W. PRELLWITZ.

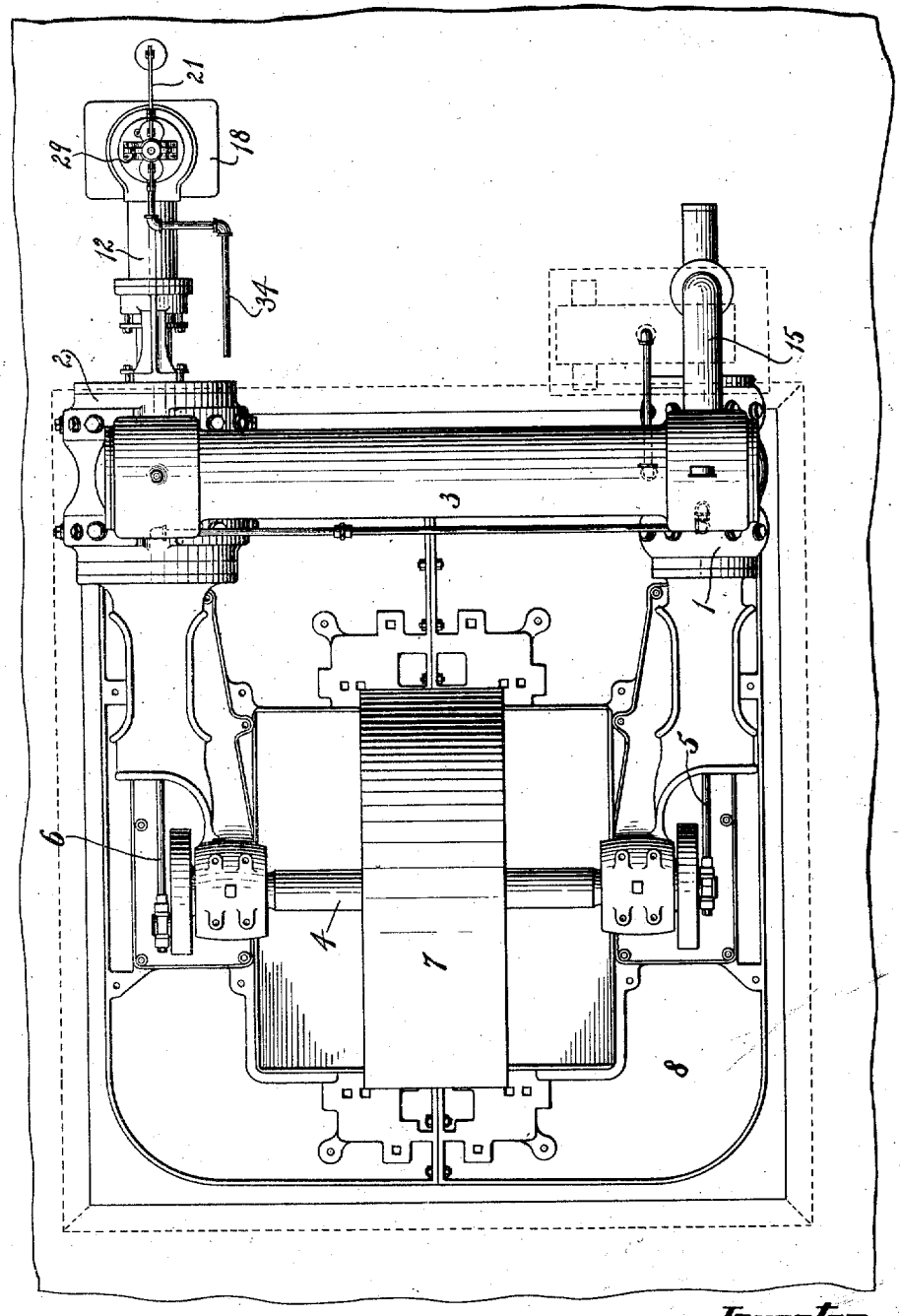
AIR COMPRESSOR.

APPLICATION FILED APR. 18, 1906.

987,912. Patented Mar. 28, 1911.

