June 25, 1940. W. H. D. BROUSE 2,205,919

UNLOADING COMPRESSOR

Filed April 14, 1938

Fig. 1.

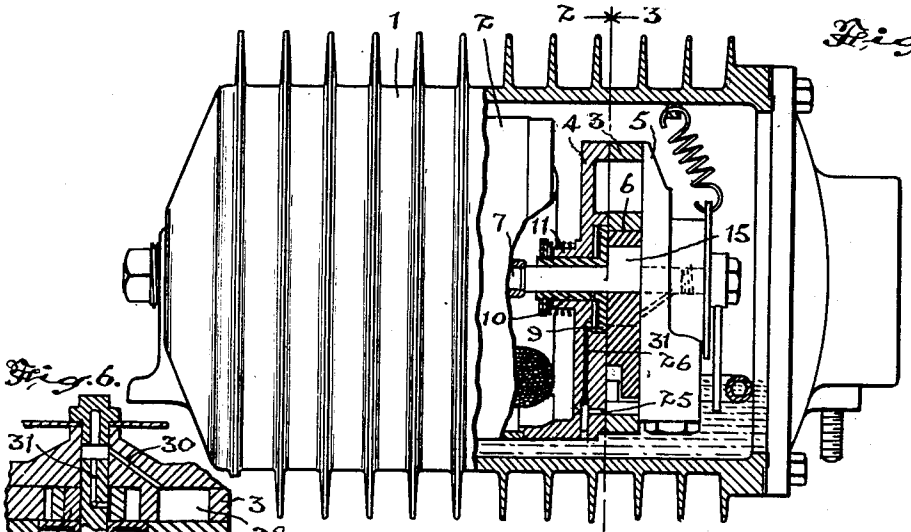


Fig. 6.

Fig. 2.

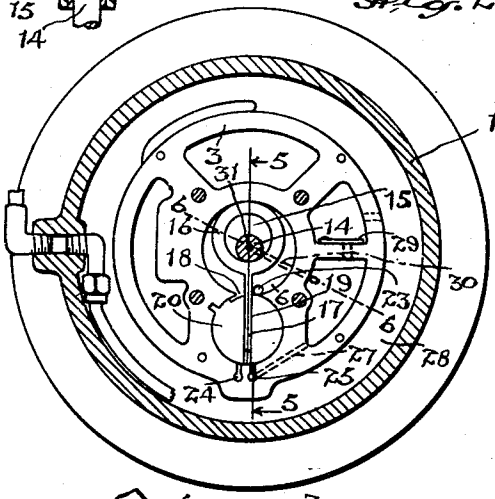


Fig. 3.

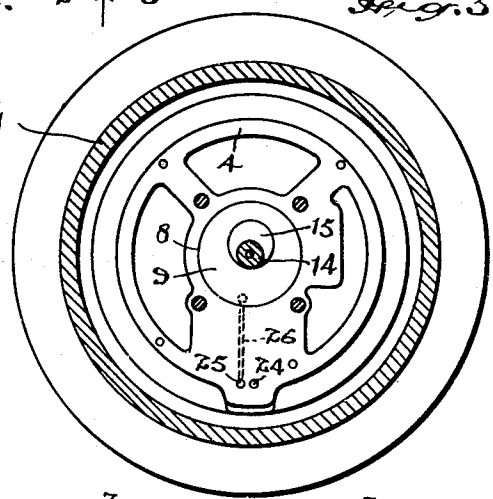


Fig. 4.

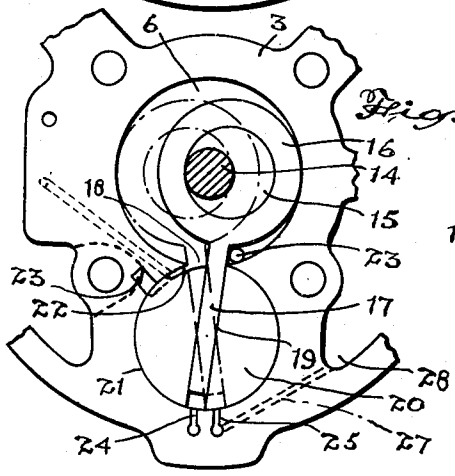
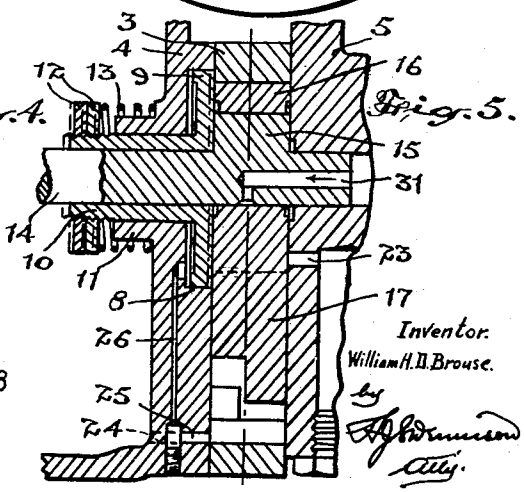


Fig. 5.



