United States Patent [19]

Cousins

[11] **3,734,122**

[45] **May 22, 1973**

[54] **DENTAL COMPRESSED AIR/VACUUM APPARATUS**

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[22] Filed: **Feb. 14, 1972**

[21] Appl. No.: **225,867**

[52] **U.S. Cl.** **137/340,** 32/22, 312/209, 417/363, 417/313

[51] **Int. Cl.**.....**F16k 49/00**

[58] **Field of Search** 137/334, 340; 32/22; 417/363, 313; 312/209

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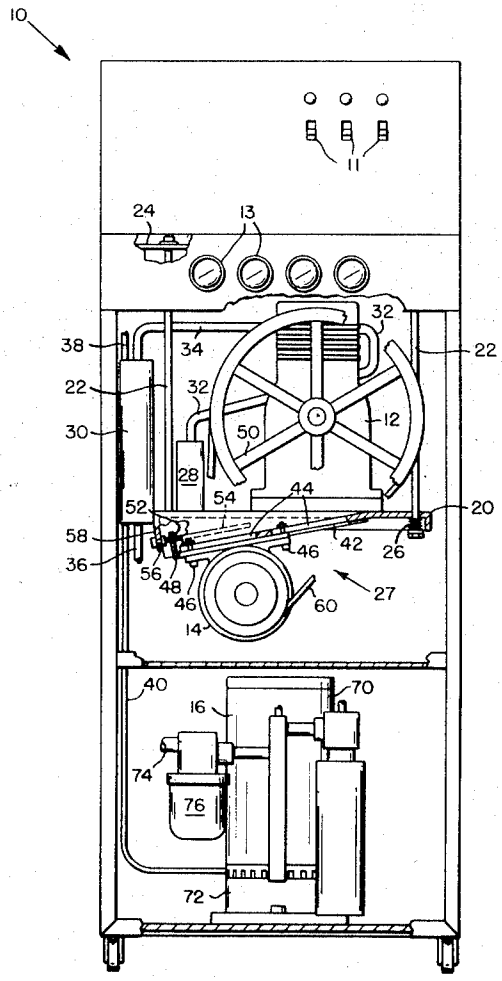
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[57] **ABSTRACT**

Disclosed is a combined water ring vacuum pump and compressor, both mounted in a single cabinet. The vacuum pump is mounted in the base of the cabinet, the compressor is mounted on a vibration insulated platform suspended from the top of the cabinet and the compressor drive motor is attached to the underside of the support platform. A water line connects the compressed air heat exchanger to the water ring vacuum pump, so that the water introduced into the vacuum pump is first used to cool the air from the compressor.