5 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
F. G. Wachenberg.
Henry Thieme

Inventor:
William Prellwitz
by attorneys
Brown & Swan

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5 SHEETS—SHEET 2.

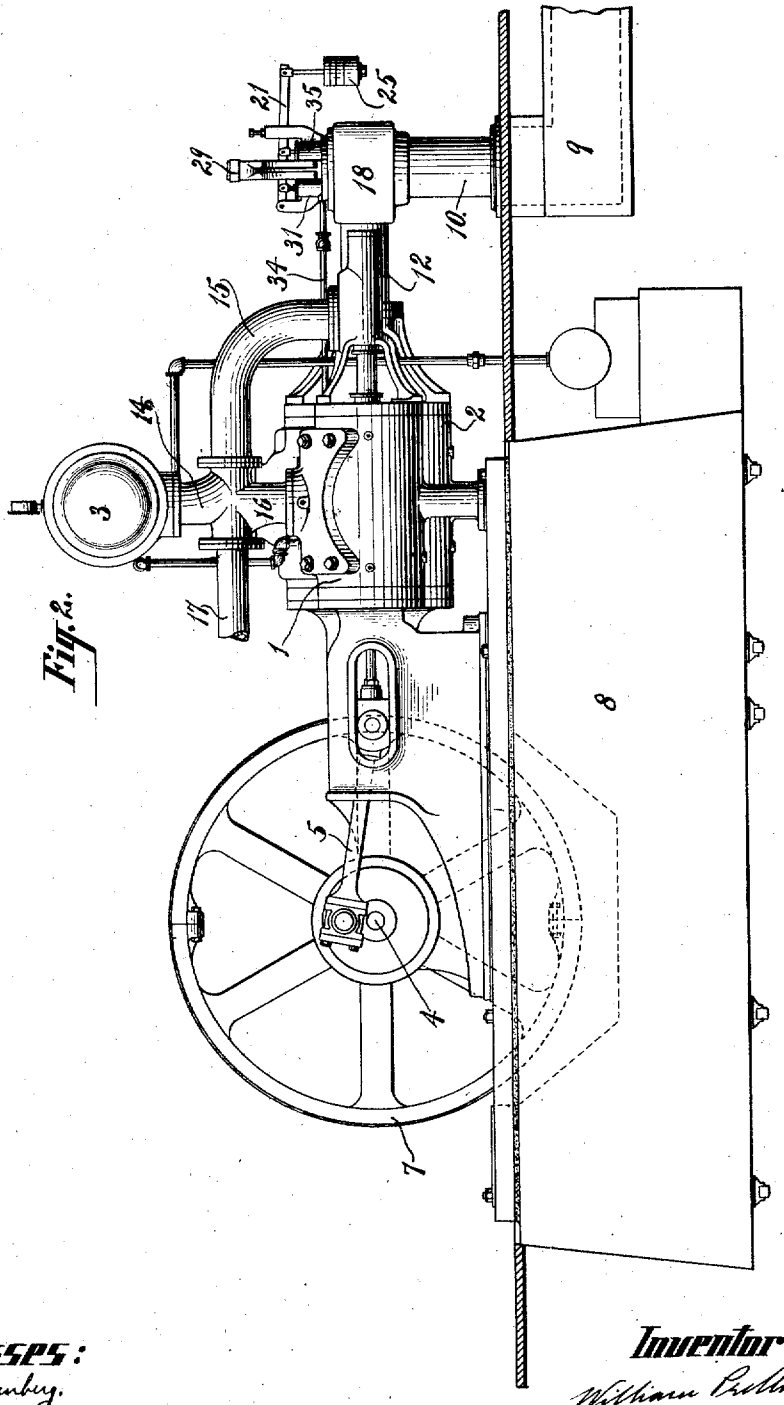

Fig. 2.

