June 6, 1944. O. SCOTT 2,350,537

FLUID TRANSLATING APPARATUS

Filed Jan. 16, 1941

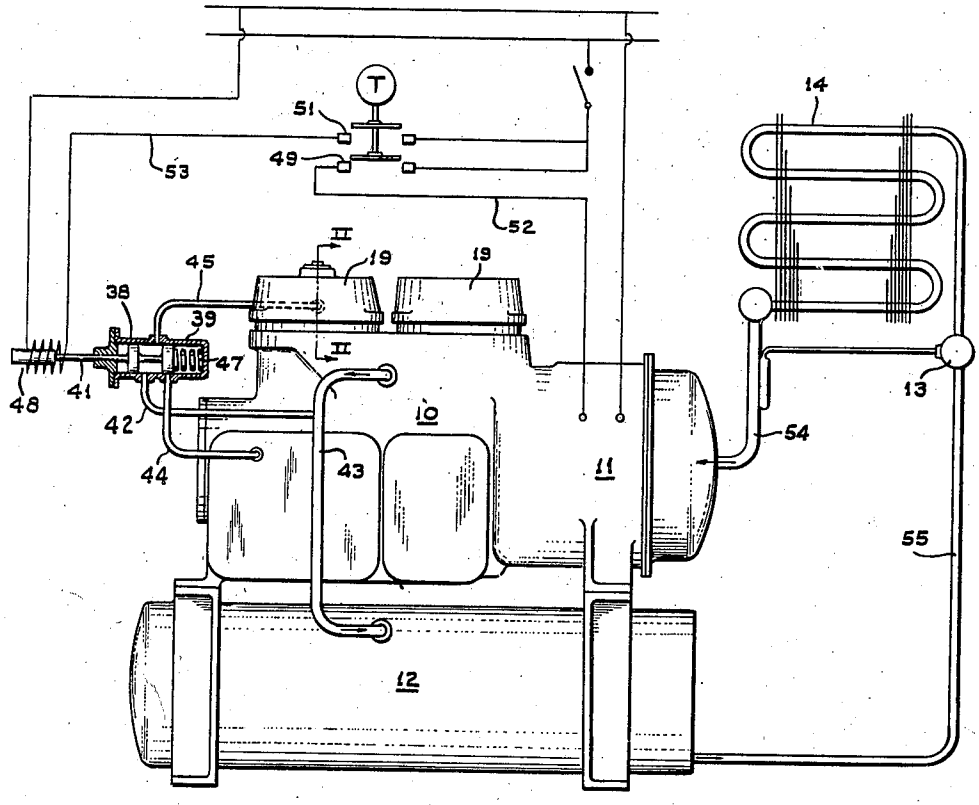


Fig. 1

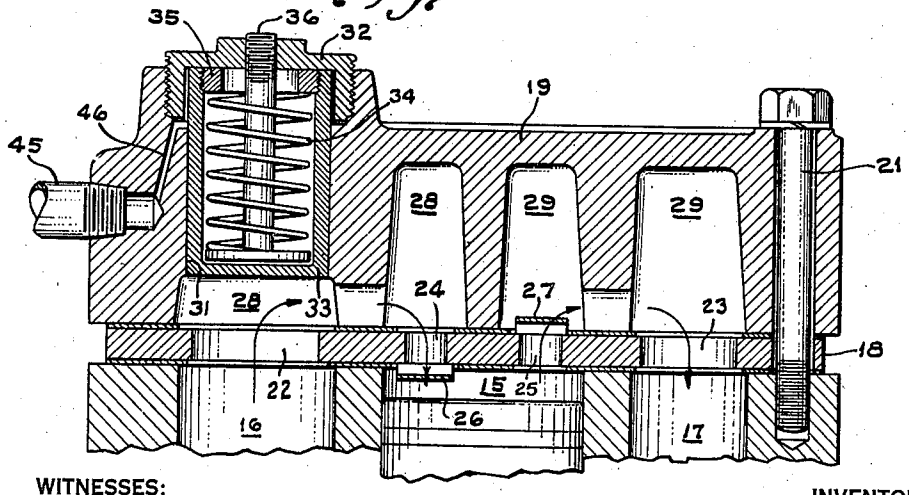


Fig. 2

WITNESSES:

W. J. Eisinger

E. H. Lutz.

INVENTOR

OLAV SCOTT

BY Masteg

ATTORNEY

Patented June 6, 1944 2,350,537

UNITED STATES PATENT OFFICE

2,350,537

FLUID TRANSLATING APPARATUS

Olav Scott, Springfield, Mass., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application January 16, 1941, Serial No. 374,649

4 Claims. (Cl. 230—31)

My invention relates to fluid translating apparatus, more particularly to a reciprocating compressor having means for unloading one or more cylinders, and it has for an object to provide an improved unloader construction.

