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SILENT AIR COMPRESSOR

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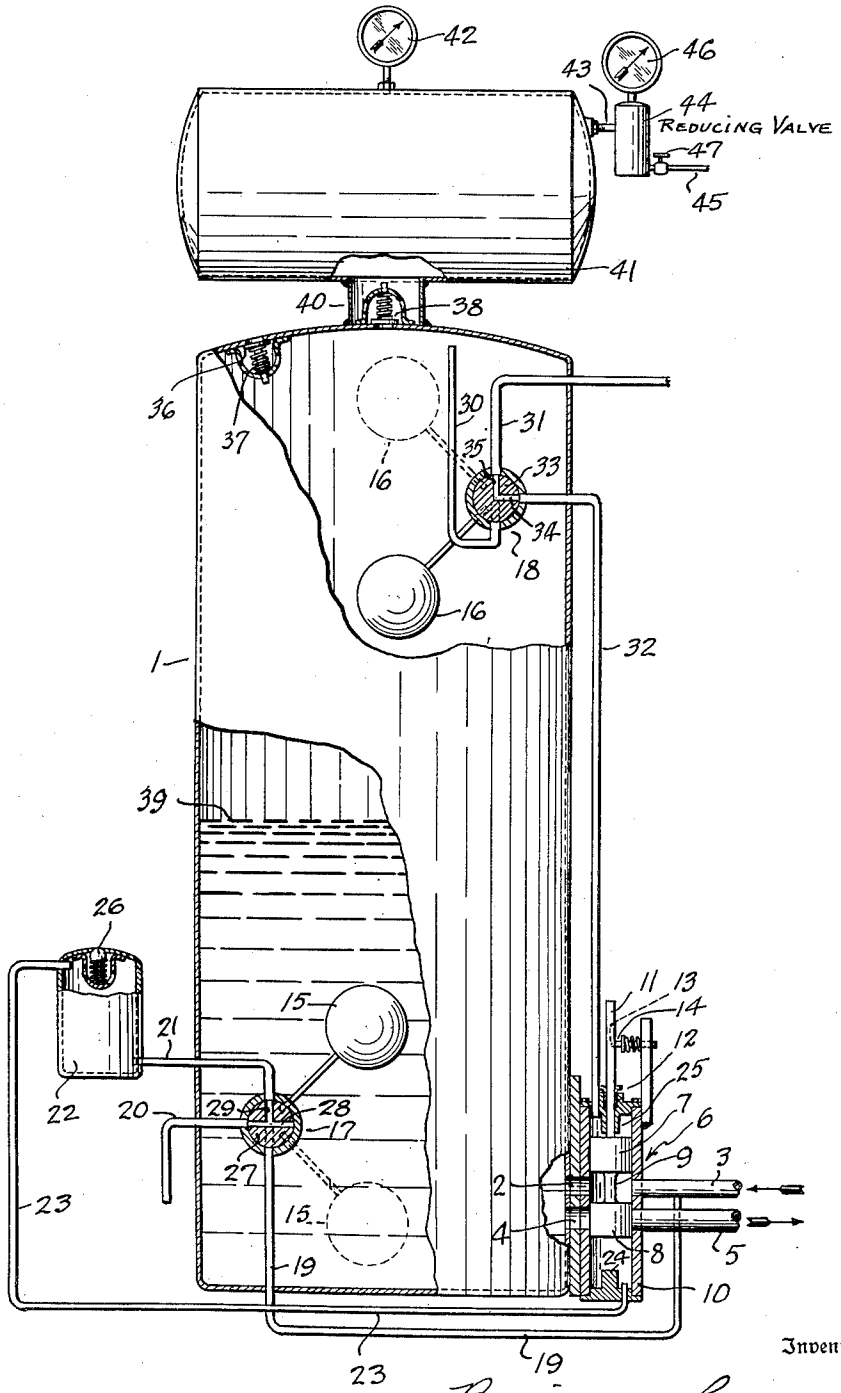

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SILENT AIR COMPRESSOR

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This invention relates to an air compressor, and has for an object to provide a simple and effective air compressor which will operate entirely automatically and will be silent in its operation.

Another object is to provide an air compressor in which the air is compressed by a rise of water level under pressure in a tank and air is supplied to the tank by action of drop of the water level in the tank, and in which both actions are automatically controlled by devices responsive to changes of water levels in the tank.

