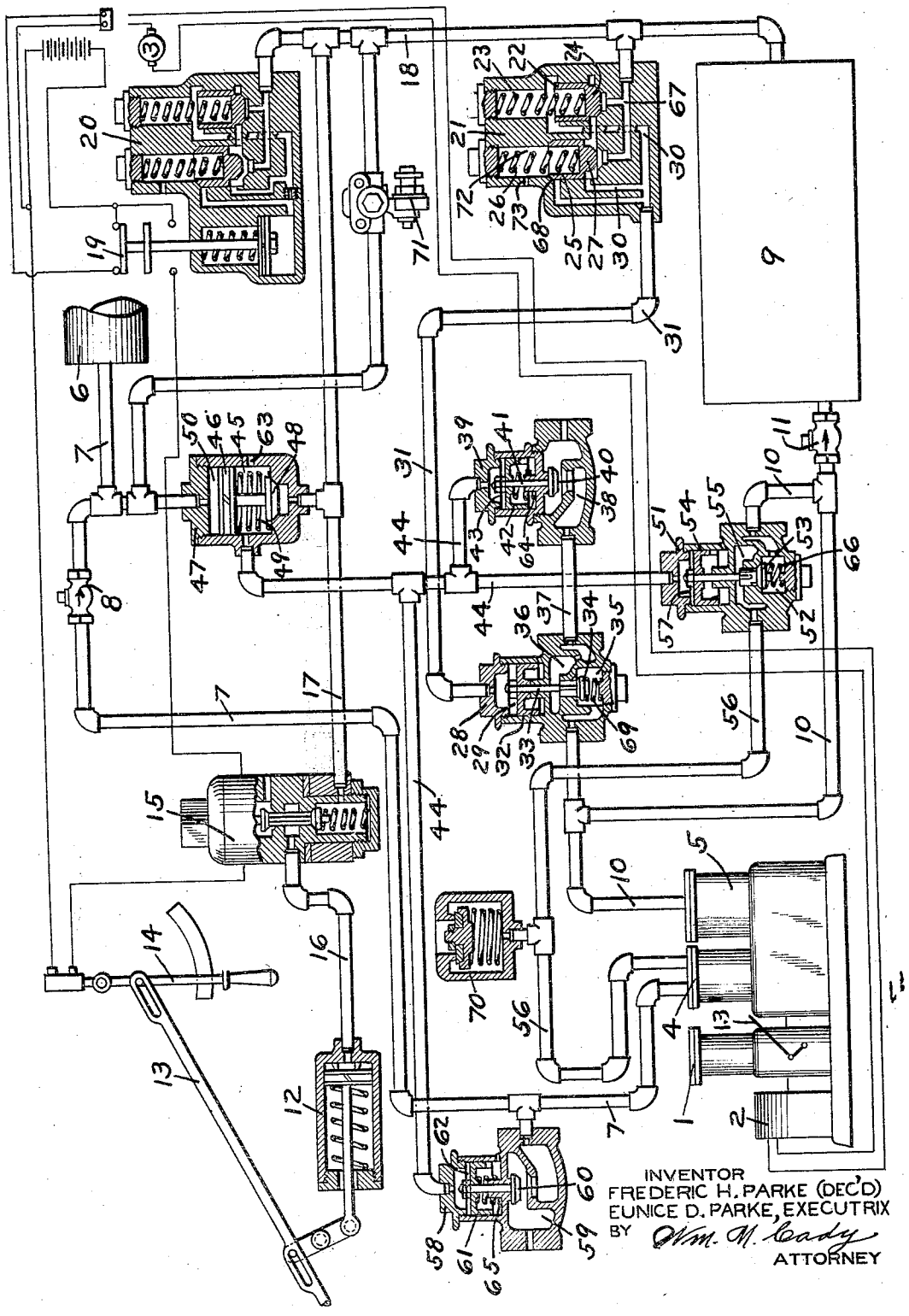
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LOADING AND UNLOADING MEANS FOR FLUID COMPRESSORS

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LOADING AND UNLOADING MEANS FOR FLUID COMPRESSORS

Original application filed January 1, 1928, Serial No. 246,875, and in Canada June 5, 1928. Divided and this application filed January 30, 1929. Serial No. 336,251.