12 Claims, 3 Drawing Figures



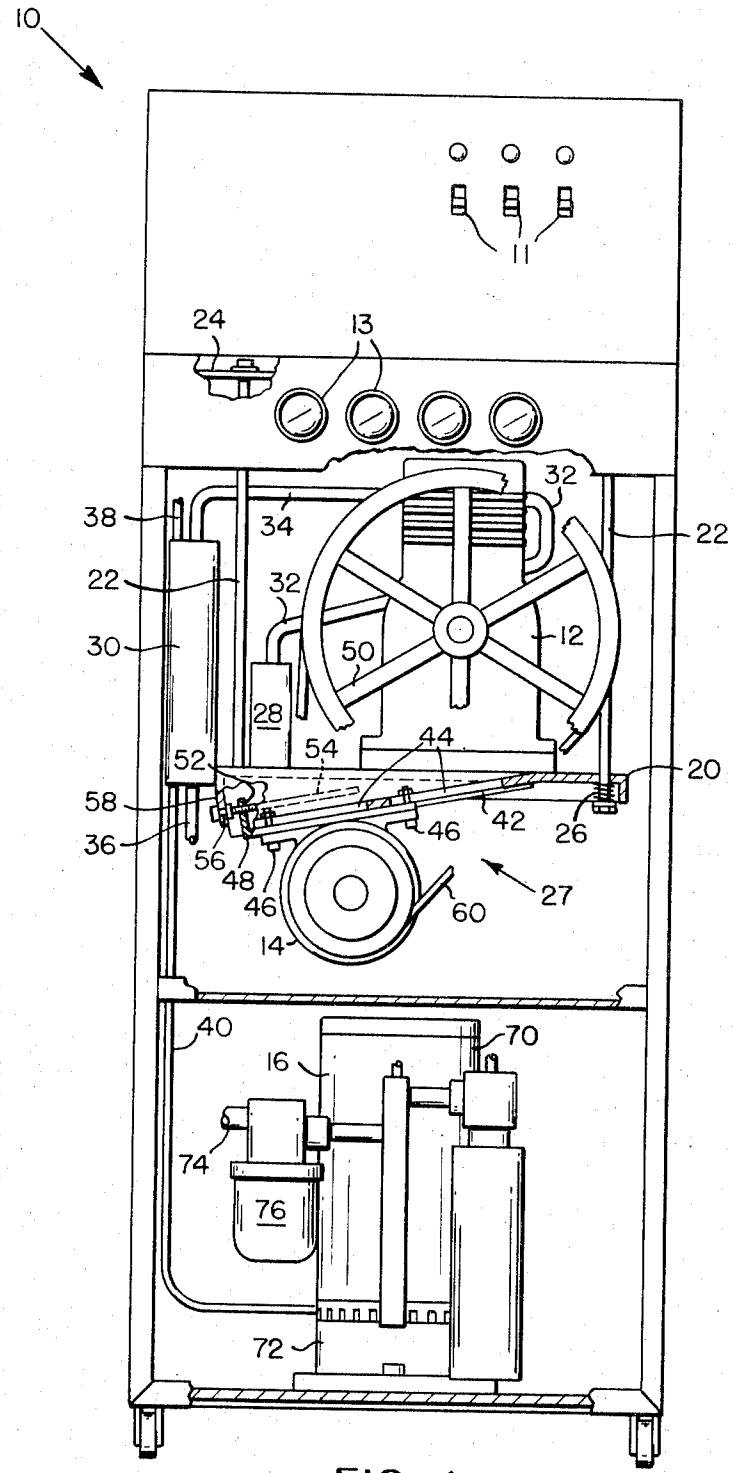

10
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FIG. 1

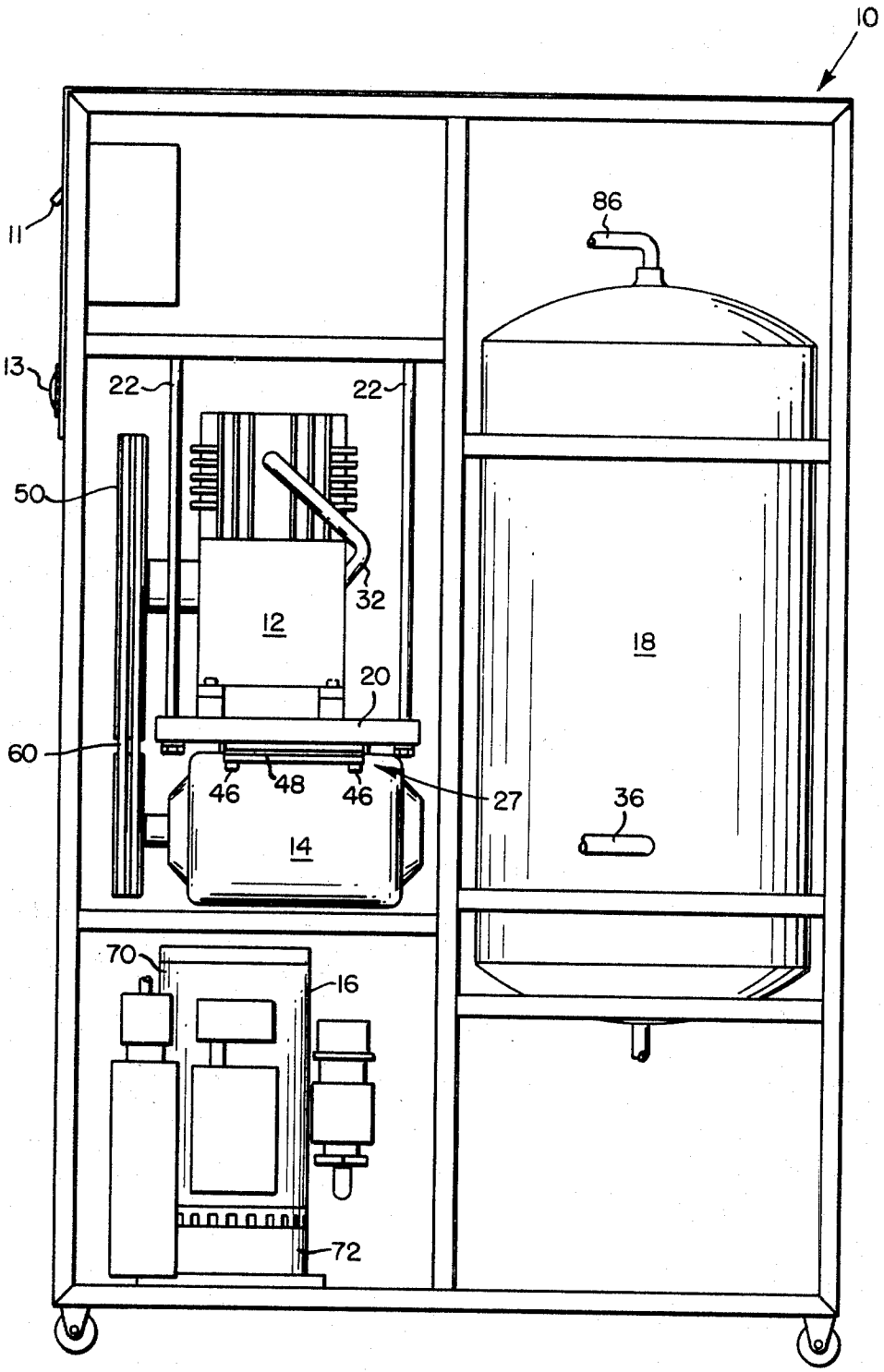


FIG. 2

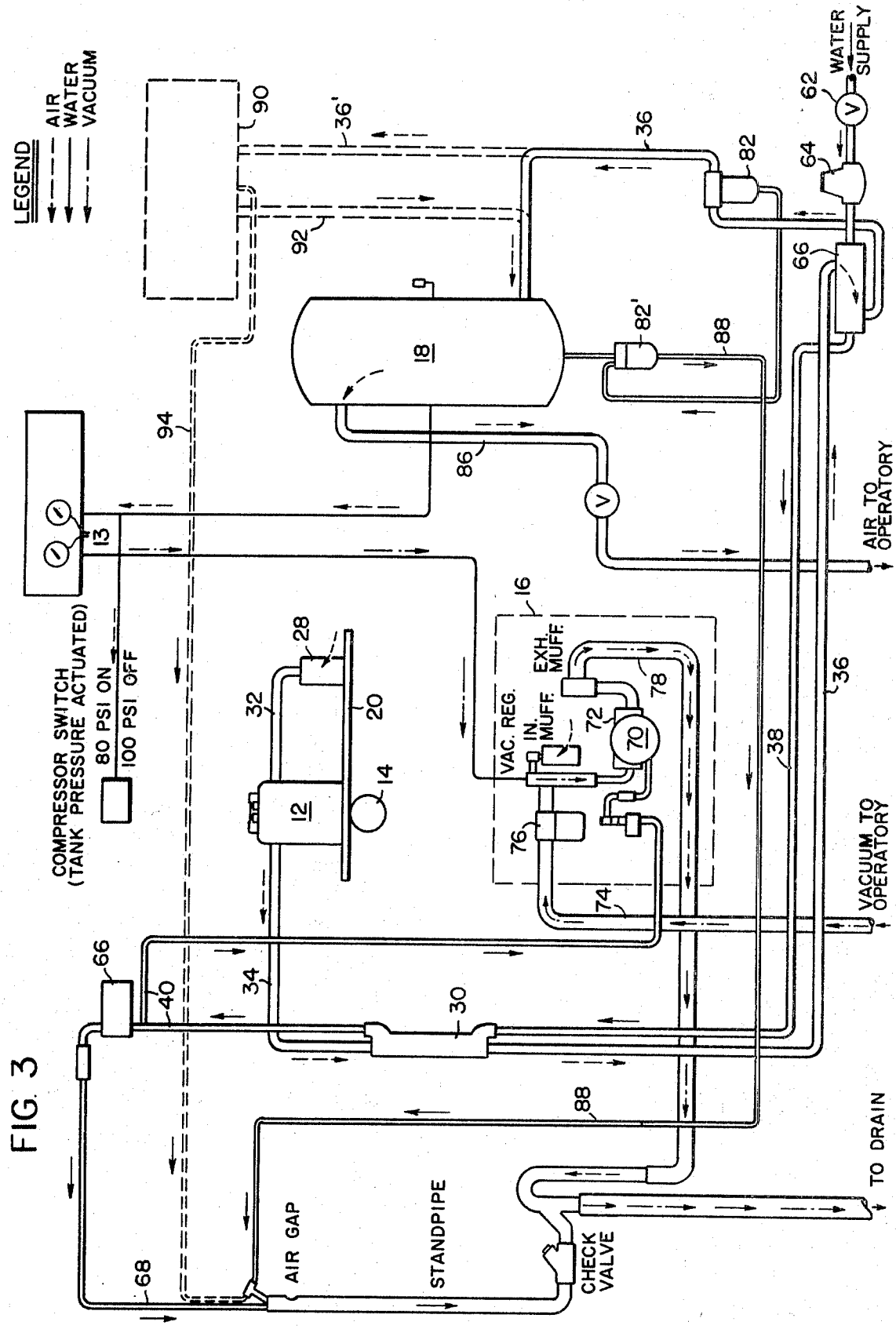

LEGEND
AIR
WATER
VACUUM
WATER SUPPLY
62
64
66
82
82'
88
36
36'
90
92
18
94
86
V
13
AIR TO OPERATORY
16
EXH. MUFF.
78
VAC. REG.
IN. MUFF.
72
70
28
32
20
14
12
38
76
74
VACUUM TO OPERATORY
COMPRESSOR SWITCH (TANK PRESSURE ACTUATED)
80 PSI ON
100 PSI OFF
66
40
34
30
88
TO DRAIN
AIR GAP
STANDPIPE
CHECK VALVE
68

FIG. 3

DENTAL COMPRESSED AIR/VACUUM APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to apparatus for use in dental offices and the like, namely a single self-contained unit providing both the vacuum and compressed air needs of the dental office.

Heretofore, compressors and vacuum pumps required by the dental practitioner were usually purchased separately and installed in some out of the way location such as a basement. Suitable utility lines then connected the compressor and vacuum pump to one or more dental operatories. The vibration noise of the compressor was particularly a problem, requiring that the compressor be installed outside of the dental laboratory. Vibration noises of the vacuum pump, particularly of the water ring pump, are minimal, but the floor space requirements of separate compressor and vacuum pump apparatus dictated the necessity of installing these components outside of the confines of the dental laboratory, where floor space is at a premium.

A secondary problem with respect to the compressors generally is the difficulty in adjusting the tension of the drive belts connecting the drive motor to the compressor.

The present invention overcomes the disadvantages of the prior art by combining a water ring vacuum pump, a compressor and a compressed air storage tank in a single cabinet, which occupies a minimum of floor space. To economize on floor space, the vacuum pump, compressor drive motor, and compressor are all arranged one above the other in the cabinet. This arrangement permits a simple, relatively vibration free, mounting of the compressor, together with means for adjusting the tension of the compressor drive belts, and also permits an integration of the water system for cooling the compressed air and running the water ring vacuum pump.

