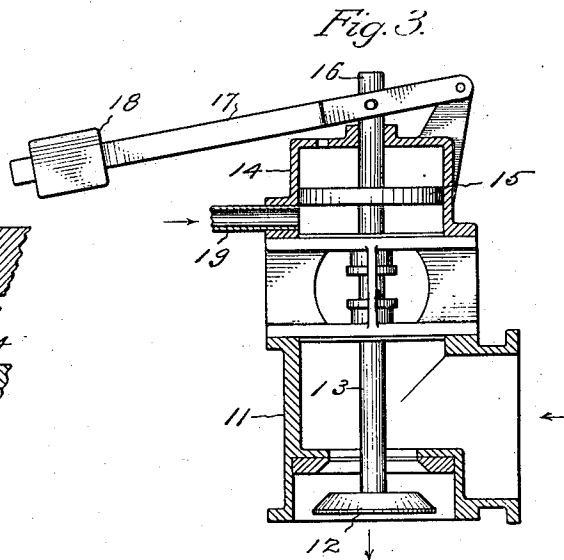
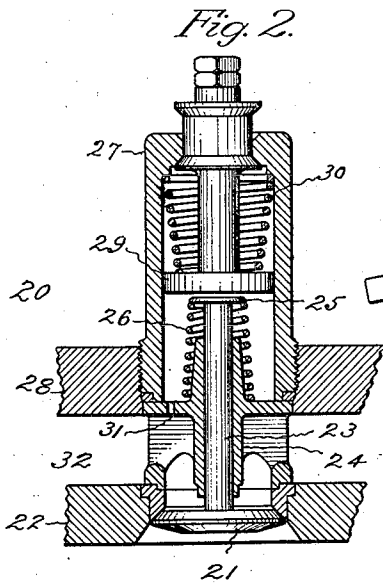
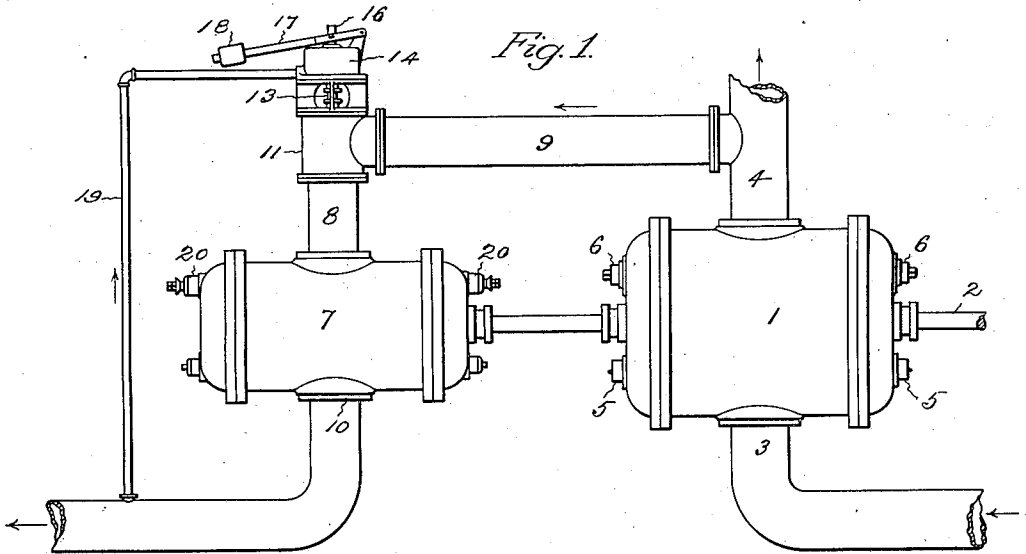


No. 819,655.

PATENTED MAY 1, 1906.

E. HILL.
AIR COMPRESSOR.
APPLICATION FILED JAN. 13, 1905.



Witnesses.

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EBENEZER HILL, OF NORWALK, CONNECTICUT.

AIR-COMPRESSOR.

No. 819,655.

Specification of Letters Patent.

Patented May 1, 1906.

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To all whom it may concern:

Be it known that I, EBENEZER HILL, a citizen of the United States, residing at Norwalk, in the county of Fairfield and State of Connecticut, have invented a new and useful Air-Compressor, of which the following is a specification.

