May 15, 1928. 1,669,530

H. MILLER

AIR COOLER FOR JACKETED CYLINDERS

Filed July 6, 1927

Fig. 1.

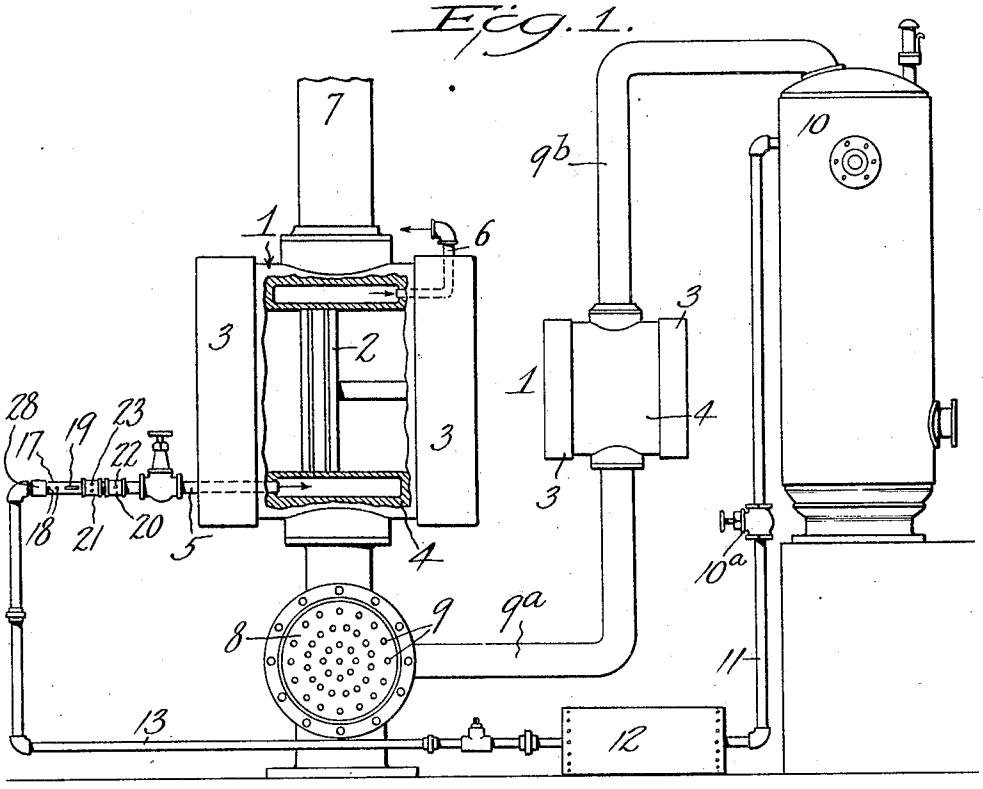


Fig. 2.

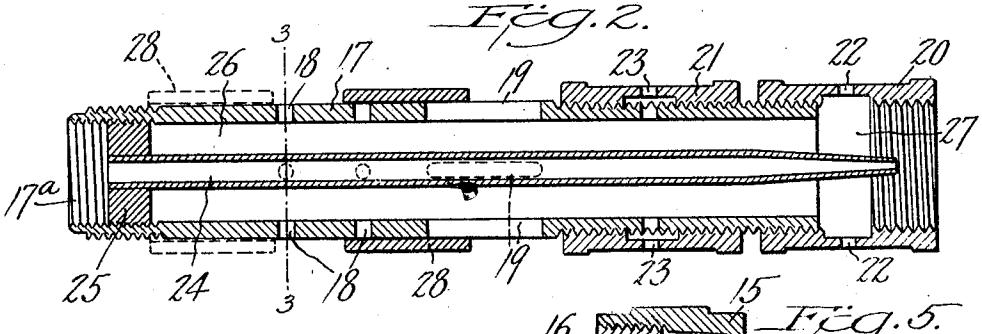


Fig. 3.

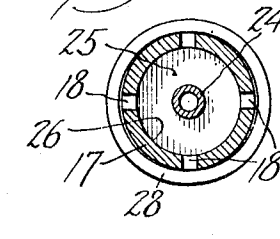


Fig. 4.

