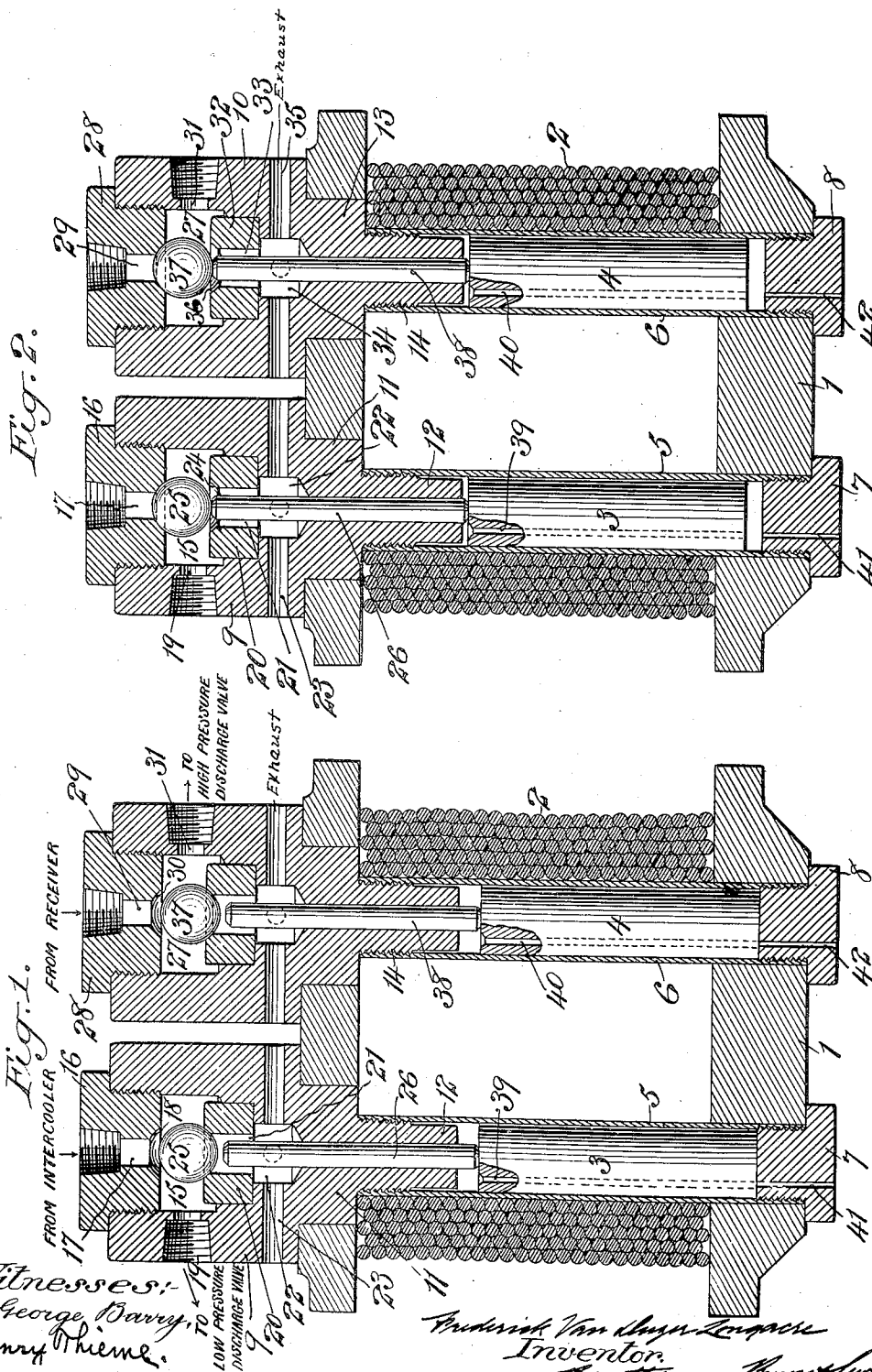


F. VAN D. LONGACRE.
UNLOADER FOR COMPOUND COMPRESSORS.

APPLICATION FILED NOV. 23, 1904.