Air or gas compressors are frequently connected so that a high-pressure compressor will receive the whole or a part of the discharge of a low-pressure compressor. These are so arranged that when the pressure beyond the high-pressure compressor becomes excessive a valve in the connection between the discharge of the low and the intake of the high pressure compressors is shut and the passage through the connection from one compressor to the other is closed. If the piston of the high-pressure compressor is mechanically joined with the piston of the low-pressure compressor, as is common, and the low-pressure compressor continues to operate, the high-pressure compressor will, with the valve in the connection closed, exhaust air or gas from its intake and force it into its discharge. As a result of this heat is developed to such a degree that the lubricant becomes volatilized and the gas is liable to be ignited and cause a disastrous explosion.

The object of this invention is to so construct and arrange the valves and the connections of the high-pressure compressor that its piston will automatically be rendered ineffective without interrupting its movement when the connection between the compressors is closed, and this danger of overheating and explosion be avoided.

In the embodiment of the invention that is illustrated the piston of the high-pressure compressor is mechanically joined with the piston of the low-pressure compressor, and the discharge of the latter is connected with the intake of the former by an ordinary connection. In this connection is a valve that is normally open, but which is closed when the pressure beyond the high-pressure compressor becomes excessive, by means of the movement of a piston in a cylinder that is connected with the discharge of the high-pressure compressor, and the high-pressure compressor is provided with intake-valves that are automatically held open, and thus become inoperative, when the passage through the connection from one compressor to the other is closed, thereby temporarily putting the high-pressure cylinder out of ac-

tion without affecting the movement of its piston.

Figure 1 of the views represents a side elevation of so much of a high-pressure compressor and low-pressure compressor and the valves and connections as is necessary to illustrate the invention. Fig. 2 shows, on greatly-enlarged scale, a section of one of the intake-valves of the high-pressure compressor, which is held open so as to render the piston ineffective when the valve in the connection between the compressors is closed. Fig. 3 shows, on enlarged scale, the valve in the connection between the compressors, the weight for opening this valve, and the piston for closing it when the pressure beyond the high-pressure compressor becomes excessive.

The low-pressure compressor 1 may be of any type for compressing air or gas. The piston of this compressor is adapted to be connected with the piston of a steam-cylinder or any other means for giving the piston a reciprocatory motion by means of the rod 2. Air or gas is drawn into this compressor through the intake 3 and is forced out through the discharge 4 in the ordinary manner, the intake-valves 5 and the discharge-valves 6 being of common construction.

The high-pressure compressor 7 may be any type and its piston may be joined with the piston of the low-pressure compressor, as usual. The intake 8 of the high-pressure compressor is connected by a pipe 9 with the discharge from the low-pressure compressor, so that the air or gas which is taken into the high-pressure compressor and is forced out through the discharge 10 of the high-pressure compressor is drawn from the discharge of the low-pressure compressor.

In the apparatus illustrated, in a fitting 11 between the high-pressure intake 8 and the connection 9, is a valve 12, that is arranged to close the passage through the fitting when it is lifted. The stem 13 of this valve passes upwardly into a cylinder 14, mounted on the fitting 11, and in that cylinder is attached to a piston 15, the stem 16 of which above the cylinder is connected with a lever 17, provided with a weight 18, the weight and lever being arranged to tend to hold the valve open.

The cylinder above the fitting is connected with the discharge of the high-pressure compressor by a pipe 19. This pipe communicates with the cylinder below the piston in

such manner that when the pressure in the discharge of the high-pressure compressor becomes excessive that pressure will be exerted through the pipe against the lower side of the piston and lift the lever and weight and close the valve. When this valve is closed, communication between the discharge of the low-pressure compressor and the intake of the high-pressure compressor is cut off, and to prevent the high-pressure compressor from exhausting air or gas from the intake and forcing it forwardly when the pressure is excessive and the valve is closed what for convenience will be termed "skip-valves" are provided for the high-pressure compressor. These valves are of such construction that when the valve in the connection between the compressor is closed and the continued movement of the piston in the high-pressure compressor tends to draw the air or gas from and lower the pressure in the high-pressure intake they will remain open and temporarily, possibly for only part of a stroke and perhaps for several strokes, put the high-pressure compressor out of effective action.

