C. WAINWRIGHT.

FLUID COMPRESSOR.

APPLICATION FILED DEC. 20, 1911.

1,081,176.

Patented Dec. 9, 1913.

3 SHEETS—SHEET 1.

Fig. 1.

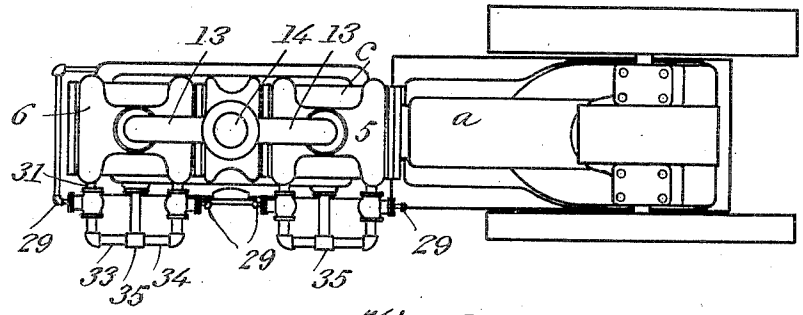
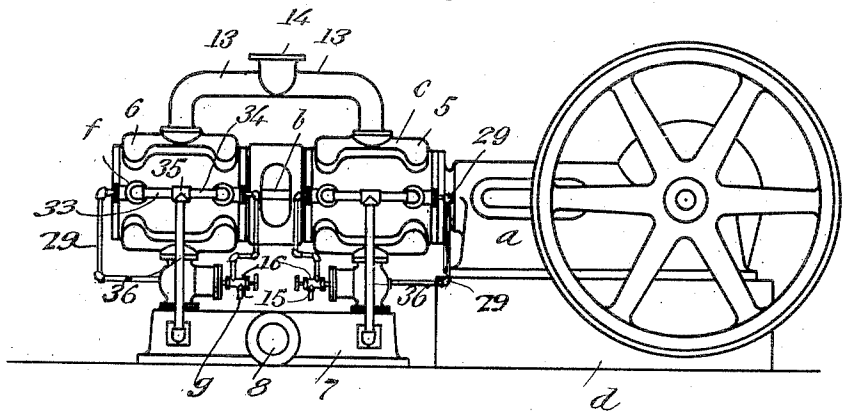



Fig. 2.



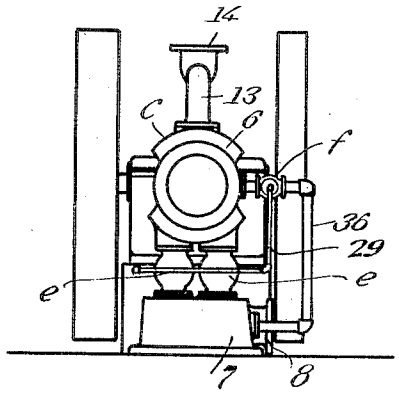




Fig. 3.

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3 SHEETS—SHEET 2.

Fig. 4.

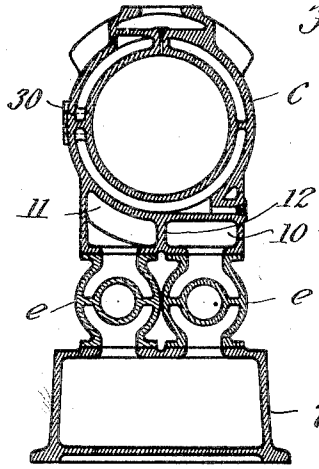



Fig. 5.

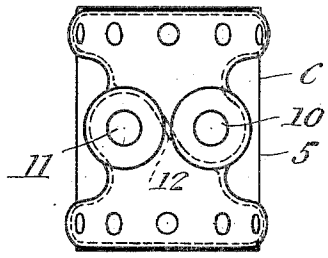



Fig. 8.