SUMMARY OF THE INVENTION

The present invention can be characterized in one aspect thereof by a generally upright cabinet, having a water ring vacuum pump mounted in the base thereof and a compressor mounted on a platform suspended from adjacent the top of the cabinet. The platform suspension is not rigid and is therefore able to absorb the vibrations produced by the compressor. The compressor drive motor is mounted to the underside of the platform on means for moving the motor with respect to the platform to adjust the tension in the compressor drive belts. The water used to operate the water ring vacuum pump is circulated first through a heat exchanger adjacent the outlet of the compressor and then through the water ring vacuum pump.

OBJECTS OF THE PRESENT INVENTION

A primary object of the present invention is to provide a relatively compact unit, occupying a minimum of floor space for supplying the vacuum and compressed air needs of a dental laboratory.

Another object of the present invention is to provide a unit as described, wherein the vacuum pump and compressor are located one above the other in a single cabinet.

Still another object of the present invention is to provide a unit of the type described, wherein the compressor is mounted to a platform suspended from the top of the unit and the vacuum pump is located on the base of the unit.

A further object of the present invention is to provide a unit of the type described wherein the vacuum pump is a water ring pump, the water used for operating the vacuum pump being first passed through a heat exchanger used to cool the compressed air output of the compressor.

A yet further object of the present invention is to provide a unit of the type described, having the compressor carried on a platform suspended from the top of the unit with the compressor drive motor being attached to the underside of the platform, both the compressor and motor being located directly above a vacuum pump in the base of the unit.

These and other objects, advantages and characterizing features of the present invention will become more apparent upon consideration of the detailed description thereof, when taken in connection with the accompanying drawings depicting the same.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevation view of the apparatus, partly broken away and in section, wherein covering panels have been removed to show the individual components;

FIG. 2 is a view similar to FIG. 1, but showing a side elevation of the apparatus; and

FIG. 3 is a schematic diagram showing air, water and vacuum flow.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, FIG. 1 shows the apparatus housed in a generally upright mobile cabinet **10.** For purposes of illustration, the panels which enclose the cabinet are not shown. Various electrical lines, hydraulic lines, miscellaneous plumbing, etc., are also omitted from FIGS. 1 and 2.

Arranged within the cabinet is a compressor **12,** an electric motor **14** for driving the compressor, a water ring vacuum pump **16** and a compressed air storage tank **18** (FIG. 2). These individual components are in themselves well known in the art, so that the construction and operation of the individual components per se is not part of the present invention and will not be described in any detail. On-off switches for the vacuum pump, compressor motor and optional air drier stage are indicated at **11** and the various pressure, vacuum gauges are indicated at **13.**

Compressor **12** is mounted on a platform **20.** The platform is in turn spaced from the sides of the cabinet and suspended by four tie rods **22** from a cross piece **24** adjacent the top of the cabinet. The tie rods provide little or no lateral support for the platform, and permit the platform to move or swing in a horizontal plane. This effectively dampens the vibration produced by the compressor, so that little or no vibration and vibration noises are transmitted through the frame of the cabinet. Springs **26** may be provided between the tie rods and platform to further dampen vibration.

Compressor drive motor **14,** as shown in the Figures, is mounted to the underside of platform **20.** Such an arrangement has several advantages. For example, the overall width of the enclosing cabinet **10** can be kept to a minimum by placing the motor below the compres-

sor as opposed to placing the motor alongside the compressor. Another advantage is that installation of the motor below the compressor to the undersurface of platform **20** lowers the center of gravity of the platform and increases its inertia. This improves the stability of the platform and reduces the start up jolts of the compressor. The motor is mounted on a slide mechanism, generally indicated at **27**, which will be described further hereinbelow.

Also mounted on platform **20** is a muffler-filter **28** and a heat exchanger **30** (FIG. **1**). Muffler **28** opens through an opening (not shown) in the platform to permit air to enter the compressor through muffler **28** and inlet line **32.** Compressed air leaves the compressor through exhaust line **34** and passes through heat exchanger **30** where the heat of compression is removed. The cooled, compressed air is then sent through line **36** to compressed air tank **18** (FIG. **2**) located in the cabinet behind the compressor.

