July 20, 1948. S. R. HIRSCH 2,445,527

COMPRESSOR UNLOADER

Filed Oct. 1, 1945 2 Sheets-Sheet 1

Fig. 1.

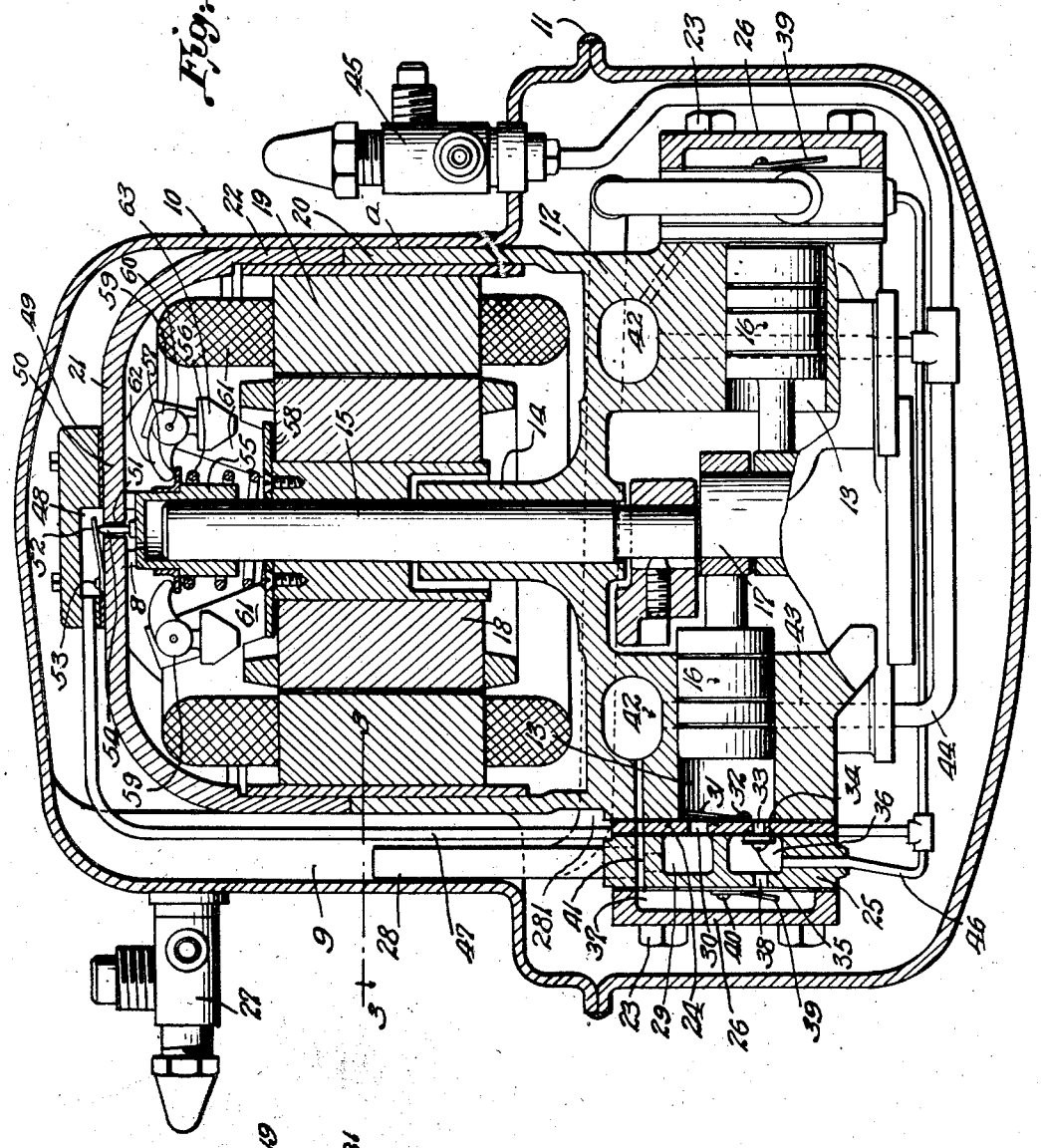
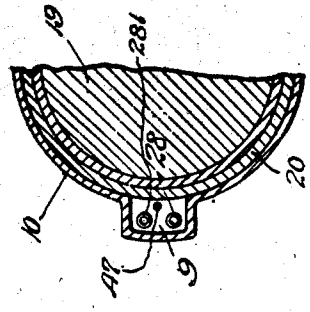


Fig. 3.



