

Nov. 30, 1948.

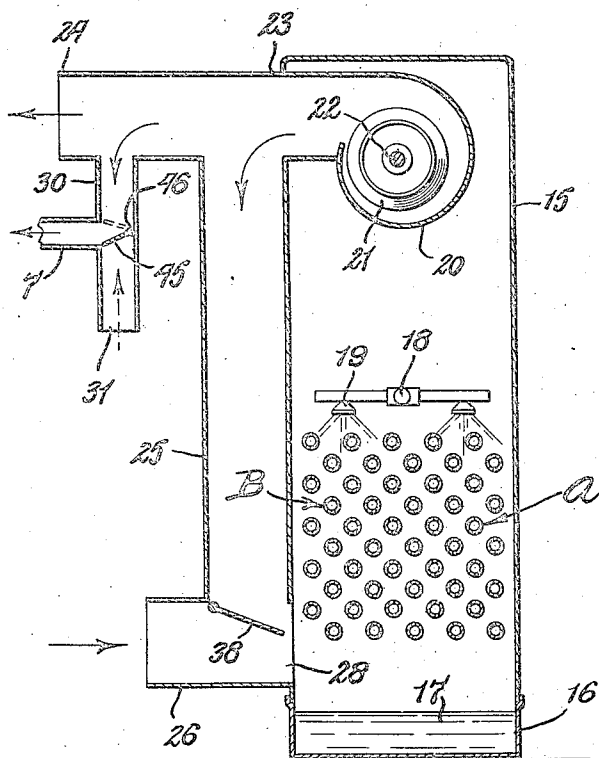
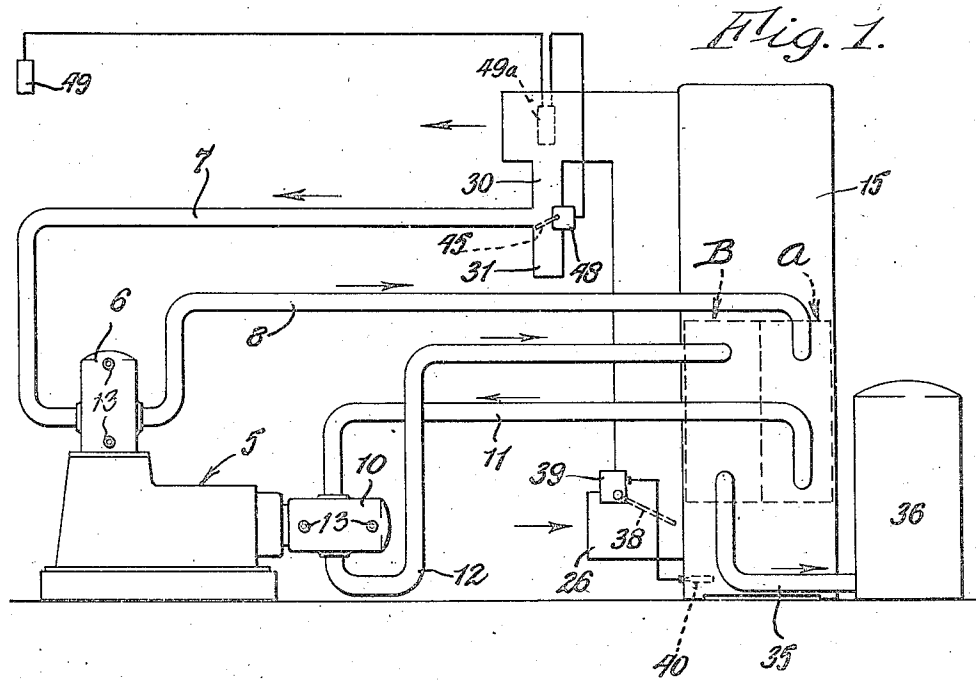
M. H. OLSTAD ET AL

2,454,883

APPARATUS FOR COOLING COMPRESSED GASES

Filed Dec. 22, 1943

2 Sheets-Sheet 1



INVENTORS
Martin H. Olstad and
 BY *Allan E. Williams*
Pope and Pope
 ATTORNEYS

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2 Sheets-Sheet 2

Fig. 3.

