F. V. D. LONGACRE.

REGULATOR FOR FLUID COMPRESSORS.

APPLICATION FILED JUNE 29, 1912. RENEWED APR. 2, 1914.

1,099,457.

Patented June 9, 1914.

2 SHEETS—SHEET 1.

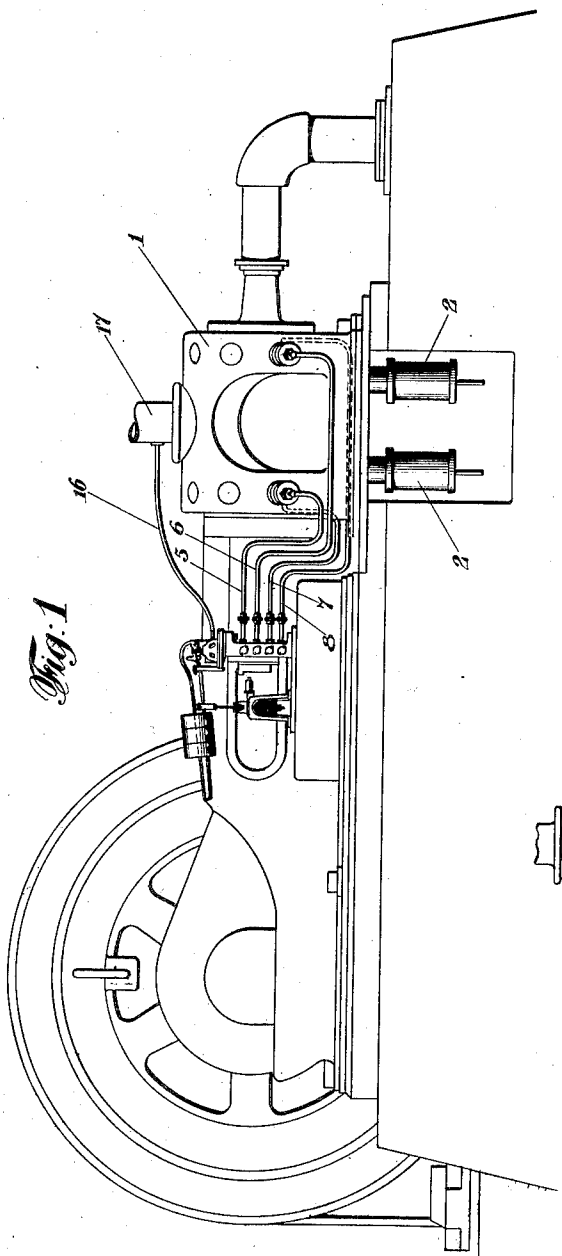


Fig. 1

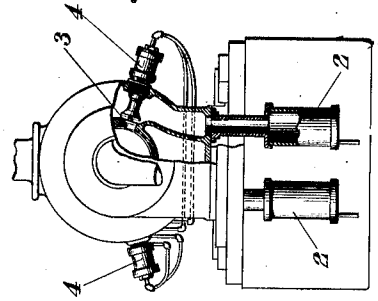


Fig. 2

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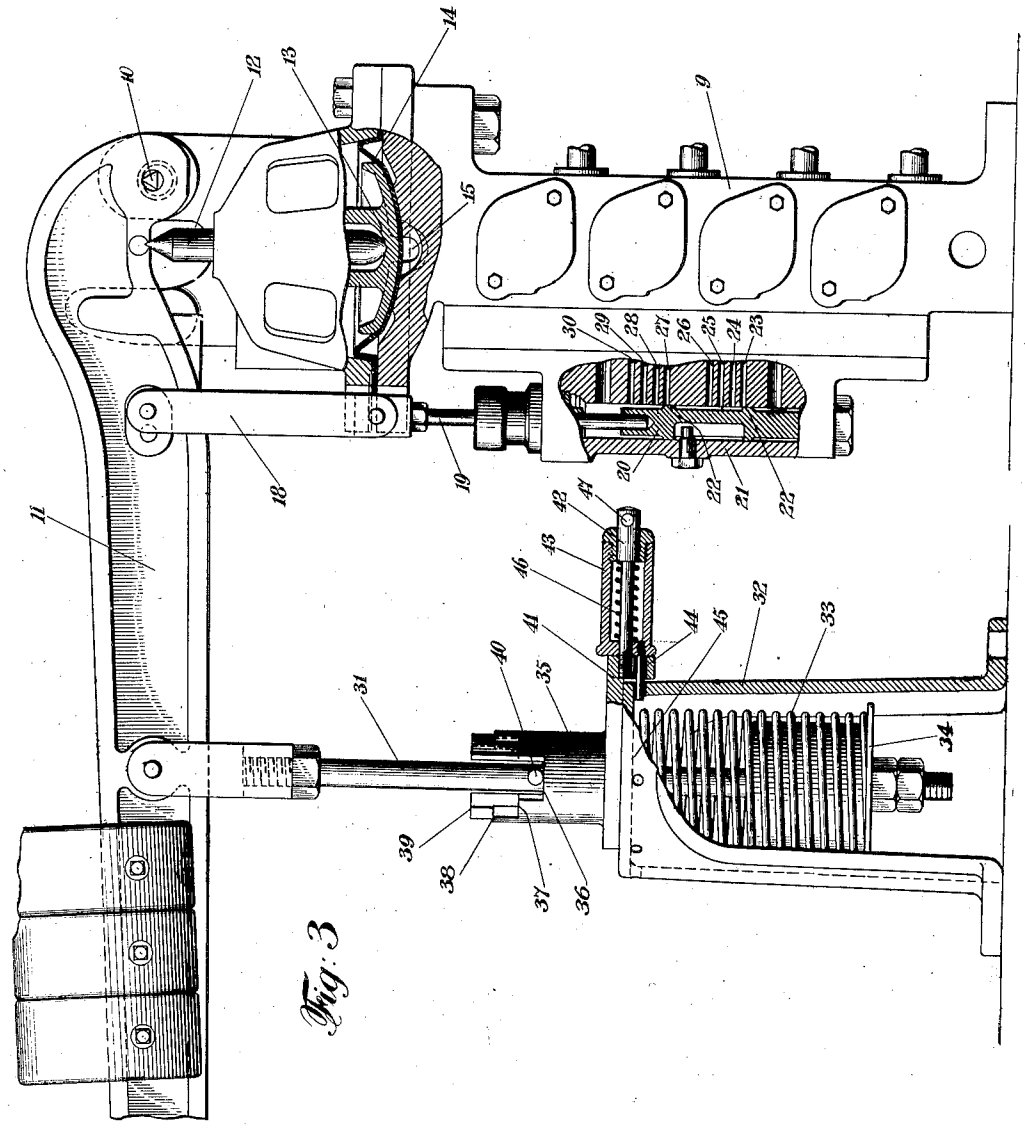


Fig. 3

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UNITED STATES PATENT OFFICE.

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REGULATOR FOR FLUID-COMPRESSORS.

1,099,457. Specification of Letters Patent. Patented June 9, 1914.

Application filed June 29, 1912, Serial No. 706,541. Renewed April 2, 1914. Serial No. 829,140.

To all whom it may concern:

Be it known that I, FREDERICK V. D. LONGACRE, a citizen of the United States, residing in Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Regulators for Fluid-Compressors, of which the following is a specification.

This invention relates to regulators for fluid compressors and more particularly to that class of regulators whereby a compressor can be unloaded to a greater or less extent when its full capacity is not required, thus economizing in the power expended in operating the compressor.

In the operation of a compressor its full capacity is often not necessary for extended periods of time, and in order not to waste power, particularly in those machines which are driven at a constant speed by synchronous motors the compressor must be partially unloaded, that is, regulated so that it does not work at its full capacity. Unloaders of various types are used, some unloading by automatic throwing in of additional clearance spaces at the ends of the cylinders, others by choking off part of the air normally admitted to the intake of the compressor, others by regulating the inlet valves so that they remain open for a part of the compression stroke. In all these unloaders however the degree of unloading is regulated by pressure in the discharge line of the compressor and at any time this pressure may fall to such an extent that the compressor, for the time being, is working at its maximum capacity. In certain cases, however, for instance where compressors are electrically driven, in calculating out the charges for electricity furnished, besides the regular charge for kilowatt-hours used, there is an additional fixed charge depending on the maximum amount of current used at any time. If therefore the compressor operates even only momentarily under full load the maximum rate of this fixed charge will be incurred for the whole period.