2 SHEETS—SHEET 1.



Witnesses:
F. George Barry,
Henry Thiele.

Fredrick Van Dusen Longacre
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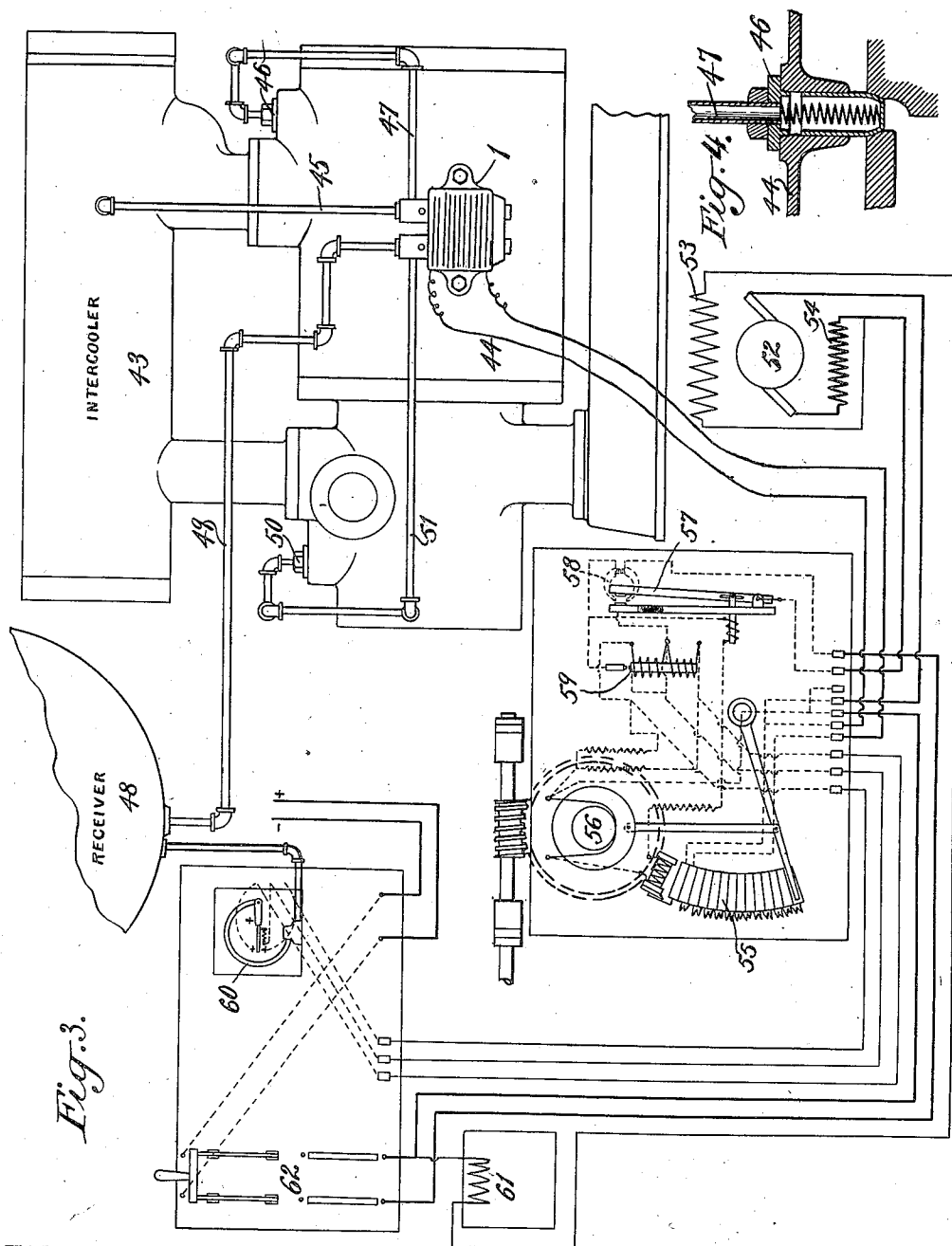
No. 834,627.