Inventor
Sylvan R. Hirsch

By Mason, Porter & Diller
Attorneys

July 20, 1948. S. R. HIRSCH 2,445,527

COMPRESSOR UNLOADER

Filed Oct. 1, 1945 2 Sheets-Sheet 2

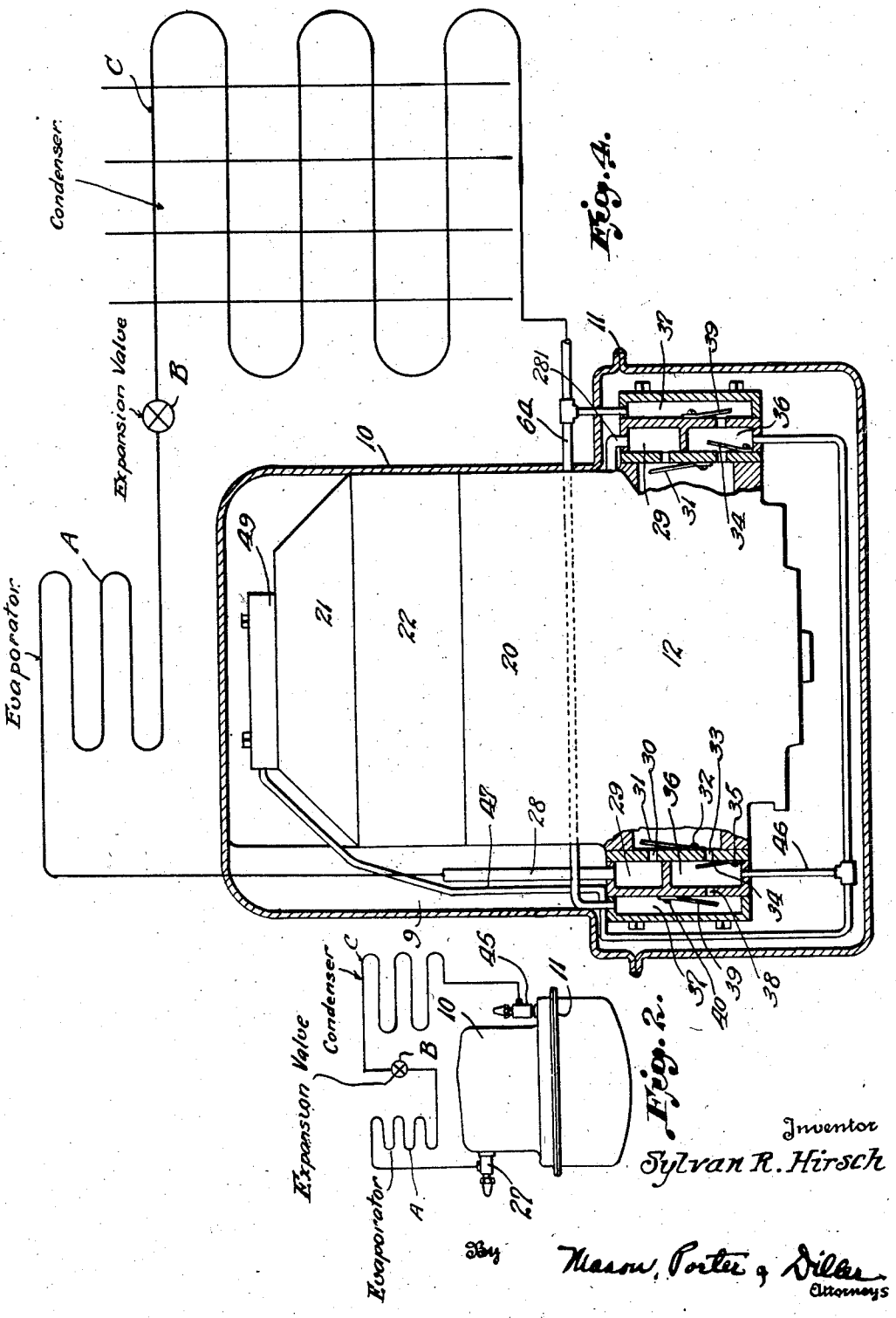


Fig. 4.

Fig. 2.

Inventor
Sylvan R. Hirsch

By Mason, Porter & Dilks
Attorneys

Patented July 20, 1948 2,445,527

UNITED STATES PATENT OFFICE

2,445,527

COMPRESSOR UNLOADER

Sylvan Roos Hirsch, Utica, N. Y., assignor to Brunner Manufacturing Company, Utica, N. Y., a corporation of New York

Application October 1, 1945, Serial No. 619,541

9 Claims. (Cl. 62—115)

1

This invention relates to a compressor-unloader especially adapted for use in an hermetic unit containing a compressor and an operating motor.

A prime object is to provide an enclosed and preferably sealed assembly especially so that the unloader tubing avoids exposure to outside air and is subject to the cooling effect of the return gas to seal the unloader valve during operation.

A second important object is to provide mechanism for unloading to the point where, upon restart, the motor builds up to speed before the pressure can sufficiently build up to restrain immediate starting of the compressor.

It is an object also to so mount the operating parts within the assembly as to provide a space for the return gas and also for disposition of the unloader line in heat-exchange relation.

Another important object is to provide means wherein the discharge gas from the compressor is under control of novel valves and passages with a valve thereof floating in the gas stream while the unit is in operation, but closing tightly if there is release of gas in the partitioning space or passage between a pair of valves, so that during inoperative periods one valve will act as a check maintaining the high pressure in the condenser and preventing that pressure from being imposed upon the compressor.

Still another important object is to provide a discharge chamber between the said valves and condenser which functions as a muffler.

A further aim is to provide a novel combination of plate, head and cap or the equivalent, for the most part providing the suction gas line to the compressor and the outlet passage or equivalent and valves between the compressor and the condenser.