In the form of the invention illustrated the intake-valves 20 of the high-pressure compressor are skip-valves. Each of these valves is provided with a disk 21, that is adapted to open inwardly from and close outwardly against a seat in the wall 22 of the compressor in the usual manner. This disk has a stem 23, that is supported by a hub 24 and is provided with a head 25. A spring 26 is arranged to thrust between the head and a portion of the hub and draw the valve to its seat. A plug 27 is screwed into the wall 28 of the head of the high-pressure cylinder, and in this plug is a piston 29. A spring 30 thrusts between this piston and the end of the plug in such manner as to tend to force the piston toward the end of the stem of the valve-disk. There is a passage 31 between the chamber in the plug and the intake-passage 32 in the head of the high-pressure cylinder, so that the pressure on the intake side of the valve-disk is always exerted against the piston in the plug in opposition to the spring. As long as the pressure in the intake-passage remains normal the piston is forced away from the head of the stem of the valve-disk. Should the pressure in this intake-passage become lowered, as by the continued reciprocation of the high-pressure piston when the valve closes the communication between the discharge of the low-pressure compressor and the intake of the high-pressure compressor, then the spring will force the piston against the head of the stem of the valve-disk and hold the disk away from its seat. While the intake-valves are held open, whether for only a part of a stroke or a single stroke at intervals or a number of strokes in succession, air pulsates back and forth past these open intake-valves in such manner as

to render the piston ineffective for forcing air forwardly into the discharge. As a result of this action the space between the choke-valve in the connection between the compressors and the high-pressure piston will not be exhausted of air—that is, the air in that space will not be exhausted and portions of it advanced beyond the high-pressure compressor so that the pressure in that space will be low and the air therein at the low pressure be forced forwardly and raised to the relatively high degree of compression beyond the high-pressure compressor, and thus sufficient heat be developed to volatilize the lubricating-oil and greases and ignite the gas thus generated and cause an explosion.

The invention claimed is—

1. An apparatus for compressing air having a low-pressure compressor, a high-pressure compressor, a connection between the discharge of the low-pressure compressor and the intake of the high-pressure compressor, a valve in the connection between the compressors that is closed by an abnormally high pressure beyond the high-pressure compressor, and an inlet-valve connected with the high-pressure compressor that is held open, when the pressure between itself and the valve in the connection between the compressors drops below normal as a result of the closing of the connection-valve, so as to render the high-pressure piston ineffective for forcing air forward when the connection-valve is closed, substantially as specified.

2. An apparatus for compressing air having a low-pressure compressor, a high-pressure compressor, a connection between the discharge of the low-pressure compressor and the intake of the high-pressure compressor, a valve for closing the connection between the compressors, means for holding the valve open, a piston connected with and adapted to move the valve, a duct forming a communication between the discharge of the high-pressure compressor and the cylinder containing the valve-piston whereby excessive pressure in the discharge of the high-pressure compressor will cause the piston to move and close the valve in the connection, and an inlet-valve connected with the high-pressure compressor that is held open when the pressure between itself and the valve in the connection between the compressors drops below normal as a result of the closing of the connection-valve so as to render the high-pressure piston ineffective for forcing air forward when the connection-valve is closed, substantially as specified.

3. An apparatus for compressing air having a low-pressure cylinder, a piston in the low-pressure cylinder, a high-pressure cylinder, a piston in the high-pressure cylinder, said pistons being mechanically connected, a connection between the discharge of the low-pressure cylinder and the intake of the high-

pressure cylinder, a valve in the connection
between the cylinders that is closed by an ab-
normally high pressure beyond the high-pres-
sure cylinder, and an inlet-valve connected
5 with the high-pressure cylinder that is held
open when the pressure between itself and
the valve in the connection between the cyl-
inders drops below normal as a result of the
closing of the connection-valve so as to ren-
10 der the high-pressure piston ineffective for
forcing air forward when the connection-
valve is closed, substantially as specified.

4. The combination of an air-compressing
cylinder, a piston movable in the cylinder, a

valve for closing the intake of the cylinder 15
that is closed by an abnormally high pressure
beyond the cylinder, and an inlet-valve con-
nected with the cylinder that is held open
when the pressure between itself and the
valve in the intake drops below normal as a 20
result of the closing of the intake-valve so as
to render the piston ineffective for forcing air
forward when the intake-valve is closed, sub-
stantially as specified.

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Witnesses:

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