PATENTED OCT. 30, 1906.

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2 SHEETS--SHEET 2.



Witnesses:-
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UNITED STATES PATENT OFFICE.

FREDERICK VAN DUZER LONGACRE, OF NEW YORK, N. Y., ASSIGNOR TO
INGERSOLL-RAND COMPANY, OF NEW YORK, N. Y., A CORPORATION OF
NEW JERSEY.

UNLOADER FOR COMPOUND COMPRESSORS.

No. 834,627.

Specification of Letters Patent.

Patented Oct. 30, 1906.

Application filed November 23, 1904. Serial No. 234,012.

To all whom it may concern:

Be it known that I, FREDERICK VAN DUZER LONGACRE, a citizen of the United States, and a resident of the borough of Manhattan, in the city and State of New York, have invented new and useful Improvements in Unloaders for Compound Compressors, of which the following is a specification.

The object of my present invention is to provide certain improvements in the construction, form, and arrangement of the several parts of an unloader for compound compressors.

This invention is intended particularly for use where the pressure back of the discharge-valves of high and low pressure cylinders may be removed by opening and closing the spaces back of the said valves to the atmosphere, the valve for controlling the loading and unloading of the said valves being under the control of an electromagnet.

In the accompanying drawings, Figure 1 represents the unloader in vertical section, the parts being in the positions which they assume when the electromagnet is deenergized and the pressure-ports are in open communication. Fig. 2 is a similar view showing the positions which the parts assume when the electromagnet is energized and the discharge-valve pressure-ports are closed from the intercooler and receiver pressure-ports and open to the atmosphere. Fig. 3 is a diagrammatic view illustrating an electric system suitable for use in operating the unloader-electromagnet, which view includes details of a compound compressor, its intercooler, a receiver, the discharge-valves, the unloader, and the pipe connections between the intercooler, receiver, discharge-valves, and the unloader; and Fig. 4 is a detail sectional view of one of the discharge-valves.

The electromagnet herein represented is of the double-solenoid type—viz., an electromagnet having two cores controlled thereby.

The bracket is denoted by 1, the coil by 2, and the two cores by 3 and 4. These cores are fitted to slide in tubes 5 and 6, the lower ends of which are closed by removable bottom caps 7 and 8, having screw-threaded engagements with the said tubes. These caps serve as stops for supporting the cores 3 and 4 when the electromagnet is deenergized.

Two valve-boxes 9 and 10 surmount the bracket 1, the valve-box 9 having stepped depending portions 11 and 12 and the valve-box 10 having similar stepped depending portions 13 14. The larger portions 11 and 13 of these valve-boxes are seated in the top of the bracket, and their smaller portions 12 and 14 are inserted within the tubes 5 and 6 and have screw-threaded engagements therewith. The interior of the valve-box 9 is provided with a valve-chamber 15, the upper end of which is closed by a removable top cap 16. This top cap 16 has a pressure-port 17 therethrough, which port is fitted to be connected to the intercooler 43 of a compound air-compressor 44 through a pipe 45. A valve-seat 18 is formed at the mouth of this port 17.

A pressure-port 19 leads through the valve-box to the valve-chamber 15, which pressure-port is fitted to be connected to the back of the discharge-valve 46 in the low-pressure cylinder of the compound air-compressor 44 through a pipe 47.

A ring 20 is seated in the bottom of the valve-chamber 15, the bore of the said ring forming an exhaust-port 21, leading to a central chamber 22, from which one or more transverse ports 23 lead to the exterior of the valve-box. The mouth of the port 21 is provided with a valve-seat 24.

A ball-valve 25 is located in the chamber 15 and normally rests on its seat 24, closing the exhaust-port 21.

A rod 26 leads from the core 3 of the electromagnet up through the valve-box 9 into engagement with the bottom of the ball-valve 25.

The valve-box 10 is provided with a valve-chamber 27, the upper end of which is closed by a removable top cap 28, having a screw-threaded engagement with the wall of the said chamber. A pressure-port 29 leads through this cap and is fitted to be connected to the receiver 48 of the compound air-compressor 44 through a pipe 49. The mouth of this port 29 is provided with a valve-seat 30.

A pressure-port 31 leads through the valve-box to the chamber 27, which port is fitted to be connected to the back of the discharge-valve 50 of the high-pressure cylinder of the compound air-compressor 44 through a pipe 51.

A ring 32 is seated in the bottom of the chamber 27, the bore of which ring forms an exhaust-port 33, which leads to a central chamber 34, from which one or more transverse ports 35 lead to the exterior of the valve-box. The mouth of this port 33 is provided with a valve-seat 36.

The ball-valve is denoted by 37 and normally rests on its seat 36.

A rod 38 rests on the core 4 of the electromagnet and extends upwardly through the valve-box into engagement with the bottom of the ball-valve 37.

The operation of the unloader is as follows:

When the electromagnet is deenergized, the valves 25 and 37 rest upon their exhaust-port seats 24 36, thus opening communication from the pressure-ports of the intercooler and receiver to the pressure-ports of the high and low pressure discharge-valves.

When it is desired to remove the pressure from the backs of the discharge-valves for unloading the compressor, the electromagnet is energized. This will raise the cores 3 and 4 and the rods 26 38, thereby raising the valves 25 37 away from their exhaust-port seats into position to close the seats of the pressure-ports leading to the intercooler and receiver. This will open communication from the pressure-ports leading to the high and low pressure discharge-valves to the atmosphere through the exhaust-ports 20 and 33.

It is desirable that the upward movements of the rods 26 and 38 be retarded to a certain extent when the electromagnet 2 is energized, so as to prevent a too rapid shifting of the valves 25 and 37. This object is accomplished by making the valve-boxes 9 and 10 of some magnetic material—such, for instance, as magnetic iron—so that when the electromagnet 2 is energized a certain amount of magnetism is imparted to the said valve-boxes 9 and 10. The attraction of the rods 26 and 38 to the valve-boxes 9 and 10 will be sufficient to retard the upward movements of the rods through the bores of the said valve-boxes. This retarding effect on the rods will reduce the noise incident to the valves 25 and 37 striking their seats 18 and 30.

To prevent the accumulation of oil, I provide longitudinal ducts 39 40, which extend through the cores 3 and 4 and coact with ducts 41 42 in the bottom caps 7 and 8.

The interior of the valve-chambers are readily accessible by removing the top caps 16 and 28. This permits the ready renewal of the ball-valves and also of the rings. It also permits the ready substitution of new top caps when necessary.

In Fig. 3 I have shown in diagram an electrical system suitable for use in operating the electromagnet 2 of the unloader. This system comprises in a general way a motor 52,

having a shunt-winding 53 and a series winding 54, a starting resistance 55, a magnetic clutch 56; an automatic switch 57, its magnetic blow-out 58, a magnetic-controlled contactor 59, an air-pressure-governed electric contactor 60, a field resistance 61, and a main-line switch 62. This electrical system forms no part of the present invention, but is shown, described, and claimed in my pending application, filed November 20, 1903, Serial No. 181,985.

What I claim is—

1. A compound air-compressor, discharge-valves therefor and an unloader provided with a plurality of valve-chambers, each valve-chamber having a pressure-supply port, an exhaust-port and a discharge-valve port in communication with the back of one of the discharge-valves, a valve for alternately opening and closing communication from the pressure-supply port and exhaust-port to the discharge-valve port and electrically-controlled means for operating the valves.