A water line **38** feeds water from a source (not shown) to heat exchanger **30** for purposes of cooling the compressed air and a water outlet line **40** connects the water outlet of the heat exchanger to the water inlet of the water ring vacuum pump.

To describe slide **27** in further detail, FIG. **1** shows that the underside of platform **20** is provided with a pair of ways **42** which are inclined with respect to the plane of the platform. Through each way is an elongated groove **44.** Motor mounting bolts **46** pass through these grooves to attach the motor and its support plate **48** to ways **42.** Ways **42** and grooves **44** are aligned generally normal to the axis of the drive motor and the axis of the compressor flywheel **50.**

Threaded to an inwardly turned leg **52** of plate **48** is a draw bolt **54.** The bolt in turn passes through a clearance opening **56** on a depending leg **58** of the platform. With this arrangement, it will be appreciated that rotating draw bolt **54** in one direction or another will cause the motor support plate and motor to travel along the inclined ways **42.** This movement is used to quickly and easily adjust the tension of the compressor drive belts **60.** Having ways **42** inclined with respect to platform **20** permits a wider range of travel for a given width of the dental cabinet than would horizontally disposed ways. This increased range of travel facilitates assembly and replacement of motor **14,** as it allows the motor to be moved to an extreme position so that drive belts **60** can be slipped easily on and off the compressor flywheel and motor drive pulley.

The operation of the apparatus will be described with reference to the flow diagram of FIG. **3.** Water from the building supply (not shown) enters the apparatus through a cut-off valve **62** and a strainer **64.** From strainer **64** the water enters a secondary heat exchanger at **66** (not shown in FIGS. **1** and **2**), and then passes through line **38** to the primary heat exchanger **30,** mounted on platform **20.** From primary heat exchanger **30,** the water passes through line **40** to the water ring vacuum pump **16.** It should be noted that when the vacuum pump is not operating, a normally closed solenoid valve **66** is open to allow the water to bypass the vacuum pump and go directly to drain through line **68.**

The operation of a water ring vacuum pump is well known in the art, and it is sufficient for the purposes of the present invention merely to say that the pump is operated by a motor **70** which drives an impeller (not shown) in housing **72.** Water entering the housing through line **40** is used both as a seal and as a pumping medium.

A vacuum line **74** connects the pump to one or more dental operatories, so that any water used during the dental procedure, together with any saliva, tooth particles, filling material, air, etc., is drawn through this line and a solid collector **76** into housing **72.** An air water mixture is discharged from housing **72** to the sewer drain through line **78.** The amount of vacuum may be read on one of the gauge dials **13** on the face of the apparatus.

As set out hereinabove, air enters the compressor **12** through intake muffler-filter **28** mounted on platform **20** and the inlet line **32.** Compressed air from exhaust line **34** first passes through the primary heat exchanger **30** and then through a first portion line **36** to the secondary heat exchanger **66.** From the second heat exchanger the air which is now substantially cooled, passes through a moisture separator **82** and the remaining portion of line **36** into the air tank **18.** From the air tank, compressed air is fed through line **86** and various shut-off and regulator valves to the instruments in the operatory requiring a supply of compressed air. Any moisture which may condense in air tank **18** passes through moisture separator **82'** together with water from moisture separator **82** through a line **88** to drain.

If it is necessary to dry the air still further, an optional air drier **90** shown in dotted line may be provided in the overall construction of the apparatus. In this respect, it would be a simple matter to pass the air through line **36'** to the drier and then return the dry air through line **92** to the compressed air tank. Moisture separated from the air would go through a line **94** to drain.