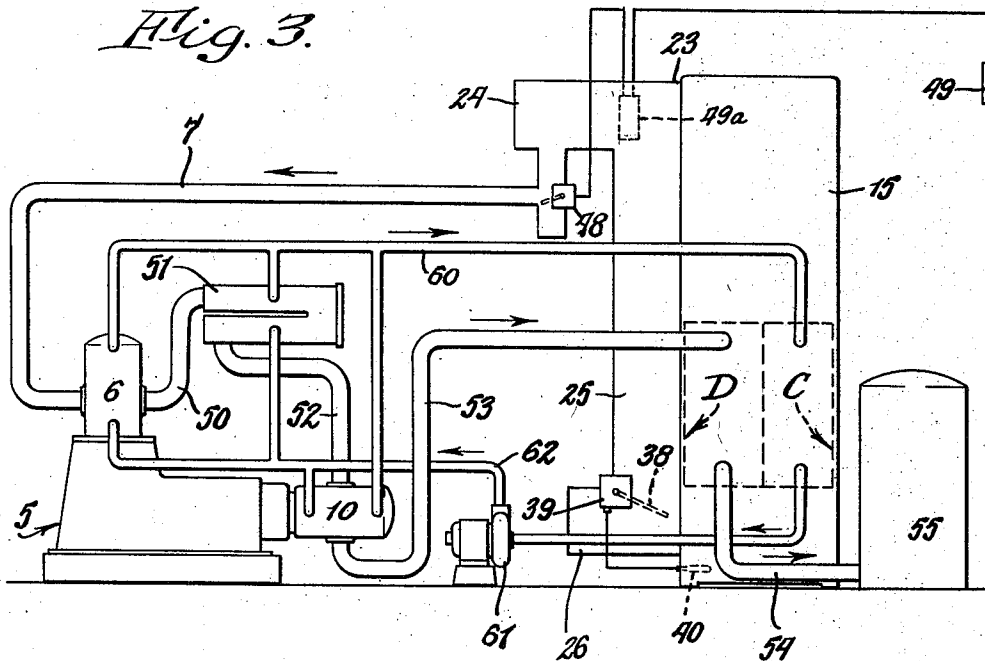
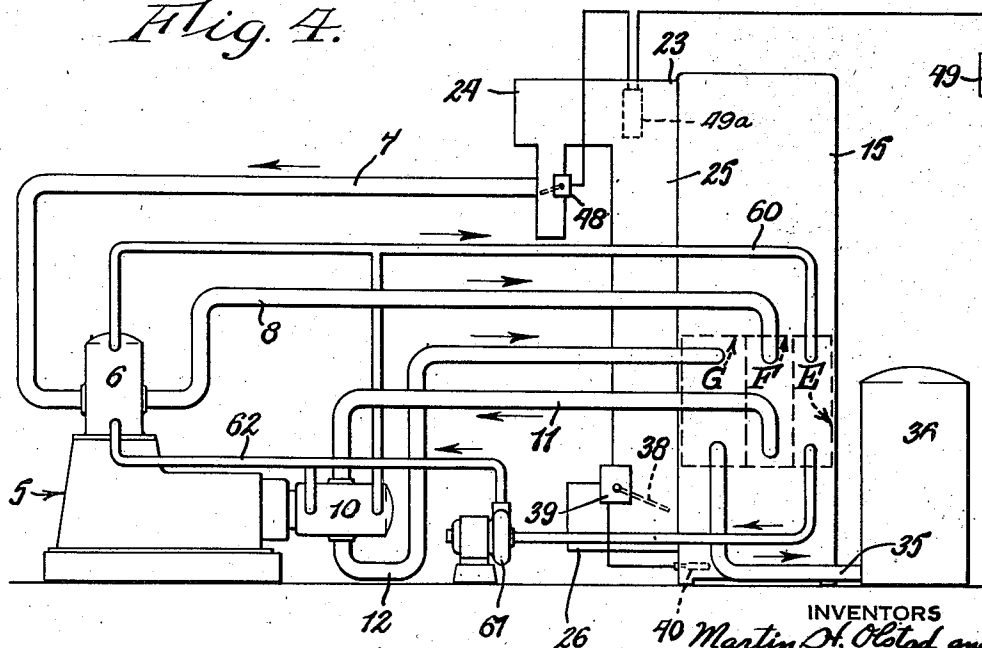


Fig. 4.



INVENTORS
Martin H. Olstad and
BY Allan E. Williams
Popp and Popp
ATTORNEYS

UNITED STATES PATENT OFFICE

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APPARATUS FOR COOLING COMPRESSED GASES

Martin H. Olstad, Port Washington, and Allan E. Williams, White Plains, N. Y., assignors to Niagara Blower Company, Buffalo, N. Y., a corporation of New York

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16 Claims. (Cl. 62—2)

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This invention relates to a heat exchanger for cooling compressed gases and more particularly to the use of an evaporative type of heat exchanger to effect the cooling of compressed air, or other gas having a component which liquefies on cooling the compressed gas, and to provide compressed air having a reduced moisture content, the practice of the invention being particularly advantageous when air is being compressed for use in driving equipment having rotating parts or for use in paint spraying, metallic shot blast equipment, or where freezing conditions are encountered where the presence of water is especially harmful.

When gases are compressed heat is developed which is removed by supplying cooling water to the jackets surrounding the compressor or surrounding an intercooler or an aftercooler through which the compressed gas is passed between and following, respectively, the several compression stages. As now practiced, surface water taken from nearby lakes and streams is used for this purpose since surface water is a readily available source of cooling medium.

