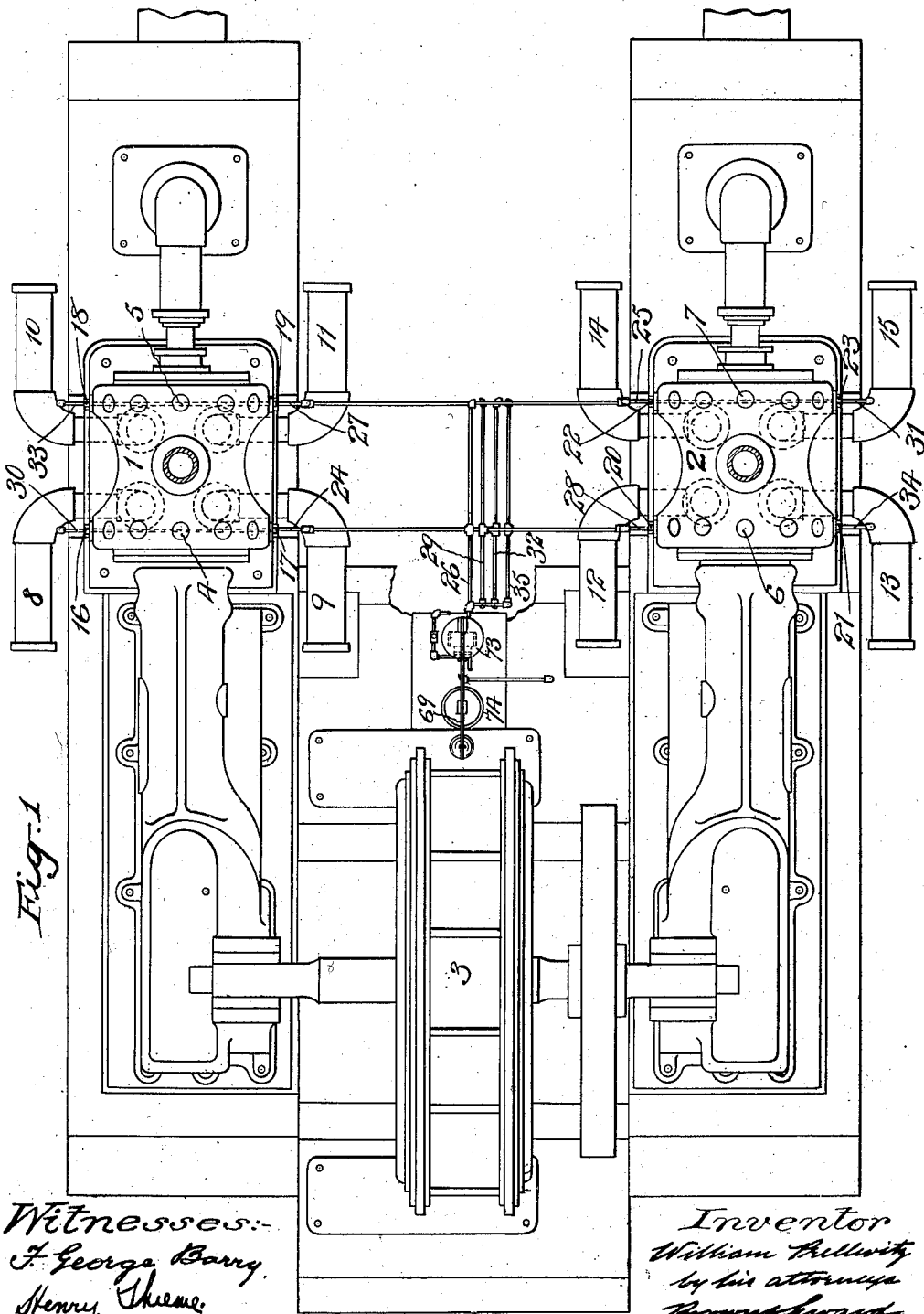


W. PRELLWITZ.
UNLOADER FOR FLUID COMPRESSORS.
APPLICATION FILED NOV. 20, 1908.

1,027,757.

Patented May 28, 1912.