The more specific objects and advantages will in part be pointed out hereinafter and otherwise become apparent from a consideration of the description following taken in connection with the accompanying drawings.

In said drawings:

Fig. 1 is a view in approximately central vertical section through a unit embodying the invention, certain parts being fragmentarily shown;

Fig. 2 is a schematic diagram of a complete refrigeration system wherein the invention is used;

2

Fig. 3 is a detail horizontal section taken on line 3—3 of Fig. 1; and

Fig. 4 is a view partly in side elevation, partly in section, and partly in diagram, of a modified form.

Referring specifically to the drawings wherein like reference characters designate like or similar parts throughout the different views, a sealed housing is employed at 10 of appropriate size and shape, conveniently made of steel and in sections welded together at 11. The interior of the housing is maintained at suction pressure and all parts shown within the same are hermetically sealed therein. Of such parts 12 is a body, which may be an iron casting and primarily form the housing or casing of a compressor shown as having two cylinders 13 although any desired number of cylinders may be employed.

Rising centrally from and integral with the body or casting 12 is a tubular bearing 14 journalling a vertical shaft 15 which reciprocates pistons 16 in said cylinders 13, through an eccentric means 17.

Said shaft 15 extends above bearing 14 and forms the main shaft of an electric motor having an overhung rotor 18 thereon coacting with a stator frame 19. Frame 19 is located within and secured to a sleeve 20 rising integrally from the body or casting 12. A spider 21 is integral with a sleeve 22 disposed above and alined with sleeve 20 to form a motor casing or enclosure and frame 19 is also secured to said sleeve 22 of the spider.

Bolts at 23 secure a valve plate 24 to each end of the body or casting 12 and they also secure on such body or casting, a head 25 and a cap 26, said head being located between the valve plate and cap.