Witnesses:

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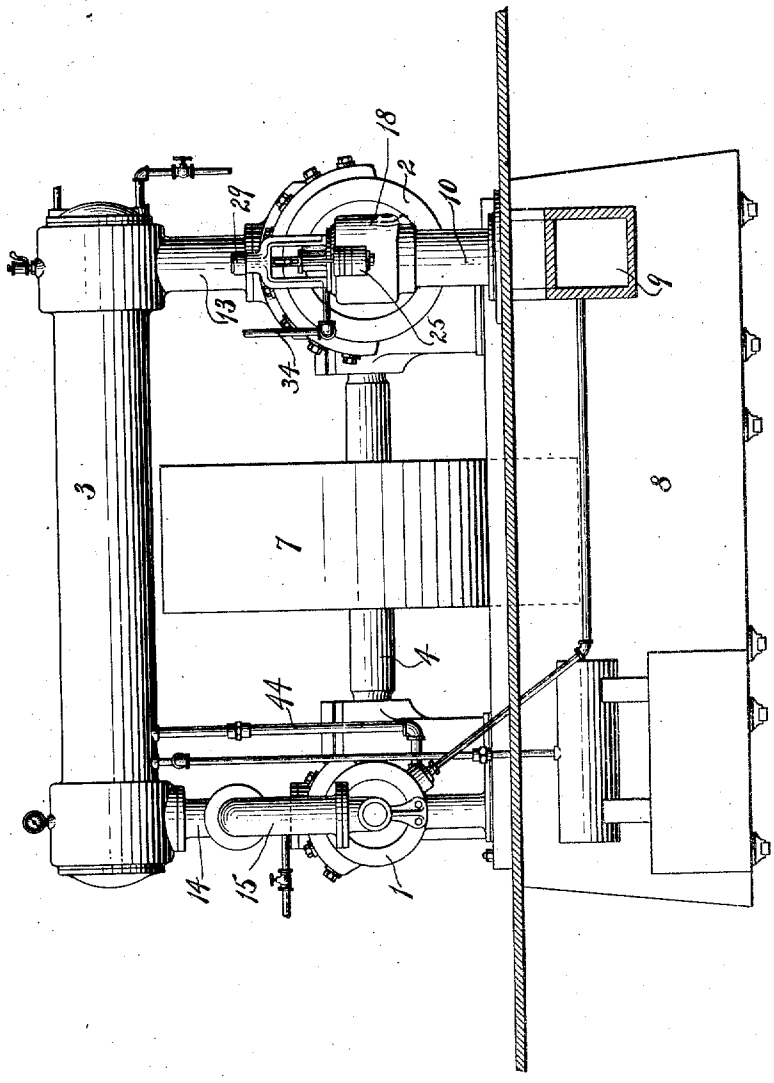
5 SHEETS—SHEET 3.

Fig. 3.



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5 SHEETS—SHEET 4.

