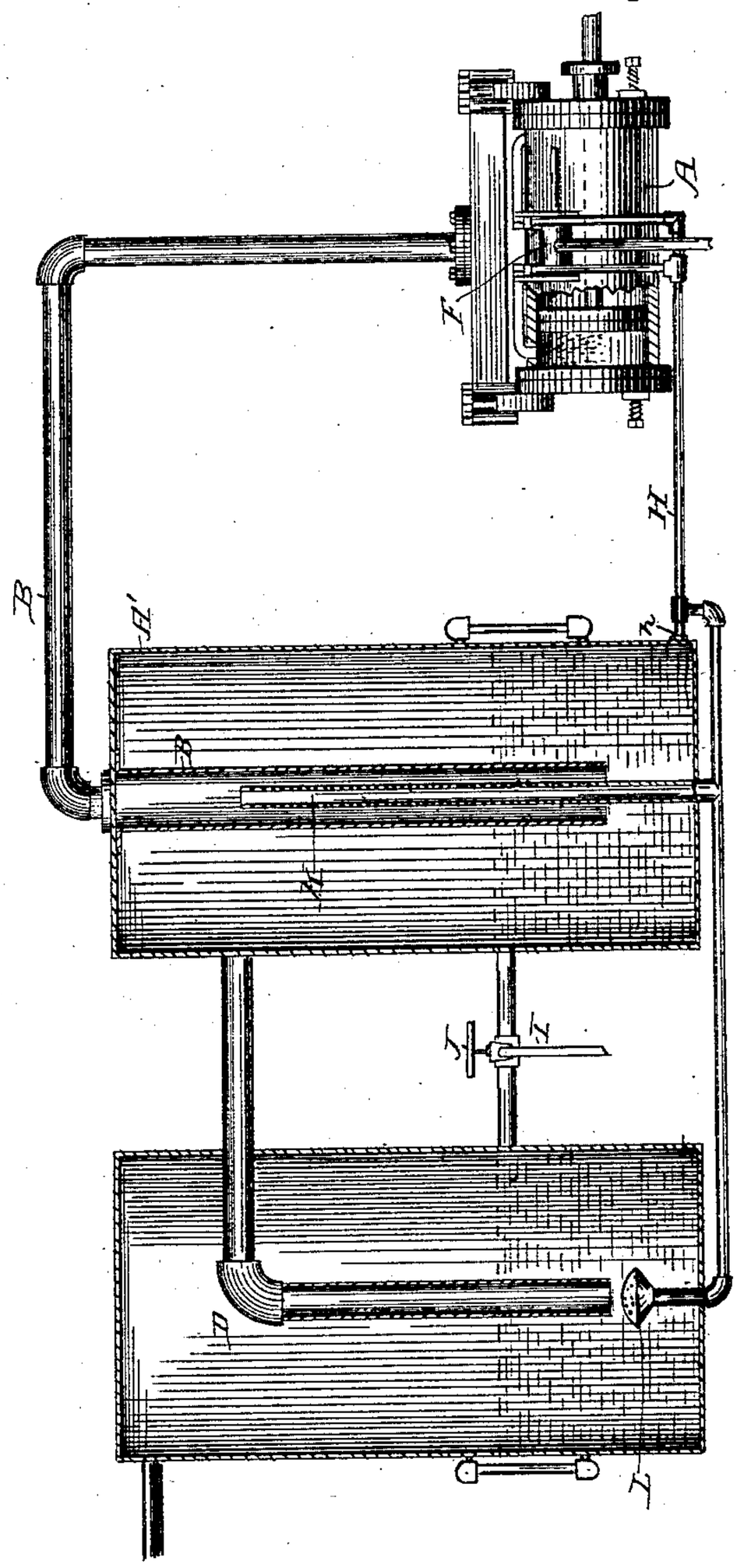
(No Model.)

A. C. DOUGLASS.

OPERATING COMPRESSED AIR APPARATUS.

No. 315,013. Patented Apr. 7, 1885.



WITNESSES
Geo. Robertson.
E. J. Robertson

INVENTOR
Anthony C. Douglass
By T. J. W. Robertson
his Attorney.

UNITED STATES PATENT OFFICE.

ANTHONY C. DOUGLASS, OF WASHINGTON, DISTRICT OF COLUMBIA.

OPERATING COMPRESSED-AIR APPARATUS.

SPECIFICATION forming part of Letters Patent No. 315,013, dated April 7, 1885.

Application filed December 9, 1884. (No model.)

To all whom it may concern:

Be it known that I, ANTHONY C. DOUGLASS, a citizen of the United States of America, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Operating Compressed-Air Apparatus, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to an improvement in compressed-air apparatus; and it consists in a method of separating from the air the water which is usually incorporated with it in the process of compression.