Thus it should be appreciated that the present invention provides a fairly compact unit for supplying the compressed air and vacuum needs of a dental office. The apparatus is relatively quiet and vibration free, which permits the apparatus to be located, if necessary, in the dental operatory. The arrangement of the components, namely the water ring vacuum pump, compressor, drive motor and compressor in a vertical relationship one above the other makes the apparatus relatively compact, so that it requires only a minimum of floor space. Arranging the compressor on a platform suspended from the top of the cabinet substantially reduces the vibration noises produced when the compressor is running. Mounting the compressor drive motor to the underside of the platform not only conserves floor space, as set forth hereinabove, but also lowers the center of gravity and increases the inertia of the platform. This improves the stability of the platform and reduces the start up jolts of the compressor. Tying the water system of the vacuum ring pump to the heat exchanger of the air compressor eliminates the need for two plumbing systems. The inclined ways on which the compressor drive motor is mounted increases the range of adjustment of the drive motor with respect to the compressor for purposes of tightening the tension on the drive belts and for replacing compressor drive motors.

Thus it will be appreciated that the present invention accomplishes its intended objects in providing the source of both compressed air and vacuum wherein the vacuum pump, compressor, compressor motor and compressed air storage tank are all contained in a rela-

tively compact mobile unit suitable for use in dental offices.

Having thus described the invention in detail, what is claimed as new is:

1. Dental apparatus for supplying compressed air and vacuum utilities to dental operatories, said apparatus comprising:

a. an upright cabinet;

b. a water-ring vacuum pump located in the bottom portion of said cabinet;

c. a platform suspended from adjacent the top of said cabinet and spaced from the sides of said cabinet;

d. an air compressor mounted to the upper surface of said platform;

e. a compressor drive motor mounted to the underside of said platform with means connecting said motor and compressor; and

f. a heat exchanger for cooling the compressed air from said compressor, said heat exchanger having a water inlet and a water outlet for recirculating cooling water through said heat exchanger, said water outlet being connected to the water inlet of said water ring vacuum pump.

2. Dental apparatus as set forth in claim **1**, including a compressed air storage tank in said cabinet receiving the cooled compressed air from said heat exchanger.

3. Dental apparatus as set forth in claim **1** wherein said means connecting said motor and compressor is a drive belt, said motor being slidably mounted on a slide mechanism inclined with respect to the underside of said platform including means for adjusting the tension of said belt.

4. Dental apparatus as set forth in claim **1**, wherein said compressor draws air through an intake muffler mounted on said platform.

5. Dental apparatus as set forth in claim **1**, including a pair of said heat exchangers, one a primary heat exchanger mounted on said platform and the other a secondary heat exchanger, said heat exchangers being connected in series so that compressed air passes first through said primary exchanger and then through said secondary exchanger whereas cooling water flows first through said secondary exchanger and then through said primary exchanger.

6. Dental apparatus as set forth in claim **1**, including a compressed air storage tank in said cabinet connected to said compressor and air drier means in said cabinet in series between said compressor and compressed air storage tank.

7. Dental apparatus as set forth in claim **1**, wherein said platform is suspended from adjacent the top of said cabinet by tie rods which permit swinging movement of said platform horizontally in said cabinet.

8. Dental apparatus as set forth in claim **7**, including spring members between said platform and tie rods.

9. Dental apparatus for supplying compressed air and vacuum utilities to dental operatories, said apparatus comprising:

a. an upright cabinet;

b. a vacuum pump located in the bottom portion of said cabinet;

c. a platform suspended from adjacent the top of said cabinet;

d. an air compressor mounted to the upper surface of said platform; and

e. a compressor drive motor mounted to the underside of said platform including means connecting said motor and compressor.

10. Dental apparatus as set forth in claim **9**, wherein said platform is suspended from adjacent the top of said cabinet by tie rods which permit swinging movement of said platform horizontally in said cabinet.

11. Dental apparatus as set forth in claim **9** wherein said compressor and motor are connected by drive belts, said motor being slidably mounted on ways provided on the undersurface of said platform, and means between said platform and motor for moving said motor along said ways to adjust the tension of said belts.

12. Apparatus as set forth in claim **9** wherein said vacuum pump is a water-ring vacuum pump, said apparatus including:

a. heat exchanger means for cooling the compressed air from said compressor;

b. means for circulating cooling water through said heat exchanger; and

c. a water conduit extending between and connecting said heat exchanger means and water ring pump for circulating water from said heat exchanger to said water ring pump to operate the latter.

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