However, in most localities of the United States, during the warm months when cooling is particularly needed, the temperature of this surface water exceeds the average wet bulb temperature by ten or more degrees. When this surface water is passed through a shell and tube cooler to cool the cooling water being recirculated through the jacket of the compressor and its inter or aftercoolers, this cooling water can be cooled to approximately 10° F. of the surface water. In accordance with the present invention it has been found that by subjecting this cooling water of the compressor in a closed circuit to evaporative cooling, this cooling water can be cooled to less than 10° F. of the wet bulb temperature of the outside air. Since the wet bulb temperature is 10° F. lower than the temperature of the surface water available, it will be seen that the cooling water cooled by evaporative cooling in accordance with the present invention is much colder than cooling water cooled by surface water as now practiced. Consequently the cooling water supplied in accordance with the present invention is much colder than when cooled by the surface water available and the compressed air is cooled to a lower temperature and as the compressed air leaves the aftercooler at its dewpoint it will be seen that compressed air cooled in accordance with the present invention contains much less water than

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compressed air cooled conventionally with surface water.

It has further been found that in the practice of the invention the compressed gas can be passed directly through the coil which is externally subjected to the evaporative cooling effect of streams of air and water. By so cooling the compressed gases directly, the gases can be cooled closer to the wet bulb temperature of the outside air than by indirect cooling as by water which is cooled and then used to cool the gases. Accordingly, an important feature of the invention resides in the direct cooling of compressed gases by evaporative cooling.

By actual test cooling compressed air by evaporative cooling in a closed circuit in accordance with the present invention provides a leaving temperature of the compressed air which is from 10° to 25° F. cooler than can be obtained by the use of surface water during the warm months when cooling is needed and provides compressed air that contains from one-half to three-fourths the amount of water formerly experienced with the best practice using surface water. The reduction of the water content of the compressed air or other gases by the practice of the present invention is a particularly important feature as the use of drier air prevents water damage to pneumatic equipment operated by the compressed air. Thus, particularly with pneumatic equipment or tools containing rotating parts, water in the compressed air supplied to the equipment washes out the lubricant and causes rapid wear of the rotating parts. Further, with pneumatic paint sprayers, the presence of water in the compressed air causes the paint to blister. Water in the compressed air also tends to freeze on release from pneumatic tools thereby freezing up the pneumatic tool and halting production. The moisture of compressed air also rusts metallic shot in blast cleaning equipment. With many gases, a low water content is desirable, as in illuminating gas where the water content must be held to a maximum fixed by the authorities and which has reduced heating value and is liable to freeze in ports when the water content is too high and also in many chemical industries, as with butane gas in the manufacture of synthetic rubber, where low water content is important. In short, the moisture in compressed air or other gases is highly detrimental and cooling the compressed air to reduce its water content is highly desirable.

Accordingly, it is one of the principal objects of the present invention to provide a heat exchanger for cooling compressed gas where the gas is cooled

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to a lower temperature and contains a substantially reduced amount of water as compared with surface water cooling equipment.

Another object of the invention is to provide a heat exchanger for cooling compressed gases wherein the evaporative cooling of the compressed gases is effected directly, instead of indirectly as through water which is cooled and then used to cool the gases, this permitting of cooling the gases closer to the wet bulb temperature of the outside air.

Another important object of the present invention is to provide a simple and efficient apparatus for cooling a plurality of streams of the cooling water or the compressed gases from a compressor and in which the cooling effect is obtained from the evaporation of water in a stream of atmospheric air, thereby to greatly reduce the amount of cooling water necessary for the operation of the apparatus.

Another object of the invention is to provide such apparatus in which the several streams of the cooling water or the compressed gas from any stage of the compressor is cooled in the same spray chamber, thereby to provide a single unit for cooling all of the streams.

Another object of the invention is to provide an apparatus for feeding the washed air discharged from the spray chamber into the air inlet of an air compressor when the temperature of this air is below the temperature of the outside air, thereby to increase the efficiency of the compressor since it is supplied with cooler and heavier air, and also washing the air supplied to the compressor and maintaining a more constant condition of the air supplied to the compressor.

Other objects are to provide such apparatus which is simple and inexpensive in construction and which will stand up under conditions of severe and constant use without getting out of order or requiring repairs.

In the accompanying drawings:

Fig. 1 is a diagrammatic representation of a two stage air compressor in which the air from both stages is cooled in an evaporative type heat exchanger embodying the invention.

Fig. 2 is a vertical central section through the evaporative type of heat exchanger shown in Fig. 1.

Fig. 3 is a view similar to Fig. 1 showing a two stage air compressor in which both the cooling water and also the compressed air is cooled in an evaporative type heat exchanger embodying the present invention.

Fig. 4 is a further modification of the invention in which air from both stages of a two stage air compressor and also the cooling water are cooled in an evaporative heat exchanger embodying the present invention.

While the invention is illustrated as used in connection with air compressors, it will be understood that features of the invention can also be applied to any type of gas compressor where cooling of the compressed gas is advantageous, as previously indicated, particularly where the gas has a component which liquefies on cooling the compressed gas.

