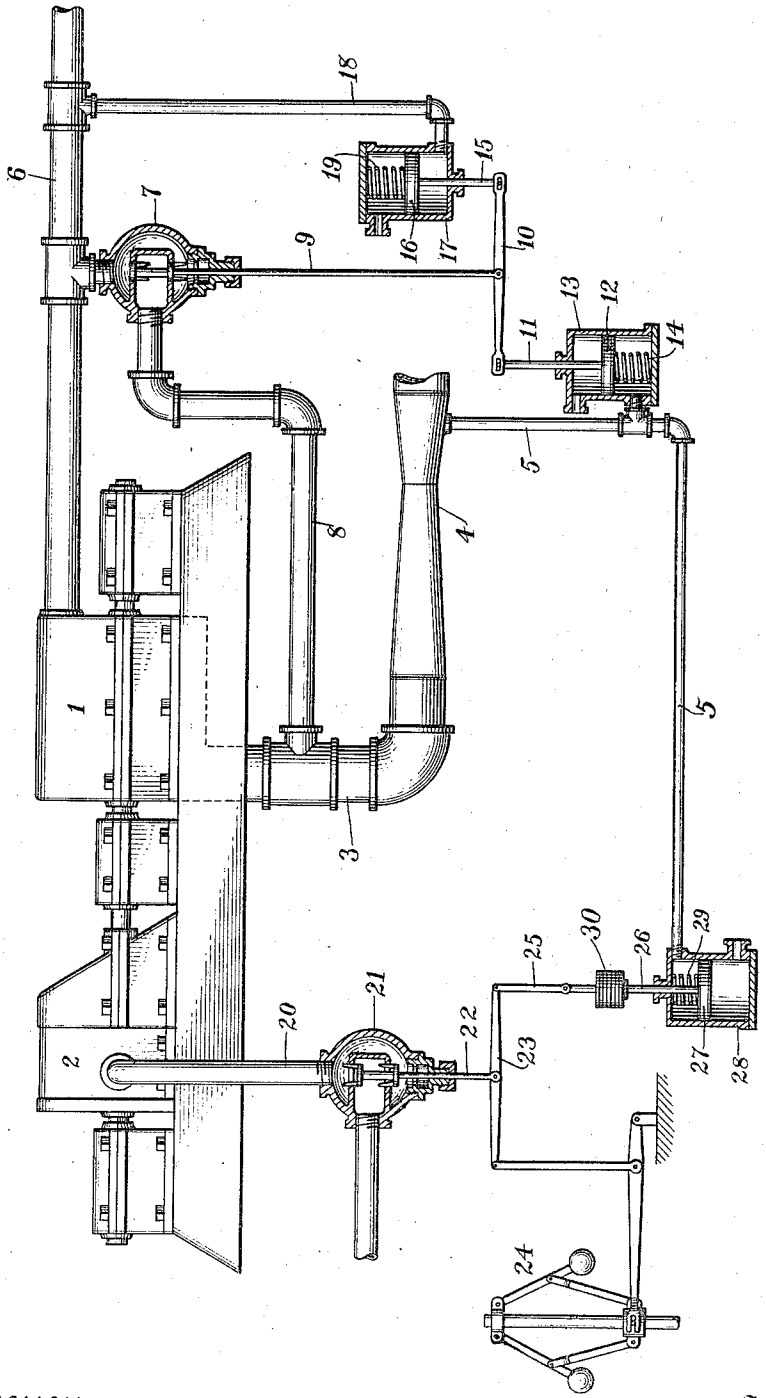
O. BANNER.

GOVERNING MECHANISM FOR CENTRIFUGAL BLOWING ENGINES.

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1,160,562. Patented Nov. 16, 1915.



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GOVERNING MECHANISM FOR CENTRIFUGAL BLOWING-ENGINES.

1,160,562. Specification of Letters Patent. Patented Nov. 16, 1915.

Application filed April 10, 1914, Serial No. 830,844. Renewed April 12, 1915. Serial No. 20,946.

To all whom it may concern:

Be it known that I, OTTO BANNER, a subject of the German Emperor, residing at Easton, in the county of Northampton and State of Pennsylvania, have invented a certain new and useful Improvement in Governing Mechanism for Centrifugal Blowing-Engines, of which the following is a specification.