2. A compound air-compressor, discharge-valves therefor and an unloader provided with a plurality of valve-chambers, each chamber having a pressure-supply port, an exhaust-port and a discharge-valve port in communication with the back of one of the discharge-valves, a ball-valve for alternately opening and closing the pressure supply and exhaust ports to the discharge-valve port and means for operating the ball-valves.

3. A compound air-compressor, discharge-valves therefor and an unloader provided with a plurality of valve-chambers, each chamber having a pressure-supply port, an exhaust-port and a discharge-valve port in communication with the back of one of the discharge-valves, a ball-valve for alternately opening and closing the pressure supply and exhaust ports to the discharge-valve port and electrically-controlled means for operating the ball-valves.

4. A compound air-compressor, discharge-valves therefor and an unloader provided with a plurality of valve-chambers, each chamber having a pressure-supply port, an exhaust-port and a discharge-valve port in communication with the back of one of the discharge-valves, a valve arranged to alternately open and close the pressure supply and exhaust ports to the discharge-valve port, and a single electromagnet for simultaneously operating the valves.

5. A compound air-compressor, discharge-valves therefor and an unloader comprising a plurality of valve-boxes, each valve-box being provided with a chamber having a pressure-supply port, an exhaust-port and a discharge-valve port in communication with the back of one of the discharge-valves, a valve for alternately opening and closing the pres-

sure supply and exhaust ports to the discharge-valve port and a single electromagnet for simultaneously operating the valves.

6. A compound air-compressor, low and high pressure discharge-valves therefor and an unloader provided with a plurality of chambers, one chamber having a pressure-supply port, an exhaust-port and a low-pressure discharge-valve port in communication with the back of the low-pressure valve, a valve for alternately opening and closing the pressure supply and exhaust ports to the low-pressure discharge-valve port and another chamber having a pressure-supply port, an exhaust-port and a high-pressure discharge-valve port in communication with the back of the high-pressure discharge-valve, a valve for alternately opening and closing the pressure supply and exhaust ports to the high-pressure discharge-valve port, and an electromagnet for operating the valves.

7. A compound air-compressor, low and high pressure discharge-valves therefor, an intercooler, a receiver and an unloader provided with a plurality of valve-chambers, one chamber having a pressure-supply port communicating with the intercooler, an exhaust-port and a discharge-valve port in communication with the back of the low-pressure discharge-valve, a valve for alternately opening and closing the intercooler pressure supply and exhaust ports to the low-pressure discharge-valve port, another chamber having a pressure-supply port communicating with the receiver, an exhaust-port and a discharge-valve port in communication with the back of the high-pressure discharge-valve, a valve for alternately opening and closing the receiver pressure supply and exhaust ports to the high-pressure discharge-valve port, and an electromagnet for operating the valves.

8. A compound air-compressor, low and high pressure discharge-valves therefor, an intercooler, a receiver and an unloader provided with a plurality of chambers, one chamber having a pressure-supply port communicating with the intercooler, an exhaust-port and a low-pressure discharge-valve port in communication with the back of the low-pressure discharge-valve, a valve for alternately opening and closing the intercooler pressure supply and exhaust ports to the low-pressure discharge-valve port, another chamber having a pressure-supply port communicating with the receiver, an exhaust-port and a high-pressure discharge-valve port in communication with the back of the high-pressure discharge-valve, a valve for alternately opening and closing the receiver pressure supply and exhaust ports to the high-pressure discharge-valve port; and an electromagnet for operating the valves.

9. A compound air-compressor, discharge-valves therefor and an unloader provided with a plurality of valve-chambers having pressure-supply ports, exhaust-ports and discharge-ports in communication with the backs of the discharge-valves, valves for alternately opening and closing the pressure-supply ports and exhaust-ports to the discharge-valve ports, a single electromagnet of the solenoid type having two cores and rods interposed between the cores and the valves thereby bringing the valves under the control of the operation of the electromagnet.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 14th day of November, 1904.

FREDERICK VAN DUZER LONGACRE.

Witnesses:

FREDK. HAYNES,
HENRY THIEME.