July 11, 1939. W. H. NOBLE 2,165,938

UNLOADER FOR COMPRESSORS

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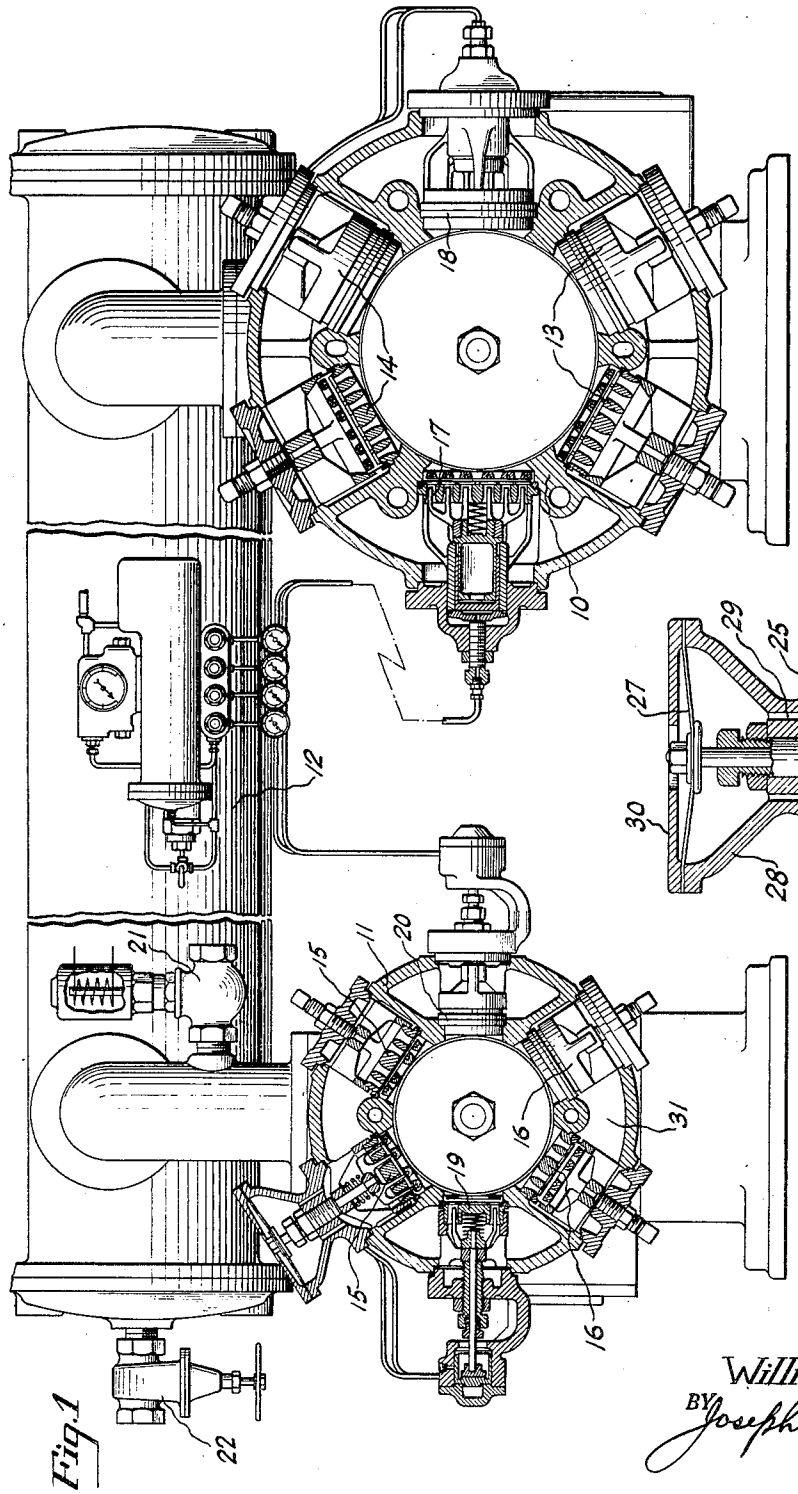


Fig. 1

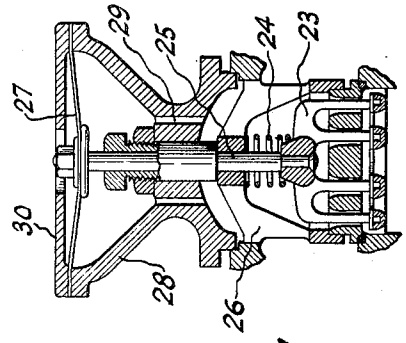


Fig. 2

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UNLOADER FOR COMPRESSORS

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7 Claims. (Cl. 230—26)

This invention relates to compressors and particularly to means to unload a compressor during the starting of the compressor driving motor.