In the form of the invention shown in Figs. 1 and 2 the numeral 5 represents an air compressor having a low pressure cylinder 6 which is supplied with air from a duct 7 and the air from which leaves through a duct 8. The compressor is also shown as having a high pressure cylinder 10, the air to which is supplied from a duct 11 and the compressed air from which passes

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through a duct 12. Each cylinder 6, 10 is suitably jacketed and a stream of cooling water is circulated through these jackets through jacket water connections 13. Both the high and low pressure stages of air are cooled in an evaporative type of cooler embodying the present invention, this being shown as comprising a sheet metal casing 15 which is mounted on a tank 16 forming the base of the casing, this tank 16 containing a body of water 17 which is evaporated to provide the cooling effect. The water 17 is pumped in any suitable manner to piping 18 arranged in the upper part of the spray chamber, this piping carrying a series of nozzles 19 through which the water is discharged over two banks of coils A and B which are in the form of separate coils and can be of any suitable construction. A fan housing 20 is shown as mounted in the upper part of the casing 15, the inlets of this fan housing being in communication with the interior of the casing 15 so as to exhaust air therefrom. A fan wheel 21 is shown as arranged within the fan housing 20 and as fast to a fan shaft 22 which can be journaled on the casing 15 and driven in any suitable manner. The fan housing is shown as provided with a horizontal outlet 23 which communicates with an exhaust duct 24. The outlet 23 of the fan housing 20 also communicates with a vertical bypass duct 25, the lower end of which connects with a horizontal air inlet duct 26 which communicates with the interior of the casing 15 below the coils A and B, as indicated at 28.

The discharge 23 of the fan housing is also shown as communicating with a vertical duct 30, the lower end 31 of which is open to the atmosphere and this duct 30 also connecting with the duct 7 to the air compressor so as to supply the air thereto.

In the form of the invention shown in Fig. 1, the ducts 8 and 11 connect with the bank of cooling coils A so that the first stage of air from the low pressure cylinder 6 of the air compressor is passed through the bank of coils A and returned to the high pressure cylinder 10. The duct 12 from the high pressure cylinder 10 connects with the bank of coils B within the casing 15 so that the second stage of air is passed through the bank of coils B, this air passing out of this bank of coils B through a duct 35 and into a compressed air storage tank 36 in which the water or other component which liquefies on cooling collects.

Means are provided for delivering different proportions of outside air from the fresh air duct 26 and recirculated or return air from the recirculation air duct 25 into the bottom of the casing 15. For this purpose a damper 38 is shown as arranged in the fresh air duct 26 in position to close the opening from the recirculation air duct 25. This recirculation air damper 38, when moved away from the opening at the lower end of the bypass duct 25, is also moved to restrict the amount of fresh air admitted through the fresh air duct 26, thereby to regulate the proportion of fresh and recirculated air supplied through the opening 28 into the bottom of the spray chamber within the casing 15.

The mixing damper 38 is shown as being operated by an air motor 39 under control of a thermostat 40 which is shown as immersed in the body of water 17 at the bottom of the spray chamber. The setting of the thermostat is such that when the temperature of the spray water comprising the body of water 17 in which the thermostat 40 is immersed rises above a predetermined temperature, the thermostat 40 actuates the damper

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motor 39 to move the damper 38 upwardly toward the recirculation air duct 25 thereby to decrease the proportion of recirculated air admitted to the lower end of the spray chamber and increase the proportion of fresh air admitted to the spray chamber.

Arranged in the duct 30 is a second damper 45 which is mounted on a damper shaft 46 and so located that it can open the air supply duct 7 to the compressor either to the fresh air supplied from the lower end of the duct 30 or the washed air supplied from the upper end thereof. The position of this damper is determined by a damper motor 48 which is under control of a master thermostat 49 and a sub-thermostat 49a. The master thermostat is shown as being responsive to the outside air temperature and the sub-thermostat 49a as being responsive to the temperature of the air delivered from the spray chamber and these thermostats are interconnected and actuate the damper motor 48 so that when the outside air temperature is below the temperature of the air discharged through the exhaust duct 24, the damper 45 is held in the dotted line position shown in Fig. 2 so that outside air is supplied to the compressor 5. When, however, the outside air temperature rises above the temperature of the air being discharged through the discharge duct 24, the thermostats 49 and 49a move the damper 45 to the full line position shown in Fig. 2 so that the cooler and washed air from the exhaust duct 24 is supplied to the air compressor instead of fresh air.

In the operation of the form of the invention shown in Figs. 1 and 2 air for the low pressure cylinder 6 of the air compressor is supplied from the duct 7 and thence through the duct 8 into the cooling coil A arranged within the casing 15 of the evaporative heat exchanger. From this cooling coil the first stage of compressed air passes through the duct 11 into the high pressure cylinder 10 of the air compressor and thence through the second stage air duct 12 into the cooling coil B. After passing through the tubes of the cooling coil B the compressed air passes through a duct 35 to a compressed air tank 36. To provide for the evaporative cooling of the two stages of compressed air so flowing through the banks of coils A and B within the casing 15, the body of spray water 17 in the bottom of the casing is recirculated through the overhead piping 18 and nozzles 19 so as to wash the tubes of the cooling coils A and B and maintain them in a moist condition. At the same time a stream of air is drawn over the tubes of the banks of cooling coils A and B so as to effect evaporation of the spray water, this air being drawn from the fresh air inlet duct 26 through the opening 28 into the bottom of the casing 15 and thence upwardly around the tubes of both banks of cooling coils A and B by a fan wheel 21 arranged within the fan housing 20.