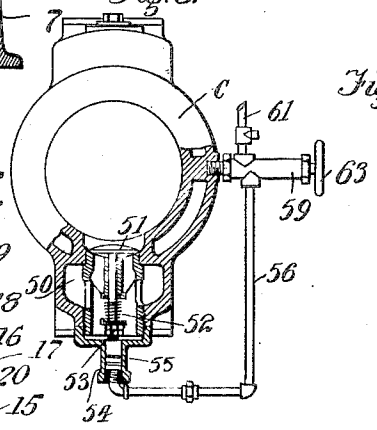



Fig. 9.

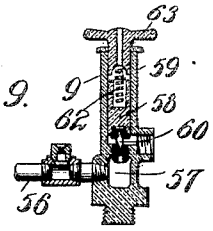



Fig. 6.

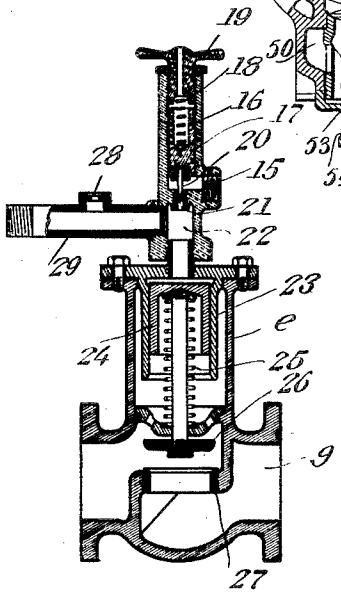
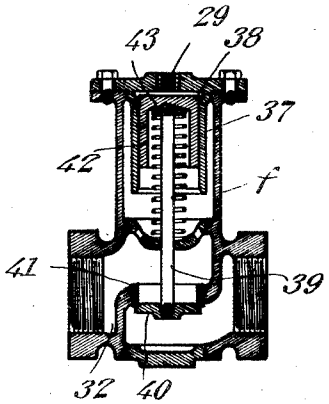



Fig. 7




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3 SHEETS—SHEET 3.

Fig. 10.

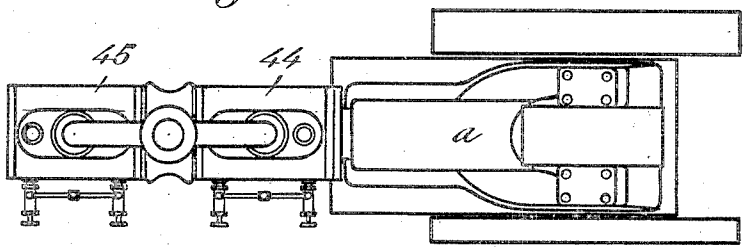



Fig. 11.

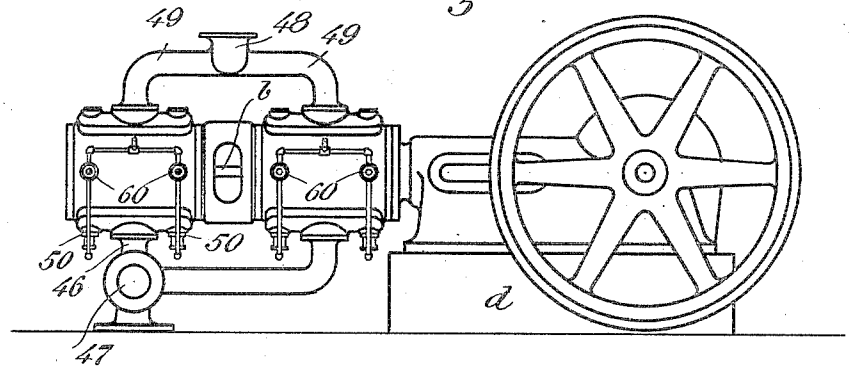
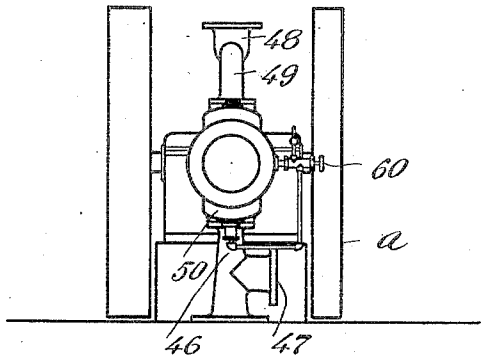



Fig. 12.