An object of the invention is to provide an improved and simple form of unloading means adapted primarily for a two-stage, electric motor-driven compressor.

One feature of the invention that is important is that means are provided normally holding one of the high pressure intake valves open until pressure begins to build up in the intercooler at which time the intake valve in the high pressure cylinder is permitted to close and operate normally.

Another object of the invention is to provide a spring surrounding the stem of one of the high pressure, intake valve unloader members normally holding the unloader member in position against the valve so that the valve is prevented from closing, there being a diaphragm operatively connected to this unloader member and having one side subjected to the high pressure intake pressure, so that when this pressure exceeds a predetermined small amount the unloader member is withdrawn, permitting closing movement of the valve.

With the above and other objects in view the invention includes the features of construction and operation set forth in the following specification and illustrated in the accompanying drawing.

In the accompanying drawing annexed hereto and forming a part of this specification, I have shown the invention embodied in a standard form of two stage air compressor but it will be understood that the invention can be otherwise embodied and that the drawing is not to be construed as defining or limiting the scope of the invention, the claims appended to this specification being relied upon for that purpose.

In the drawing:

Fig. 1 is an elevation in section taken transversely through the low and high pressure cylinders of a two stage compressor provided with the present invention; and

Fig. 2 is a sectional view taken through one of the high pressure intake valves and the unloading member therefor forming a feature of the present invention.

In the above mentioned drawing, there has been shown but one embodiment of the invention which is now deemed preferable, but it is to be understood that changes and modifications may be made within the scope of the appended claims without departing from the spirit of the invention.

Briefly, and in its preferred aspect, the invention may include the following principal parts: first, a compressor preferably of the two or more stage type, and having a step-by-step form of regulation; second, an unloader member movable relative to one of the intake valves of the high pressure cylinder and in one position serving to hold the valve in its open position; third, a diaphragm attached to the unloader member and mounted within the valve casing; fourth, parts connecting one side of the diaphragm with the intake passage, and fifth, a spring normally holding the unloader member in position against the intake valve when there is no appreciable pressure in the intake of the high pressure cylinder.

Referring more in detail to the figures of the drawing I show a two-stage air compressor having a low pressure cylinder 10 and a high pressure cylinder 11, there being an intercooler 12 disposed between them. The low pressure cylinder 10 is provided with intake valves 13 and discharge valves 14, and the high pressure cylinder 11 is provided with intake valves 15 and discharge valves 16. Clearance control valves 17 and 18 are provided in the low pressure cylinder 10 and similar controlling valves 19 and 20 in the high pressure cylinder 11. The above valves are or may be those usually found in a standard form of air or other compressor and it will be understood that there are valves as above described at both ends of both cylinders. As these valves 13, 14, 15 and 16 and the method of controlling the clearance valves 17, 18, 19 and 20 form no part of the present invention further description of them will not be required.

In starting compressors operated by electric motors it is essential, particularly in larger sized compressors, to permit the motor to come up to speed prior to the compressor being operated under load. Provision is therefore made to exhaust the air under pressure in the intercooler 12 and to hold an intake valve such as 15 open at each end of the high pressure cylinder during the time the compressor motor is coming up to speed. During this starting period no compression takes place so that there is no substantial load on the motor.

To relieve the air from the intercooler 12 there may be provided a solenoid operated valve 21 which may be opened by suitable electric connections at the control panel energizing the solenoid of switch 21. There may also be pro-

vided a manual valve 22. Both valves 21 and 22 are in direct connection with the interior of the intercooler 12 and may be of any usual types.