The discharge 23 of the fan housing 20 connects with an exhaust duct 24 and also with a recirculation air duct 25 which is connected with the fresh air inlet duct 26 under control of a damper 38. This damper 38 is actuated by the damper motor 39 which in turn is under control of a thermostat 40 shown as immersed in the spray water 17. When the temperature of the spray water drops below the setting of the thermostat 40, the thermostat 40 actuates the damper 38 downwardly thereby to restrict the flow of fresh air into the casing 15 and to increase the proportion of recirculated air from the recirculation air duct

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25 admitted to the bottom of the casing. Since the recirculated air from the duct 25 has been humidified on passing the sprays 19 and washed tubes of the banks of cooling coils A and B, increasing the proportion of recirculated air admitted to the bottom of the casing serves to reduce evaporation within the casing 15 and thereby serves to reduce the cooling effect upon the streams of compressed air passing through the tubes of the cooling coils A and B. Under increased load conditions, the temperature of the spray water 17 will rise and the thermostat 40 actuates the damper motor to lift the damper 38, thereby to decrease the proportion of recirculated air and increase the proportion of fresh air admitted to the bottom of the casing 15, thereby to increase the cooling effect of the apparatus and reduce the temperature of the spray water to the setting of the thermostat 40.

The discharge of the fan housing 20 also connects with the vertical duct 30, the lower end of which is open to the atmosphere and the central part of which communicates with the duct 7 supplying air to the compressor. When the temperature of the outside air is higher than the temperature of the air discharged through the exhaust duct 24, the master and sub-thermostats 49 and 49a actuate the damper motor 48 to move the damper 45 to the full line position shown in Fig. 2. In this position the air which is supplied to the compressor 5 is the washed air which has passed through the casing 15 and since this air is cooler than the outside air the efficiency of the compressor is increased because the air from the spray chamber of the evaporative cooler is cooler and heavier than the outside air. When, however, the conditions are reversed and the outside air is cooler than the air discharged from the spray chamber by the fan 21, the damper is moved by the thermostats 49 and 49a to the dotted line position shown in Fig. 2 so that the cooler fresh air is supplied to the compressor.

In the form of the invention shown in Fig. 3 the evaporative cooler is identical to that shown in Fig. 1 and hence the same reference numerals have been applied. However, the two banks of cooling coils are used for cooling the cooling water and air, respectively, and hence have been designated as C and D.

The low pressure cylinder 6 of the compressor 5 is shown as supplied with air through a duct 7 in the same manner as in the form of the invention shown in Fig. 1, but the outlet air duct 50 from the low pressure cylinder is shown as passing through an intercooler 51 and thence through a duct 52 to the high pressure cylinder 10 of the compressor. From the high pressure cylinder 10 the air passes through a duct 53 into the coil D within the casing 15 of the evaporative heat exchanger and after passing through this coil D the air passes through a duct 54 into a compressed air tank 55 in which the water or other component which liquifies on cooling collects. The cooling water from the low pressure cylinder 6, intercooler 51 and high pressure cylinder 10 passes out through a line 60 into the cooling coil C within the casing 15 and thence is returned by a pump 61 through a line 62 having branches connecting with the jackets of the low pressure cylinder 6, intercooler 51 and high pressure cylinder 10 so that the cooling water is constantly recirculated through these jackets and through the cooling coil C.

It will be seen that in the form of the invention shown in Fig. 3 the cooling water is passed

through the cooling coil C and the compressed air is passed through the cooling coil D. Since both of these coils are sprayed with water and also arranged in the stream of air drawn through the casing 15, it will be seen that both the cooling water and also the compressed air are cooled in the evaporative heat exchanger in the same manner as with the two stages of compressed air in the form of the invention shown in Figs. 1 and 2.

In the form of the invention shown in Fig. 4, three banks of coils E, F and G are arranged in the casing 15 of the evaporative cooler, the construction of this evaporative cooler being otherwise identical to the form of the invention shown in Figs. 1 and 2 and hence the same reference numerals having been applied. In the form of the invention shown in Fig. 4, air is supplied to the low pressure cylinder 6 from a duct 7 as in the form of the invention shown in Figs. 1 and 2 and this air thence passes through the duct 8 to the cooling coil F in the same manner as in the form of the invention shown in Figs. 1 and 2. Also, as with the form of the invention shown in Figs. 1 and 2, the air from the cooling coil F passes through a duct 11 to the high pressure cylinder 10 and thence through a duct 12 into the cooling coil G from which it passes through the duct 35 into a compressed air tank 36 in the same manner as shown in Figs. 1 and 2. Cooling water from the cylinders 6 and 10 is withdrawn through a line 60 in the same manner as in Fig. 3 and is drawn through the cooling coil E by a pump 61 and returned to the jackets of the cylinders 6 and 10 through a line 62 in the same manner as shown in Fig. 3. It will be seen that the form of the invention shown in Fig. 4 represents a combination of the forms of the invention shown in Figs. 1-3 and that both stages of air from the compressor and also the cooling water of the compressor are separately cooled in the three banks of coils E, F and G provided in the casing 15 of the evaporative cooler.