It will be noted that the motor and compressor are disposed concentrically in housing 10 with the motor casing or enclosure at one portion press fitted or otherwise secured to the vertical wall thereof as at *a*, and that said housing 10 is bulged or struck out to provide an interior vertical channel 9 (Figs. 1 and 3).

The invention has been shown (Fig. 2) with parts diagrammatically within a complete refrigerating system in which A is an evaporator, B an expansion valve, and C a condenser. At the low pressure side of the system, a suction

valve 27 is secured to housing 10 adjacent the top of the latter in communication with the interior thereof in order to direct therethrough the return gas from the evaporator of the refrigeration system. Suction conduits or pipes 28 and 28' have vertical portions open to the interior of said housing within channel 9. Pipe 28 leads to a chamber or passage 29 in the left hand head 25, while a companion pipe 28' leads to the corresponding chamber or passage 29 of the right hand head 25. From chambers or passages 29 the gas enters the compression cylinders 13 through the ports 30 in the valve plates 24 under control of metallic leaf valves 31 secured to said plates at 32 and biased to close ports 30 through inherent resilience.

Outlet ports 33 for passage of the gas from the compressor cylinders are provided in said valve plates 24 controlled by metallic leaf valves 34 secured at 35 to the opposite sides of said plates to valve 31. Valves 34 may be, but are not necessarily like valves 31, shown as disposed at a right-angle with respect to the position thereof and are biased to close outlet ports 33 through inherent resilience. Ports 33 open into chambers or passages 36 provided in the heads 25.

The caps 26 have spaces or passages 37 communicating with passages 36 through ports 38 in the heads 25, under control of metallic leaf valves 39 secured at 40 to the heads, which for instance are like the valves 31 and 34 and biased to close ports 38 through inherent resilience. From passages or chambers 37 in the caps, the gas passes through passages 41 extending through the heads 25, valve plates 24 and body or casting 12 to discharge chambers 42 in the latter and thence through the passages 43 in said body or casting 12 to a conduit 44. Said passages 36, 37, associated ports, passages 41, chambers 42, passages 43 and conduit 44 form a discharge line for the gas leading to a discharge valve 45, and in turn leading to the condenser C.

The unloader tube 46 is in communication with both discharge chambers or passages 36 and has a branch 47 leading up through the return gas channel 9 to an unloader chamber 48 formed within a crown block 49 secured to a top plate 50 of spider 21. A port 51 in said plate 50 communicates with the unloader chamber 48 and the interior of housing 10 but is closed when the motor is operating by the inherent resilience of a metal leaf unloader valve 52 secured at 53 to plate 50, and held tightly closed by the pressure within chamber 48 which is higher than the pressure within enclosure 10. Since the unloader tube branch 47 is disposed in channel 9, it is exposed to or in heat transfer relation with the return gas, which latter is cold and hence there will be some condensation or a partial condensation in the unloader line 47, so that liquid will collect in unloader chamber 48 to hydraulically seal the unloader valve therein when closed, that is when the motor is operating.

The unloader valve 52 is opened and maintained open when the motor and compressor are idle by a finger 54 extending through port 51, but which finger is of less diameter than the port to permit unloading through the port into the interior of housing 10. A slidable cap 55 carrying said finger 54 is mounted on the upper end of shaft 15 and urged to uppermost position by an expansive coil spring 56 surrounding the cap and abutting a flange 57 thereon and a bracket 58 rigid with shaft 15 and rotor 18. Centrifugally operable governor levers 59 are pivoted at 60 to

arms 61 of said bracket 58 and lugs 62 of said levers overlap flange 57. The lower ends of governors 59 are weighted at 63 so that rotation of the motor will cause the levers to act centrifugally to depress or lower the cap 55 and finger 54, so that the unloader valve 52 will be free to close. Cap 55 does not have closing engagement against the spider plate 50 since the upper limit of movement of said cap is defined by spaced apart lugs 8 projecting from said plate.