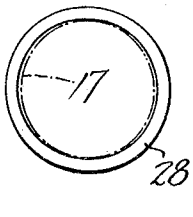
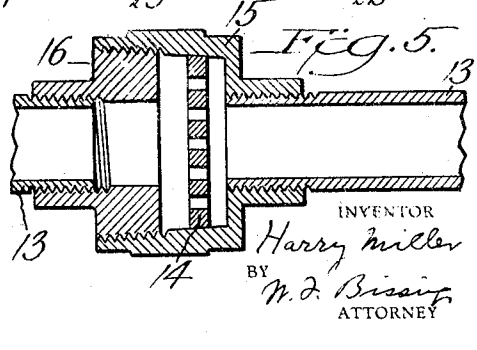


Fig. 5.



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UNITED STATES PATENT OFFICE.

HARRY MILLER, OF LITTLE NECK, NEW YORK.

AIR COOLER FOR JACKETED CYLINDERS.

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My invention relates to a method and means for air-cooling jacketed cylinders, such as the jacketed cylinders of an air compressor, and more particularly to means whereby jacketed cylinders may be cooled by a gas, preferably air, under pressure, drawing in and delivering to the cylinder jacket predetermined large quantities of free, atmospheric air to cool the cylinder.

Heretofore, the use of water circulated through the cylinder jacket to cool the cylinder necessitated the continuous supply of fresh water or the installation of cooling towers, both of large expense, to prevent the temperature of the cylinder from rising to a point where the efficiency of the apparatus would be lowered.

By my invention the use of water and the above described disadvantages are done away with.

One of the objects of my invention is to provide an independent means whereby, preferably, cooled compressed air is supplied to the cylinder jacket, and which draws in large quantities of free, atmospheric air, outside of the cylinder jacket, which atmospheric air is also cooled; the said cooled air being then supplied to the cylinder jacket where it may be circulated to cool the cylinder and then discharged.

Another object of the invention is to provide means for cooling the compressed air and for cooling the free, atmospheric air, before the air reaches the jacket of the cylinder to be cooled.

Another object of the invention is to provide means whereby the quantity of air delivered to the cylinder jacket may be regulated and controlled.

Another object of the invention is to provide a device through which compressed air is supplied and free air is drawn, and delivered to a cylinder jacket, which device is of little cost and economical in operation and which may be readily attached, removed or replaced.

With the above and other objects in view, my invention consists in the parts, improvements and combinations more fully pointed out hereinafter.

Turning now to the drawings, which illustrate one embodiment of the invention:

Figure 1, is a diagrammatic view, showing the air-cooling device connected to the inlet pipe of an air compressor cylinder jacket.

Figure 2, is a horizontal section of the device showing the compressed air feed tube and the perforated sleeve and hollow chamber, through which free air is drawn.

Figure 3 is a cross-sectional view on line 3—3 of Figure 2.

Figure 4, is a front view of the ring for regulating the free air supply, and

Figure 5, is a perspective view showing the perforated disc for preliminarily cooling the compressed air, interposed in the compressed air supply line.

In the embodiment of the invention illustrated, one application of my invention is shown, to wit: when used to supply air to the jacket of the cylinder of an air compressor to cool the cylinder.

In the drawings, the air compressor shown is of the usual type, in which air is initially compressed and which air is later compressed in another compressor to gage pressure. The compressor shown is provided with the usual cylinder 1, in which the piston 2, moves. The cylinder 1, is provided at each end with a head 3, and the cylinder casing is surrounded by the jacket 4. Connected to and projecting from the jacket 4, is the inlet pipe 5, and the outlet pipe 6, (see Figure 1). Cold air for compression is supplied to cylinder 1, through pipe 7, and the air after it has been initially compressed say to 30 or 40 lbs. passes from this compressor through pipe 8, provided with water tubes 9, for intercooling, then thru pipe 9^a, to the cylinder 1, of a second compressor, which may be similarly air-cooled. In the second compressor, the air is compressed to gage pressure, say 100 lbs., from which it passes through pipe 9^b, to air receivers, such as air receiver 10, see Figure 1, where it is stored for use as desired.

Means are provided for supplying a gas, preferably compressed air, under pressure, so as to draw in and supply quantities of free, atmospheric air, to the cylinder jacket, and means are also provided for cooling the compressed air and free air so supplied.

When, as illustrated, the invention is applied to cool the cylinder of an air compressor, the compressed air used in the cooling operation is supplied from an air receiver, such as receiver 10. The receiver 10 is filled

with compressed air, which, as is known, passes from the compressor at a high temperature to the air receivers, where due to expansion and heat radiation, it becomes considerably cooler.

As shown in the drawings (see Figure 1), compressed air to be used for cooling the cylinder 1, is tapped from receiver 10, and controlled by valve 10a. The compressed air passes through pipe 11 to tank 12. In tank 12, a further expansion of the air and radiation of heat takes place to further cool the compressed air. From tank 12, the compressed air passes into supply pipe 13.