All forms of the invention can be used in most sections of the United States during the summer months to cool the compressed air or gases to a lower temperature and having a much lower water content than compressed air or gases cooled by surface water by the best practice. Thus, in most localities of the United States, during the warm weather when cooling is particularly needed, the temperature of the surface water exceeds the average wet bulb temperature by ten or more degrees. With this condition and with the ability of cooling the compressed gas or cooling water to within better than 10° F. of this wet bulb temperature with the apparatus forming the subject of this invention as compared with cooling the cooling water to 10° F. of the temperature of the surface water by shell and tube coolers, it will be seen that by the practice of the present invention the air or gas from the compressor can be cooled to a much lower temperature. This is especially true in the forms of the invention where the compressed gas is cooled directly by passing it through closed coils in the spray chamber and where the compressed gas can be brought closer to the wet bulb temperature of the outside air. By cooling to a lower temperature, a greater amount of water is condensed out of the compressed air or gas and consequently the water content of the compressed air or gas is greatly reduced by the practice of the present invention. This reduction in the amount of water present in the compressed

air or gas is especially important where the compressed air or gas is used for operating equipment having rotating parts and where the water washes out the lubricant of the equipment and subjects the parts to rapid wear. On release the compressed gas also approaches a freezing temperature and the water in the compressed gas tends to freeze and thereby halt production until thawed. In spray painting water is especially damaging in that it causes blistering of the paint. In blast cleaning equipment where metallic shot is used, the water in the compressed air rusts the shot. In many compressed gases, such as illuminating gas and other gases used in the chemical industries, a high water content is also disadvantageous. By "non-condensable" gases as used in the appended claims is meant those gases, such as air, illuminating gas, or butane, which do not liquify under any normal or usual conditions encountered in the commercial processing or handling of such gases.

From the foregoing it will be seen that by cooling compressed air or gas in accordance with the present invention, the air or gas is cooled to a temperature of from 10° to 25° F. lower than that which can be obtained by the best practice with surface water cooling and the air or gas also contains only one-half to three-quarters the amount of water. The reduction of the water content is especially important where the compressed air or gas is used to drive equipment having rotating parts, where freezing is likely to occur, or where the compressed air is used in a paint sprayer or in blast cleaning equipment using metallic shot or where high water content of the gas is otherwise undesirable.

Further, the present invention provides a single evaporative type of heat exchanger for cooling a plurality of streams of the cooling water or compressed gases from a compressor in the same stream of air and by the same sprays of water. By this means the separate cooling of the several streams can be effected in a very compact unit and with a minimum of control instruments. It will also be seen that the evaporative cooler maintains the temperature of the cooling water and gases within very close limits.

We claim as our invention:

1. In combination with a compressor having means for compressing a stream of noncondensable gas having a component which liquifies on cooling the compressed gas and a jacket through which a stream of cooling water is circulated, means forming a chamber having an air inlet and an air outlet, a fan arranged to force a current of air from said inlet, through said chamber and out through said outlet, a cooling coil arranged in the current of air passing through said chamber, means for discharging and distributing water over said cooling coil to wet the exterior of said cooling coil and to evaporate and absorb heat therefrom, means for conducting said stream of non-condensable gas through said cooling coil to cool said gas and liquify said component, and means for collecting said liquified component.

2. In combination with a compressor having means for compressing a stream of gas and a jacket through which a stream of cooling water is circulated, means forming a chamber having an air inlet and an air outlet, a fan arranged to force a current of air from said inlet, through said chamber and out through said outlet, a cooling coil arranged in the current of air passing through said chamber, means for discharging and distributing water over said cooling coil to wet

the exterior of said cooling coil and to evaporate and absorb heat therefrom, and means for continuously conducting said stream of cooling water through said cooling coil.

3. In combination with a compressor having means for compressing a stream of non-condensable gas having a component which liquefies on cooling the compressed gas, means forming a chamber having an air inlet and an air outlet, a fan arranged to force a current of air from said inlet, through said chamber and out through said outlet, a cooling coil arranged in the current of air passing through said chamber, means for discharging and distributing water over said cooling coil to wet the exterior of said cooling coil and to evaporate and absorb heat therefrom, means for conducting said stream of non-condensable gas, after compression, through said cooling coil to liquify said component, and means for collecting said liquified component.

4. In combination with a compressor having means for compressing a plurality of streams of gas and a jacket through which a stream of a cooling fluid is circulated, means forming a chamber having an air inlet and an air outlet, a fan arranged to force a current of air from said inlet, through said chamber and out through said outlet, a pair of independent cooling coils arranged in the current of air passing through said chamber, means for discharging and distributing water over said pair of cooling coils to wet the exterior of said cooling coils and to evaporate and absorb heat therefrom, means for continuously conducting one of said streams through one of said pair of cooling coils, and means for continuously conducting another of said streams through the other of said pair of cooling coils.