With these and other objects in view, I have devised the construction illustrated in the accompanying drawing, forming a part of this specification. It is, however, to be understood the invention is not limited to the specific details of construction and arrangement, but may embody various changes and modifications within the scope of the invention.

In this drawing, the figure is a partial side elevation and partial section of one embodiment of the invention, certain parts being shown somewhat diagrammatically.

In the embodiment shown the device comprises an upright main tank or generator 1 with a water inlet 2 connected to the lower part thereof and a water supply pipe 3 to supply water under pressure to the tank through the inlet opening 2. This may be from the usual water main in a city water supply system. Also in communication with the lower part of the tank is an outlet opening 4 communicating with an outlet pipe 5 leading to any suitable drain or discharge (not shown). This inlet and outlet are controlled by any suitable valve or other control means 6. The present valve shown comprises upper and lower spaced plungers 7 and 8 connected by a reduced connection 9 slidable in a suitable casing or cylinder 10. At its upper end a rod 11 connected to these plungers passes through a suitably packed gland 12, and has a recess 13 cooperating with a spring-pressed plunger 14 to yieldably retain the valve in its upper position, if it is found that the friction of the valve is not sufficient for this purpose.

Located at the lower and upper parts of the tank are automatic means for controlling the supply of water to the tank and discharge of water from the tank, both of these means being responsive to changes of water level in the tank. These may be any suitable water level responsive means, but a simple and effective means is a pair of floats 15 and 16 and each is connected to an operating control valve 17 and 18 respectively. Connected with the lower valve 17 is a pressure

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pipe 19 connected to the water supply pipe 3. A second connection 20 leads from this valve to any suitable discharge means, such, for example, as a drain (not shown), and a third connection 21 leads to the lower part of a pilot air storage tank 22 from the upper part of which leads a pipe connection 23 to the lower part of the valve casing or cylinder 10 under the plunger 8. It is preferred that the lower end wall of this cylinder be provided with an upward extension 24 of smaller diameter to form a stop to limit downward movement of the valve plunger and provide an air space under the lower plunger when in its lower position. A similar extension 25 depends from the upper head of the cylinder to limit upward movement of the valve. A nonreturn valve 26, such, for example, as a spring-pressed ball valve controls an air inlet opening to the top of the tank 22. The valve 17 includes a movable valve member 27 having passages 28 and 29 so arranged that when the valve is in the upper or full line position the drain connection 20 is in communication with the connection 21, as shown in full lines, and when the float is in its lower or dotted line position the connection 19 is in communication with the connection 21 while connection to pipe 20 is closed.

The float 16 in the upper part of the tank, as indicated, is connected to and controls the valve 18. From this valve there is a communication 30 close to the top of the tank, a second communication 31 to the atmosphere, and a third pipe connection 32 to the top of the valve cylinder 10 above the upper plunger 7. The float operates the movable valve member 33 which is provided with passages 34 and 35 so arranged that when the float is in its lower or full line position the pipe connection 32 is in communication with the pipe 31 to the atmosphere, and when the float is in its upper or dotted line position the pipe 32 is in communication with the pipe 30 leading to the space at the top of the tank. In the upper part of the tank is a nonreturn inlet valve 36 which is automatically closed by a spring 37 and is arranged to supply air to the tank on the drop of water level in the tank 1. A similar nonreturn spring-pressed valve 38 leads from the tank and permits air under pressure to flow from the tank on rise of water level 39 in the tank. This valve is in the pipe communication 40 to any suitable compressed air pressure storage tank 41 which may have a suitable gauge 42 to indicate the pressure therein, and an outlet pipe 43 from the tank leads to any suitable reducing valve 44, and a discharge pipe 45 leads to any suitable source

of use for the compressed air. The reducing valve may also be provided with a pressure gauge **46**, and the discharge pipe **45** may be provided with a shut-off valve **47**.