Means may be provided for further cooling the compressed air as it passes through the supply pipe 13. As illustrated, see Figure 5, the supply pipe 13 may be sectioned. Between the sections of the pipe, a tapered, perforated disc (see Figure 5) is interposed. The perforated disc 14, is held in place, and the pipe sections joined by means of couplings 15, 16, threaded to their respective pipe sections, the coupling 15 being suitably tapered and threaded so as to receive tapered coupling 16. The compressed air thus passes from tank 12 into pipe 13, and through the perforations in disc 14, the air expanding and cooling as it passes through the perforations and into the adjoining section of pipe 13.

As illustrated, a perforated sleeve 17, is provided between the compressed air supply pipe 13, and the inlet pipe 5 of the jacket 4. As shown in the drawings, (see Figure 2), the sleeve 17, is provided with a plurality of rows of openings as at 18, and with a plurality of slots as at 19, through which openings and slots atmospheric air is admitted. The sleeve 17, is screw-threaded at 17a, so that it may be joined to the compressed air supply pipe 13. At its distal end the sleeve is screw-threaded on its outside and preferably carries a pair of suitably threaded couplings 20, 21, each of which is provided with rows of separated orifices at 22, 23, extending around the couplings. The coupling 20, is shown screw-threaded on its inner side, so as to receive the projecting end of inlet pipe 5. The perforated sleeve is thus connected at one end to the compressed air supply pipe 13, and at its other end to the inlet pipe of the cylinder jacket.

A feed tube 24, is provided for feeding the compressed air from pipe 13, so as to draw quantities of free air through the perforated sleeve and cool and supply it to the cylinder jacket. As shown in the drawings, see Figure 2, the feed tube 24, is mounted within the sleeve 17, by means of a bushing 25, through which bushing the tube passes. The feed tube is thus so mounted within the perforated sleeve 17, as to provide a hollow chamber 26, between the perforated sleeve and the feed tube and the bushing 25 prevents compressed air from pipe 13, entering the hollow chamber (see Figure 2). The coupling 21, is so mounted on the sleeve 17, and connected to inlet pipe 5, as to provide a second chamber 27, into which the compressed air, passing through feed tube 24, from pipe 13, discharges. The compressed air discharging into chamber 27, exhausts the air in chamber 26, and draws in large quantities of free, atmospheric air, through the orifices in the couplings and the openings and slots in the sleeve. The preliminarily cooled compressed air discharging into the hollow chamber 27, expands and cools and also cools the free, atmospheric air, drawn into the chamber through the sleeve 17 and the chamber 26. The cooled compressed air and the cooled atmospheric air passes from chamber 27, into the inlet pipe 5, and thence to the cylinder jacket 4 where it circulates and cools the cylinder before discharging through outlet pipe 6.

Means are provided for regulating and controlling the amount of free, atmospheric air delivered to cool the cylinder.

As shown in the drawings, see Figures 2 and 4, an elongated, oval ring 28, is provided, carried by the sleeve 17. When the ring is in its normal position at the rear of the slots and openings in sleeve 17, (shown in dotted lines in Figure 2) the passage of atmospheric air through the slots and openings is free and unimpeded. When, due to the size of the cylinder, or the temperature conditions, less air is necessary, the ring may be slid along the sleeve 17, to any desired position, where it may cover the openings in the sleeve, the slots in sleeve, or the openings and a portion of the slots, as shown in full lines in Figure 2, so as to regulate and control the supply of free air, in any manner desired. The regulating ring 28, is constructed so as to permit it being locked in its adjusted position. The ring is preferably made slightly oval, so that it may pass along the sleeve and when in the desired position is slightly twisted so as to be frictionally held in position.

It will be noted that the air-cooling means above described only necessitates the supply of a small amount of compressed air, or gas under pressure, to the feed tube mounted within the perforated sleeve, so that the compressed air or gas discharging from the feed tube will draw in large quantities of free, atmospheric air to cool the cylinder. It will also be noted that the sleeve carrying the feed tube may be readily attached to or removed from any cylinder having a jacket, without alteration or change to the cylinder in any way. The air-cooling device, it will be seen, is of little cost, economical in operation and may be readily removed or replaced as desired.