6 SHEETS—SHEET 1.



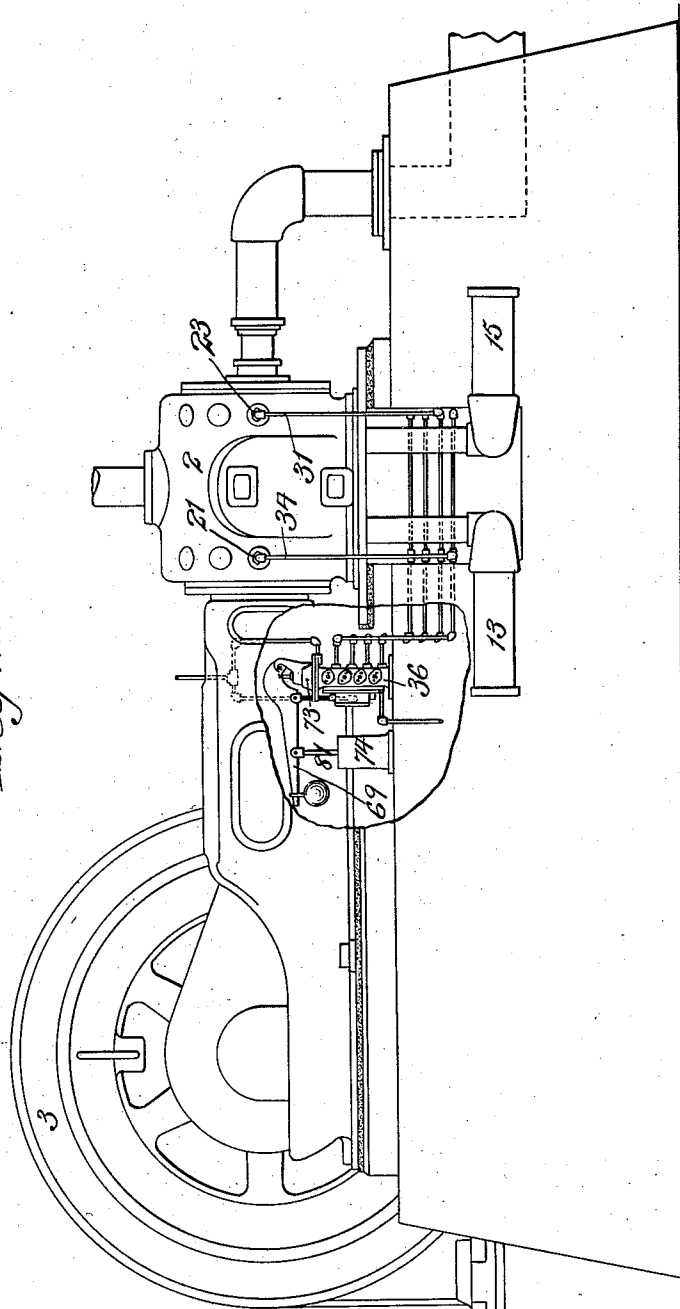
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6 SHEETS—SHEET 2.

1,027,757.

Fig. 2.



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Henry Shime.

Inventor:
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by his attorneys
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6 SHEETS—SHEET 3.

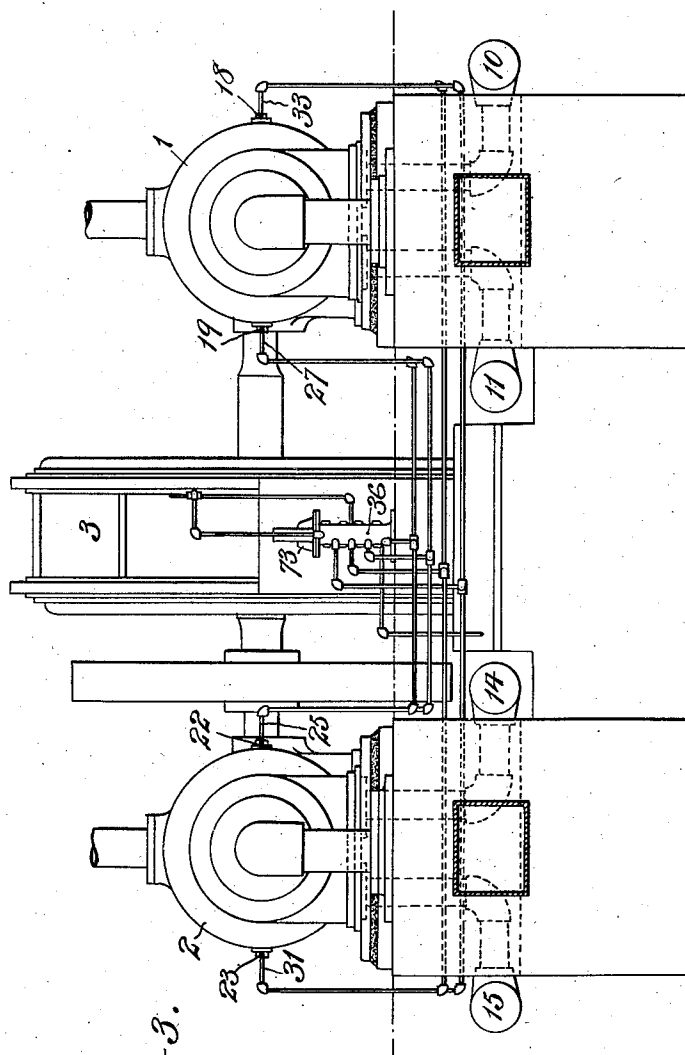


Fig. 3.