5. In combination with a compressor having means for compressing a plurality of streams of gas having a component which liquefies on cooling the compressed gas and a jacket through which a stream of a cooling fluid is circulated, means forming a chamber having an air inlet and an air outlet, a fan arranged to force a current of air from said inlet, through said chamber and out through said outlet, a pair of independent cooling coils arranged in the current of air passing through said chamber, means for discharging and distributing water over said pair of cooling coils to wet the exterior of said cooling coils and to evaporate and absorb heat therefrom, means for collecting the spent discharged water in said casing for recirculation through said discharging and distributing means, means for continuously conducting one of said streams through one of said pair of cooling coils, means for continuously conducting another of said streams through the other of said pair of cooling coils and means for collecting said liquefied component.

6. In combination with a compressor having means for compressing a stream of gas and a jacket through which a stream of a cooling fluid is circulated, means forming a chamber having an air inlet and an air outlet, a fan arranged to force a stream of air from said inlet, through said chamber and out through said outlet, a cooling coil arranged in the stream of air passing through said chamber, means for discharging and distributing a stream of water over said cooling coil to wet the exterior of said cooling coil and to evaporate and absorb heat therefrom, means for continuously conducting one of the said streams from said compressor through said cooling coil, said streams of air and water normally being heated through heat derived from

the said stream from said compressor passing through said cooling coil, means for conducting outside air to said air inlet, a recirculation air duct conducting a part of the stream of air leaving said chamber back to said air inlet, and means for adjusting the relative amounts of outside and recirculated air admitted to said air inlet to prevent the temperature of said stream from said compressor from falling below a predetermined temperature range, comprising damper means in the currents of outside and recirculated air and movable to restrict the flow of one of said currents of air and to relieve the restriction to the flow of the other of said currents of air and vice versa, and thermostat means responsive to the temperature of one of said streams and regulating said dampers.

7. In combination with a compressor having means for compressing a plurality of streams of gas having a component which liquefies on cooling the compressed gas and a jacket through which a stream of a cooling fluid is circulated, means forming a chamber having an air inlet and an air outlet, a fan arranged to force a stream of air from said inlet, through said chamber and out through said outlet, a pair of independent cooling coils arranged in the stream of air passing through said chamber, means for discharging and distributing a stream of water over said pair of cooling coils to wet the exterior of said cooling coils and to evaporate and absorb heat therefrom, means for continuously conducting one of the said streams from said compressor through one of said pair of cooling coils, means for continuously conducting another of said streams from said compressor through the other of said pair of cooling coils, said streams of air and water normally being heated through heat derived from the said streams from said compressor passing through said pair of cooling coils, means for conducting outside air to said air inlet, recirculation air means for conducting a part of the stream of air leaving said chamber back to said air inlet, thermostat means responsive to the temperature of one of said streams to adjust the amount of air so conducted back by said recirculation air means to prevent the temperature of said streams from said compressor from falling below a predetermined temperature range and means for collecting said liquefied component.

8. In combination with a compressor having means for compressing a gas to provide a stream of compressed gas and a jacket through which a stream of cooling fluid is circulated, means forming a chamber having an air inlet and an air outlet, a fan arranged to force a current of air from said inlet, through said chamber and out through said outlet, a pair of independent cooling coils arranged in the current of air passing through said chamber, means for discharging and distributing water over said pair of cooling coils to wet the exterior of said cooling coils and to evaporate and absorb heat therefrom, means for continuously conducting said stream of compressed gas through one of said pair of cooling coils, and means for continuously conducting said stream of cooling fluid through the other of said pair of cooling coils.

9. In combination with a compressor having means for compressing a gas to provide a stream of compressed gas and a jacket through which a stream of cooling fluid is circulated, means forming a chamber having an air inlet and an air outlet, a fan arranged to force a current of air from said inlet, through said chamber and out

through said outlet, a pair of independent cooling coils arranged in the current of air passing through said chamber, means for discharging and distributing water over said pair of cooling coils to wet the exterior of said cooling coils and to evaporate and absorb heat therefrom, means for collecting the spent discharged water in said casing for recirculation through said discharging and distributing means, means for continuously conducting said stream of compressed gas through one of said pair of cooling coils, and means for continuously conducting said stream of cooling fluid through the other of said pair of cooling coils.