This invention relates to centrifugal compressors and pumps and more particularly to regulating mechanisms therefor for preventing "pumping" of such machines at light loads.

In a previous application, No. 743,433 filed Jan. 22, 1913, I have described a mechanism whereby centrifugal compressors can be automatically prevented from "pumping" and at the same time the volume of fluid passing through the discharge line of the compressor accurately determined, these results being accomplished by placing a demand measuring device in the intake of the compressor, and a blow off valve in the discharge line of the compressor, the amount of fluid blown off through the blow off valve being automatically determined by connection with the demand measuring device, and an accurate measurement of the fluid actually passing through the discharge line obtained by returning the air blown off through the blow off valve to the intake of the compressor between the compressor and demand measuring device.

The object of the present invention is to provide a mechanism whereby the compressor can be regulated to give a constant volume of fluid through the discharge line through considerable variations of pressure, such as required, for instance, in connection with blowing engines for blast furnaces, the amount of blow off being automatically adjusted to the volume of fluid passing through the compressor, so that when the constant volume regulation of the compressor is changed to allow different constant volumes to be furnished by the compressor, the blow off will be automatically adjusted to the proper amount.

A further object is to provide means whereby the amount of blow off will be varied also in accordance with pressure in the discharge line of the compressor, less blow off being required at lower pressure.

With these objects in view I have devised the regulating mechanism, a practical embodiment of which is shown in the accompanying drawing, which shows a side elevation of the compressor, its engine, and the regulating mechanism, the essential parts of the latter being shown in section.

In the drawings is shown a compressor 1, driven by a turbine 2, in the intake 3 of which compressor is a demand measuring device 4, here shown as a Venturi tube of known construction which produces a subatmospheric pressure in the pipe 5 varying with the amount of fluid passing through the venturi. In the discharge line 6 of the compressor is a blow off valve 7, the discharge of which is connected by a pipe 8 to the inlet 3 of the compressor between the compressor proper and the demand measuring device 4. The valve stem 9 of the valve 7 is attached centrally to a lever 10 to one end of which is attached by a rod 11 a piston 12 sliding in a cylinder 13, the lower end of the cylinder being connected to the pipe 5 while the upper end is open to atmosphere, a spring 14 being provided tending to move the piston 12 in a direction to open the valve 7. To the other end of the lever 10 by means of a rod 15 is attached a piston 16 sliding in a cylinder 17 the lower end of the cylinder 17 being connected with the discharge line 6 of the compressor by a pipe 18 and a spring 19 being provided in the upper end of the cylinder tending to move the piston 16 in a direction to close the valve 7.

Referring now to the control of the driving engine 2. This engine 2 is provided with a fluid inlet pipe 20 controlled by a throttling valve 21. The stem 22 of the valve 21 is attached centrally to a lever 23. One end of this lever is connected to the moving element of a speed governor 24 driven from the engine 2 by connections, not shown, the attachment of the governor to the lever 23 being so arranged that increasing the speed of the engine will tend to close the valve 21. The other end of the lever 23 is attached by means of a link 25 to the piston rod 26 of a piston 27 sliding in a cylinder 28, the upper end of the cylinder 28 being connected to the pipe 5 and the lower end to atmosphere, a spring 29 being provided tending to move the piston 27 in a direction to open the valve 21. A series of weights 30 are pro-

vided on the piston rod 26 by means of which the position of the valve 21 and hence the speed of the engine and the output of the compressor can be manually varied.