Witnesses:

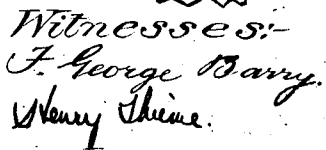
F. George Barry,
Henry Thiem.

Inventor:

William Prellwitz
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Arnold & Swank

1,027,757.

6 SHEETS—SHEET 4.



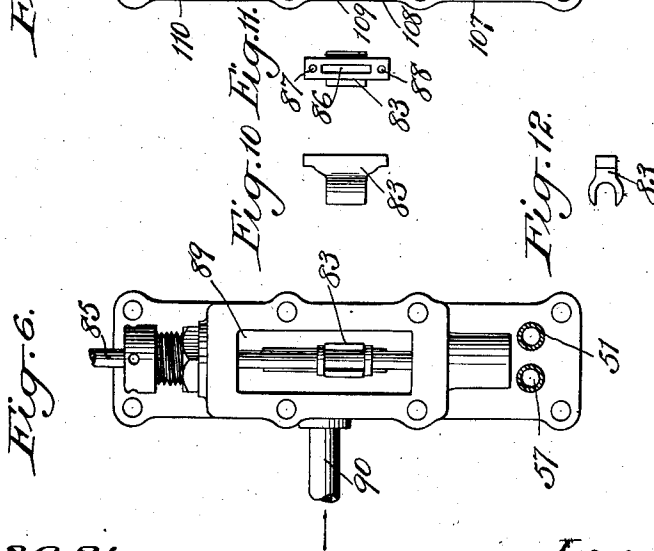
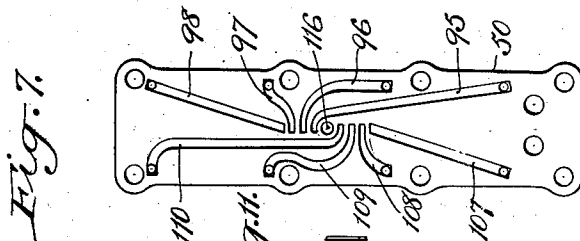
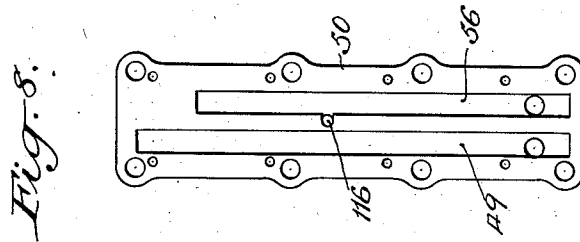
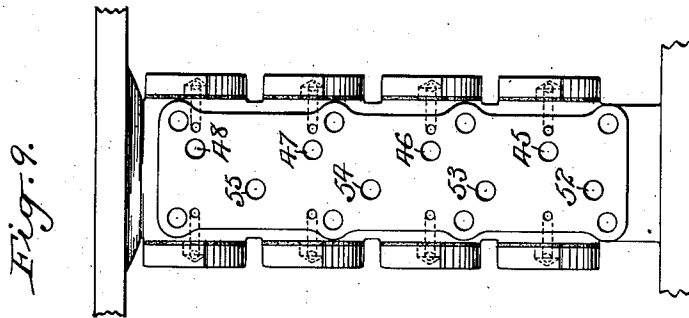
Inventor { William Halliday
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W. PRELLWITZ.
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APPLICATION FILED NOV. 20, 1908.

1,027,757.

Patented May 28, 1912.

6 SHEETS—SHEET 5.



Witnesses:
F. George Barry,
Henry Thime.