When air is being compressed, the process of compression generates a great amount of heat, and thus the cylinders and pistons of the compressors become so much heated as to prevent the working of the same at any reasonably fast speed. To overcome this difficulty it has been the practice to force into the cylinder of the compressor at each stroke cold water, preferably and generally in the form of spray, to keep the cylinder and piston cool, and thus the compressor could be worked at a reasonably fast speed, say from sixty to eighty strokes per minute; but another trouble arose. The water thus sprayed into the cylinder became incorporated with the air, and the combined water and air passed off together to the compressed-air reservoirs, where it has been the custom to discharge the mixed air and water below, and through water contained in the bottom of said reservoirs. The water, however, in the reservoir soon becomes hot from the continued increment of the heat in the air, and hence the fine spray or vapor mingled with the air is not condensed in the water, but passes into the pipes with the air, and from thence goes to the engine, thus frequently stopping the work until the water has been removed or has passed away. This is a great difficulty in cold weather, for it frequently happens that the air has to be conveyed a long distance in the pipes before it reaches the engine, and thus frequently the water settles in the bends of the pipes or low places and becomes frozen, or if not frozen lessens the capacity of the pipes by the amount of the contained water, and thus the pressure of the air is lessened and the duty of the compressors increased. Attempts have been made to overcome this by surrounding the cylinder of the compressor with a water-jacket, instead of injecting water into the cylinder. This, however, is objectionable, as it does not affect the piston, which becomes highly heated by the generated heat, and hence the packing and lubricant become burned from the combined heat and friction, and the compressors thus made necessarily have to be run very slowly compared with that class of compressors wherein the cooling-water is forced into the inside of the cylinder, and thus, although water-jacketed compressors are partially successful for some purposes, they cannot begin to compete with those in which the water is injected into actual contact with the piston and the inside of the cylinder, and the latter class of compressors are therefore almost invariably used, notwithstanding the difficulty of the water carried over by the air, heretofore referred to. To overcome this difficulty I propose to keep the water into which the compressed air is discharged always cool by continually forcing a fresh supply of water into the vessels containing the cooling-water, and allowing the heated water to pass away, as hereinafter described.

The accompanying drawing represents a side view of the apparatus I employ in carrying out my invention, partly in vertical section.

A shows an air-compressor of any suitable form, and operated in any known manner.

A′ represents one of the coolers, into which enters the pipe B, connected with the air-compressor and terminating below the level of the water contained in said cooler, and near the top of said cooler A′ is a pipe, C, which passes into another cooler, D, and terminates below the level of the water in said cooler D, which cooler is provided with a pipe, E, near its top to carry the air to the air-drill M, or other machinery to be driven by the compressed air.

At F is shown a pump connected directly with the air-compressor, and used to force a jet of cold water into each end of the cylinder alternately, in the usual manner for cooling the cylinder, piston, &c. Connected with each end of the discharge of the pump F is a pipe, H, through which a constant supply of cold water from said pump F is forced into

the coolers A′ D, so that the water in said coolers is always cold.

At I is shown a pipe connecting the two coolers, by which an equal level is maintained in both, and at J is shown a cock by which the water can be withdrawn as it becomes too high.

I have shown three ways of discharging the water from the pump into the coolers A′ D, either of which, or others, may be employed at the will of the constructor of the apparatus. In the first of these the water is discharged in a solid stream into the side of the cooler A′ by the branch pipe *h*. In the second form shown the water is carried up into the interior of that part of the air-pipe B contained within the cooler A′ by a perforated pipe, K, through which the water is discharged in a series of jets, whereby the incoming air is subjected to jets of cold water before it enters the main body of the water in the cooler. In the third form shown the incoming water is discharged through a rose, L, directly beneath the incoming air, as in the cooler D.

The coolers A′ D should be provided with glass gages, so that the height of the water may be known and regulated by the cock J.

By this method of operation, all the water, or substantially all, is eliminated from the air, and thus a great hinderance to the work of the engine is avoided.

I deem it important that the air passes freely through the water, and that there be nothing contained in the same that will hinder such free passage, because if the air does not have such free passage more power will be necessary to drive the air through, and the pressure available for driving the air-engine will be lessened.

I also deem it important that the incoming water enters the body of water at a low point therein, and that the heated water be withdrawn at a high point, because the water at the highest point is the hottest.

I am aware that it has been proposed in ice-making machines to moisten air before it has been compressed, and then after compression to cool the same by first forcing it through porous matter over which water was continually sprinkled, and then drying the air thus cooled by forcing it through other porous matter kept at a comparatively dry state, as shown in the Patent No. 112,726; but this mode, although it may act with considerable success in an ice-making apparatus, would be a failure in working air-engines, owing to the loss of power caused by forcing the air through the porous material. Moreover, the said porous material would act as a filter, and by gradually separating the solid matter from the water passing through become in time such a solid mass as to make it almost impossible to force the air through without too great an expenditure of power to make it pay to use air cooled in this manner to drive air-engines. These modes of drying air are essentially different from mine, in which the air is cooled and the spray separated from the same by the actual contact with a body of water kept at a substantially uniformly-cold temperature by the continual injection of cold water, through which body of water the intermingled air and water freely passes without losing its power by being forced through the pores of solid materials.

What I claim as new is—

1. The improvement in operating compressed-air apparatus, which consists in first compressing air in pumps kept cool by forcing water into the interior of the pump-cylinder, and then passing the mixed air and spray through a body of free water kept at a substantially uniformly-cold temperature by the injection of fresh cold water and the withdrawal of the water heated by the air, substantially as and for the purpose specified.

2. The improvement in operating compressed-air apparatus, which consists in first compressing the air in pumps kept cool by forcing jets of water into the interior of the pump-cylinder, and then passing the mixed air and spray through a body of free water kept at a substantially uniformly-cold temperature by the injection of cold water at a low point in said water and the withdrawal at a high point of the water heated by the air, substantially as and for the purpose specified.

3. The improvement in operating compressed-air apparatus, which consists in first compressing the air in pumps kept cool by forcing water into the pump, then subjecting the mixed air and spray to jets of cold water, and then passing the same through a body of free water kept at a substantially uniformly-cold temperature by the admission therein at a low point of said jets of cold water and the withdrawal at a high point of the heated water, substantially as and for the purpose specified.

In testimony whereof I affix my signature, in presence of two witnesses, this 9th day of December, 1884.

ANTHONY C. DOUGLASS.

Witnesses:
T. J. W. ROBERTSON,
M. P. CALLAN.