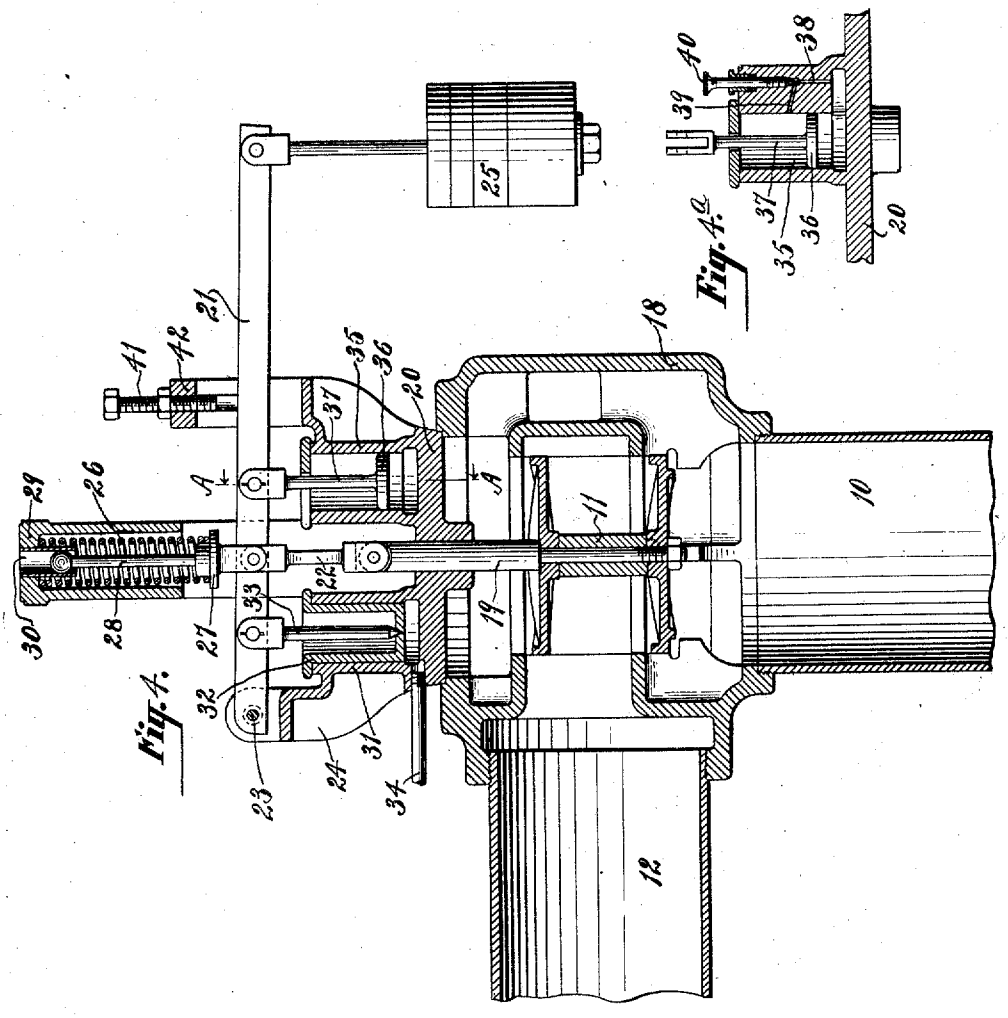

Fig. 4.

Fig. 4a.

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5 SHEETS—SHEET 5.

Fig. 7.

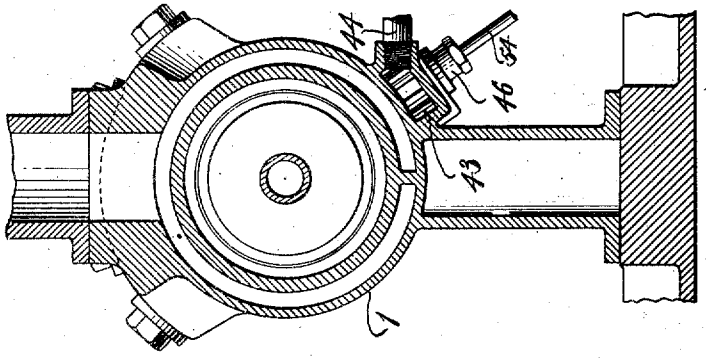


Fig. 6.