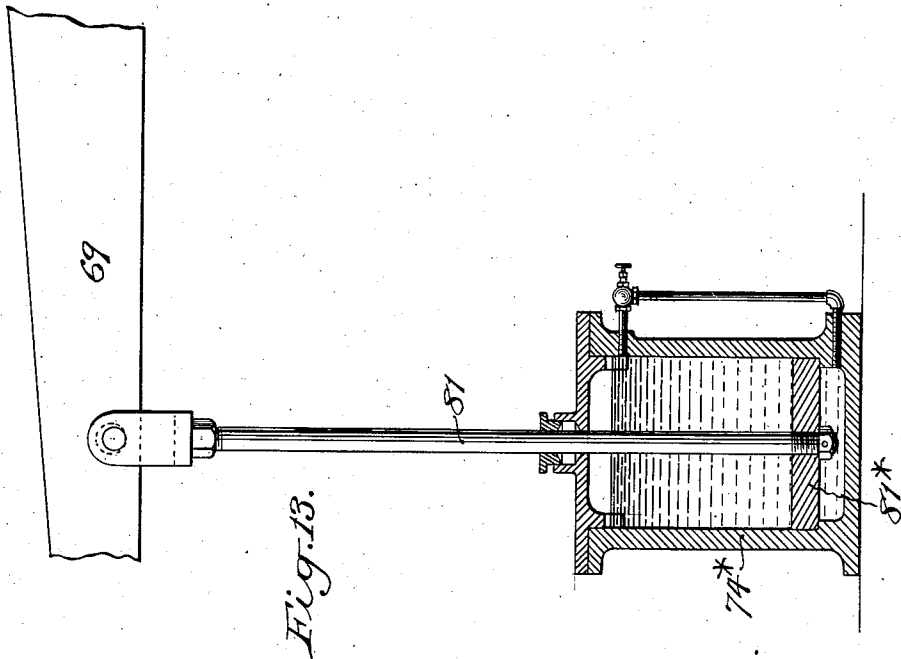
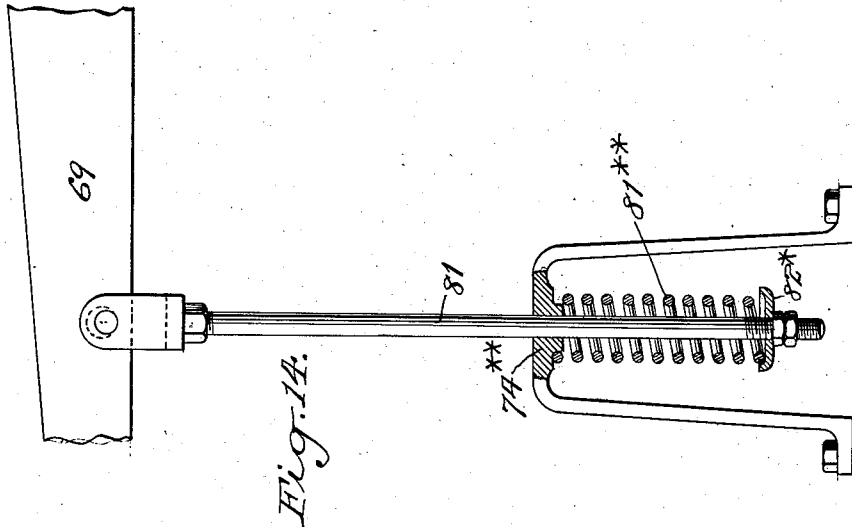
Inventor:
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W. PRELLWITZ.
UNLOADER FOR FLUID COMPRESSORS.
APPLICATION FILED NOV. 20, 1908.

1,027,757.

Patented May 28, 1912.

6 SHEETS—SHEET 6.



Witnesses:-
J. George Barry.
Henry Ching

Inventor:
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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.

UNLOADER FOR FLUID-COMPRESSORS.

1,027,757.

Specification of Letters Patent.

Patented May 28, 1912.

Application filed November 20, 1908. Serial No. 463,603.

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 Unloaders for Fluid-Compressors, of which the following is a specification.

This invention relates to improvements in fluid compressors and has for its principal object to provide a single device for controlling the loading and unloading of the pumping mechanism of a fluid compressor at successively attained pressures.

A further object is to provide a fluid pressure governed regulator having means, such as an auxiliary valve, arranged to successively operate a plurality of main regulator valves which control the loading and unloading of the compressor pumping mechanism.

A practical embodiment of my invention is represented in the accompanying drawings in which,

Figure 1 is a top plan view of a duplex single stage fluid compressor with my invention applied thereto, Fig. 2 is a side view of the compressor with a portion of the same broken away, Fig. 3 is an end view of the compressor, Fig. 4 is an enlarged detail view partially in section, of my improved regulator, Fig. 5 is a view taken at right angles to Fig. 4, partially in elevation and partially in section, Fig. 6 is an outer face view of the auxiliary valve chest with the cover plate removed, Fig. 7 is an outer face view of the port plate which is interposed between the auxiliary valve chest and the main valve chest, Fig. 8 is an inner face view of the same, Fig. 9 is a face view of the main valve chest, Figs. 10, 11 and 12 are detail side, face and end views of the auxiliary valve, Fig. 13 is a detail sectional view showing a dash pot resistance for the regulator lever, and Fig. 14 is a detail sectional view showing a spring resistance for the regulator lever.

I have chosen to illustrate my improved regulator in connection with a duplex single stage fluid compressor provided with auxiliary receivers arranged to be brought into and out of communication with the interiors of the compressor cylinders for securing a step by step unloading or loading of the

same as the fluid in the receiver reaches successively attained pressures.