The object of the present invention is to provide a means whereby, when a compressor is to be operated for a long period of time, partially unloaded, the degree of load can not exceed a predetermined maximum or, in other words, the compressor, at all times, can be kept unloaded to a certain degree or more. With such a means the regulator of the compressor can be set so that the compressor will furnish a slightly greater amount of air or other gas than is necessary on the average and can not momentarily be forced to full capacity, by a temporary fluctuation in demand, the fixed charge referred to above thus being kept at a minimum.

A practical embodiment of a device comprising the above invention is shown in the accompanying drawings, in connection with an unloader of the type wherein the capacity of the compressor is varied by successively throwing in additional clearance spaces into the ends of the compressor cylinder.

In the drawings: Figure 1 is a side elevation of a compressor having a clearance unloader embodying my invention. Fig. 2 is an end elevation of the compressor cylinder showing the connections of the clearance controller and Fig. 3 is a side elevation, partly in section, of the clearance controller regulating mechanism together with the additional regulating means resulting from my invention.

The compressor and clearance controlling mechanism proper are of known construction, the particular form of clearance controller being fully described in the patent to Prellwitz, #1,027,760, May 28, 1912, and so will be here described only to such an extent as is necessary to understand the application of my invention.

As shown, the complete system comprises a compressor having a cylinder 1, each end of which is arranged to be connected to two clearance chambers 2, the openings between the cylinder and these clearances being controlled by valves 3. These valves are actuated by fluid pressure in the cylinders 4 which is conveyed separately to each by pipes 5, 6, 7, and 8 from the regulator 9. Pivoted on a pin 10 on the upper part of the regulator 9 is a weighted lever 11, against which contacts the upper end of a rod 12, the lower end of which is seated in the cup 13, which is secured to the diaphragm 14. On the under side of the diaphragm 14 is a chamber 15 to which a pipe 16 leads from the discharge pipe 17 of the compressor. Toward the free end of the lever from the rod 12 is pivoted a link 18, the lower end of which is pivotally secured to a rod 19. Fas-

tened to the rod 19 is a valve 20 which slides in a valve chest 21. When the pressure in the discharge line and hence in the chamber 15, reaches a certain amount the diaphragm 14 will be raised carrying with it the lever 11, the rod 19 and hence the valve 20.

As stated above, the details of the construction of this regulating mechanism form no part in the present invention as they are fully described in the patent of Prellwitz, mentioned above, and it is sufficient for the present purpose to state that as the flanges 22 on the valve 20 successively pass the ports 23, 24, 25, 26 and ports 27, 28, 29, and 30 leading from the valve chest, receiver pressure is successively exhausted from the pipes 8, 7, 6, and 5, successively opening the valves 3 and adding additional clearances in the cylinder. It will be therefore understood that when one of the flanges 22 is between the ports 23 and 24 and the other is between the ports 27 and 28, but one of the clearance chambers 2 will be open to the cylinder the compressor thus having somewhat less than its maximum capacity, while when the flanges 22 are above the ports 26 and 30 all four clearance chambers will be connected with the cylinder and its output capacity will be at a minimum.