10. In combination with a compressor having means for compressing gas to provide a stream of compressed gas and a jacket through which a stream of cooling fluid is circulated, means forming a chamber having an air inlet and an air outlet, a fan arranged to force a stream of air from said inlet, through said chamber and out through said outlet, a pair of independent cooling coils arranged in the stream of air passing through said chamber, means for discharging and distributing a stream of water over said pair of cooling coils to wet the exterior of said cooling coils and to evaporate and absorb heat therefrom, means for continuously conducting said stream of compressed gas through one of said pair of cooling coils, means for continuously conducting said stream of cooling fluid through the other of said pair of cooling coils, said streams of air and water normally being heated through heat derived from the streams of compressed gas and cooling fluid from said compressor passing through said coils, means for conducting outside air to said air inlet, recirculation air means for conducting a part of the stream of air leaving said chamber back to said air inlet, and thermostat means responsive to the temperature of one of said streams to adjust the amount of air so conducted back by said recirculation air means to prevent the temperature of said streams of compressed gas and cooling fluid from said compressor from falling below a predetermined temperature range.

11. In combination with a two stage compressor having means for compressing gas to provide a stream of low pressure gas and a stream of high pressure gas, means forming a chamber having an air inlet and an air outlet, a fan arranged to force a stream of air from said inlet, through said chamber and out through said outlet, a pair of independent cooling coils arranged in the current of air passing through said chamber, means for discharging and distributing water over said pair of cooling coils to wet the exterior of said cooling coils and to evaporate and absorb heat therefrom, means for continuously conducting said stream of low pressure gas through one of said pair of cooling coils and thence back to said compressor, and means for continuously conducting the stream of high pressure gas through the other of said pair of cooling coils.

12. In combination with a two stage compressor having means for compressing gas to provide a stream of low pressure gas and a stream of high pressure gas, means forming a chamber having an air inlet and an air outlet, a fan arranged to force a stream of air from said inlet, through said chamber and out through said outlet, a pair of independent cooling coils arranged in the current of air passing through said chamber, means for discharging and distributing water over said pair of cooling coils to wet the exterior of said cooling coils and to evaporate and absorb heat therefrom,

means for collecting the spent discharged water in said casing for recirculation through said discharging and distributing means, means for continuously conducting said stream of low pressure gas through one of said pair of cooling coils and thence back to said compressor, and means for continuously conducting the stream of high pressure gas through the other of said pair of cooling coils.

13. In combination with a two stage compressor having means for compressing gas to provide a stream of low pressure gas and a stream of high pressure gas, means forming a chamber having an air inlet and an air outlet, a fan arranged to force a stream of air from said inlet, through said chamber and out through said outlet, a pair of independent cooling coils arranged in the stream of air passing through said chamber, means for discharging and distributing a stream of water over said pair of cooling coils to wet the exterior of said cooling coils and to evaporate and absorb heat therefrom, means for continuously conducting said stream of low pressure gas through one of said pair of cooling coils and thence back to said compressor, means for continuously conducting the stream of high pressure gas through the other of said pair of cooling coils, said streams of air and water normally being heated through heat derived from the streams of gas from said compressor passing through said coils, means for conducting outside air to said air inlet, recirculation air means for conducting a part of the stream of air leaving said chamber back to said air inlet, and thermostat means responsive to the temperature of one of said streams to adjust the amount of air so conducted back by said recirculation air means to prevent the temperature of said streams of compressed gas from falling below a predetermined temperature range.

14. In combination with a two stage compressor having means for compressing gas to provide a stream of low pressure gas and a stream of high pressure gas and a jacket through which a stream of cooling fluid is circulated, means forming a chamber having an air inlet and an air outlet, a fan arranged to force a stream of air from said inlet, through said chamber and out through said outlet, three independent coils arranged in the current of air passing through said chamber, means for discharging and distributing water over all of said cooling coils to wet the exterior of said cooling coils and to evaporate and absorb heat therefrom, means for continuously conducting said stream of low pressure gas through one of said cooling coils and thence back to said compressor, means for continuously conducting said stream of high pressure gas through another of said cooling coils, and means for continuously conducting said stream of cooling fluid through the third of said cooling coils and thence back to said compressor.

15. In combination with an air compressor having an air inlet and means for compressing a stream of air and a jacket through which a stream of cooling fluid is circulated, means forming a chamber having an air intake and an air outlet, a fan arranged to force a current of air from said air intake, through said chamber and out through said air outlet, a cooling coil arranged in the current of air passing through said chamber, means for discharging and distributing water over said cooling coil to wet the exterior of said cooling coil and to evaporate and absorb heat therefrom, means for continuously conducting one of said streams through said cooling coil, and means for conducting the air from said out-

let of said casing to said inlet of said compressor.

16. In combination with an air compressor having an air inlet and means for compressing a stream of air and a jacket through which a stream of cooling fluid is circulated, means forming a chamber having an air intake and an air outlet, a fan arranged to force a current of air from said air intake, through said chamber and out through said air outlet, a cooling coil arranged in the current of air passing through said chamber, means for discharging and distributing water over said cooling coil to wet the exterior of said cooling coil and to evaporate and absorb heat therefrom, means for continuously conducting one of said streams through said cooling coil, a passage for conducting the air from said outlet of said casing to said inlet of said compressor, a passage for conducting fresh air to said inlet of said compressor, and damper means for alternately connecting said inlet of said compressor with said passages.

MARTIN H. OLSTAD.
ALLAN E. WILLIAMS.

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