It will also be observed that the size of

the feed tube, and of the perforated sleeve, and of the openings and slots, may be varied in accordance with the size or working conditions of the cylinder to which it is to be attached, so that more or less compressed air, or gas under pressure, may be supplied through the feed tube and more or less free, atmospheric air, may be drawn through the perforated sleeve to cool the particular cylinder.

Having thus described the invention and its construction, the operation will be clear.

When my air-cooling system is used to cool the jacketed cylinders of air compressors, compressed air is used in the cooling operation, and this compressed air is that produced from the cylinders which are being cooled in accordance with my invention. The compressed air so produced reaches the receivers 10, at a very high temperature, where through expansion and heat radiation it becomes cooler. A portion of this compressed air is tapped from receiver 10 to be used for cooling the compressor cylinders. I have found it possible to secure this cooling result with the use of only a small amount of compressed air, which is passed through pipe 11 from the receiver 10, to a tank 12. The compressed air passing through tank 12, becomes further cooled by expansion and heat radiation, and is again cooled, by means of the perforated disk 14, as it passes through supply pipe 13, on its way to the cylinder jacket. From supply pipe 13, the compressed air passes into the feed tube 24, and out into the hollow chamber 27, provided by the coupling 20, between the sleeve 17 and the inlet pipe 5. When the air reaches this chamber 27, it has been cooled to a temperature below that of the atmosphere. The compressed air discharging into the chamber 27, and into the inlet pipe 5, of the cylinder jacket, draws in quantities of free, atmospheric air through the perforated sleeve 17, and through the hollow chamber 26, provided between the sleeve and the feed tube 24. This free air is cooled by the compressed air as it passes through the chamber 27, on its way to the cylinder jacket, so that the compressed air and free air enter the cylinder jacket at a temperature below that of the atmosphere. The number of perforations and slots provided in the sleeve and couplings is such and they are so arranged, that the quantity of free, atmospheric air supplied to the cylinder jacket is many times that of the compressed air supplied. A large quantity of free, atmospheric air and a small quantity of compressed air, is thus cooled and supplied to the cylinder jacket, where it circulates and discharges through outlet pipe 6, thus providing an efficient and economical means for cooling the cylinder. If it is desired to regulate the quantity of free air that is being supplied, this may be done by means of the regulating ring 28, which may be moved to any desired position along the sleeve, and cover the slots or perforations, as desired, this ring being slightly oval so that it may be locked in its adjusted position.

Having thus described the invention and its operation, it will be understood that changes may be made in carrying the invention into effect and that it may be applied to the jacketed cylinders of various machines, such as the cylinders of a gas engine or the like.

What I claim is:

1. An air cooler for jacketed cylinders, comprising in combination with a cylinder and its jacket, means for supplying a gas under pressure, means through which said gas under pressure draws in quantities of free air, means for delivering the free air to the cylinder jacket, and means for discharging the air, after it has circulated through the jacket to cool the cylinder.

2. An air cooler for jacketed cylinders, comprising in combination with a cylinder and its jacket, means for supplying a gas under pressure, means through which said gas under pressure draws in quantities of free air, means for delivering the air to the cylinder jacket, means for regulating the quantity of air delivered, and means for discharging the air, after it has circulated through the jacket to cool the cylinder.

3. An air cooler for jacketed cylinders comprising in combination with a cylinder and its jacket, means for supplying compressed air, means through which said compressed air draws in quantities of free, atmospheric air, inlet means connected to the compressed air and atmospheric air supply means, through which the air passes to the cylinder jacket and outlet means connected to the cylinder jacket for discharging the air, after it has circulated to cool the cylinder.

4. An air cooler for jacketed cylinders comprising in combination with a cylinder and its jacket, means for supplying compressed air, means through which said compressed air draws in quantities of free air, means for cooling the compressed air and for cooling the free air, an inlet pipe connected to and projecting from said cylinder jacket, means for supplying the compressed air and free air to said inlet pipe and the cylinder jacket, and an outlet pipe connected to the cylinder jacket through which the air is discharged, after it has circulated to cool the cylinder.

5. An air cooler for jacketed cylinders of air compressors, comprising in combination with an air compressor cylinder and its jacket, an inlet pipe connected to and projecting from the cylinder jacket, a feed tube

arranged to register with said inlet pipe, means for supplying cooled compressed air from the air compressor to said feed tube, means through which said compressed air, discharging from said feed tube, draws in and cools quantities of free air, the compressed air and free air passing through the inlet pipe to the compressor cylinder jacket, and an outlet pipe connected to the compressor cylinder jacket, through which the air discharges, after it has circulated to cool the compressor cylinder.