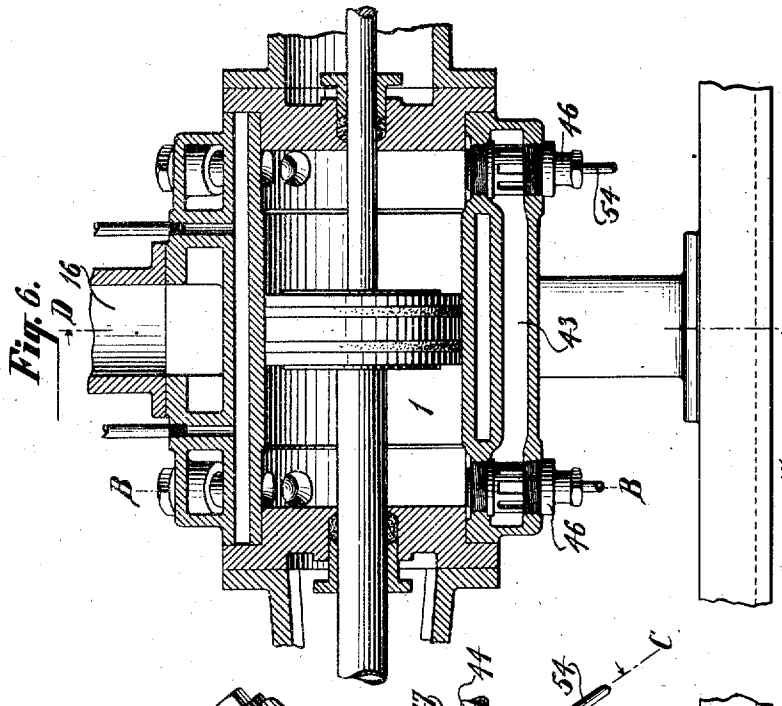
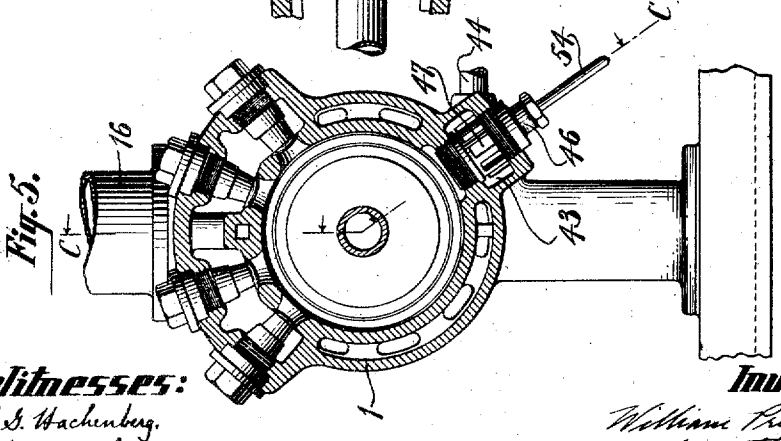


Fig. 8.

Fig. 5.



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UNITED STATES PATENT OFFICE.

WILLIAM PRELLWITZ, OF EASTON, PENNSYLVANIA, ASSIGNOR TO INGERSOLL-RAND COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

AIR-COMPRESSOR.

987,912. Specification of Letters Patent. Patented Mar. 28, 1911.

Application filed April 18, 1906. Serial No. 312,301.

To all whom it may concern:

Be it known that I, WILLIAM PRELLWITZ, a citizen of the United States, and resident of Easton, in the county of Northampton and State of Pennsylvania, have invented a new and useful Improvement in Air-Compressors, of which the following is a specification.

In a compound air compressor in which an automatic choking controller is used on the low pressure cylinder, it has been found that when the choking valve begins to close the intake to the low pressure cylinder, the low pressure cylinder starts to pull a vacuum, the vacuum becoming greater the more the intake opening is reduced. When less air is furnished by the low pressure cylinder than the capacity of the high pressure cylinder, the high pressure cylinder will also start to pull a vacuum.

The object of this present invention is to provide means for absolutely preventing a vacuum in the high pressure cylinder, which means comprises a bypass valve in each end of the high pressure cylinder connected by a port, which port is at all times in open communication with the intercooler of the compressor.

In the accompanying drawings, Figure 1 represents a power driven compound air compressor in top plan with my improvement applied thereto. Fig. 2 is a side view of the same, Fig. 3 is an end view, Fig. 4 is a detail vertical central section through the automatic choking controller for the intake of the low pressure cylinder, the choking valve being shown open, Fig. 4ª is a detail section in the plane of the line A—A of Fig. 4 looking in the direction of the arrows, Fig. 5 is a transverse section through the high pressure cylinder taken in the plane of the line B—B of Fig. 6, Fig. 6 is a longitudinal section taken in the plane of the line C—C of Fig. 5 looking in the direction of the arrows, Fig. 7 is a transverse section taken in the plane of the line D—D of Fig. 6, looking in the direction of the arrows, and Fig. 8 is a detail longitudinal central section through one of the bypass valves and its controlling mechanism.

