pressurized air line to said master valve and the connection of said electrical line to said auxiliary electrical outlet; and

h. conditioning means selectively positionable for conditioning said pressurized air line for connection to said master valve in one position thereof and for conditioning said electrical line for connection to said auxiliary electrical outlet in another position thereof, whereby said foot control means controls the pneumatic energization of said dental instruments in said one position of the conditioning means and the electrical energization of said prophylaxis in the other position of the conditioning means.

19. A dental unit according to claim **9** further including: a pluralty of air-operated dental instruments connected to the lines of said supply system; foot control means for controlling flow through said lines toward said instruments, normal valve structure having a valve and a compartment and being responsive to the flow of pressurized air to said compartment for opening said valve to the flow of air from said supply system therethrough to its associated instrument; and a delivery valve for each one of said instruments, responsive to removal of the weight of said one instrument for delivery in air to the compartment of said valve structure for initiating delivery of air from the valve of said valve structure to said one instrument.

20. A dental unit according to claim **19** further including latch means optionally employed for holding the other of said delivery valves against response to removal of the weight of said other instrument to prevent delivery of air to the compartment of the valve structure associated with said other instrument.

21. In a dental unit:

a. a supply system including lines for pressurized air, pressurized water, and electrical current;

b. a plurality of air-operated dental instruments;

c. means selectively connecting said lines to said dental instruments;

d. normally closed valve structure for each instrument, said valve structure having a compartment and being responsive to the flow of air to said compartment for opening itself to the flow of air from said supply system therethrough to said instruments; and

e. a delivery valve for each one of said instruments, responsive to removal of the weight of said one instrument for delivering air to the compartment of said valve structure for initiating delivery of drive air from said valve structure to said one instrument.

22. In a dental unit according to claim **21**, further including latch means optionally employed for holding the other of said delivery valves against response to removal of the weight of said other instrument to prevent delivery of air to the compartment of the valve structure associated with said other instrument.

23. A dental unit according to claim **9**, and further including a tray assembly mounted on said base frame, a dental evacuation instrument connected to said evacuation system, a vacuum source, means connecting said vacuum source and said dental evacuation instrument, and hanger valve means located on said tray assembly for removably supporting said dental evacuation instrument, said hanger valve means being operative to open said dental evacuation instrument to said vacuum source upon removal of said dental evacuation instrument from said hanger valve means and operative to close said dental evacuation instrument to said vacuum source when said hanger valve means supports said dental evacuation instrument.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,778,903 **Dated** December 18, 1973

Inventor(s) John M. Gardella, Anthony Ciavattoni, Joseph I. Ujvary

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

Column 24, Claim 3, line 44, "lins" should read -- lines --.

Column 25, Claim 3, Line 2, "fluid sto" should read -- fluids to --.

Column 25, Claim 5, line 12, "aid" should read -- said --.

Column 28, Claim 17, line 54, "and" should read -- said --.

Column 29, Claim 18, line 17, "instrumnts" should read -- instruments --.

Column 29, Claim 18, line 39, after "phylaxis" and before "in", insert -- apparatus --.

Column 29, Claim 19, line 45, after "structure" and before "having", insert -- for each instrument downstream of said foot control means, said valve structure --.

Column 30, Claim 19, line 3, "ery in" should read -- ing --.

Column 30, Claim 23, line 45, after "and" and before "operative", insert -- being --.

Signed and sealed this 11th day of June 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents