

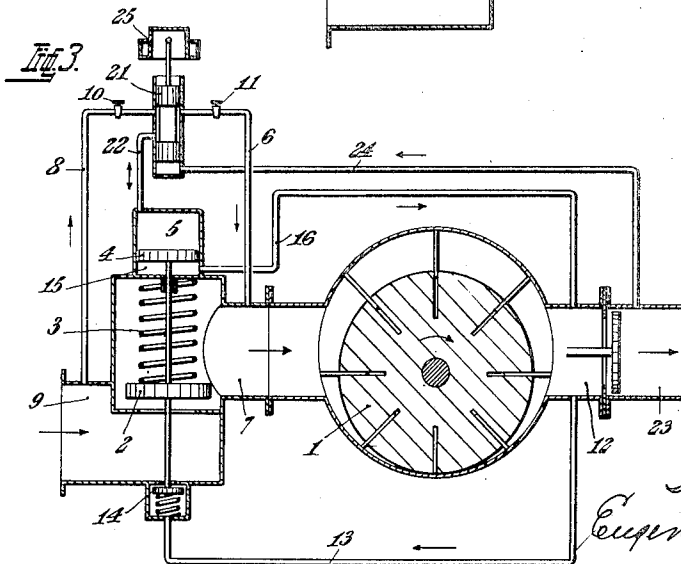
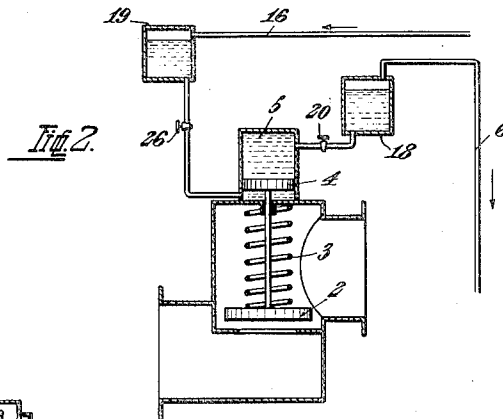
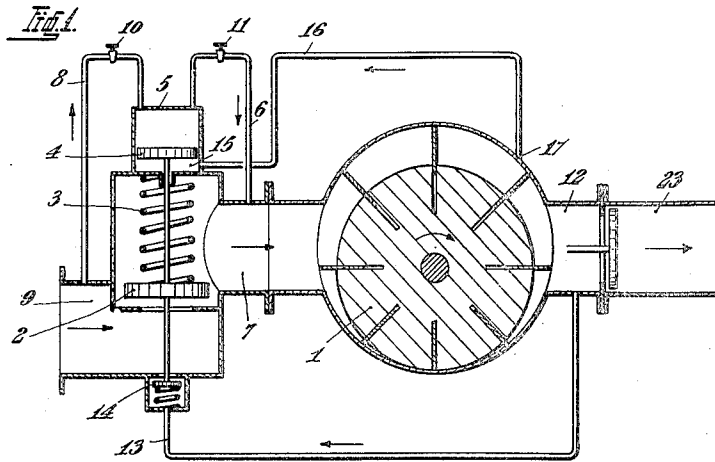
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COMPRESSOR

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COMPRESSOR

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The provision of automatically acting no-load starting devices in compressors makes it possible to start up with a small torque and therefore to make the starting device of small dimensions.

Similar arrangements are already known, which however have the disadvantage that at the first starting up of the compressor the starting valve does not yet become operative.

The present invention relates to an automatically acting no-load starting valve for compressors, which, when the engine is stationary, closes the suction branch owing to the pressure of a spring. After starting up the valve opens again under the influence of the vacuum on the suction side and is kept open while the plant is in operation through the pressure on the delivery side.

As compared with the known constructions the invention has the advantage that already at the first starting up of the engine the valve is closed, so that there is no danger of damage to the electric starter which is designed only for the starting current at no-load. Furthermore, should for any reason, for instance owing to the compressor or a pipe becoming leaky, the production of the vacuum in the suction branch or of the pressure in the delivery branch fail, the valve automatically separates the pressure side from the suction side.

In the drawing:—

Figure 1 illustrates a schematic view, partly in section, showing one form of the invention.

Figure 2 illustrates a similar view showing modifications of certain parts of the arrangement shown in Figure 1.

Figure 3 illustrates a schematic view, partly in section, showing a still further modified form of the invention.