This invention relates to fluid pressure brake equipment and more particularly to the means for compressing fluid for use in said equipment.

The principal object of the invention is to provide novel means for automatically loading and unloading the high and low pressure cylinders of a fluid compressor according to the pressure of the fluid compressed by the compressor.

Other objects and advantages will appear in the following more detailed description of the invention.

The present application is a division of an application for Letters Patent filed by Frederic H. Parke, (now deceased) on January 14, 1928, and serially numbered 246,875 for improvements in pressure governors.

In the accompanying drawing, the single figure is a diagrammatic view, principally in section, of fluid compressing apparatus embodying the invention.

In the accompanying drawing, the reference character 1 indicates an internal combustion or oil engine which may be mounted on a vehicle in any desired manner and drives an electric generator 2 for supplying current to the vehicle propelling motor 3 and also drives a two stage fluid compressor having a high pressure cylinder 4 and a low pressure cylinder 5, the compressor piston, (not shown) in the high pressure cylinder 4 being adapted to operate to supply fluid under pressure to a high pressure reservoir or bottle 6 through a pipe 7, a check valve device 8 being interposed in the pipe 7 to prevent the back flow of fluid from the reservoir or bottle 6, and the compressor piston (not shown) in the low pressure cylinder 5 being adapted to operate to supply fluid under pressure, to a storage or main reservoir 9 through a pipe 10, there being a check valve device 11 interposed in this pipe to prevent the back flow of fluid from the reservoir 9.

In the drawing there is illustrated a piston device 12 adapted to operate the usual throttle valve device, with which the engine 1 may be equipped, through the medium of a throttle rod 13 to accelerate or decelerate the engine to or from its idling speed according to the pressure carried in the main reservoir 9. Connected to the throttle rod 13 is a lever 14 adapted to be operated manually to control the speed of the engine 1. For the purpose of controlling the operation of the piston device 12, an electro-magnet valve device 15 is provided which is connected to the piston device 12 through a pipe 16, and is also connected to the main reservoir 9 through pipes 17 and 18. The energization and deenergization of the magnet of the electro-magnet valve device is controlled through an electric circuit, the opening and closing of which is controlled by a switch device 19 operative in accordance with the pressure of fluid from the main reservoir 9 as supplied through pipe 18 and through a low pressure governor device 20, said switch device also controlling the opening and closing of the car motor control circuit.

The details of all of the devices and electric circuits referred to in the preceding paragraph, as well as their functions and operation have been fully described in the aforementioned application for United States Letters Patent so that a more detailed description thereof is deemed unnecessary.

A high pressure governor device 21 is also provided comprising a casing containing a cut-out piston 22 subject to the pressure of a coil spring 23 and carrying a valve 24, and also comprises a cut-in piston 25 subject to the pressure of a coil spring 26 and carrying a valve 27.

Associated with the high pressure governor device 21, is a valve device 28, which may comprise a casing having a piston chamber 29 connected to a passage 30 in the governor device 21 by a pipe 31 and containing a piston 32 having a stem 33, carrying a valve 34 which is contained in a chamber 35, connected to the low pressure compressor cylinder 5, through pipe 10. The valve device 28 also has a chamber 36 which is adapted to be connected to the atmosphere through a pipe 37 and a passage 38 in a valve device 39, there being a valve 40 contained in the casing of said valve device 39, adapted to control the flow of fluid from the low pressure cylinder 5 of the compressor to the atmosphere. The

valve 40 has a stem 41 which is secured to a piston 42, the chamber 43 at one side of which, is connected through a pipe 44 to a chamber 45 at one side of a piston 46 contained in the casing of a piston valve device 47. Contained in the chamber 45 is a valve 48 which is carried by the piston 46. The pipe 17 leads to the small seated area of this valve 48. Also contained in the chamber 45 and interposed between the casing and the piston 48 is a coil spring 49. The chamber 50 at the other side of the piston 46 is connected to the high pressure reservoir 6 through pipe 7 leading from the high pressure cylinder 4 of the compressor.

For controlling the flow of fluid under pressure from the low pressure cylinder 5 to the high pressure cylinder 4 of the compressor, a valve device 51 is provided which may comprise a casing having a valve chamber 52, connected by the pipe 10, to the low pressure cylinder 5 in advance of the check valve 11 and containing a valve 53 operative by a piston 54 for controlling communication from the valve chamber 52 and a chamber 55 connected to the high pressure cylinder 4 by a pipe 56. The pipe 44 leads to the chamber 57 at the upper side of the piston 54.