The operation of the device is as follows:

Assuming that, as is shown in the drawing, the water supply control valve **6** is in its upper position so that water is being supplied from the pipe **3** under pressure to the tank and the water level **39** is rising. As this water level rises the air in the top of the tank above the water will be compressed and will discharge through the valve **38** into the storage tank **41**. The maximum air pressure attainable is substantially the water pressure. During this operation the float **15** is in its upper position and the float **16** is in its lower position and pipe **32** is in communication with the atmosphere through the pipe **31**. When the water level reaches a position adjacent the top of the tank, it raises the float **16** and shifts the valve element **33** to cut off communication of the pipe **32** with the atmosphere through the pipe **31**, but places it in communication with the pipe **30** leading to the top of the air space in the tank. This conducts air pressure from the tank to the top of the valve control plunger **7** forcing this valve downwardly and cutting off communication of the water supply pipe **3** to the tank and opening communication through the discharge opening **4** and drain pipe **5**, permitting the water to drain from the tank. This causes the water level to drop and as it does so the top float **16** drops, cutting off the air pressure to the water control valve **6** and again placing the pipe **32** in communication with the atmosphere through the pipe **31**. The valve **6**, however, remains in its lower position as the float **15** remains in its upper position. Also as the water level drops, air is drawn into the upper part of the tank **1** through the inlet valve **36** while the discharge valve **38** automatically closes to maintain the air pressure in the storage tank **41**. As the water level reaches the lower part of the tank, the float **15** drops, as indicated in dotted lines, shifting the valve **27** to place the pipe **19** from the water supply **3** in communication with the pilot tank **22**. This permits water to flow into this tank **22**, compressing the air therein, which pressure is transmitted by the pipe **23** to the under side of the plunger **8** of the water control valve **6**. This forces the plungers **7** and **8** upwardly to the position shown in the drawing to again cut off communication from outlet **4** to the pipe **5** and opening communication from the supply pipe **3** through inlet opening **2** to the tank **1**. The water level again rises, shifting the float **15** upwardly to the full line position. This shuts off communication of the pipe **19** to the tank **22** and places the pipe **21** in communication with the drain pipe **20**. This permits the water to drain from the tank **22** and releases the air pressure on the under side of the plunger **8**, and any air which has been lost from tank **22** will be replaced through valve **26**. This water valve **7, 8** however, will not fall as it is retained in its upper position by the spring-pressed plunger **14**. The water level continues to rise to compress the air in the main tank and force it through the discharge valve **38** into the air storage tank or receiver **41**. When the air pressure in the receiver equals the water supply pressure, the inlet flow of water stops until air is drawn from the receiver or is used to cause the pressure to drop in the receiver. When the water level again reaches the upper part of the tank, it raises the float **16** to operate valve **33** to again supply air pressure to valve **6** to cut off the water supply from pipe **3** and open outlet to pipe **5**, and the cycle is repeated. It will therefore be seen that the action of the device is entirely automatic, that it operates to compress more air to force it into the receiver only when the air pressure in this receiver is lower than the water supply pressure, but that as soon as this air pressure does drop the device automatically starts to function to bring the air pressure up to the proper limit. The device can be connected to any source of supply of water under pressure and it is practically noiseless as the only noise is that caused by the flow of water through the supply and drain pipes.

Other types of water level responsive devices could be used as well as other types of means for operating the water supply and drain valve.

Having thus set forth the nature of my invention, I claim:

1. An air compressor comprising a main tank, means for supplying water under pressure to the tank and a discharge means for water from the tank, a fluid operated valve controlling said water supply and discharge means, a float in the upper part of the tank, a second float in the lower part of the tank, a valve controlled by the upper float having connections with the upper part of the tank, the atmosphere and said fluid operated valve, a fluid pressure supply, and a fluid discharge means, a valve controlled by the lower float having connections whereby it may be connected with said fluid pressure supply, a fluid discharge means and said fluid operated valve, a nonreturn valve to permit entrance of air to the tank, a nonreturn valve for discharge of air under pressure from the tank under action of water rising in the tank, said floats being controlled by water levels in the tank, said upper float operated valve having ports to place the connection with the fluid operated valve in communication with the atmosphere when the float is in its lower position and with the upper part of the tank when the float is in its upper position, and said lower float operated valve having ports to place the fluid operated valve in communication with the fluid pressure supply when this float is in its lower position and with the fluid discharge means when this float is in its upper position.

