

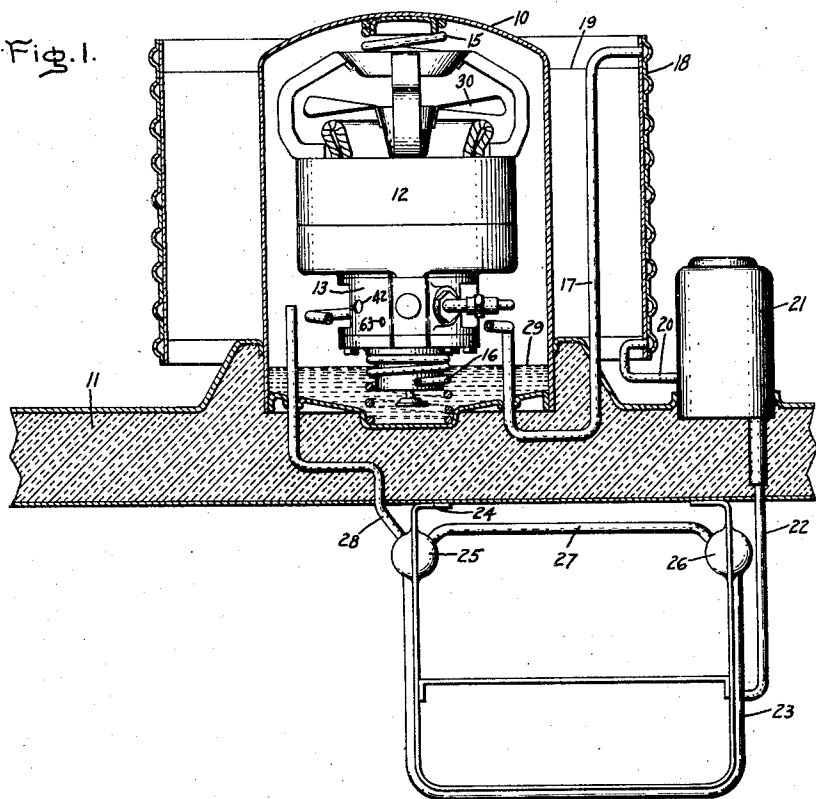
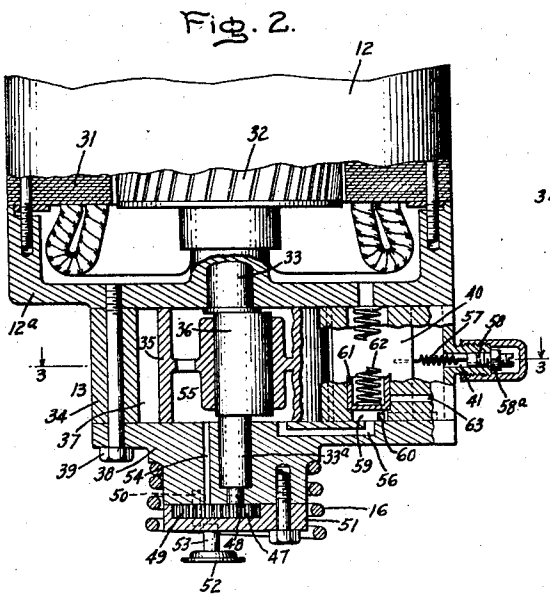
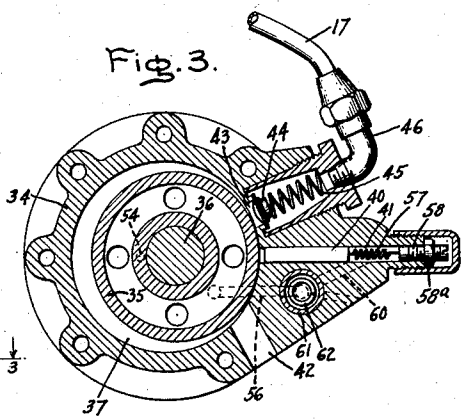
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COMPRESSOR UNLOADER

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## UNITED STATES PATENT OFFICE

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## COMPRESSOR UNLOADER

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8 Claims. (Cl. 230—138)

My invention relates to unloaders for fluid compressors, and more particularly to devices for unloading fluid compressors of the rotary type.