One fluid compressor cylinder is denoted by 1 and the other by 2. The motor for driving the fluid compressor is denoted by 3. The cylinder 1 may be provided with the usual discharge valves 4 and 5 at its opposite ends and the cylinder 2 with the usual discharge valves 6 and 7 at its opposite ends. The cylinder 1 is provided with four auxiliary receivers, the receivers 8 and 9 communicating with the inner end of the cylinder and the receivers 10 and 11 with the outer end of the cylinder. The cylinder 2 is similarly provided with four auxiliary receivers, the receivers 12 and 13 communicating with the inner end of the said cylinder and the receivers 14 and 15 with the outer end thereof. Communication between these several auxiliary receivers and the interiors of the cylinders 1 and 2 is opened and closed by auxiliary receiver valves 16, 17, 18, 19, 20, 21, 22, 23. The backs of these auxiliary receiver valves are brought into communication with a single fluid pressure governed regulator. In the present instance the branch pipes 24, 25 which lead from the backs of the auxiliary receiver valves 17, 22, join in a common pipe 26 leading to the regulator. The branch pipes 27, 28 which lead from the backs of the auxiliary receiver valves 19, 20, join in a common pipe 29 leading to the regulator. The branch pipes 30, 31 leading from the backs of the auxiliary receiver valves 16, 23, join in a common pipe 32 leading to the regulator. The branch pipes 33, 34 leading from the backs of the auxiliary receiver valves 18, 21, join in a common pipe 35 leading to the regulator.

The fluid pressure governed regulator herein shown is one which is adapted to load or unload the pumping mechanism of the compressor in four steps at successively attained pressures. The main valve chest 36 of the regulator is provided with four main regulator valves 37, 38, 39, 40, having double headed pistons 41, 42, 43, 44 respectively. The spaces between the heads of the several pistons are at all times open to receiver pressure through ports 45, 46, 47, 48, opening into a common port 49 in the port plate 50, which port is connected to a pipe 51 leading from the receiver. The main regulator valve ports 52, 53, 54, 55 are at

all times in open communication with external atmosphere through a common port 56 in the port plate, which port is in open communication with a pipe 57 leading to
5 any suitable point.

The pipes 26, 29, 32 and 35 are provided with main regulator valve ports 58, 59, 60, 61, controlled by the main regulator valves 41, 42, 43, 44, respectively. These main
10 regulator valves are provided with bridge ports 62, 63, 64, 65. When these main valves are at the limit of their movements in one direction, the ports 58, 59, 60, 61, will be
15 open to receiver pressure, thus throwing the load on to the backs of the auxiliary receiver valves. When the main regulator valves are at the limit of their movements in the other direction, the several ports 58, 59, 60, 61, will be brought into open communication with
20 external atmosphere through the bridge ports in the said valves, thus unloading the auxiliary receiver valves.

Any suitable means may be employed for operating the several main regulator valves
25 at successively attained pressures so as to load or unload the pumping mechanism step by step, which means is shown in the present instance as constructed, arranged and operated as follows: A chamber 66 is provided
30 in the top of the main valve chest 36, which chamber is at all times open to receiver pressure through the pipe 67. This chamber is provided with a flexible diaphragm 68, which diaphragm receives the weight of a
35 lever 69, through connecting pieces 70, 71. This lever 69 is pivoted at 72 on the top 73 of the main valve chest 36. A graduated resistance is provided for the lever 69, which resistance is shown in Fig. 4 as a device
40 arranged to successively add additional weights to the lever 69 as the receiver pressure rises and for successively removing the weights therefrom as the receiver pressure falls, as follows. A suitable casing 74 is
45 provided with a stepped bore, the smallest bore being denoted by 75, the next larger by 76 and the largest by 77. Three disks 78, 79, 80, rest normally on the shoulders at the bottoms of their respective bores and are
50 arranged to be successively picked up and deposited by providing a rod 81, which rod passes downwardly through the said weights and is pivoted at its upper end to the lever 69, and is provided at its lower end with a
55 collar 82 below the weight 78. In Fig. 13 this resistance for the lever 69 is shown as a dash pot 74*, the piston 81* being carried by the rod 81. In Fig. 14 this resistance is shown as a spring 81** surrounding the rod
60 81 and interposed between the collar 82* on the rod and a support 74**. This weighted lever 69 operates the means which controls the movements of the main valves, which means in the present instance, is shown as
65 an auxiliary valve 83 fitted to slide within