In operation, a constant volume of fluid is taken in through the venturi 4 and discharged through the discharge line 6 to the blast furnace or other apparatus in the following way. If the resistance in the discharge line is increased, a temporary fall in the amount of fluid passing through the venturi 4 will result. This will cause the pressure to rise in the pipe 5, which will result in a movement of the piston 27 and lever 23 opening the valve 21 of the engine and admitting sufficient extra steam to the engine to overcome the resistance in the discharge line 6 of the compressor, and force the required amount of air through. Conversely, if the resistance in the discharge line 6 is decreased for any cause, the flow of fluid increases and the pressure in the pipe 5 is lowered with the result that the valve 21 is closed to a certain extent. Any desired amount of fluid can be constantly passed through the compressor by adding or removing weights 30 and consequently varying the normal position of the valve 21. The governor 24 prevents the speed of the engine from becoming too great at any time. When the desired output of the compressor is above its pumping limit the deficiency in pressure in the pipe 5 will be such that the piston 12 will be held at the bottom of the cylinder 13 and the blow off valve 7 at all times closed. If, however, it is desired to furnish an amount of air through the discharge line 6 which is below the pumping limit of the compressor the flow of this amount of fluid through the venturi 4 will cause such a pressure in the pipe 5 that the piston 12 will be raised a certain amount, opening the valve 7 to allow enough air to be blown out from the discharge line and pass through the pipe 8 back to the intake of the compressor to make up the difference between the amount passing through the venturi 4, and the amount required to pass through the compressor to prevent pumping. As the pumping limit is lower when the pressure in the discharge line is lower an additional refinement is added in that when the pressure in the discharge line becomes less the piston 16 moves in such a direction as to modify the action of the piston 12 to a certain extent by closing the valve 7 to an extent dependent on the drop in pressure in the discharge line 6 thus reducing the amount of air blown off from the discharge line. This discharge line pressure controlled mechanism can be omitted in some cases without affecting the operation of the device.

It is to be understood that the present showing and description discloses only one specified modification of the invention, and other forms and modifications are included in the spirit and scope of the invention as expressed in the claims.

I claim—

1. The combination with a centrifugal compressor and a driving motor therefor, intake and discharge lines for said compressor, a demand measuring device in the intake line of the compressor, a blow off valve in the discharge line of the compressor, a conduit for returning the blow off air to the intake of the compressor between the demand measuring device and the compressor inlet, a governing device for the motor controlled by the demand measuring device to furnish a constant volume of fluid through said demand measuring device, means to adjust the governing device to supply different volumes of fluid through said demand measuring device, and means controlled by said demand measuring device for adjusting said blow off valve in accordance with the amount of fluid passing through said demand measuring device.

2. The combination with a centrifugal compressor and a driving motor therefor, intake and discharge lines for said compressor, a demand measuring device in the intake line of the compressor, a blow off valve in the discharge line of the compressor, a conduit for returning the blown off air to the intake of the compressor between the demand measuring device and the compressor inlet, a governing device for the motor controlled by the demand measuring device to furnish a constant volume of fluid through said demand measuring device, means to adjust the governing device for different volumes through said demand measuring device, means controlled by said demand measuring device for adjusting said blow off valve in accordance with the amount of fluid passing through said demand measuring device and means to vary the adjustment of said blow off valve in accordance with the pressure in said discharge line.

3. The combination with a centrifugal compressor and a driving motor therefor, intake and discharge lines for said compressor, a demand measuring device in the intake line of the compressor, a blow off valve in the discharge line of the compressor, a conduit for returning the blown off air to said compressor at a point where it will not be measured by said demand measuring device, a governing device for the motor controlled by the demand measuring device to furnish a constant volume of fluid through said demand measuring device, means to adjust the governing device to supply different volumes of fluid through said demand measuring device, and means controlled by said demand measuring de-

vice for adjusting said blow off valve in accordance with the amount of fluid passing through said demand measuring device.

4. The combination with a centrifugal compressor and a driving motor therefor, intake and discharge lines for said compressor, a demand measuring device in the intake line of the compressor, a blow off valve in the discharge line of the compressor, a conduit for returning the blown off air to said compressor at a point where it will not be measured by said demand measuring device, a governing device for the motor controlled by the demand measuring device to furnish a constant volume of fluid through said demand measuring device, means to adjust the governing device for different volumes through said demand measuring device, means controlled by said demand measuring device for adjusting said blow off valve in accordance with the amount of fluid passing through said demand measuring device and means to vary the adjustment of said blow off valve in accordance with the pressure in said discharge line.

In testimony whereof, I have hereunto set my hand.

OTTO BANNER.

Witnesses:
PAUL HOFFMAN,
F. A. POPE.