To hold an intake valve of the high pressure cylinder 15 open there is provided an unloading member 23 having fingers projecting between portions of the valve body and contacting directly with the valve rings. In the position of the unloading member 23 shown in Fig. 2 the valve 12 is being held in its open position so that air may freely pass into and out of the high pressure cylinder 11 and intake passages. To normally hold the unloader members 23 against their respective valves (but one of which is shown) a compressed spring 24 surrounding a stem 25 secured to the member 23 is provided. One end of spring 24 bears against the member 23 and the opposite end against a portion of the fixed valve supporting member 26. The pressure exerted by spring 24 to hold the valve 15 open is relatively light. To retract the unloader member 23 from its valve contacting position so that the intake valve may function normally there is provided a diaphragm 27 the central portion of which is attached to the stem 25 and the periphery of which is attached to a fixed portion of the valve housing 28. Ports 29 connect the space within the intake passage with the space within and below the diaphragm 27. To protect the diaphragm from injury there may be provided a cover plate 30 extending over the upper portion of the housing 28.

In operation and when the compressor is being started one of valves 21 or 22 is opened. As soon as the motor or other driving means for the compressor has been started and is up to normal speed, valves 21 and 22 are closed, thus allowing pressure to build up slowly in the intercooler 12. As soon as an appreciable amount of pressure exists in the intercooler 12 above that of the low pressure intake the pressure within the high pressure cylinder intake, which corresponds to that of the intercooler, forces the diaphragm 27 upward against the pressure of spring 24 and withdraws the member 23 from contacting with the intake valve 15 at each end of the cylinder 11. This valve 15 therefor may close and then start its normal opening and closing movements during normal operation of the compressor. The compressor then begins to operate to build up pressure in the discharge passage 31 of the high pressure cylinder from which the air or other gas being compressed is admitted to a receiver or other outlet (not shown). As long as any appreciable pressure exists in the intercooler 12 above that of the low pressure intake which continues during normal operation of the compressor, the unloader member 23 will be held in retracted position so that the high pressure cylinder intake valves 15 can function normally. The application of the member 23 to an intake valve 15 at each end of the high pressure cylinder does not in any manner interfere with the step-by-step or other form of volume regulation controlling the output of the compressor. Also the operation of the high pressure intake valve 15 is pressure controlled so that no manual or other means other than the intercooler pressure acting upon the diaphragm is necessary.

I claim as my invention:

1. An unloader for compressors comprising in combination with the intake valves thereof, means to hold said valves in an inoperative position and means operated by an increase in pressure surrounding said valves to render said valves operative.

2. An unloader for compressors comprising in combination, a cylinder, an intake valve therein, a member engaging said valve and normally spring pressed in a direction to hold said valve open, a diaphragm connected to said member adapted upon an increase in pressure surrounding said valve to retract said member from engagement with said valve.

3. An unloader for two-stage compressors, comprising in combination, low and high pressure cylinders, an intercooler interconnecting said cylinders, means to release the pressure within said intercooler, intake and discharge valves for said cylinders, a member spring pressed in a direction to engage and retain a high pressure intake valve in open position, and pressure responsive means engaging said member to retract said member and permit normal operation of said intake valve when pressure within said intercooler is increased.

4. A starting unloader for two-stage compressors comprising in combination, low and high pressure cylinders, intake and discharge valves for said cylinders, means to hold an intake valve for said high pressure cylinder in an inoperative position, and means to render said valve operative when pressure within said high pressure intake increases to a pressure substantially above that of the low pressure intake.

5. A starting unloader for two-stage compressors comprising in combination, low and high pressure cylinders, an intercooler connecting said cylinders, means to release the pressure within said intercooler, intake and discharge valves for said cylinders, means to hold an intake valve for said high pressure cylinder in an inoperative position, and means to render said valve operative when pressure within said intercooler and high pressure intake increases to a pressure substantially above that of the low pressure intake.

6. A starting unloader for two-stage compressors comprising in combination, low and high pressure cylinders, intake and discharge valves for said cylinders, means to hold the intake valves for said high pressure cylinder in an inoperative position, and means operated by an increase in pressure surrounding said last named valves to render said valves operative.

7. A starting unloader for two-stage compressors comprising in combination, low and high pressure cylinders, intake and discharge valves for said cylinders, an intercooler between said cylinders, means to release the pressure within said intercooler, means to hold the intake valves for said high pressure cylinder in an inoperative position, and means operated by an increase in pressure surrounding said last named valves to render said valves operative.

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