In the present invention a means is provided whereby the maximum capacity of the compressor can at no time exceed a certain amount, this amount being determined by the degree of unloading, and in the present embodiment this is accomplished by limiting the downward movement of the valve 20. In the ordinary form of clearance controllers of this type a rod 31 is pivoted to the lever 11 and passes through a frame 32. The rod 31 is held resiliently against upward movement by a spring 33 which is held between a flanged stop 34, on the lower end of the rod 31, and the frame 32. In the present invention, on the upper side of this frame 32 is mounted a sleeve 35 which is provided around its upper circumference with a series of three opposite indentations of different depths which form a series of four steps or ledges 36, 37, 38 and 39. Through the rod 31 is secured a pin 40 with projecting ends which are of sufficient length to contact with the upper side of the steps or ledges 36 to 39. The sleeve 35 is rotatable on the frame 32 and is provided with an arm 41 to which is attached a pin 42 on which slides a cylindrical handle 43. The handle 43 is provided with a projecting pin 44 which is adapted to slide into holes 45 which are placed at intervals around the outer surface of the frame 32. The spring 46 tends to hold the handle 43 so that the pin 44 will thus engage one of the holes 45 and from which it can be disengaged by merely pulling back the handle 43. The pin 42 is provided at its outer end with a hole 47 through which a padlock, or any other lock, can be fastened thus locking the sleeve 35 in position.

The operation of the device can easily be understood from the description. When it is desired to operate the compressor at a certain average capacity, it is first determined which of the clearance chambers must be opened to give the compressor a capacity best adapted to the capacity required, the capacity chosen being preferably, of course, a little greater than that required. The capacity desired will require a certain number of the clearance chambers 2 to be connected with the cylinder at all times and hence will require that the valve 20, at no time, shall go below the point where these clearance chambers are thrown in. This is accomplished by setting the sleeve 35 so that the downward movement of the pin 40 will be stopped by the proper shoulder or step and after it is once set in this position the compressor will operate below this minimum degree of unloading until the sleeve 35 is set in another position.

Although the device is here shown in connection with an unloader of the clearance control type it is applicable to other forms of unloaders and it is to be understood that the present showing and description discloses only one specified modification of my invention and other forms and modifications are included in the spirit and scope of the invention as expressed in the claims.

What I claim is:

1. In combination, a compressor, its discharge line, an unloader for said compressor, means to operate said unloader variably by discharge line pressure, and means for limiting the action of said unloader to a minimum.

2. In combination, a compressor, its discharge line, means for unloading and loading said compressor in well defined steps in accordance with discharge line pressure and manually controlled mechanism for limiting the loading of said compressor to a capacity below a predetermined step.

3. In combination, a compressor, its discharge line, a series of unloading valves for said compressor, automatic means for successively operating said valves in accordance with discharge line pressure, and manually controlled means for operating one or more of said valves.

4. In combination, a fluid compressor, its discharge line, a series of unloading valve mechanisms, automatic means for successively operating said valves from discharge line pressure, and manually controlled mechanism for holding one or more of said valves in unloading position.

5. In a regulator for fluid compressors, a compressor cylinder, a discharge line therefrom, a series of clearance chambers, means

to successively throw said clearance chambers into communication with said cylinder at predetermined pressures in said discharge line, and means for maintaining one or more of said clearance chambers in communication with said cylinder during periods of underload.

6. In a regulator for fluid compressors, a compressor cylinder, a discharge line therefrom, a series of clearance chambers, means to successively throw said clearance chambers into communication with said cylinder at predetermined discharge line pressures comprising an element moving with said discharge line pressure, and an adjustable stop for limiting the movement of said element to retain one or more of said chambers in communication with the cylinder during periods of underload.

7. In a regulator for fluid compressors, a compressor cylinder, a discharge line therefrom, a series of clearance chambers, means to successively throw said clearance chambers into communication with said cylinder, at successively greater pressures in said discharge line, and manually operated stop mechanism for retaining one or more of said clearance chambers in communication with said cylinder during periods of underload, irrespective of the discharge line pressure.

8. In a regulator for fluid compressors, a compressor cylinder, a discharge line therefrom, a series of clearance chambers, valves for throwing said clearance chambers into communication with said cylinder, means for successively opening said valves at successive discharge line pressures, and manually operable mechanism for holding one or more of said valves open during periods of underload irrespective of said discharge line pressure.

9. In combination, a compressor, an unloader comprising a plurality of clearance chambers and a valve for successively throwing in said clearance chambers, the numbers of said chambers in operation being dependent on the position of said valve, and means for limiting the movement of said valve to a position where it throws in a predetermined minimum number of said clearance chambers.

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