A typical rotary compressor 1 is shown in connection with the controlling device properly forming this invention, this compressor having the usual suction and exhaust or outlet pipes.

The valve 2 is kept closed by the spring 3 when the engine is stationary and is controlled by the piston 4. The space 5 above this piston communicates through the pipe 6 with the part 7 of the suction branch. When starting up, a vacuum is produced in both spaces 7 and 5, which influences the piston 4 and opens the valve 2. The opening of the valve is only to take place when the engine has reached its full revolutions. A corresponding retardation may be produced in various ways. By connecting for instance the

space 5 through the pipe 8 with the atmosphere or the suction side 9 and causing atmospheric air to flow in, the time taken to evacuate the space 5 may be regulated at will by means of the throttling cocks 10 and 11. The valve only moves after a definite degree of vacuum has been reached. The air which has been compressed in the compression space 12 flows during the no-load period of the compressor through the by-pass 13 and the overflow valve 14 back into the suction pipe 9. After the valve 2 has opened the vacuum in the suction branch drops and the valve would close again owing to the pressure of the spring. In order to prevent this, the space 15 below the piston 4 is connected by the pipe 16 with the compression side of the compressor, so that the pressure keeps the valve open during the operative period. In many cases it is of advantage to withdraw the pressure at a suitable point 17 of the compression space, at which the desired amount of pressure is available.

In order to prevent the rapid opening and closing of the valve and the consequent loading and unloading shocks, the valve may be operated by pressure oil, as is shown by way of example in Fig. 2. For this purpose oil-filled intermediate vessels 18 and 19 are interposed in the compressed air pipe 16 and in the suction pipe 6. On starting up the compressor, the oil is, owing to the vacuum in the pipe 6, drawn by suction from the space 5 into the vessel 18, so that the piston 4 rises and opens the valve 2. For keeping the valve open in this case pressure oil from the vessel 19 is used, which is connected to the compressed air pipe 16. The valve motion may be retarded to any desired extent by throttling the flow of oil by means of a cock 20 or 26.

The described starting device can be very simply combined with means for regulating the output, which are interposed in a known manner on the suction side of the compressor and which on a certain pressure being reached in the delivery pipe close the suction branch and cause the compressor to run idle. Fig. 3 shows by way of example an arrangement of such a constructional form. The auxiliary controlling means 21 connect the pipes 6, 8 and 22 with one another, so that the above-described starting condition is obtained. Should the pressure in the delivery branch 23 and in the pipe 24 increase too greatly during operation, the auxiliary controlling means 21 which are loaded by a weight 25 are raised and the pipes 6 and 8 are closed, while at the same time the pipe 24 is connected to the pipe 22 and the space 5. The pressure

in the space 23 acts on the upper side of the piston 4. Consequently the valve 2 closes and remains in the no-load position until the pressure in the branch 23 has sunk to such an extent 5 that the weight 25 can cause the auxiliary controlling means to sink again. The valve thereupon opens again, as during the starting period.

What I claim is:

1. In apparatus for starting compressors under no-load conditions, the combination with a compressor having an inlet pipe and an exhaust pipe; of a valve in the suction pipe opening towards the compressor, spring means urging the valve to close, a cylinder alined with the valve 10 on the side towards the compressor, a piston in said cylinder having a rod connected with said valve, and means to establish piston operative communication between a point on the suction pipe located between the valve and compressor 15 and a point on the cylinder at the side of the piston remote from the valve.

2. In apparatus for starting compressors under no-load conditions, the combination with a compressor having an inlet pipe and an exhaust 25 pipe; of a valve in the suction pipe opening towards the compressor, spring means urging the valve to close, a cylinder alined with the valve on the side towards the compressor, a piston in said cylinder having a rod connected with said 30 valve, and a duct leading from a point in the suction pipe between the valve and compressor to a point in the cylinder on the side of the piston remote from the valve.

3. In apparatus for starting compressors under no-load conditions, the combination with a compressor having an inlet pipe and an exhaust 35 pipe; of a valve in the suction pipe opening towards the compressor, spring means urging the valve to close, a cylinder alined with the valve on the side towards the compressor, a piston in said cylinder having a rod connected with said 40 valve, a closed fluid containing reservoir communicating with the cylinder on the side of the piston remote from the valve, and a duct leading from a point on the suction pipe between the 45 valve and the compressor to the reservoir above the fluid therein.