For the purpose of controlling the unloading of the high pressure cylinder 4, a valve device 58 is provided which may comprise a casing having a passage 59, through which fluid under pressure from the high pressure cylinder 4 may flow to atmosphere, communication through said passage being controlled by a valve 60 secured to and operative by a piston 61. The pipe 44 leads to a chamber 62 at the upper side of the piston 61.

It will here be noted that the pipe 44 connects the chambers 43, 57 and 62 of the valve devices 39, 51 and 58 respectively, with the chamber 45 of the valve device 47, which latter chamber is open to atmosphere through a passage 63 of small diameter.

Assuming the high pressure reservoir 6 to be fully charged, the pressure of fluid from this reservoir, present in the chamber 50 in the valve device 47, acting on the upper side of the piston 46, maintains the valve 48 seated against the pressure of the spring 49. With the valve 48 thus seated, the chambers 43, 57 and 62 in the valve devices 39, 51 and 58, respectively, are connected to the atmosphere through pipe 44, valve chamber 45 in the valve device 47 and passage 63 in the casing of said valve device.

With the chambers 43, 57 and 62 thus connected to the atmosphere, the pressures of springs 64 and 65, acting on the under sides of the pistons 42 and 61 of the valve devices 39 and 58 respectively, maintains the respective valves 40 and 60 unseated, and the pressure of the spring 66 of the valve device 51 maintains the valve 53 seated.

Assuming also that the main reservoir 9 is charged with fluid under pressure in excess of a predetermined pressure, the pressure of fluid supplied through pipe 18 and a passage 67 from said reservoir, maintains the cut-in valve 27 of the high pressure governor device 21 unseated and a valve 68 carried by the cut-in piston 25 seated. With the cut-in valve 27 unseated, fluid at main reservoir pressure present in valve chamber 29 of the valve device 28, as supplied past the unseated cut-in valve 27, through passage 30 and pipe 31, acts upon the upper face of the piston 32 to maintain the valve 34 unseated against the pressure of the spring 69 contained in the valve chamber 35.

With the engine 1 running, the compressor is operated so that the high pressure cylinder continues to supply fluid through the pipe 7 and the low pressure cylinder 5 continues to supply fluid to the pipe 10.

Since the high pressure reservoir 6 is fully charged and the valve 60 of the valve device 58 is unseated, fluid thus supplied to the pipe 7 will flow to the atmosphere by way of passage 59 of said valve device, thus unloading the high pressure cylinder 4. It will here be noted that since the valve 53 of the valve device 51 is seated fluid cannot flow therethrough to the high pressure cylinder, and for the purpose of preventing a vacuum from being created in pipe 10 while this cylinder is operating, a relief valve 70 is provided which is connected to the pipe 56 between the high pressure cylinder 4 and the valve device 51 and which permits fluid to flow to the pipe 56 but prevents the flow of fluid from the pipe 56 to the atmosphere.

Since the main reservoir is charged sufficiently to maintain the cut-in valve 27 of the high pressure governor device 21 unseated and the valve 34 of the valve device 28 unseated, fluid supplied to the pipe 10 by the low pressure cylinder 5 will flow to the atmosphere through valve chamber 35 in the valve device 28, past the unseated valve 34, through chamber 36, pipe 37 and open passage 38 in the valve device 39, thus unloading the low pressure cylinder 5.

Interposed between and connected to the pipes 7 and 18 is a reducing valve device 71 which is adapted to operate to supply fluid under pressure from the high pressure reservoir 6 to the main reservoir 9 only when the main reservoir pressure reduces below the setting of the feed valve device. Such a reduction can only be caused by the failure of the low pressure cylinder to maintain the main reservoir pressure above the setting of the feed valve device, since the low pressure governor device operates at a higher pressure than the setting of the feed valve device, to increase the main reservoir pressure. This increase in main reservoir pressure is accomplished by the acceleration of the engine 1 in the manner described in the

hereinbefore referred to application for patent.