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# UNITED STATES PATENT OFFICE.

CHARLES WAINWRIGHT, OF ERIE, PENNSYLVANIA.

## FLUID-COMPRESSOR.

1,081,176. Specification of Letters Patent. Patented Dec. 9, 1913.

Application filed December 20, 1911. Serial No. 666,946.

*To all whom it may concern:*

Be it known that I, CHARLES WAINWRIGHT, a citizen of the United States, residing at Erie, in the county of Erie and State of Pennsylvania, have invented new and useful Improvements in Fluid-Compressors, of which the following is a specification.

The general object of the invention is to improve or refine the mode of unloading the cylinder of an air compressor as shown in my co-pending application, Serial No. 646,349, filed August 28th, 1911.

In the above named application I provide a series of unloaders which operate successively at predetermined increasing pressures in the container to close the intake chambers of the cylinders. With this arrangement admirable results have been attained and especially with altitude compressors, but I have found and especially with the use of single stage compressors, that a considerable amount of negative work, due to the piston's compressing and expanding the air entrapped in the cylinder by the closing of the intake, is thrown on the piston and consequently on the motor as each unloader goes into operation. With the present construction I overcome this defect by providing means adapted for permitting the escape of air entrapped by the closing of the unloader; and further adapt this means to operate synchronously, or substantially so, with the unloader; and to this end the invention consists in certain improved constructions, arrangements, and combinations of devices, which will be fully described hereinafter, and then pointed out in the claims.

Other objects will appear and be better understood from that embodiment of my invention of which the following is a specification, reference being had to the accompanying drawings forming a part hereof, in which:

Figure 1 is a plan of a single stage air compressor which I select for one adaptation of my invention. Fig. 2 is a side elevation thereof. Fig. 3 is an end elevation. Fig. 4 is a detail vertical cross section taken through one of the cylinders, unloaders and the intake box. Fig. 5 is a detail bottom plan of one of the cylinders. Fig. 6 is a detail vertical section of one of the unloaders. Fig. 7 is a similar view of one of the supplemental unloaders. Fig. 8 is a detail end elevation partly in section of the cylinder of an air compressor showing a modified form of my invention applied thereto. Fig. 9 is a detail vertical section of the type of unloader shown in Fig. 8. Fig. 10 is a plan of a compressor provided with the modification shown in Fig. 8. Fig. 11 is a side elevation of Fig. 10. Fig. 12 is an end elevation thereof.

In Figs. 1 to 3 inclusive, and 10 to 12 inclusive, *a* indicates generally a motor which may be of any improved or desired construction and of any preferred or desired type such as steam or electric, and suitably adapted for operating the piston rod *b* to which are suitably secured the pistons (not shown) which operate to compress the air in the cylinders 5 and 6 of the fluid compressor which is herein shown to be of the single stage type and designated by *c*.

The base *d* which supports the motor *a* is arranged beyond one end of the intake box 7 through the opening 8 of which the air or fluid to be compressed is drawn either from the atmosphere or other suitable source of supply. From the intake box 7 the air is drawn through the passages 9 of the unloaders or choking controllers *e* which are arranged in pairs at the opposite end portions of the intake box 7 and connected to the intake ports 10 and 11 which as shown in Figs. 4 and 5, are divided by a wall 12 so that one of said chambers communicates with one end of the cylinder of which it forms a part, while the other chamber communicates with the opposite end of the said cylinder. Suitable valves either of the puppet, or rotary type but not herein shown, are arranged so as to control the passages (not shown) between the intake ports 10 and 11 and the interior of the cylinders 5 and 6, these valves being operable either mechanically or by the action of the piston, all of which is well-known and in use with various types of air compressors.