The compound air compressor shown herein to which my invention is applied comprises a high pressure cylinder 1, low pressure cylinder 2, intercooler 3, driving shaft 4, its pitman connections 5 and 6 with the pistons of the high and low pressure cylinders 1 and 2, respectively, and the belt driven pulley 7 for the said drive shaft. The sub-base of the compressor is denoted by 8. The intake is denoted by 9, its pipe by 10 which leads through the choking valve 11 to the inlet pipe 12 of the low pressure cylinder. A pipe 13 leads from the low pressure cylinder to one end of the intercooler 3 and the inlet pipe 14, 15, for the high pressure cylinder leads from the other end of the intercooler. The outlet pipe 16, 17, of the high pressure cylinder leads to any suitable compressed air receiver not shown herein.

The choking valve casing 18 of the automatic choking controller for the low pressure cylinder is interposed between the pipes 10 and 12, which casing is so arranged that a double choking valve 11 may be used. The stem of the valve 11 is denoted by 19 and it extends upwardly through the top 20 of the casing 18 where it is attached to the weighted lever 21 through a link 22. This lever 21 is pivoted at 23 in a bracket 24 uprising from the top 20 of the valve casing. The outer end of this lever is provided with weights 25.

An auxiliary spring pressure is exerted tending to open the choking valve 11, which pressure comprises a coil spring 26 interposed between a shoulder 27 on an upward extension 28 of the piston rod and a socket piece 29 uprising from the top 20 of the casing. The upper end of the piston rod extension has a sliding movement in a tubular guide 30 in the top of the socket piece 29.

An air cylinder 31 is provided with a piston 32, the rod 33 of which is attached to the lever 21. The space below the piston 32 is connected to the receiver, not shown herein, through a pipe 34. If the lever 21 were permitted to rise and fall rapidly, the choking valve 11 would cause too sudden a change on the drive for the compressor. To prevent this I provide an oil cylinder 35 having a piston 36, the rod 37 of which is attached to the lever 21. The spaces in front and back of the piston 36 are connected through ports 38, 39, controlled by a manually operated needle valve 40 so that the speed of the rise and fall of the lever 21 may be regulated to the utmost accuracy. The limit of the upward movement of the

lever 21 is adjusted by means of a set screw 41 carried by bracket 42 uprising from the top 20 of the valve casing.

The spring 28 serves to require a greater amount of air to operate the choking valve but at the same time assists in the smooth working of the valve and only permits the shutting of the valve when no air is wanted for the low pressure cylinder.

The means which I have devised for preventing a vacuum in the high pressure cylinder is constructed, arranged and operated as follows:—A bypass port 43 extends from end to end of the high pressure cylinder 1, which port is at all times in open communication with the intercooler 3 through a pipe 44. The opposite ends of this bypass port 43 are brought into and out of open communication with the ends of the high pressure cylinder chamber upon opposite sides of its piston by bypass valves 45. These bypass valves are similar in construction and one only of them will be described in detail. The casing for the valve 45 is denoted by 46 and it is inserted from the exterior of the cylinder through the port 43 and has a screw threaded engagement with the inner and outer walls of the port. The interior of the valve casing 46 is at all times in open communication with the port 43 through one or more holes 47. A central guide 48 is provided for the stem 49 of the valve 45, which guide is connected to the inner walls of the casing 46 by a plurality of webs 50. The seat for the valve 45 is located at the inner end of the casing 46. The valve 45 is held yieldingly closed by means of a spring 51 which is interposed between the guide 48 and a cap 52 carried by the stem 41 of the said valve. A piston 53 is located within the casing 46 and the inner side of said piston is at all times open to the port 43. The outer side of the piston is open at all times to atmosphere in the present instance through a pipe 54 which leads to atmosphere, as, for instance, to the intake 9. A spring 55 is also located within the casing 46 in position to force the piston 53 inwardly against a pressure of from two to five pounds on the back of the piston from within the bypass port 43.

The backs of both of the bypass valves 45 are at all times in open communication with the bypass port 43 so that they are subjected at all times to the pressure within said port, viz; intercooler pressure. It is also to be observed that the intercooler pressure is in direct communication with the interior of the high pressure cylinder, through the high pressure inlet valves.