Should the pressure of fluid in the main reservoir 9 be decreased below that of the adjustment of the spring 26 of the high pressure governor device 21, the pressure of said spring causes the cut-in piston 25 to move downwardly, seating the valve 27 and unseating the valve 68. The seating of the valve 27 cuts off the supply of fluid under pressure from the main reservoir 9 to the piston chamber 29 in the valve device 28, and the unseating of the valve 68 permits the fluid under pressure in said chamber to flow to atmosphere by way of pipe 31, passage 30 in the high pressure governor device, past the unseated valve 68, through a chamber 72, containing the spring 26, and passage 73. With the piston chamber 29 thus vented, the pressure of the spring 69 of the valve device 28 causes the valve 34 to seat, thus closing communication from the valve chamber 35 to the chamber 36 and thereby preventing further flow of fluid from the low pressure cylinder 5 to the atmosphere. Fluid being compressed by the low pressure cylinder is supplied to the main reservoir 9 through pipe 10 and check valve device 11.

Now when the pressure of fluid in the main reservoir 9 is increased sufficiently to overcome the pressure of the spring 26 of the high pressure governor device 21 acting on the cut-in valve piston 25, said piston will move upwardly, unseating the valve 27 and seating the valve 68. The seating of the valve 68 closes the atmospheric vent for the piston chamber in the valve device 28 and the unseating of the valve 27 permits fluid under pressure to again flow to the piston chamber 28, which causes the piston 32 to move downwardly against the pressure of the spring 69, unseating the valve 34, thus again unloading the low pressure cylinder to the atmosphere.

Should the pressure of fluid in the high pressure reservoir 6 be reduced below a predetermined degree, fluid at main reservoir pressure flowing through pipes 18 and 17 and acting on the seated area of the valve 48, together with the pressure of the spring 49, causes the piston 46 to move upwardly, unseating the valve 48. With the valve 48 unseated fluid under pressure flows from the pipe 17 to the piston chambers 43, 57 and 62 in the valve devices 39, 51 and 58 respectively through chamber 45 in the valve device 47 and pipes 44, causing the respective pistons 42, 54 and 61 to move downwardly.

The downward movement of the pistons 42 and 61 of the valve devices 39 and 58 respectively, causes the valves 40 and 60 to seat, the seating of the valve 40 closing off the flow of fluid from the low pressure cylinder to atmosphere and the seating of the valve 60 closing off the flow of fluid from the high pressure cylinder to the atmosphere. The downward movement of the piston 54 of the valve device 51 causes the valve 53 to be unseated, permitting fluid supplied by the low pressure cylinder 5 through pipe 10 to flow to the high pressure cylinder 4 through pipe 56, the check valve device 11 preventing back flow of fluid under pressure from the main reservoir.

Fluid thus supplied to the high pressure cylinder 5 and compressed by said cylinder flows through pipe 7 and check valve device 8 to the high pressure reservoir 6, the check valve device 8 preventing back flow of fluid from the reservoir.

Now when the pressure of fluid in the reservoir 6 is again increased to a predetermined degree, the pressure of fluid in the piston chamber 50 causes the piston 46 to move downwardly seating the valve 48, thus cutting off the further supply of fluid under pressure from the main reservoir to the piston chambers 43, 57 and 62 of the valve devices 39, 51 and 58 respectively. Fluid under pressure from these three chambers now flows to the atmosphere through pipes 44, valve chamber 45 in the valve device 47 and passage 63, which permits the valves 40 and 60 of the valve devices 39 and 58 to be unseated and the valve 53 of the valve device 51 to be seated.

With the valves 40 and 60 unseated the high and low pressure cylinders are again unloaded and with the valve 53 of the valve device 51 seated, communication between the high and low pressure cylinders is closed off and fluid from the atmosphere flows to the high pressure cylinder through the relief valve device 70.

While one illustrative embodiment of the invention has been described in detail, it is not the intention to limit its scope to that embodiment or otherwise than by the terms of the appended claims.

Having now described the invention, what is claimed as new and desired to be secured by Letters Patent, is:—

1. The combination with an engine driven fluid compressor comprising a low pressure cylinder for supplying fluid under pressure to a low pressure reservoir of means operative upon a predetermined reduction in the pressure of fluid in said reservoir for accelerating the engine to increase the supply of fluid under pressure from said low pressure cylinder and operative when the pressure of fluid in said reservoir has been increased to a predetermined degree for decelerating said engine, and means operative upon a predetermined further increase in the pressure of fluid in said reservoir for unloading said low pressure cylinder.