4. In apparatus for starting compressors under no-load conditions, the combination with a 50 compressor having an inlet pipe and an exhaust pipe; of a valve in the suction pipe opening towards the compressor, spring means urging the valve to close, a cylinder alined with the valve on the side towards the compressor, a piston 55 in said cylinder having a rod connected with said valve, a duct leading from a point in the suction pipe between the valve and compressor to a point in the cylinder on the side of the piston remote from the valve, a valve in said duct, and 60 a pressure regulator controlling the opening and closing the last mentioned valve.

5. In apparatus for starting compressors under no-load conditions, the combination with a compressor having an inlet pipe and an exhaust 65 pipe; of a valve in the suction pipe opening towards the compressor, spring means urging the valve to close, a cylinder alined with the valve on the side towards the compressor, a piston in said cylinder having a rod connected with said valve, means 70 to establish piston operative communication between a point on the suction pipe located between the valve and compressor and a point on the cylinder at the side of the piston remote from the 75 valve, and other means to establish piston operating communication between the pressure side

of the compressor and the cylinder on the side of the piston adjacent said valve.

6. In apparatus for starting compressors under no-load conditions, the combination with a compressor having an inlet pipe and an exhaust pipe; 80 of a valve in the suction pipe opening towards the compressor, spring means urging the valve to close, a cylinder alined with the valve on the side towards the compressor, a piston in said cylinder having a rod connected with said valve, a duct 85 leading from a point in the suction pipe between the valve and compressor to a point in the cylinder on the side of the piston remote from the valve, and a second duct leading from the compression side of the compressor to the cylinder on the side 90 of the piston adjacent the valve.

7. In apparatus for starting compressors under no-load conditions, the combination with a compressor having an inlet pipe and an exhaust pipe; 95 of a valve in the suction pipe opening towards the compressor, spring means urging the valve to close, a cylinder alined with the valve on the side towards the compressor, a piston in said cylinder having a rod connected with said valve, a closed 100 fluid containing reservoir communicating with the cylinder on the side of the piston remote from the valve, a duct leading from a point on the suction pipe between the valve and the compressor to the reservoir above the fluid therein, a second 105 closed fluid containing reservoir communicating with the cylinder on the side of the piston adjacent the valve, and a second duct leading from the pressure side of the compressor to the second reservoir above the fluid therein.

8. In apparatus for starting compressors under no-load conditions, the combination with a compressor having an inlet pipe and an exhaust pipe; 110 of a valve in the suction pipe opening towards the compressor, spring means urging the valve to close, a cylinder alined with the valve on the side towards the compressor, a piston in said cylinder having a rod connected with said valve, 115 a duct leading from a point in the suction pipe between the valve and compressor to a point in the cylinder on the side of the piston remote from the valve, a second duct leading from the compression side of the compressor to the cylinder on the side of the piston adjacent the valve, a valve 120 in said first duct, and a pressure regulator controlling the opening and closing of the last mentioned valve. 125

9. In apparatus for starting compressors under no-load conditions, the combination with a compressor having an inlet pipe and an exhaust pipe; 130 of a valve in the suction pipe opening towards the compressor, spring means urging the valve to close, a cylinder alined with the valve on the side towards the compressor, a piston in said cylinder having a rod connected with said valve, means to establish piston operative communication 135 between the valve and compressor and a point on the cylinder at the side of the piston remote from the valve, a by-pass duct leading from the exhaust pipe to a point on the suction pipe more remote from the compressor than the first valve, 140 a by-pass valve controlling the by-pass duct, and means connecting the first valve and the by-pass valve and closing one valve as the other opens.

10. In apparatus for starting compressors under no-load conditions, the combination with a compressor having an inlet pipe and an exhaust pipe; 145 of a valve in the suction pipe opening towards the compressor, spring means urging the valve to close, a cylinder alined with the valve on the side 150

towards the compressor, a piston in said cylinder having a rod connected with said valve, a duct leading from a point in the suction pipe between the valve and compressor to a point in the cylinder on the side of the piston remote from the valve, a by-pass duct leading from the exhaust pipe to a point on the suction pipe more remote from the compressor than the first valve, a by-pass valve controlling the by-pass duct, and means connecting the first valve and the by-pass valve and closing one valve as the other opens.

