C. O. PALMER.

GOVERNOR FOR AIR COMPRESSORS.

APPLICATION FILED JULY 29, 1912.

1,154,798.

Patented Sept. 28, 1915.

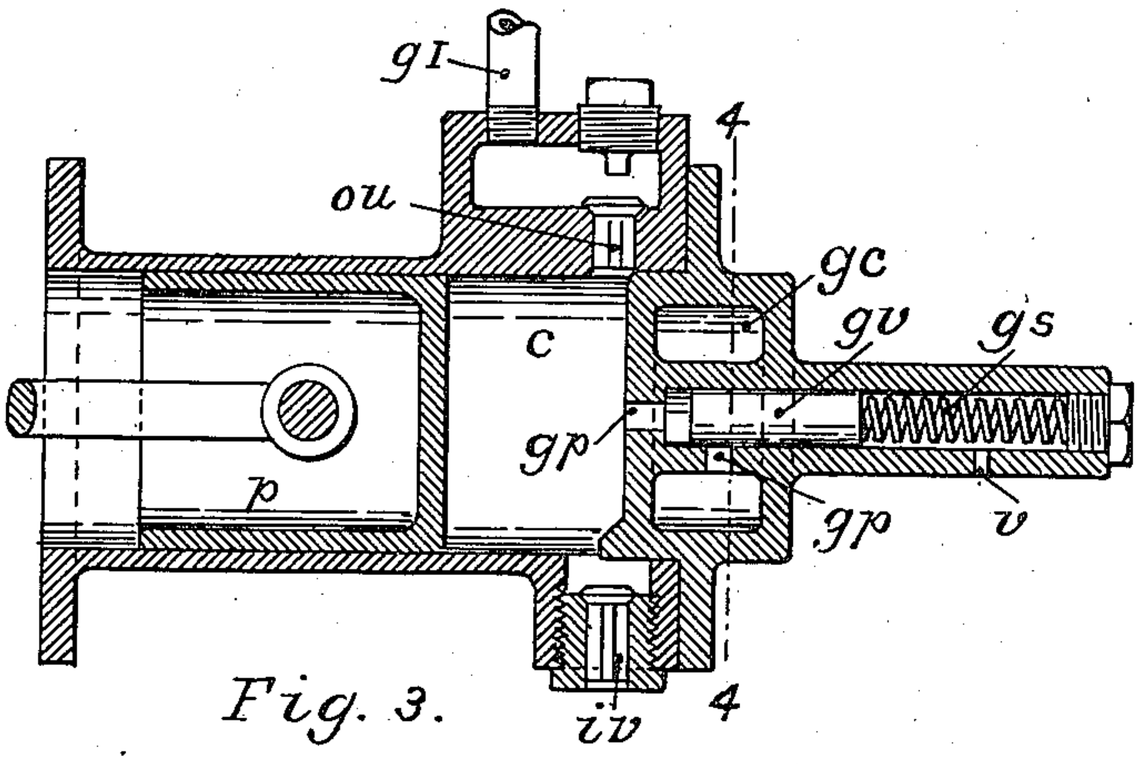


Fig. 3.