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UNITED STATES PATENT OFFICE

2,205,919

UNLOADING COMPRESSOR

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Application April 14, 1938, Serial No. 201,919

10 Claims. (Cl. 230—138)

The principal objects of this invention are to provide a compressor particularly of the type that is used in connection with refrigerating machines which will enable the easy starting of the motor for operating the compressor, thereby eliminating complicated mechanisms and valves which are difficult to maintain in operating condition in order to enable the compressor being started with the least possible effort and expenditure of power, thereby enabling the use of a low starting torque motor.

The principal feature of the invention consists in the novel arrangement of a movable wall in the compressor whereby such a wall will recede from its sealing position in contact with the moving element to permit the moving element to operate freely and the operation of such element is utilized to build up a pressure to hold said movable wall in pressure-holding contact with the moving element.

In the accompanying drawing,

Figure 1 is a part sectional elevation of a compressor unit constructed in accordance with this invention.

Figure 2 is an enlarged sectional elevation taken through the line 2—2 of Figure 1 looking toward the right and into the compressor mechanism.

Figure 3 is a cross sectional view taken through the line 3—3 of Figure 1 looking to the left or in the direction of the motor for operating the compressor.

Figure 4 is an enlarged elevational detail of the compressor and pressure pumping units.

Figure 5 is an enlarged vertical sectional detail through the line 5—5 of Figure 2.

Figure 6 is a horizontal sectional detail taken on the line 6—6 of Figure 2.

In the structure herein shown the compressor is incorporated as part of a refrigerating unit which comprises a cylindrical casing 1 having suspended therein a motor 2, to the frame of which is connected the compressor housing 3 which is arranged between the side bearing sections 4 and 5 respectively.

The compressor housing 3 is provided with a cylindrical compressor chamber 6 which is in axial alignment with the motor shaft 7. The member 4 is provided with a cylindrical recess 8 concentric with the compressor chamber 6 and of slightly larger diameter than said compressor chamber.

Within the cylindrical recess 8 is mounted a circular plate 9 which has a sliding and substantial sealing fit within the perimeter of the recess 8 so that a pressure chamber is formed and said plate is provided with a hub 10 of cylindrical formation which extends through and is slidable concentrically in a cylindrical bearing support 11 which extends from the section 4.

A pair of threaded ring nuts 12 are threaded on the threaded end of the hub 10 which extends beyond the bearing 11 and these nuts engage a coil compression spring 13 which encircles the bearing 11. With this arrangement the effective tension on the spring 13 may be accurately adjusted by means of the nuts 12.

The plate 9 is of a lesser thickness than the depth of the cylindrical recess 8 and normally when the compressor is at rest the thrust of the spring 13 forces the plate member outwardly, so that the inner face of the plate is held out of engagement with the compressor housing 3.

The compressor shaft 14, which is rigidly coupled in one end of the motor shaft, extends through and is journalled concentrically in the hub 10 of the plate 9 and is also journalled in the side bearing plate 5. An eccentric 15 is mounted on or forms part with the compressor shaft 14 and is arranged within the compressor chamber.

A cylindrical annular member 16, which forms the pump impeller, is journalled on the eccentric 15 and rotates eccentrically within the compressor chamber 6 and in contact with the inner cylindrical surface thereof. The impeller 16 is provided with a radial vane 17 which extends from the said impeller through an opening 18 at the bottom of the compressor chamber and engages in the transverse slot 19 of the rocker valve 20 which is rotatably mounted in a cylindrical chamber 21 arranged in the compressor housing immediately below the compressor chamber 6.

A notched port 22 in the rocker valve 20 connects the compressor chamber at predetermined intervals with the port 23 which directs the compressed gas into the refrigerant compressor chamber.

A port 24 arranged at the bottom of the chamber 21, which houses the rocker valve, connects with the bottom of the refrigerant compressor chamber in the casing 1, said port being below the level of the oil constantly maintained in the casing and permitting the inflow of oil upon the upward stroke of the vane 17. A port 25 similar to the port 24 and arranged adjacent thereto, connects with the bottom end of the slot 19 in the rocker valve on said valve being rocked through the operation of the compressor impeller to close the port 24 and then open the port 25. The con-

tinued movement of the compressor member moves the vane 17 outwardly, thereby forcing the oil drawn into the slot, out through the port 25 and upwardly through a duct 26 leading to the outward side of the recess 8, so that the recurrent operation of the vane 17 will pump an oil pressure back of the plate 9 which will eventually overcome the pressure of the spring 13 which acts to hold the plate 9 out of contact with the rotating impeller, thereby bringing the plate into engagement with the compressor housing 3 and forming a seal with the edge of the impeller, so that the compressor will act to force the gaseous refrigerant under high compression from the chamber 6.