the auxiliary valve chest 84. A rod 85 is connected at its upper end to the lever 69 and is connected to the auxiliary valve 83 within the auxiliary valve chest 84. This
70 auxiliary valve 83 is provided with a bridge port 86 and through ports 87, 88. The chamber 89 within which the auxiliary valve 83 slides, is at all times open to receiver pressure through a pipe 90. The inner wall of
75 the auxiliary valve chest 84 is provided with ports 91, 92, 93, 94, which are in open communication through passages 95, 96, 97, 98, in the port plate 50, with ports 99, 100, 101, 102, at the corresponding ends of the
80 main regulator valve pistons 41, 42, 43, 44. The inner wall of the auxiliary valve chest 84 is also provided with ports 103, 104, 105, 106, which are in open communication through passages 107, 108, 109, 110, in the
85 port plate 50, with ports 111, 112, 113, 114, on the opposite sides of the main regulator valve pistons 41, 42, 43, 44. The auxiliary valve chest 84 is also provided with a port 115 which is at all times in open communication
90 with external atmosphere, through a port 116 opening into the common exhaust port 56 in the port plate 50. The ports 91, 92, 93, 94, 103, 104, 105, 106 and 115 are arranged in alinement in the path of the
95 auxiliary valve 83.

The operation of the fluid pressure governed regulator as illustrated in Figs. 1-12 inclusive is as follows: When the parts are in their normal position shown in the accompanying drawings, the auxiliary valve
100 will be at the limit of its downward movement. This position of the valve will leave the ports 91, 92, 93, 94, and thereby the ports 99, 100, 101, 102, open to receiver pressure; and the ports 103, 104, 105, 106
105 and thereby the ports 111, 112, 113, 114, open to external atmosphere. This will cause all of the main regulator valves to be forced to the limits of their movements in a direction which will open the backs of the several
110 auxiliary receiver valves to receiver pressure and thus hold the said valves closed. As the receiver pressure begins to rise, it will act upon the diaphragm 68, thus raising the lever 69. When the lever 69 has
115 been raised a predetermined distance, the auxiliary valve 83 will be moved into a position to open the port 91 and thereby the port 99, to external atmosphere and at the same time open the port 103 and thereby the
120 port 111, to receiver pressure within the auxiliary valve chamber 89 through the port 88 in the auxiliary valve 83. This condition will force the main regulator valve 37 to the limit of its movement in the
125 opposite direction, thereby unloading the backs of the auxiliary receiver valves 17, 22, by opening the backs of the same to external atmosphere through the ports 58, 52, and
130 valve bridge port 62. If the receiver pres-

sure still continues to rise after this partial unloading of the pumping mechanism, the further upward movement of the lever 69 will cause the collar 82 to lift the weight 78.

5 The auxiliary valve 83 is so constructed that it will cause the shifting of the next succeeding main regulator valve 38 to cause it to unload the auxiliary receiver valves 19, 20, without disturbing the unloaded condition of the auxiliary receiver valves 17, 22. If the receiver pressure still continues to rise, the upward movement of the lever 69 will cause the weight 79 to be picked up and will cause the auxiliary valve 83 to unload the auxiliary receiver valves 16, 23. A still further rise in the receiver pressure will cause the weight 80 to be picked up and will cause the auxiliary valve 83 to unload the auxiliary receiver valves 18, 21. It will thus be seen that as the receiver pressure falls, the influence of the several weights will be removed from the lever 69 and also that the load will be thrown on to the pumping mechanism step by step.

25 While I have shown and described this fluid pressure governed regulator as applied to a fluid compressor having auxiliary receivers for returning the pressure fluid back to the pumping mechanism, it is to be understood that this regulator may be used for unloading any fluid compressor at predetermined points. Furthermore, it is to be understood that while this fluid pressure governed regulator is shown in connection with a duplex single stage compressor, it may be used in connection with any other type as may be desired. It is also to be understood that I do not wish to limit myself to a four step loading and unloading of a fluid compressor by a single regulator but it is intended that this regulator should cover the unloading of a fluid compressor in any number of steps desired.

What I claim is:

45 1. The combination with the cylinder of a fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinder and the auxiliary receivers and a regulator connected to the backs of the valves for successively unloading them as different predetermined high pressures are reached, for unloading the compressor step by step.

55 2. The combination with the cylinders of a duplex single stage fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinders and the auxiliary receivers and a regulator connected to the backs of the valves for successively unloading them as different predetermined high pressures are reached, for unloading the compressor step by step.

65 3. The combination with the cylinder of a fluid compressor, of auxiliary receivers, valves for opening and closing communication

between the cylinder and the auxiliary receivers and a single fluid pressure governed regulator connected to the backs of the valves, for successively unloading them as different predetermined high pressures are reached, for unloading the compressor step by step.

4. The combination with the cylinders of a duplex single stage fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinders and the auxiliary receivers and a single fluid pressure governed regulator connected to the backs of the valves for successively unloading them as different predetermined high pressures are reached, for unloading the compressor step by step.