6. An air cooler for jacketed cylinders of air compressors, comprising in combination with an air compressor cylinder and its jacket, a perforated sleeve, connections between said sleeve and the cylinder jacket, a feed tube arranged within said sleeve, so as to provide a hollow chamber between the feed tube and the sleeve, means for supplying cooled compressed air to said feed tube so as to draw in quantities of free air through the perforated sleeve and hollow chamber and cool it before delivery to the cylinder jacket, and means for discharging the air, after it has circulated through the jacket to cool the cylinder.

7. An air cooler for jacketed cylinders of air compressors, comprising in combination with an air compressor cylinder and its jacket, a perforated sleeve, a feed tube arranged within said sleeve, so as to provide a hollow chamber between the feed tube and the sleeve, an inlet pipe connected to the compressor cylinder jacket, means for connecting the perforated sleeve to the inlet pipe so as to provide a chamber between the sleeve and the inlet pipe, means for supplying compresed air, from the air compressor, to the feed tube, so as to draw quantities of free air through the perforated sleeve, the said compressed air expanding and cooling as it discharges into the chamber between the sleeve and inlet pipe, thus cooling the free air as it passes to the inlet pipe, and means for discharging the air, after it has circulated to cool the cylinder.

8. An air cooler for jacketed cylinders of air compressors, comprising in combination, with a compression cylinder and its jacket, a perforated sleeve, connections between the sleeve and the cylinder jacket, a feed tube arranged within said sleeve, so as to provide a hollow chamber between the feed tube and sleeve, means for supplying cooled compressed air from the air compressor to said feed tube so as to draw in quantities of free air through said sleeve and hollow chamber, means for cooling the free air and delivering it to the compressor cylinder jacket, a regulating ring adapted to be moved over the perforated sleeve to regulate the quantity of free air delivered, and means for discharging the air, after it has circulated through the jacket to cool the cylinder.

9. An air cooler for jacketed cylinders of air compressors comprising in combination with a compressor cylinder and its jacket, a perforated sleeve, connections between said sleeve and jacket, said connections forming a chamber between the sleeve and jacket, a feed tube arranged within said sleeve so as to provide a chamber between the sleeve and feed tube, means for supplying cooled compressed air through said feed tube so as to draw quantities of free air through the perforated sleeve, the compressed air discharging into the chamber between the sleeve and the jacket, where it expands and cools the free air, before the air is delivered to the compressor cylinder, an elongated, oval ring for regulating the quantity of free air delivered, said ring being constructed to be moved along the perforated sleeve and to be self-locking in its adjusted position, and means for discharging the air, after it has circulated through the jacket to cool the cylinder.

10. An air cooler for jacketed cylinders for air compressors, comprising in combination with the compressor cylinder and its jacket, a pipe for supplying compressed air, means for cooling the compressed air so supplied, a perforated sleeve connected to the supply pipe, said sleeve being provided at its rear end with a bushing, a feed tube mounted in said sleeve and passing through said bushing, said feed tube registering with the compressed air supply pipe, a coupling carried by the forward end of said sleeve, so as to couple the sleeve to the inlet pipe of the cylinder jacket to provide a hollow chamber between the sleeve and inlet pipe, the said coupling being provided with orifices, the compressed air passing from the feed tube so as to draw in quantities of free air through the perforated sleeve and the orifices in the coupling and cooling the free air in the chamber between the sleeve and inlet pipe before the air circulates through the cylinder jacket to cool the cylinder.

11. An air cooler for jacketed cylinders of air compressors comprising in combination with the compressor cylinder and its jacket, means for supply compressed air from the compressor to the compressor cylinder, said means including an air receiver, a pipe line leading from said receiver to the compressor cylinder, a cooling tank for the compressed air, interposed in said pipe line, a perforated sleeve connected to said pipe line, a feed tube mounted within said sleeve, said feed tube arranged to register with the pipe line so as to receive the compressed air therefrom, an inlet pipe connected to and projecting from the compressor cylinder jacket, a coupling carried by the perforated sleeve for coupling the sleeve to the inlet pipe, so as to provide a hollow chamber between the sleeve and the inlet pipe, the com-

pressed air discharging from the feed tube and drawing in quantities of free air through the perforated sleeve, the compressed air cooling and cooling the free air in the hollow chamber between the sleeve and the inlet pipe before the air passes into the cylinder jacket, and an outlet pipe connected to the cylinder jacket, for discharging the air, after it has circulated to cool the cylinder.

In testimony whereof, I have signed my name to this specification.

HARRY MILLER.