It will be understood that when the device is at rest the spring 13 holds the plate 9, which forms one of the side walls of the compression chamber, out of contact with the impeller. While special provision may be made in the form of a small bleed hole or the like to drain the oil from the recess 8, it will be found in practice that this is not essential since the oil will find its way out slowly past the various surfaces under the pressure of the spring 13, thereby allowing the plate to recede from its sealing relation to the impeller and housing 3. This slight leakage however is easily compensated for by the rapidly operating pump when set in motion which quickly builds up the required pressure to effect the sealing displacement. Consequently the said impeller initially operates without compression and it thus turns freely so that there will be the minimum starting load upon the motor.

As the motor continues to revolve and operates the pump vane 17 to draw a small quantity of oil into the valve slot with each stroke and force it up through the duct 26 to the chamber 8, the pressure ultimately overcomes the oppositional pressure of spring 13 and presses the plate tightly against the housing in close sealing co-operation with the impeller, causing it to function as a compressor. Thus as the working pressure is then built up within the chamber 6 against the inner surface of the wall 9, this pressure will be opposed by the concurrent building up of the oil pressure against the outer side. The duct 26 is of a restricted diameter to obviate pulsations against the plate 9.

End pressure exerted by the oil against the plate 9 holds the end surfaces of the compressor impeller in fluid tight contact with the surface of said plate and of the side bearing plate 5 during the functioning of the device as a compressor, but immediately upon the shutting off of the current to the electric motor, the pressure of the spring 13 relieves the pressure of the plate 9 against the impeller, so that the rotor will spin freely without load for a few revolutions, thereby effecting a very thorough lubrication of the surfaces. So also in the commencement of operation on the starting of the motor, the compressor impeller operates freely until the oil pump develops a pressure sufficient to overcome the longitudinal pressure of the spring.

The oil pressure developed by the longitudinal movement of the vane 17 of the impeller is conducted through the duct 27 to a chamber 28 in the compressor casing which is sealed by a reed valve 29 controlling the pressure of oil so that such pressure will not become excessive. A duct 30 leads from the chamber 28 to a passage 31 in the shaft 14 which conducts oil under pressure to the bearings to lubricate same effectively.

It will be understood from this description that the compressor as herein described is equipped with an automatic unloading device which is extremely simple and is very positive and dependable in its operation.

What I claim as my invention is:

1. A compressor comprising a cylinder compressor chamber having an enlarged recess at one end and a longitudinal slot in the cylinder wall, a cylindrical valve cavity arranged parallel to said cylinder and open thereto through said slot, a compressor impeller concentrically mounted in said cylinder having a radial vane extending through said slot, a cylindrical valve arranged in said valve cavity having a slot to receive said vane, ports controlled by said valve connected with said cylinder, ports controlled by said valve connecting the outer extremity of the vane slot with a fluid supply and with the enlarged recess at the cylinder end, a reciprocable member operating in said enlarged recess to engage the compressor impeller under the influence of the fluid supplied to said recess, and means for moving said reciprocable member away from said rotor upon the cessation of the operation of the impeller.

2. A compressor comprising a block having a cylinder cavity and a cylindrical valve cavity opening thereto, end blocks closing the ends of said cavities, one of said blocks having a cavity concentric with said cylinder cavity, an eccentric shaft journalled in said end blocks, a compressor impeller eccentrically mounted on said shaft and operating in said cylinder cavity and having a vane extending into said valve cavity, an outlet port from said cylinder cavity, a rotary valve arranged in said valve cavity controlling said outlet port and having a slot to receive said vane, said valve being operated by the oscillations of said vane, a port in one of said end blocks connected with a fluid supply and leading to the end of the vane slot in said valve, a port adjacent to the aforesaid port leading from the end of the vane slot to the cavity concentric with said cylinder cavity, a floating plate arranged in said latter cavity adapted to engage in sealing contact with said compressor impeller, and means for moving said floating plate out of pressure contact with said compressor impeller.

3. In a compressor having a member formed with a compressor chamber and a side wall and a rotary compressor element operable in said chamber in peripheral sealing relation to a wall of the compressor chamber, an end wall for said chamber movable independent of said compressor element into and out of sealing relation to the said side wall of said first-mentioned member to load and unload the compressor, means responsive to the operation of the compressor for moving said end wall into sealing relation to said side wall, and means for breaking said sealing relation at the end of said operation.