11. In apparatus for starting compressors under no-load conditions, the combination with a compressor having an inlet pipe and an exhaust pipe; of a valve in the suction pipe opening towards the compressor, spring means urging the valve to close, a cylinder alined with the valve on the side towards the compressor, a piston in said cylinder having a rod connected with said valve, a closed fluid containing reservoir communicating with the cylinder on the side of the piston remote from the valve, a duct leading from a point on the suction pipe between the valve and the compressor to the reservoir above the fluid therein, a by-pass duct leading from the exhaust pipe to a point on the suction pipe more remote from the compressor than the first valve, a by-pass valve controlling the by-pass duct, and means connecting the first valve and the by-pass valve and closing one valve as the other opens.

12. In apparatus for starting compressors under no-load conditions, the combination with a compressor having an inlet pipe and an exhaust pipe; of a valve in the suction pipe opening towards the compressor, spring means urging the valve to close, a cylinder alined with the valve on the side towards the compressor, a piston in said cylinder having a rod connected with said valve, a duct leading from a point in the suction pipe between the valve and compressor to a point in the cylinder on the side of the piston remote from the valve, a valve in said duct, a pressure regulator controlling the opening and closing the last mentioned valve, a by-pass duct leading from the exhaust pipe to a point on the suction pipe more remote from the compressor than the first valve, a by-pass valve controlling the by-pass duct, and means connecting the first valve and the by-pass valve and closing one valve as the other opens.

13. In apparatus for starting compressors under no-load conditions, the combination with a compressor having an inlet pipe and an exhaust pipe; of a valve in the suction pipe opening towards the compressor, spring means urging the valve to close, a cylinder alined with the valve on the side towards the compressor, a piston in said cylinder having a rod connected with said valve, means to establish piston operative communication between a point on the suction pipe located between the valve and compressor and a point on the cylinder at the side of the piston remote from the valve, other means to establish piston operating communication between the pressure side of the compressor and the cylinder on the side of the piston adjacent said valve, a by-pass duct leading from the exhaust pipe to a point on the suction pipe more remote from the compressor than the first valve, a by-pass valve controlling the by-pass duct, and means connecting the first valve and the by-pass valve and closing one valve as the other opens.

14. In apparatus for starting compressors under no-load conditions, the combination with a compressor having an inlet pipe and an exhaust pipe; of a valve in the suction pipe opening towards the compressor, spring means urging the valve to close, a cylinder alined with the valve on the side towards the compressor, a piston in said cylinder having a rod connected with said valve, a duct leading from a point in the suction pipe between the valve and compressor to a point in the cylinder on the side of the piston remote from the valve, a second duct leading from the compression side of the compressor to the cylinder on the side of the piston adjacent the valve, a by-pass duct leading from the exhaust pipe to a point on the suction pipe more remote from the compressor than the first valve, a by-pass valve controlling the by-pass duct, and means connecting the first valve and the by-pass valve and closing one valve as the other opens.

15. In apparatus for starting compressors under no-load conditions, the combination with a compressor having an inlet pipe and an exhaust pipe; of a valve in the suction pipe opening towards the compressor, spring means urging the valve to close, a cylinder alined with the valve on the side towards the compressor, a piston in said cylinder having a rod connected with said valve, a closed fluid containing reservoir communicating with the cylinder on the side of the piston remote from the valve, a duct leading from a point on the suction pipe between the valve and the compressor to the reservoir above the fluid therein, a second closed fluid containing reservoir communicating with the cylinder on the side of the piston adjacent the valve, a second duct leading from the pressure side of the compressor to the second reservoir above the fluid therein, a by-pass duct leading from the exhaust pipe to a point on the suction pipe more remote from the compressor than the first valve, a by-pass valve controlling the by-pass duct, and means connecting the first valve and the by-pass valve and closing one valve as the other opens.

16. In apparatus for starting compressors under no-load conditions, the combination with a compressor having an inlet pipe and an exhaust pipe; of a valve in the suction pipe opening towards the compressor, spring means urging the valve to close, a cylinder alined with the valve on the side towards the compressor, a piston in said cylinder having a rod connected with said valve, a duct leading from a point in the suction pipe between the valve and compressor to a point in the cylinder on the side of the piston remote from the valve, a second duct leading from the compression side of the compressor to the cylinder on the side of the piston adjacent the valve, a valve in said first duct, a pressure regulator controlling the opening and closing of the last mentioned valve, a by-pass duct leading from the exhaust pipe to a point on the suction pipe more remote from the compressor than the first valve, a by-pass valve controlling the by-pass duct, and means connecting the first valve and the by-pass valve and closing one valve as the other opens.

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