Attention is called to the fact that the valves 34 control the actual discharge of gas from the compressor cylinders and valves 39 float upon the gas stream during operation of the unit, but close off tightly when there is any release of gas from the spaces or passages 36. Therefore, during inoperative periods, valves 39 act as check valves and maintain the high pressure gas in the condenser C and prevent the pressure from being imposed upon the compressor.

Presuming operation, when the compressor is running, the centrifugal governor levers 59 are thrown out which depress the unloader slide or plunger 55 and finger 54 carried thereby, permitting valve 52 to close port 51. Suction gas from the evaporator enters under control of suction valve 27 and passes down through the suction channel or space 9 formed in housing 10 and enters the suction inlets 28 and 28' to the compressor and is drawn into the suction passageways 29 in heads 25, entering through ports 30, and is discharged through ports 33 under control of valves 34 into the discharge pasageways 36 where the main part of the gas then proceeds under control of valves 39 into the discharge chambers 37 and from there proceeds through passageways 41 into discharge chambers 42 which serve as mufflers, then discharging through the passageways 43 into the discharge tubing 44, proceeding then to the discharge valves 45 and to the condenser C. A portion of the gas from the chambers 36 of heads 25 passes into the tubing 46 and into the line 47 through the refrigerated channel 9 which allows a portion of this gas to condense and collect in chamber 48 to seal unloader valve 52. When the refrigeration cycle is complete and the motor stops, the governor levers 59 collapse to the position shown in the drawings, in which case the spring 56 returns the unloader plunger 55 to its original position and the finger 54 opens valve 52 and releases all pressure in chamber 48, line 46—47 and chamber 36 into the housing 10, which as before stated, is maintained at suction pressure. All pressure between the two valves 34 and 39 is therefore reduced to that of the low side pressure and the higher pressure which is present in chamber 37, is sufficient to close and seal valve 39. The net effect is unloading of the cylinder to the point where, upon restart, the motor comes up to speed before the pressure in chamber 36 is built up sufficiently to restrain immediate starting of the compressor. When the presure in chamber 36 is built up sufficiently to overcome the pressure in chamber 37, the valve 39 opens and floats in the open position while gas from the cylinder is passing through.

Various changes may be resorted to provided they fall within the spirit and scope of the invention. For instance, as shown in Figure 4, the discharge line or passage to the condenser may be a conduit 64 separate from the main body or casting, and in communication with the passages or chambers 37 in the caps. Otherwise the structure and operation is the same as in Figures 1 to 3 and the same reference characters have been

applied. It will be noted, specifically, that said conduit 64 replaces the passages 41, chambers 42 and passages 43 and that conduit 64 in effect is conduit 44 of the first form connected directly to the caps 26 in communication with chambers 37 thereof.

What is claimed is:

1. In a refrigeration compressor assembly, a compressor, a housing containing said compressor providing a space therein through which gas is returned to the housing, unloader mechanism for the compressor, and a discharge line for the compressor in communication with said unloader mechanism including a valve which is seated during operation of the compressor and unseated when the compressor is idle, said discharge line including a portion extending through said space so as to be subject to the cooling effect of said space during operation of the compressor to cause sufficient condensation of gas in said line to liquid seal the valve of the unloader mechanism.

2. In a refrigeration compressor assembly, a compressor, a housing containing said compressor, unloader mechanism for the compressor including a valve which is seated during operation of the compressor and unseated when the compressor is idle, a discharge line for the compressor having a portion in communication with said unloader mechanism, means to return gas through the housing to said compressor, and said portion being in heat exchange relation in the path of return gas so as to be cooled in a degree sufficient to cause sufficient condensation of gas in said line during operation of the compressor to liquid seal the valve of the unloader mechanism.

3. In a refrigeration compressor assembly, a compressor, a housing hermetically containing said compressor, an unloader mechanism for the compressor including a valve which is seated during operation of the compressor and unseated when the compressor is idle, a discharge line for the compressor having a portion in communication with said unloader mechanism, and means to return gas through the housing to said compressor in heat-exchange relation to said portion to cause sufficient condensation of gas in said line during operation of the compressor to liquid seal the valve of the unloader mechanism.