2. The combination with an engine driven fluid compressor comprising a high and a low

pressure cylinder adapted to supply fluid under pressure to a high and a low pressure reservoir respectively, of means for unloading said high and low pressure cylinders when both of said reservoirs are charged to a predetermined degree, and means operative upon a predetermined reduction in the pressure of fluid in said high pressure reservoir for causing said high and low pressure cylinders to be connected together, and for causing the first mentioned means to operate to load said cylinders.

3. The combination with an engine driven fluid compressor comprising a high and a low pressure cylinder adapted to supply fluid under pressure to a high and a low pressure reservoir respectively, of means for unloading said high and low pressure cylinders when both of said reservoirs are charged to a predetermined degree, means operative for controlling the connecting and disconnecting of said high and low pressure cylinders, and means operative upon a predetermined reduction in the pressure of fluid in said high pressure reservoir for operating the first mentioned means for loading said cylinders, and for operating the second mentioned means for connecting said cylinders.

4. The combination with an engine driven fluid compressor comprising a high and a low pressure cylinder adapted to supply fluid under pressure to a high and a low pressure reservoir respectively, of means for unloading said high and low pressure cylinders when both of said reservoirs are charged to a predetermined degree, means operative for controlling the connecting and disconnecting of said high and low pressure cylinders, and means connected with both of said reservoirs and operative upon a predetermined reduction in the pressure of fluid in said high pressure reservoir for supplying fluid under pressure from said low pressure cylinder to operate the first mentioned means for loading the cylinders and to operate the second mentioned means for connecting said cylinders together.

5. The combination with two fluid compressing cylinders, a reservoir into which one cylinder compresses fluid and a reservoir into which the other cylinder compresses fluid, of an unloading device associated with each cylinder, and means operated upon a predetermined reduction in pressure in one reservoir for effecting the operation of both unloading devices to load both cylinders.

6. The combination with two fluid compressing cylinders, a reservoir into which one cylinder compresses fluid and a reservoir into which the other cylinder compresses fluid, of a valve device for controlling the supply of fluid compressed by one cylinder to the other cylinder, and means subject to the pressure of fluid in one reservoir for controlling the operation of said valve device.

7. The combination with two fluid compressing cylinders, a reservoir into which one cylinder compresses fluid and a reservoir into which the other cylinder compresses fluid, of a valve device for controlling the supply of fluid compressed by one cylinder to the other cylinder, and means operated upon a predetermined reduction in pressure in one reservoir for effecting the operation of said valve device to supply fluid compressed in one cylinder to the other cylinder.

8. The combination with two fluid compressing cylinders, a reservoir into which one of said cylinders compresses fluid and a reservoir into which the other of said cylinders compresses fluid supplied by the first mentioned cylinder, of means operative according to the pressures of fluid in said reservoirs for loading and unloading said cylinders, and means controlled according to the pressure of fluid in the second mentioned reservoir for controlling the supply of fluid from the first mentioned cylinder to the second mentioned cylinder.

9. The combination with two fluid compressing cylinders, a reservoir into which one of said cylinders compresses fluid and a reservoir into which the other of said cylinders compresses fluid supplied by the first mentioned cylinder, of means operative according to the pressures of fluid in said reservoirs for loading and unloading said cylinders, and means controlled by the operation of the first mentioned means for controlling the flow of fluid from one cylinder to the other.

10. The combination with two fluid compressing cylinders, a reservoir into which one of the cylinders compresses fluid and a reservoir into which the other cylinder compresses fluid supplied by the first mentioned cylinder, of a valve device for unloading and loading the second mentioned cylinder, and two valve devices, either one of which is adapted to be operated to control the loading and unloading of the first mentioned cylinder, one of the two valves being operative in accordance with the pressure of fluid in the first mentioned reservoir and the other being operative in accordance with the pressure of fluid in the second mentioned reservoir.

11. The combination with two fluid compressing cylinders, a reservoir into which one of the cylinders compresses fluid and a reservoir into which the other cylinder compresses fluid supplied by the first mentioned cylinder, of a valve device operative according to the mentioned cylinder, one of the last mentioned reservoir for loading and unloading the second mentioned cylinder, and two valve devices operative to load and unload the first mentioned cylinder, one of the last mentioned valve devices being operative according to the pressure of fluid in one of said reservoirs and the other being operative according to the

pressure of fluid in the other of said reservoirs.