When an electric motor, such as the motors commonly employed for driving the compressors of refrigerating machines, is started, it is desirable that the load connected thereto be as small as possible, so that a minimum starting current shall be required. In order to accomplish this, it is necessary to provide some means for preventing the loading of the compressor until the motor has attained sufficient speed to carry the load without requiring excessive current. The unloading of refrigerant compressors is usually accomplished by some by-passing arrangement whereby the intake and exhaust ports are placed in communication, thus preventing the building up of any pressure by the compressor. When a rotary compressor is employed, it has heretofore been necessary to provide additional valves and ports in order satisfactorily to unload the compressor.

It is an object of my invention to provide an improved and simplified positive unloading mechanism for fluid compressors of the rotary type employing a blade for compressing fluid therein. I accomplish this object by providing an arrangement for retaining the blade in a retracted position to unload the compressor, and a fluid pressure arrangement responsive to operation of the compressor for forcing the blade out of its retracted position to load the compressor when a predetermined speed has been reached.

Further objects and advantages of my invention will become apparent as the following description proceeds, and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of my invention reference may be had to the accompanying drawing, in which Fig. 1 is a sectional elevational view of a refrigerating machine provided with a compressor embodying my invention; Fig. 2 is an enlarged sectional view of the compressor shown in Fig. 1, and Fig. 3 is a sectional view on the line 3—3 of Fig. 2.

Referring now to the drawing, in Fig. 1 I have shown a refrigerating machine including a casing 10 mounted on an insulated top 11 of a refrigerator cabinet, and within the casing 10 are arranged a motor 12 and a compressor 13 of the rotary type resiliently supported within the casing on upper and lower helical springs 15 and 16. Gaseous refrigerant is withdrawn from the

casing 10 of the compressor 13, and is compressed and discharged through a connection 17 to an air-cooled condenser 18 spaced from the casing 10 and secured thereto on a plurality of radial fins 19. The compressed refrigerant is cooled and liquefied within the condenser 18 and flows through a connection 20 to a receiver or float valve chamber 21. The liquid refrigerant which collects in the chamber 21 flows through a connection 22 to an evaporator 23 suspended by legs 24 below the top 11. The rate of flow of liquid refrigerant from the chamber 21 to the evaporator 23 is regulated by a float valve or other suitable flow controlling device. Liquid refrigerant within the evaporator 23 is vaporized upon the absorption of heat from the compartment to be cooled, and the vaporized refrigerant collects in the headers 25 and 26 which are in communication through conduit 27 and is withdrawn from the header 25 through a suction line 28 and returns to the casing 10. In order to lubricate the motor and compressor a body of oil 29 is maintained in the bottom of the casing 10 and is circulated through the motor and compressor by an oil pump. Cooling of the motor and compressor is facilitated by a fan 30 secured on the motor shaft and rotated thereby.

Referring now to Fig. 2, the motor 12 comprises a stator 31 mounted on a frame 12a and a rotor 32 arranged to drive a shaft 33 which is journaled in the frame 12a of the compressor. The compressor 13 comprises a cylinder block 34, a rotor 35 mounted on an eccentric portion 36 of the shaft 33 and arranged to rotate within a compression chamber 37 formed in the cylinder block 34. A cylinder head 38 is secured by a plurality of bolts 39 which pass through the cylinder block 34 and firmly secure the block 34 and the head 38 to the motor frame 12a, the lower end 33a of the motor shaft being journaled in the head 38. The motor frame 12a thus forms the upper cylinder head of the compressor.