A more particular object is to provide a simple, inexpensive and reliable unloader construction.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawing, forming a part of this application, in which:

Fig. 1 is a diagrammatic view of a refrigerating system including a compressor, shown in elevation, that incorporates my novel unloader construction; and,

Fig. 2 is a cross-sectional view taken mainly on the line II—II of Fig. 1, the plane of the section being partly offset, however, to include one of the cylinders and its suction and discharge ports.

Referring to the drawing in detail, I show a compressor 10 driven by a motor 11, the compressor and motor being enclosed in a common casing. The compressor is part of a refrigerating system including a condenser 12, a thermostatic expansion valve 13, and an evaporator 14. The refrigerating system may be used, for example, for air conditioning an enclosure, air being circulated over the surface of the evaporator 14 and conveyed to the enclosure.

The cylinder block or main casting of the compressor 10 is formed with a plurality of cylinders 15 arranged in a row, suction passages 16 arranged on one side of the row and discharge passages 17 arranged on the opposite side of the row. These cylinders and passages extend vertically and terminate at their upper ends in the plane upper face of the cylinder block. The compressor further comprises valve plates 18 disposed against the upper plane face of the cylinder block, cylinder heads 19 disposed against the opposite or upper side of the valve plates 18 and bolts 21 securing the cylinder heads to the cylinder block as will be apparent from Fig. 2. I prefer to provide one suction passage 16, discharge passage 17, valve plate 18, and cylinder head 19 for each pair of cylinders, as more fully shown and described in patent No. 2,134,077 of E. Ehret. But, so far as the present invention is concerned, they may be provided for each cylinder. The valve plate 18 is formed with ports 22 and 23 registering with the passages 16 and 17, respectively. It is also provided with a suction valve port 24 and a discharge valve port 25 for each cylinder. Movable valve elements 26 and 27, of any suitable type, such as reed valve strips, cooperate with the ports 24 and 25 to provide suction and discharge valves for the cylinder. The cylinder head 19 is formed with a suction chamber or passage 28 providing communication between the port 22 and the suction valve ports 24 of the pair of cylinders. It is also formed with a discharge chamber passage 29 providing communication between the discharge ports 25 of the pair of cylinders and the port 23.

The cylinder head 19 is formed with a cylinder 31 disposed in alignment with the port 22. The upper end of the cylinder is closed by a cap 32 which may be screw-threaded into the cylinder. A piston 33 is disposed within the cylinder 31 and is adapted to move downwardly against the upper surface of the valve plate 18 to close the port 22. The piston 32 is biased upwardly by a compression spring 34, the upper end of which abuts against a collar 35 screw-threaded in the piston and the lower end of which abuts against the head of a bolt 36 screw-threaded in the cap 32.

Any suitable fluid under pressure may be utilized for actuating the piston 33, such as oil pressure from the lubricating oil pump or refrigerant gas from the high pressure side of the refrigerating system, the latter being employed in the illustrated embodiment. The application of fluid pressure to the upper side of the piston 33 is controlled by a pilot valve 38 which includes a casing 39 and a piston valve element 41 as shown in Fig. 1. A conduit 42 provides communication between the casing 39 and the conduit 43 which conveys the compressed gas from the compressor 10 to the condenser 12. A conduit 44 provides communication between the casing 39 and the crankcase of the compressor which contains refrigerant gas at suction pressure. A conduit 45 and a passage 46 formed in the cylinder head 19 provide communication between the casing 39 and the upper end of the cylinder 31. The valve element 41, when moved to the left by a spring 47, places the conduits 45 and 42 in communication, and when moved to the right by a solenoid 48 places the conduits 45 and 44 in communication.

The unloader mechanism just described may be utilized in connection with any desired scheme of partial load operation. For the purpose of example, I show a thermostat T which may be responsive to the temperature of the air in the enclosure cooled by the evaporator 14. The ther-

mostat has two sets of contacts, 49 and 51, which are adapted to close as the thermostat responds to successively higher temperatures, which will be assumed to be 76° and 78°, respectively. The contacts 49 are adapted to close the circuit 52 supplying electrical current to the motor 11, and the contacts 51 are adapted to close a circuit 53 for energizing the solenoid 48.

Operation

Assume first that the temperature in the enclosure is above 78°, so that the thermostat T closes the contacts 49 and 51 to call for full load operation of the refrigerating system. The contacts 49 complete the circuit 52 which then supplies current to the motor 11. The latter drives the compressor 10 for circulating refrigerant through the system. The contacts 51 complete the circuit 53 to energize the solenoid 48. The latter moves the pilot valve 41 to the right placing the conduits 44 and 45 in communication. Accordingly, suction gas from the compressor crankcase is communicated through the conduits 44 and 45 and the passage 46 to the upper end of the cylinder 31. The lower side of the piston 33 is also subject to suction gas pressure which balances the suction gas pressure above the piston, so that the spring 34 is effective to move the piston upwardly. Accordingly, suction gas may flow through the port 22 and the passage 28 to the associated cylinders.