5. The combination with the cylinder of a fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinder and auxiliary receivers and a regulator for successively unloading the valves as the pressure rises to predetermined points and for successively loading the valves as the pressure falls to predetermined points, for automatically unloading and loading the compressor step by step.

6. The combination with the cylinders of a duplex single stage fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinders and auxiliary receivers and a regulator for successively unloading the valves as the pressure rises to predetermined points and for successively loading the valves as the pressure falls to predetermined points, for automatically unloading and loading the compressor step by step.

7. The combination with the cylinder of a fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinder and auxiliary receivers and a single fluid pressure governed regulator for successively unloading the valves as the pressure rises to predetermined points and for successively loading the valves as the pressure falls to predetermined points, for automatically unloading and loading the compressor step by step.

8. The combination with the cylinders of a duplex single stage fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinders and auxiliary receivers and a single fluid pressure governed regulator for successively unloading the valves as the pressure rises to predetermined points and for successively loading the valves as the pressure falls to predetermined points, for automatically unloading and loading the compressor step by step.

9. The combination with the cylinders of a fluid compressor, of auxiliary receivers, valves for opening and closing communication

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tion between the cylinders and auxiliary receivers and a regulator connected to the backs of the valves for successively unloading them as different predetermined high pressures are reached, for unloading the compressor step by step.

10. The combination with the cylinders of a fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinders and auxiliary receivers and a single fluid pressure governed regulator connected to the backs of the valves for successively unloading them as different predetermined high pressures are reached, for unloading the compressor step by step.

11. The combination with the cylinders of a fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinders and auxiliary receivers and a single regulator for successively unloading the valves as the pressure rises to predetermined points and for successively loading the valves as the pressure falls to predetermined points, for automatically unloading and loading the compressor step by step.

12. The combination with the cylinders of a fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinders and auxiliary receivers and a single fluid pressure governed regulator for successively unloading the valves as the pressure rises to predetermined points and for successively loading the valves as the pressure falls to predetermined points, for automatically unloading and loading the compressor step by step.

13. The combination with the cylinder of a fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinder and auxiliary receivers and a regulator comprising a plurality of main valves arranged to control the operation of the auxiliary receiver valves to load and unload the compressor and means for controlling the movements of the said main valves.

14. The combination with the cylinder of a fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinder and auxiliary receivers and a regulator comprising a plurality of main valves arranged to control the operations of the auxiliary receiver valves to load and unload the compressor and fluid pressure operated means for controlling the movements of said main valves.

15. The combination with the cylinders of a duplex single stage fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinders and the auxiliary receivers and a regulator comprising a plurality of main valves arranged to control the operation of the auxiliary receiver valves to load and unload the

compressor and means for controlling the movements of the said main valves.

16. The combination with the cylinders of a duplex single stage fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinders and the auxiliary receivers and a regulator comprising a plurality of main valves arranged to control the operation of the auxiliary receiver valves to load and unload the compressor and fluid pressure operated means for controlling the movements of the said main valves.

17. The combination with the cylinder of a fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinder and the auxiliary receivers and a regulator comprising a plurality of main valves arranged to open the backs of the auxiliary receiver valves either to receiver pressure or to atmosphere and means for controlling the movements of the said main valves.

18. The combination with the cylinder of a fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinder and the auxiliary receivers and a regulator comprising a plurality of main valves arranged to open the backs of the auxiliary receiver valves either to receiver pressure or to atmosphere and fluid pressure operated means for controlling the movements of the said main valves.

19. The combination with the cylinders of a duplex single stage fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinders and the auxiliary receivers and a regulator comprising a plurality of main valves arranged to open the backs of the auxiliary receiver valves either to receiver pressure or to atmosphere and means for controlling the movements of the said main valves.

20. The combination with the cylinders of a duplex single stage fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinders and the auxiliary receivers and a regulator comprising a plurality of main valves arranged to open the backs of the auxiliary receiver valves either to receiver pressure or to atmosphere and fluid pressure operated means for controlling the movements of the said main valves.

21. The combination with the cylinder of a fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinder and auxiliary receivers and a regulator comprising a plurality of main valves arranged to open the backs of the auxiliary receiver valves either to receiver pressure or to atmosphere and a single auxiliary valve for controlling the movements of the said main valves.

22. The combination with the cylinder of a fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinder and auxiliary receivers and a regulator comprising a plurality of main valves arranged to open the backs of the auxiliary receiver valves either to receiver pressure or to atmosphere, a single auxiliary valve for controlling the movements of the said main valves and a fluid pressure operated lever for moving the auxiliary valve.