4. In a compressor having a member formed with a compressor chamber and a side wall and a rotary compressor element operable in said chamber in peripheral sealing relation to a wall of the compressor chamber, an end wall for said chamber separate from said compressor element mounted for bodily displacement, axially only, relative to said rotary element into and out of sealing relation to said side wall to load and unload the compressor respectively, means for moving said movable wall axially out of said sealing relation to unload the compressor, and means for applying pressure in the reverse axial direction

to said movable wall to overcome the force applied to effect unloading and to effect a sealing relation to said side wall while the compressor is in operation.

5. In a compressor having a member formed with a compressor chamber and a side wall, and a rotary compressor element operable in said chamber in peripheral sealing contact with a wall of the compressor chamber, a movable end wall for said chamber formed separate from said rotary compressor element and displaceable relative thereto into and out of sealing relation to said side wall and said compressor element to load and unload the compressor, means for moving said movable wall out of sealing relation with said side wall and compressor element to unload the compressor for starting purposes, and means actuated by the movement of said compressor element for moving said movable wall into sealing engagement with said rotary element and side wall following the initial movement of the compressor element.

6. In a compressor having a member formed with a compressor chamber and a side wall, and a rotary compressor element eccentrically operable in said chamber in peripheral sealing contact with a wall of the compressor chamber, a movable end wall for said chamber formed separate from said rotary compressor element and displaceable axially in relation thereto into and out of sealing relation to said side wall and eccentrically operable compressor element to load and unload the compressor, means for moving said movable wall axially out of sealing contact with said side wall and compressor element to unload the compressor for starting purposes, and means actuated by the eccentric movement of said compressor element for gradually applying pressure to move said movable wall in the reverse axial direction in opposition to the aforesaid means into sealing contact with said side wall and compressor element.

7. In a compressor having a member formed with a compressor chamber and a side wall, and a rotary compressor element operable in said chamber in peripheral sealing contact with a wall of the compressor chamber, a movable end wall for said chamber separate from said rotary compressor element and mounted for displacement axially in relation thereto into and out of sealing relation to said side wall and said compressor element to load and unload the compressor, means for moving said movable end wall axially from sealing contact with said side wall and compressor element to unload the compressor for starting purposes, and means for applying a fluid pressure against said movable chamber wall to move same in the reverse axial direction into sealing contact with said side wall and compressor element.

8. In a compressor, a compressor chamber having a cylindrical recess in one of its end walls and a side face at the inner end of said recess, a plate reciprocably mounted in said recess and having peripheral sealing engagement with the cylindrical recessed wall to form a sealed pressure chamber, a rotary compressor member separate from said plate operating in said compressor chamber in peripheral sealing relation thereto, said plate being movable into and out of sealing relation to said side face and said compressor member, spring means for moving said plate away from said side face and compressor member, and means directing fluid pressure within said sealed pressure chamber to force said plate into sealing contact with said side face and compressor member.

9. In a compressor, a compressor chamber having a cylindrical recess in one of its end walls and a side face at the inner end of said recess, an outer sleeve extending beyond said recess, an inner sleeve slidably mounted in the aforesaid sleeve extension having a circular plate end housed in said recess and reciprocable therein with its periphery in sliding and sealing relation to the cylindrical recess wall forming a sealed chamber, a coiled compression spring encircling the inner and outer sleeves, means adjustable on the inner sleeve engaging said spring to variably tension the same, said spring acting through said inner sleeve to urge the plate portion free from sealing engagement with said side face, a shaft journalled in said slidable sleeve, a rotor compressor member separate from said circular plate mounted on said shaft within said compressor chamber in peripheral sealing relation thereto, and means operated by said compressor member for directing fluid pressure to said sealed chamber to move said slidable circular plate positively inwardly in opposition to said spring urge to bring the circular plate into sealing contact with said side face and compressor member.

10. In a compressor having a member formed with a compressor chamber and a side wall, a rotary compressor element operable in said compressor chamber in peripheral sealing contact with a wall of the compressor chamber, a movable end wall for said chamber separate from said rotary compressor element and mounted for displacement axially in relation thereto into and out of sealing relation to said side wall and said compressor element to load and unload the compressor, spring means for moving said end wall axially from sealing contact with said side wall and said compressor element to unload the compressor for starting purposes, and fluid pressure means operated by the eccentric displacement of said compressor element for applying a pressure to overcome said spring pressure and move said end wall in the reverse axial direction into sealing contact with said side wall and compressor element.

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