The air compressed in the cylinders may pass directly therefrom through suitable pipes 13—13 connected by a T 14, to the point where the air is to be used, or the air may pass through these pipes and T into the container (not shown). It being understood, of course, that there will be provided suitable valves which will yield so as to admit air from the cylinders into the pipes and close under the pressure in the pipes.

By means of suitable pipes *g* communication is established between the container or

any other suitable portion of the discharge system of the compressor and the inlet openings 15 of the cylinders 16 of the unloaders *e*. The piston 17 in each of the cylinders 16 is operated by the fluid pressure in the said cylinder and moves against the action of a spring 18, the tension of which is adjusted by an adjusting screw 19. Now, when the tension of the spring in each unloader is different from the tension of the springs in the other unloaders, it will be manifest that the piston whose spring tension is slightest will operate under less container pressure than the pistons of the other unloaders. When each of the pistons 17 is operated as just described it lifts a needle valve 20 from its seat 21 through which the container pressure passes into a chamber 22 and finally into a cylinder 23 wherein a plunger 24 is located and adapted to be moved under the action of the compressed air and against the action of a spring 25. The plunger, during its downward movement against the action of the spring 25 lowers a valve 26 to its seat 27 in the passage 9. This will have the effect of closing the passage 9 and preventing the entrance of air into that chamber of the cylinder with which the passage 9 communicates. Thus, the passage 9 will be closed until the container pressure on the piston 16 is such as may be overcome by the spring 18. When this takes place the spring 18 will move the piston 16 so that the needle valve 20 will close the chamber 22 and the entrapped air in the chamber 22 will escape through a vent 28 in the pipe 29 which is suitably connected to an opening communicating with the chamber 22. As the air escapes through the vent 28 the spring 25 will operate to raise the piston 24 and open the passage 9 by unseating the valve 26.

As shown in Figs. 1 to 4 inclusive, the opposite ends of the cylinders 5 and 6 have exhaust passages 30 to each of which is suitably connected such as by a nipple 31, one end of a passage 32 of a supplemental unloader *f*. The passage 32 is suitably adapted to communicate with the source of fluid supply for the compressor. In the present instance and merely to illustrate one application of my invention, I show the unloaders *f* of each cylinder connected by pipes 33 and 34 which are in turn connected to the exhaust passages 32 of the unloaders *f* and to a T 35 to which is connected a pipe 36 which is directed into the supply chamber 7, all of which is shown in Figs. 1 to 3 inclusive.

Each unloader *f* has an interior cylinder 37 which is connected by the pipe 29 (fragments of which are shown in Figs. 1 to 3 inclusive and in Fig. 6), to the chamber 22 of one of the unloaders *e* and the compressed air which is conveyed through the pipe 29 to the cylinder 37 operates a piston 38 in the said cylinder to which a valve 40 is suitably connected such as by means of a rod 39. In their normal positions, the valve 40 is held to its seat 41 in the passage 32, and the piston is held to the lower end of the cylinder, as viewed in Fig. 7, by the action of a spring 42 so that normally the valves 40 of the unloaders *f* will cut off communication between the exhaust passages 30 and the source of fluid supply, or the chamber 7.

In carrying out the principles of my invention the springs of the supplemental unloaders *f* are adjusted by any suitable means such as by nuts, one of which is shown and indicated by 43, so that the tension of each spring of each supplemental unloader corresponds to the tension of the spring 16 of the unloader *e* to which it is connected. In doing this I adapt each connected unloader and supplemental unloader to act in unison and under a predetermined container pressure. In order to set forth the advantage gained by this combination of parts and at the same time to give an understanding of the broad principle of my invention regardless as to the type of compressor to which it may be applied or the number of unloaders and supplemental unloaders used, the following is given:—In the embodiment shown, four unloaders and four supplemental unloaders are employed. Now let it be assumed that the unloaders on cylinder 6 are adjusted so as to operate at 90 and 93 pounds respectively and the supplemental unloaders to which these unloaders are connected are adjusted so as to operate at the same predetermined pressures, viz., 90 and 93 pounds. The unloaders connected to the cylinder 5 are adjusted so as to operate at 95 and 98 pounds respectively, so also are the supplemental unloaders connected to these last-named unloaders adjusted so as to operate at the last stated pressures. Thus, it will be seen that when the container pressure is at 90 pounds the compressed air from the container which enters the chamber 22 and closes the valve 26, will also pass through the pipe 29 and into the cylinder 37 so that the valve 40 will be opened substantially synchronously with the closing of the valve 26. This will have the effect of preventing the drawing of air through the chamber to which the unloader *e* is connected, but will permit of air being drawn through the passage 32 and into the cylinder during the suction stroke of the piston thereof. But the passage 32 is now open, and the air drawn into the cylinder, instead of being compressed by the compression stroke of the piston therein, will be expelled through the passage 32. Thus, it will be seen that the provision of the supplemental unloaders will have the effect of eliminating the negative work on the pistons after the closing of the main unloaders. And this will be further manifest upon the closing of the second unloader, and still further