2. An air compressor comprising a main tank, means for supplying water under pressure to the tank and discharging it therefrom, a fluid operated valve means for controlling the water supply and discharge means, an air inlet valve for supplying air to the tank on drop of water level therein, a storage tank, an outlet connection from the main tank to the storage tank, an air outlet valve for said outlet connection for passage of compressed air from the main tank on rise of water level therein, a float in the lower part of the main tank, a fluid pressure supply, a valve controlled by said float to supply fluid pressure from said supply to said fluid operated valve means on drop of water level in the main tank to a given low to open the water supply and close the water discharge means and to release said pressure on rise of the water level to a given high, a float in the upper part of the main tank, and a valve controlled by said latter float to supply fluid pressure from the top of the main tank to said fluid operated valve means on rise of water level in the main tank to a given high to close the water supply and open the water dis-

charge means and to release said pressure on drop of the water level to a given low.

3. An air compressor comprising a main tank, means for supplying water under pressure to the tank and discharge means for water from the tank, a valve for controlling said water supply and discharge means, air pressure responsive means for shifting said valve to open the supply means and close the discharge means and vice versa, a nonreturn valve in the upper part of the tank communicating with the atmosphere to supply air to the tank on drop of the level of the water in the tank, a non-return valve at the upper part of the tank for discharge of air under pressure from the tank under action of water rising in the tank, means at the lower part of the tank responsive to changes of water level therein connected to the air pressure responsive means to control said latter means to shift the water supply valve to open position to supply water to the tank and close the water discharge means when the water level drops to a certain position and to release the valve when the water level rises to a given position, and means at the upper part of the tank responsive to changes of the water level connected to the air pressure responsive means to control said latter means to shift the water supply valve to closed position when the water level rises to a certain position in the tank and open the water discharge means and to release said valve when the water level drops to a given position, said means responsive to changes of water level being disconnected so as to operate independently of each other.

4. An air compressor comprising a main tank, means for supplying water under pressure to the tank and discharging it from the tank, valve means controlling said supplying and discharging means, means for operating the valve means to control the supply of water to and its discharge from the tank, means permitting entrance of air to the upper part of the tank on drop of water level therein, means for discharge of air under pressure from the tank under action of rise of water in the tank, means at the lower part of the tank responsive to changes of water level therein connected to said valve operating means to control supply of water to the tank, said valve operating means including air pressure responsive means to control the valve means for supplying water to the tank and its discharge from the tank, a conduit connecting said air pressure responsive means to the air space at the upper part of the tank, and means at the upper part of the tank responsive to changes in water level therein to control air pressure from the tank to said air responsive means and release the pressure therefrom to control discharge of water from the tank, said water level responsive means being disconnected so as to operate independently of each other.

5. An air compressor comprising a main tank, means for supplying water under pressure to the tank and discharge of water from the tank, water valve means controlling supply of water to and discharge of water from the tank, a nonreturn valve permitting entrance of air to the tank on drop of water level therein, a nonreturn valve for discharge of compressed air from the tank under action of rise of water level in the tank, a float in the lower part of the tank, operating means to shift the water valve means, a connection from the float to the valve operating means to control said latter means when the water level reaches a certain low to open the water supply and close the water discharge and to release said valve means when the water level reaches a certain high, a float in the upper part of the tank, and the water valve operating means including pressure responsive means connected to the upper part of the tank, control means for said pressure responsive means controlled by the latter float to shift the water valve means when the water level reaches a certain upper limit to close the water supply and open the water discharge and to release said valve means when the water level reaches a certain lower limit, said floats being disconnected so as to operate independently of each other.

6. An air compressor comprising a main tank, means for supplying water under pressure to the tank and discharge of water from the tank, valve means controlling supply of water to and discharge of water from the tank, fluid pressure supply means, fluid pressure operating means for said valve means connected to the fluid pressure supply means, a nonreturn valve permitting entrance of air to the tank on drop of water level therein, a nonreturn valve for discharge of compressed air from the tank under action of rise of water level in the tank, a float in the lower part of the tank, a valve controlled by said float to supply fluid pressure from the fluid pressure supply means to said fluid pressure operating means on drop of the water level in the tank to a certain low to shift the water control valve means to open the water supply to the tank and close the water discharge therefrom and to release said pressure on rise of the water level to a certain high, a float in the upper part of the tank, a connection from the upper part of the tank to said fluid pressure operating means, and a valve in said connection controlled by said latter float to supply fluid pressure from the upper part of the tank to said fluid pressure operating means on rise of the water level to a certain high to shift the water control valve means to close the water supply to the tank and open the water discharge therefrom and to release said pressure on drop of the water level to a certain low.

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