12. The combination with two fluid compressing cylinders, a reservoir into which one of the cylinders compresses fluid and a reservoir into which the other cylinder compresses fluid supplied by the first mentioned cylinder, of a valve device operative according to the pressure of fluid in the second mentioned reservoir for loading and unloading the second mentioned cylinder, two valve devices operative to load and unload the first mentioned cylinder, one of the last mentioned valve devices being operative according to the pressure of fluid in one of said reservoirs and the other being operative according to the pressure of fluid in the other of said reservoirs, and means controlled according to the pressure of fluid in the second mentioned reservoir for controlling the flow of fluid from the first mentioned cylinder to the second mentioned cylinder.

13. The combination with two fluid compressing cylinders, a reservoir into which one of the cylinders compresses fluid and a reservoir into which the other cylinder compresses fluid supplied by the first mentioned cylinder, of a valve device operative to load and unload the second mentioned cylinder, two valve devices operative to load and unload the first mentioned cylinder, one of the two valve devices being operative according to the pressure of fluid in the first mentioned reservoir, a valve device operative to control the supply of fluid from the first mentioned cylinder to the second mentioned cylinder, and a valve device operative according to the pressure of fluid in the second mentioned reservoir for controlling the first mentioned valve device, the other of the two valve devices and the valve device for controlling the supply of fluid from one cylinder to the other.

14. The combination with a low pressure fluid compressing cylinder and a high pressure fluid compressing cylinder, a main reservoir into which the low pressure cylinder compresses fluid, a high pressure reservoir into which the high pressure cylinder compresses fluid supplied by the low pressure cylinder, of a valve device operative to load and unload the high pressure cylinder, a valve device operative according to the pressure of fluid in the main reservoir for loading and unloading the low pressure cylinder, another valve device for controlling the loading and unloading of the low pressure cylinder, and means operative according to the pressure of fluid in the high pressure cylinder for controlling the operation of the first and last mentioned valve devices.

15. The combination with a low pressure fluid compressing cylinder and a high pressure fluid compressing cylinder, a main reservoir into which the low pressure cylinder compresses fluid, a high pressure reservoir into which the high pressure cylinder compresses fluid supplied by the low pressure cylinder, of a valve device operative to load and unload the high pressure cylinder, a valve device operative to load and unload the low pressure cylinder, a governor device operative according to the pressure of fluid in the main reservoir for controlling the operation of the last mentioned valve device, another valve device operative to load and unload the low pressure cylinder, a valve device operative to control the supply of fluid from the low pressure cylinder to the high pressure cylinder, and means operative according to the pressure of fluid in the high pressure reservoir for controlling the operation of all of said valve devices with the exception of the second mentioned valve device.

16. The combination with two fluid compressing cylinders, a reservoir into which one cylinder compresses fluid and a reservoir into which the other cylinder compresses fluid, of two valves operative upon a predetermined increase in the pressures of fluid in both of said reservoirs for establishing communication through which one of said cylinders is unloaded.

17. The combination with two fluid compressing cylinders, a reservoir into which one cylinder compresses fluid and a reservoir into which the other cylinder compresses fluid, of two valves operative according to the pressures of fluid in said reservoirs for loading and unloading one of said cylinders.

18. The combination with a fluid compressor comprising a high pressure cylinder and a low pressure cylinder, a high pressure reservoir into which the high pressure cylinder compresses fluid and a low pressure reservoir into which the low pressure cylinder compresses fluid, of two valves operative to control the loading and unloading of the low pressure cylinder, one of said valves being subject to the pressure of fluid from the low pressure reservoir, a valve operative to control the loading and unloading of the high pressure cylinder, a valve operative to control the flow of fluid from the low pressure cylinder to the high pressure cylinder, and means subject to the pressure of fluid from the high pressure reservoir for controlling the operation of all of said valves with the exception of the valve which is subject to the pressure of fluid from the low pressure reservoir.

In testimony whereof I have hereunto set my hand.

EUNICE D. PARKE,
Executrix of the last will and testament of Frederic H. Parke, Deceased.