manifest upon the closing of all the unloaders and the opening of the supplemental unloaders in which event, the only resistance to the compression strokes of the pistons will be that of the atmosphere or the pressure in the chamber 7, and this under most conditions is so relatively small as to require no notice.

In the modified form shown in Figs. 9 to 12 inclusive, the cylinders 44 and 45 are connected by tubing 46—46.

The cylinders 44 and 45 are constructed similarly to the cylinders 5 and 6, as shown in Figs. 4 and 5. As shown in Figs. 8 and 11, however, the intake chamber 50 is connected by the tubing 46—46 to the common inlet 47. In this instance the inlet valve 51, which is of standard construction, also acts as an unloader or choking controller or exhaust valve. Each inlet valve 51 or the desired number on each end of a cylinder, is controlled through the action of a plunger or piston 54 in a cylinder 55 which is connected by a pipe or tube 56 to the chamber 57 in a controller *g*. A piston 58 located in a cylinder 59 formed with the controller carries a needle valve 60 which controls communication between the cylinder 59 and the chamber 57 and the pipe 61 which connects with the cylinder 59 and with the container (not shown) conveys the compressed air from the container to the cylinder 59. The spring 62 which bears upon the piston 58 and operates to hold the needle valve 60 to its seat, is adjusted by means of the screw 63. Inasmuch as there is a controller *g* provided to operate or raise the inlet valve or valves 51 for each end of each cylinder, and that each controller *g* has its spring 62 tensioned to work at a given predetermined pressure, it will be manifest that when the several controllers are adjusted to operate at different predetermined container pressures the same result as heretofore pointed out with reference to the preferred form, will be obtained as each end of the cylinder or cylinders are in their turn unloaded.

In conclusion I may state that I do not intend to limit myself to the use of the particular types of unloaders shown and described. My invention does not reside so much in the construction or particular operation of any of the unloaders shown, as in the result obtained. In the preferred form by connecting the unloaders so that they will operate in unison or substantially so, the parts are connected so that each unloader may control the operation of that unloader to which it is connected; while in the modified form each unloader or inlet valve or valves is operated directly by the container pressure. Moreover, and for the reason that the principle of my invention does not depend upon pneumatically operated unloaders it must be understood that I do not intend to limit myself to the use of liquid pressure for carrying out the principle of my invention, since it will be manifest that this principle may be carried out by the use of mechanically operated unloaders which are now in use or by a combination of mechanically and pneumatically operated controllers.

What I claim as new is:

1. In an air compressor, the combination of an intake box, a cylinder superimposed on the box and having an intake port, a choking controller interposed between the cylinder and the intake box and communicating with the intake of the cylinder, a relief device directed into one end of the cylinder and operatively connected to the choking controller.

2. In a double acting air compressor, the combination of an intake box, a cylinder superimposed upon the box and having spaced intake ports and a pair of choking controllers interposed between the cylinder and the intake box and communicating with the intakes of the cylinder, a plurality of relief devices directed into the opposite end portions of the cylinder and operatively connected to the said choking controllers.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES WAINWRIGHT.

Witnesses:
JAMES N. ALLBURN,
FRED J. CARNEY.