23. The combination with the cylinders of a fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinders and auxiliary receivers and a regulator comprising a plurality of main valves arranged to open the backs of the auxiliary receiver valves either to receiver pressure or to atmosphere and a single auxiliary valve for controlling the movements of the said main valves.

24. The combination with the cylinders of a fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinders and auxiliary receivers and a regulator comprising a plurality of main valves arranged to open the backs of the auxiliary receiver valves either to receiver pressure or to atmosphere, a single auxiliary valve for controlling the movements of the said main valves and a fluid pressure operated lever for moving the auxiliary valve.

25. The combination with the cylinders of a duplex single stage fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinders and auxiliary receivers and a regulator comprising a plurality of main valves arranged to open the backs of the auxiliary receiver valves either to receiver pressure or to atmosphere and a single auxiliary valve for controlling the movements of the said main valves.

26. The combination with the cylinders of a duplex single stage fluid compressor, of auxiliary receivers, valves for opening and closing communication between the cylinders and auxiliary receivers and a regulator comprising a plurality of main valves arranged to open the backs of the auxiliary receiver valves either to receiver pressure or to atmosphere, a single auxiliary valve for controlling the movements of the said main valves and a fluid pressure operated lever for moving the auxiliary valve.

27. A regulator for fluid compressors comprising a plurality of main valves independent of the compressor valves arranged to control the loading and unloading of the compressor, and a single auxiliary valve for controlling the movements of the said main valves.

28. A regulator for fluid compressors

comprising a plurality of main valves independent of the compressor valves arranged to control the loading and unloading of the compressor, a single auxiliary valve for controlling the movements of the said main valves, and a fluid pressure controlled lever for moving the auxiliary valve.

29. A regulator for fluid compressors comprising a plurality of main valves arranged to control the loading and unloading of the compressor, a single auxiliary valve for controlling the movements of the said main valves, a fluid pressure controlled lever for moving the auxiliary valve, and means for successively applying weights to and removing them from said lever as the lever reaches different predetermined points.

30. A regulator for fluid compressors comprising a plurality of main valves independent of the compressor valves arranged to open the backs of certain of the compressor valves either to receiver pressure or to atmosphere for loading or unloading the compressor valves, and a single auxiliary valve for controlling the movements of the said main valves.

31. A regulator for fluid compressors comprising a plurality of main valves independent of the compressor valves arranged to open the backs of certain of the compressor valves either to receiver pressure or to atmosphere for loading or unloading the compressor valves, a single auxiliary valve for controlling the movements of the said main valves, and a fluid pressure controlled lever for moving the auxiliary valve.

32. A regulator for fluid compressors comprising a plurality of main valves arranged to open the backs of certain of the compressor valves either to receiver pressure or to atmosphere for loading or unloading the compressor valves, a single auxiliary valve for controlling the movements of the said main valves, a fluid pressure controlled lever for moving the auxiliary valve, and means for successively applying weights to and removing them from said lever as the lever reaches different predetermined points.

33. A regulator for single stage fluid compressors comprising a plurality of main valves independent of the compressor valves arranged to control the loading and unloading of the compressor, and a single auxiliary valve for controlling the movements of the main valves.

34. A regulator for single stage fluid compressors comprising a plurality of main valves independent of the compressor valves arranged to control the loading and unloading of the compressor, a single auxiliary valve for controlling the movements of the main valves, and a fluid pressure controlled lever for moving the auxiliary valve.

35. A regulator for single stage fluid compressors comprising a plurality of main

valves arranged to control the loading and unloading of the compressor, a single auxiliary valve for controlling the movements of the main valves, a fluid pressure controlled lever for moving the auxiliary valve, and means for successively applying weights to and removing them from said lever as the lever reaches different predetermined points.

36. A regulator for duplex single stage fluid compressors comprising a plurality of main valves independent of the compressor valves arranged to control the loading and unloading of the compressor cylinders, and a single auxiliary valve for controlling the movements of the main valves.

37. A regulator for duplex single stage fluid compressors comprising a plurality of main valves independent of the compressor valves arranged to control the loading and unloading of the compressor cylinders, a single auxiliary valve for controlling the movements of the main valves, and a fluid

pressure controlled lever for moving the auxiliary valve.

38. A regulator for duplex single stage fluid compressors comprising a plurality of main valves arranged to control the loading and unloading of the compressor cylinders, a single auxiliary valve for controlling the movements of the main valves, a fluid pressure controlled lever for moving the auxiliary valve and means for successively applying weights to and removing them from said lever as the lever reaches different predetermined points.

In testimony, that I claim the foregoing as my invention, I have signed my name in presence of two witnesses, this ninth day of November 1908.

WILLIAM PRELLWITZ.

Witnesses:

F. GEORGE BARRY,
HENRY THIEME.