4. In combination, a compressor body, cylinder means therein, a bearing rising from said body, a motor on the body having a driving shaft journalled in said bearing, piston means for the cylinder means, a driving connection between said shaft and piston means, enclosing means surrounding the motor including a sleeve on said body, unloader means on said enclosing means, centrifugally operable mechanism movable with said shaft to maintain the unloader means operable during operation of the compressor, a discharge line from the compressor having a portion leading to the unloader means, and means to return gas to the compressor, said discharge line portion and said means to return gas being in heat exchange relation so as to bring about condensation in said discharge line portion during operation of the compressor and which is effective to seal said unloader means.

5. In combination, a compressor body, cylinder means therein, a bearing rising integrally from said body, a motor on the body having a driving shaft journalled in said bearing, piston means for the cylinder means, a driving connection between said shaft and piston means, enclosing means surrounding the motor including a shaft integral on and rising from said body, unloader means on said enclosing means, centrifugally operable mechanism movable with said shaft to maintain the unloader means operable during operation of the compressor, a discharge line from the compressor having a portion leading to the unloader means, and means to return gas to the compressor, said discharge line portion and said means to return gas being in heat exchange relation so as to bring about condensation in said discharge line portion during operation of the compressor and which is effective to seal said unloader means.

6. In a refrigeration compressor assembly, a compressor, a housing containing said compressor, unloader mechanism for the compressor, a discharge line for the compressor having a portion in communication with said unloader mechanism, means to return gas through the housing to said compressor, said portion being in the path of return gas to cause sufficient condensation of gas in said line during operation of the compressor to seal the unloader mechanism, normally retracted means slidable on the shaft to operate the unloader mechanism, and centrifugal means to move said slidable means when the assembly is operating to close the unloader mechanism.

7. In a refrigeration compressor assembly, a compressor, a housing containing said compressor, unloader mechanism for the compressor, a discharge line for the compressor having a portion in communication with said unloader mechanism, means to return gas through the housing to said compressor, and said portion being in the path of return gas to cause sufficient condensation of gas in said line during operation of the compressor to seal the unloader mechanism, said discharge line also having a space therein constituting a muffler.

8. In a refrigeration compressor assembly, a compressor, a housing containing said compressor, unloader mechanism for the compressor, a discharge line for the compressor having a portion in communication with said unloader mechanism, means to return gas through the housing to said compressor, said portion being in the path of return gas to cause sufficient condensation of gas in said line during operation of the compressor to seal the unloader mechanism, said return means including a suction valve for the cylinder, said discharge line including a main discharge valve for the cylinder, a space to receive discharge after passing said discharge valve, an auxiliary discharge valve in said space functioning as a check valve to maintain high pressure gas in the associated condenser and preventing the pressure from being imposed upon the compressor, and said portion of the discharge line leading from such line intermediate said discharge valves.

9. In a refrigeration compressor assembly, a compressor, a housing containing said compressor, unloader mechanism for the compressor, a discharge line for the compressor having a portion in communication with said unloader mechanism, means to return gas through the housing to said compressor, said portion being in the path of return gas to cause sufficient condensation of gas in said line during operation of the compressor to seal the unloader mechanism, a plate on the compressor closing one end of the cylinder, a head disposed against said plate, a cap disposed against said head, said return means including a suction valve on the plate for the

cylinder, said discharge line including a main discharge valve on the plate for the cylinder, a space in said head to receive discharge after passing said discharge valve, and an auxiliary discharge valve in the cap functioning as a check valve to maintain high pressure gas in the associated condenser and preventing said high pressure from being imposed upon the compressor, said portion of the discharge line leading from such line intermediate said discharge valves.

SYLVAN ROOS HIRSCH.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,043,058	Ploeger	June 2, 1936
2,164,405	Hintze	July 4, 1939
2,338,486	Bixler	Jan. 4, 1944
2,408,932	Hirsch	Oct. 8, 1946