The arrangement of the rotor 35 within the chamber 37 is clearly shown in Fig. 3. It will be noted that a crescent-shaped space is formed between the block 34 and the rotor 35, and that as the rotor moves eccentrically within the chamber 37 the crescent-shaped space will likewise rotate about the chamber. In order to utilize the movement of the rotor 35 to compress gas within the chamber 37 I provide a blade 40 slidably mounted within a slot 41 in the block 34 at one side of the chamber 37 and extending between the upper and lower cylinder heads of the compressor. The blade 40 is arranged to be pressed into contact

with the rotor 35 so that the crescent-shaped space between the rotor and the cylinder block will be divided into intake and compression portions, except when the rotor 35 is in the position nearest the slot 41 as shown in Fig. 3. The fluid to be compressed is admitted to the chamber 37 through an intake port 42 and, as the rotor 35 turns around in a clockwise direction from the position shown in Fig. 3, the gas is compressed between the line of contact between the rotor 35 and the walls of the chamber 37 and the blade 40, and as the gas is compressed it is forced out through an exhaust port 43 provided with a check valve 44, which is urged against the port 43 by a spring 45. The compressed gas is discharged through a connection 46 and enters the conduit 17 leading to the condenser 18.

In order to lubricate the compressor I provide a gear type oil pump including a gear 47 mounted on a reduced portion 48 of the shaft 33, and a second gear 49 meshing with the gear 47 and rotating on a pin 50 mounted in the head 38. Both of the gears rotate in a chamber in a pump block 51. During operation of the motor oil is drawn through a strainer 52 and a connection 53 into the gear pump and is discharged through a passage 54 to a chamber 55 formed within the rotor 35. The oil fills the chamber 55 and thoroughly lubricates and seals the bearing surfaces of the compressor and is discharged therefrom through a passage 56.

In accordance with my invention I provide a mechanism for retaining the blade of the rotary compressor in a retracted position to prevent loading of the compressor during starting, and an arrangement whereby fluid pressure developed by the operation of the compressor will force the blade into operating position when a predetermined speed of the motor has been reached. In the embodiment illustrated, I provide a helical tension spring 57 secured to the blade 40 and to an adjusting screw 58 to retain the blade 40 in a retracted position within the slot 41. When the blade is retracted in this manner the space between the rotor and the cylinder block is no longer divided into intake and compression portions and the gas within the space is not compressed. The rotor then does no work on the gas and the compressor is unloaded. The oil from the passage 56 enters a cylinder 59 and is discharged therefrom through a passage 60 and enters the slot 41 to the rear of the blade 40. When the compressor has attained a predetermined speed the pressure of oil supplied by the gear pump becomes sufficiently great to force the blade 40 through the slot 41 against the tension of the spring 57 into contact with the rotor 35 to load the compressor. The pressure necessary to force the blade 40 into contact with the rotor 35 may be varied by adjusting the screw 58 and the nut 58a threaded thereon. The oil pressure will remain sufficient throughout operation of the compressor to maintain the blade 40 under pressure against the rotor 35. Should the oil pressure at any time become greater than a predetermined desired value a piston 61 arranged within the cylinder 59 will be raised against the force of a spring 62, and when a predetermined pressure has been reached the upward movement of the piston 62 will uncover a passage 63 in the block 34 and the oil will be discharged through the passage 63 out into the casing 10. This arrangement regulates the pressure of the oil by preventing an increase of pressure above a predetermined maximum value, since the oil pas-

sages are placed in communication with the casing as soon as the pressure is sufficient to uncover the passage 63, and thus release the pressure and discharge excess oil. As a result the pressure of oil supplied back of the blade 40 is limited, and the pressure exerted by the blade on the surface of the rotor 35 is sufficiently limited to prevent excessive friction between the blade and the rotor during operation of the compressor. When the power supplied to the motor 12 is shut off the compressor will slow down, and at a predetermined speed the oil pressure will be insufficient to maintain the blade 40 in contact with the rotor 35 and the compressor will be unloaded. This unloading action is positive and prevents jarring of the mechanism when the motor is stopped.