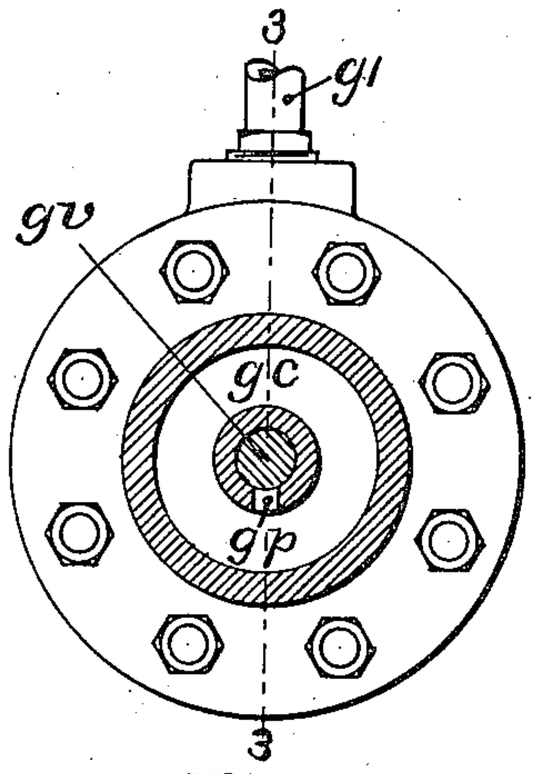


Fig. 4.

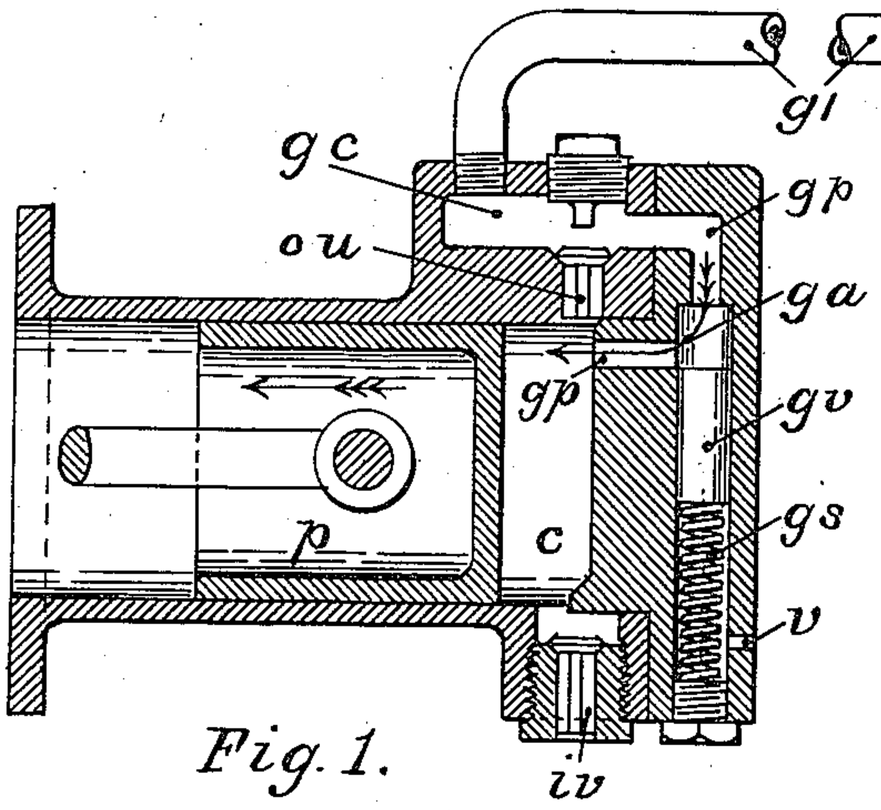
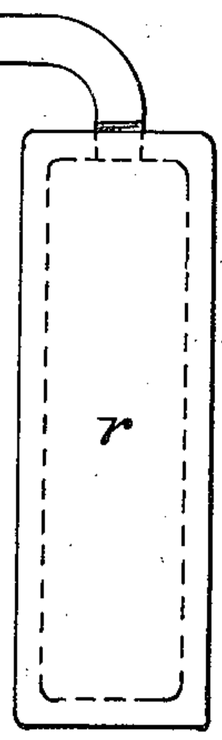


Fig. 1.