In operation, as the choking controller starts to operate the pressure in the intercooler begins to fall. This reduction in pressure in the intercooler continues as long as the choking valve continues to reduce the admission of air through the intake. The bypass valves will not be brought into operation until about one-half of the capacity of the compressor is reached or, in other words, until the intercooler pressure falls to a point anywhere between two and five pounds. As the intercooler pressure is in direct communication with the high pressure cylinder and also is in communication with the bypass port, the bypass valves are substantially balanced, an increase in the intercooler pressure serving to shut them and a decrease in the intercooler pressure serving to open them. When this intercooler pressure is reduced to a sufficiently low point, the springs on the outer sides of the bypass valve pistons will push the valves open thus bringing both ends of the high pressure cylinder into open communication. As the opening and closing of the bypass valves are controlled by the pressure from the intercooler, this pressure is kept about uniform excepting that as the air from the low pressure cylinder is discharged into the intercooler at each stroke, the intercooler pressure will rise sufficiently to shut the bypass valve at one end of the high pressure cylinder or at the other end thereof at some part of the piston stroke. This will permit the high pressure cylinder to compress the amount of air which may have been contained in the cylinder in front of the piston at the time and discharge it to the final receiver. The more the choking valve is shut off, the less will be the amount of air delivered to the intercooler from the low pressure cylinder at each stroke until when the choking valve is shut off entirely only the leakage through the same will be delivered to the intercooler. In this event, the rise in the intercooler will be very slow and the opening and shutting of the bypass valves will be intermittent as they will only operate when the intercooler pressure is raised to a sufficiently high point to close either one or the other of the said valves. By this arrangement, air is never discharged to the atmosphere as all of the air that is taken into the compressor is compressed and delivered to the final receiver.

As the air which is fed to the high pressure cylinder never gets below atmospheric pressure, the high pressure cylinder does not require any greater number of compressions in compressing the air therein to the receiver pressure than if the cylinder took its supply from the atmosphere direct.

What I claim is:—

1. In a compound air compressor, a high pressure cylinder, a low pressure cylinder, a choking controller for the low pressure cylinder and means operating in conjunction with the choking controller for automatically preventing a vacuum in the high pressure cylinder as the admission of air to the

low pressure cylinder is reduced by the choking controller.

2. In a compound air compressor, a high pressure cylinder, a low pressure cylinder, a choking controller for the low pressure cylinder, an intercooler and means controlled by intercooler pressure and operating in conjunction with the choking controller for automatically preventing a vacuum in the high pressure cylinder as the admission of air to the low pressure cylinder is reduced by the choking controller.

3. In a compound air compressor, a high pressure cylinder, a low pressure cylinder, a choking controller for the low pressure cylinder, an intercooler and means controlled by intercooler and atmospheric pressure and operating in conjunction with the choking controller for automatically preventing a vacuum in the high pressure cylinder as the admission of air to the low pressure cylinder is reduced by the choking controller.

4. In a compound air compressor, a high pressure cylinder, a low pressure cylinder, a choking controller for the low pressure cylinder, an intercooler, a by-pass port for the high pressure cylinder in communication with the intercooler and valves in the by-pass port, operating in conjunction with the choking controller, arranged to open the by-pass port to the opposite sides of the piston in the high pressure cylinder as the admission of air to the low pressure cylinder is reduced by the choking controller, for automatically preventing a vacuum in the high pressure cylinder.

5. In a compound air compressor, a high pressure cylinder, a low pressure cylinder, a choking controller for the low pressure cylinder, an intercooler, a by-pass port for the high pressure cylinder in open communication with the intercooler, valves in the by-pass port, operating in conjunction with the choking controller, arranged to open the by-pass port to the opposite sides of the piston in the high pressure cylinder as the admission of air to the low pressure cylinder is reduced by the choking controller, for automatically preventing a vacuum in the high pressure cylinder, and means for placing said valves under the influence of pressure at all times.

In testimony, that I claim the foregoing as my invention, I have signed my name in presence of two witnesses, this fourteenth day of April 1906.

WILLIAM PRELLWITZ.

Witnesses:
WARD RAYMOND,
CHAS. C. HAUSUN.