While I have described my invention as applied to a compression refrigerating machine, other applications will readily become apparent to those skilled in the art, and I do not desire my invention to be limited to the specific construction shown and described, and I intend in the appended claims to cover all modifications which do not depart from the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. A fluid compressor including a stationary member having a compression chamber therein and inlet and outlet ports communicating with said chamber, a rotatable member arranged within said compression chamber, means for driving said rotatable member, means including a blade slidably mounted in one of said members for compressing fluid between said members, means for retracting said blade and for retaining said blade in a retracted position in said one member to unload said compressor, and means dependent upon the operation of said driving means and producing fluid pressure for moving said blade into contact with the other of said members to load said compressor.

2. A fluid compressor including a stationary member having a compression chamber therein, and inlet and outlet ports communicating with said chamber, a rotatable member arranged within said compression chamber, means for driving said rotatable member, means including a blade slidably mounted in one of said members for compressing fluid in said chamber, means including a spring for retracting said blade and for retaining said blade in a retracted position in said one member to unload said compressor, and means dependent upon the operation of said driving means and producing fluid pressure for moving said blade into contact with the other of said members to load said compressor.

3. A fluid compressor including a stationary member having a compression chamber therein and inlet and outlet ports communicating with said chamber, a rotatable member arranged within said compression chamber, means including a blade slidably mounted in one of said members for compressing fluid in said chamber, means including a spring for retracting said blade and for retaining said blade in a retracted position in said one member to unload said compressor, means for supplying lubricant under pressure to said compressor, and means dependent upon the pressure of said lubricant for moving said blade into contact with the other of said members to load said compressor.

4. A fluid compressor including a cylinder block having a compression chamber therein and inlet and outlet ports communicating with said cham-

ber, a rotor arranged within said compression chamber, means for driving said rotor, means including a blade slidably mounted in said block and movable into contact with said rotor for compressing fluid in said chamber, means for retracting said blade and for retaining said blade in a retracted position within said block to unload said compressor, and means dependent upon the operation of said driving means and producing fluid pressure for moving said blade into contact with said rotor to load said compressor.

5. A fluid compressor including a stationary member having a compression chamber therein and inlet and outlet ports communicating with said chamber, a rotatable member arranged within said compression chamber, means including a blade slidably mounted in one of said members for compressing fluid in said chamber, means including a spring for retracting said blade and for retaining said blade in a retracted position in one member to unload said compressor, means for supplying lubricant under pressure to said compressor, and means dependent upon the pressure of said lubricant for moving said blade into contact with said rotor to load said compressor.

6. A fluid compressor including a cylinder block having a compression chamber therein and inlet and outlet ports communicating with said chamber, a rotor arranged within said compression chamber, a motor for driving said rotor, means including a blade slidably mounted in said cylinder block and movable into contact with said rotor for compressing fluid in said chamber, means for retracting said blade and for retaining said blade in a retracted position within said block to unload said compressor, means including a lubricant pump driven by said motor for supplying lubricant under pressure to said compressor, means utilizing said lubricant for

forcing said blade against said rotor to load said compressor, and means for limiting the maximum pressure of said lubricant.

7. A fluid compressor including a stationary member having a compression chamber therein and inlet and outlet ports communicating with said chamber, a rotatable member arranged within said compression chamber, means including a blade slidably mounted in one of said members for compressing fluid between said members, means for supplying lubricant under pressure to said compressor, means for retracting said blade and for retaining said blade in a retracted position in said one member to unload said compressor, means utilizing the pressure of lubricant supplied to said compressor for moving said blade into contact with the other of said members to load said compressor, and means for limiting the maximum pressure of said lubricant utilized to load said compressor.

8. A fluid compressor including a cylinder block having a compression chamber therein and inlet and outlet ports communicating with said chamber, a rotor arranged within said compression chamber, means including a blade slidably mounted in said block and movable into contact with said rotor for compressing fluid in said chamber, means for retracting said blade and for retaining said blade in a retracted position within said block to unload said compressor, means responsive to the operation of said compressor for supplying lubricant under pressure to said compressor, means utilizing the pressure of lubricant supplied to said compressor for moving said blade into contact with said rotor to load said compressor, and means for limiting the maximum pressure of said lubricant utilized to load said compressor.

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