The refrigerating system operates in the usual manner of such apparatus. Vaporized refrigerant discharged from the evaporator 14 is passed through the conduit 54, through the casing of the motor 11, through a suitable manifold in the compressor cylinder block to the suction passages 16. From the latter, the suction gas passes through the ports 22 and passages 28 to the respective suction valve ports 24. Upon the downstroke of the piston, the gas enters the cylinder and upon the upstroke is discharged through the discharge valve port 25, the chamber 29, and the port 23 to the discharge passage 17. It then flows through a suitable manifold passage and the conduit 43 to the condenser 12 in which it is condensed. Condensed refrigerant is then conveyed through the conduit 55 and the expansion valve 13, in which its pressure is reduced and its flow is regulated. In the evaporator 14, refrigerant is vaporized in extracting heat from the air flowing thereover. The vaporized refrigerant is then discharged to the conduit 54 and recirculated. In the operation just described, all of the cylinders are effective to compress refrigerant and the system operates at full load.

Assume now that the temperature in the enclosure drops to 77 degrees, so that the thermostat calls for partial load operation by opening the contacts 51. The solenoid 48 is deenergized so that the spring 47 moves the valve element 41 to the left. High pressure refrigerant gas is now conveyed through the conduits 43, 42, and 45 and the passage 46 to the upper end of the cylinder 31. The pressure of this gas is sufficient to overcome the force of the spring 34 and the pressure of the suction gas acting on the lower side of the piston 32. Accordingly, the piston is held firmly against the upper face of the valve plate 18 and closes the port 22. Accordingly, the flow of gas to the two associated cylinders is cut off.

The refrigerating system now operates in the same manner as before except that it operates at only partial capacity, the cylinders associated with the closed port 22 being ineffective to compress refrigerant.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. In a compressor, the combination of a cylinder member having a cylinder formed therein, a valve plate closing one end of said cylinder and having a suction valve port in registry with said cylinder and an unloader valve port out of registry with said cylinder, a movable valve element cooperating with said suction valve port to form a suction valve for the cylinder, a cylinder head disposed against the opposite side of said valve plate and having a suction chamber or passage providing communication between said ports in the valve plate, said cylinder head being formed with a cylinder disposed in alignment with said unloader port, a piston in said cylinder movable against said valve plate to close said unloader valve port, and means for admitting fluid pressure to said last-mentioned cylinder to move said piston to closing position.

2. In a compressor, the combination of a cylinder member having a cylinder formed therein, a valve plate closing one end of said cylinder and having a valve port communicating with the cylinder, a movable valve element cooperating with said valve port to provide a suction valve for the cylinder, a cylinder head disposed against the opposite side of said valve plate, the compressor having a suction passage for conveying suction gas to said valve port, said passage including an unloader valve port and a chamber or passage in said head providing communication between said ports, said cylinder head being formed with a cylinder in alignment with said unloader valve port, a piston in said last-mentioned cylinder movable to and from position closing said unloader valve port, means for admitting fluid under pressure to said cylinder to move said piston to closing position, and a spring biasing said piston to open position.

3. In a compressor, the combination of a cylinder member having a cylinder and a suction passage extending to and opening upon one face thereof, a valve plate disposed against said face and having an unloader valve port communicating with said suction passage and a valve port communicating with said cylinder, a movable valve element cooperating with the latter port to form a suction valve for the cylinder, a cylinder head disposed against the opposite side of said valve plate and having a suction chamber or passage therein communicating with both of said ports in the valve plate, an unloader valve member movable into and out of position against the valve plate closing said unloader valve port, and means for actuating said unloader valve member, whereby said cylinder may be loaded and unloaded by opening and closing said unloader valve.

4. In a compressor, the combination of a cylinder member having a cylinder and a suction passage extending to and opening upon one face thereof, a valve plate disposed against said face and having an unloader valve port communicating with said suction passage and a valve port communicating with said cylinder, a movable

valve element cooperating with the latter port to form a suction valve for the cylinder, a cylinder head disposed against the opposite side of said valve plate and having a suction chamber or passage therein communicating with both of said ports in the valve plate, said cylinder head being formed with a cylinder disposed in alignment with said unloader valve port, a piston in said cylinder movable against said valve plate to close said unloader valve port, and means for actuating said piston to and from said closing position.

OLAV SCOTT.