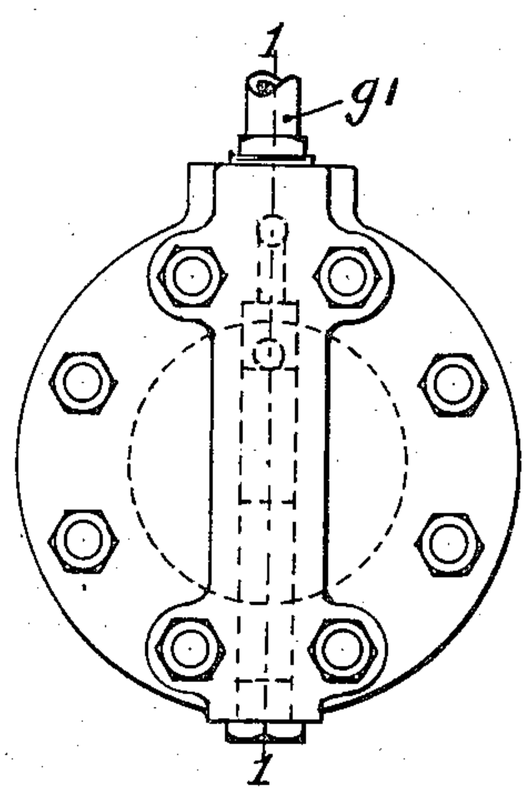


Fig. 2.

Witnesses:

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UNITED STATES PATENT OFFICE.

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GOVERNOR FOR AIR-COMPRESSORS.

1,154,798. Specification of Letters Patent. Patented Sept. 28, 1915.

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To all whom it may concern:

Be it known that I, CHARLES OTIS PALMER, a citizen of the United States of America, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Governors for Air-Compressors; and I hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

My invention relates to pressure governors for air compressors and has for its object to so control or govern the pressure attainable by the compressor that it shall not exceed a certain amount and thereby endanger the receiver and the connecting tubes and passages into which the air is delivered.

Roughly stated my invention consists in the combination with the compressor cylinder of a compressed air chamber, a passage between them, a valve controlling said passage and adapted to be opened by pressure from within said passage when said pressure exceeds the atmospheric pressure by a predetermined amount. By opening said port, the clearance of the air compressor is thereby increased by the volume of said air chamber, and the pressure of which the compressor is capable, is thereby limited by the total clearance of the compressor cylinder under the new conditions.

It also consists of certain details of construction hereafter more fully set forth.

In the accompanying drawings Figure 1 is a longitudinal section (on line 1—1 of Fig. 2) through a compressor cylinder equipped with my improved governor, in which the receiver with its associated air passages also forms the governor chamber; Fig. 2 is a back view of Fig. 1; Fig. 3 is a longitudinal section (on line 3—3 of Fig. 4) through a compressor cylinder provided with my improved governor, in which the governor chamber is formed separate from the air receiver, the valve being unseated in the act of opening; Fig. 4 is a section on line 4—4 of Fig. 3.

Similar characters denote similar parts throughout the several views.

A compressor delivering air continuously and without any safe-guard would raise the pressure in the air receiver and connections beyond their strength and so cause more or less serious injury. To prevent such an occurrence is the object of this invention.

In an ordinary dry air compressor the amount of clearance at the end of stroke, between the piston and cylinder head and the communicating ports and chambers, is a matter that has a direct bearing on the capacity of the compressor which may be explained as follows: Toward the end of the compression stroke the compressed air in front of the piston *p* begins to pass through the delivery valve *ou* as soon as the pressure exceeds that of the air in the discharge pipe *q*I leading from the cylinder to the receiver. But remaining in the clearance space, on the completion of the stroke, is a certain quantity of warm compressed air which cannot be discharged. On the back stroke of the piston this clearance air expands and partly fills the cylinder behind the piston. No air can enter through the inlet valve *iv* until the pressure inside the cylinder falls below the incoming air, (which is usually at atmospheric pressure). It is therefore never possible to take a full cylinder of outside air at atmospheric pressure under ordinary conditions, and is less so as the clearance increases in proportion to the piston displacement. The amount of air taken into the cylinder becomes less the higher the pressure in the cylinder increases. Or in other words the higher the terminal pressure, the farther must the piston travel before the inlet valve *iv* can open to receive outside air.

Just as it required work to compress the air in the clearance space, so does it give out work in expanding on the return stroke after being compressed. So that although the clearance space reduces the capacity of the compressor it does not involve a corresponding loss of useful work. This is the reason why the pressure attainable by an air compressor is limited by the clearance of the compressor cylinder. That is, the greater the clearance the lower the pressure attainable. So that the limit of pressure possible might be limited by simply making the percentage of clearance in the compressor cylinder to correspond with the limit of pressure desired. For instance, a 25% clearance air compressor taking air at atmospheric pressure and compressing it isothermally would be limited to about 4 atmospheres. But this mode of limiting the pressure has the objection that this large clearance reduces

very largely the capacity of the compressor near its highest pressure to such an extent as to render this method impracticable under ordinary conditions. I therefore preferably make my compressor with as little clearance as practical considerations will allow. The cylinder *c* is then connected with a chamber of compressed air *gc* by a governor port or passage *gp*. In this governor port is placed a governor valve *gv* opening outwardly and closed by a governor spring *gs*. The spring is sufficiently strong to keep the valve closed under the regular working pressure, but when the pressure in the governor port rises above the desired maximum pressure determined upon, then it opens and allows communication between the cylinder *c* and the auxiliary chamber *gc* which then forms part of the clearance of the cylinder. The volume of the auxiliary or governor chamber *gc* is such that the total clearance of the cylinder as thus formed with valve *gv* open shall be at least sufficient to correspond to the clearance required to limit the pressure in the compressor to the required maximum amount as before explained.

It is usually desirable to have the governor chamber sufficiently large to limit the maximum compressor pressure to a point greater than that required to open the governor valve.

Air in a "dry compressor" cylinder is not compressed and expanded entirely isothermally as in my hypothetical case above mentioned but partially adiabatically, depending on circumstances, as is well known. But the above explanation is nevertheless true.

The valve opening pressure is maintained uniform by connecting the outer end of the governor valve *gv* with the atmosphere (or other volume of air at practically constant pressure) by the vent *v*.

The governor chamber *gc* may be either the air receiver *r* with its connecting governor passage *gp* as shown in Figs. 1 and 2 or it may be a separate chamber as shown in Figs. 3 and 4. In either case when the pressure in the governor passage *gp* exceeds the limit set by the governor spring *gs* the pressure against the end of the valve *gv* presses it outward and opens the governor port *gp* as in Fig. 1 and establishes connection between the cylinder *c* and the governor chamber *gc*. So that the air from the chamber *gc* follows the piston *p* during part or all of its return stroke as shown by the arrow *ga*. It thereby keeps the pressure in the cylinder above the atmosphere and so prevents the opening of the inlet valve *iv* and allows no air to be taken into the cylinder as in the normal working of the compressor.

As air compressors may be used to compress other gases besides air so my governor is adapted to be used on the air compressor when used on other gases than air. I have used the term air compressor rather than gas compressor as that is the name more commonly used.

Having thus described my invention, I claim:

1. In apparatus of the class described the combination with an air compressor cylinder, and piston therein, of a compressed air chamber, a governor passage connecting said chamber and cylinder, a branch passage opening communication between the atmosphere and said governor passage, a valve adapted to slide in said branch passage and to be opened by pressure within said governor passage when the pressure in the governor passage exceeds that of the atmosphere by a predetermined amount.

2. The combination with an air compressor cylinder, of a compressed air chamber, a governor passage connecting said chamber and cylinder, a branch passage opening communication between the atmosphere and said governor passage, a governor valve adapted to slide in said branch passage and to control said governor passage, a spring of predetermined tension holding said valve closed when the pressure in said governor passage is below the maximum, but allowing the opening of said governor valve when the pressure in said governor passage exceeds the atmospheric pressure by the tension on said spring, substantially as and for the purpose set forth.

In testimony whereof, I sign the foregoing specification, in the presence of two witnesses.

CHARLES OTIS PALMER.

Witnesses:
HARRY T. GETTINS,
N. L. MCDONNELL.