

June 12, 1934.

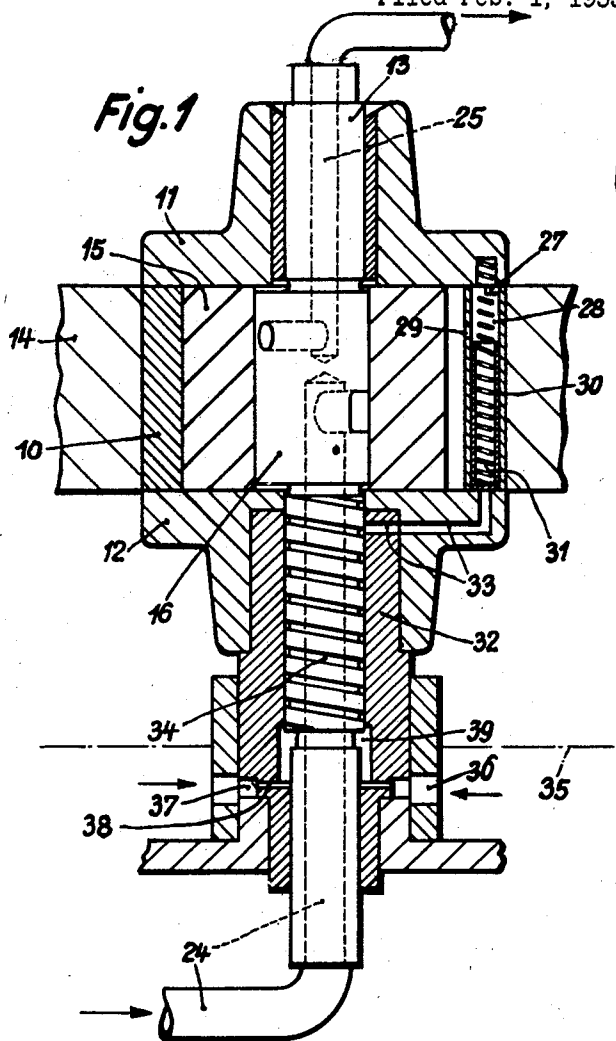
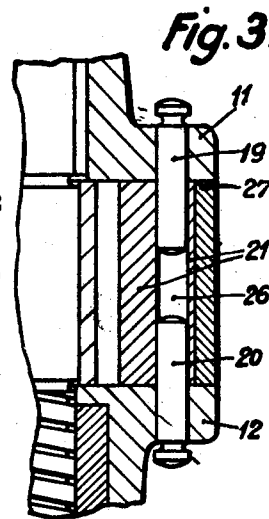
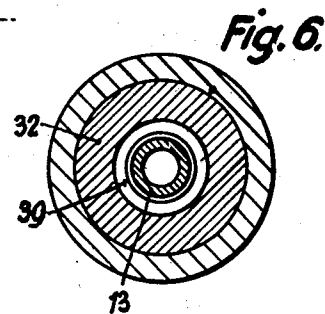
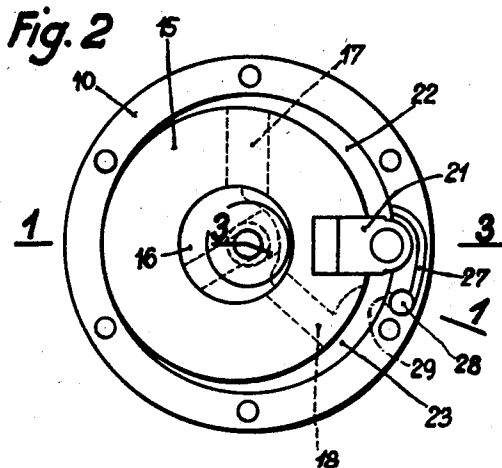
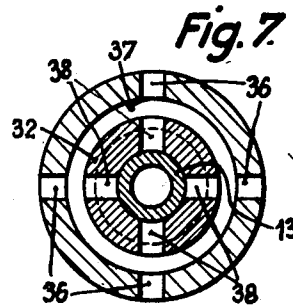
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1,963,024

COMPRESSOR

Filed Feb. 1, 1933

2 Sheets-Sheet 1



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COMPRESSOR

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2 Sheets-Sheet 2

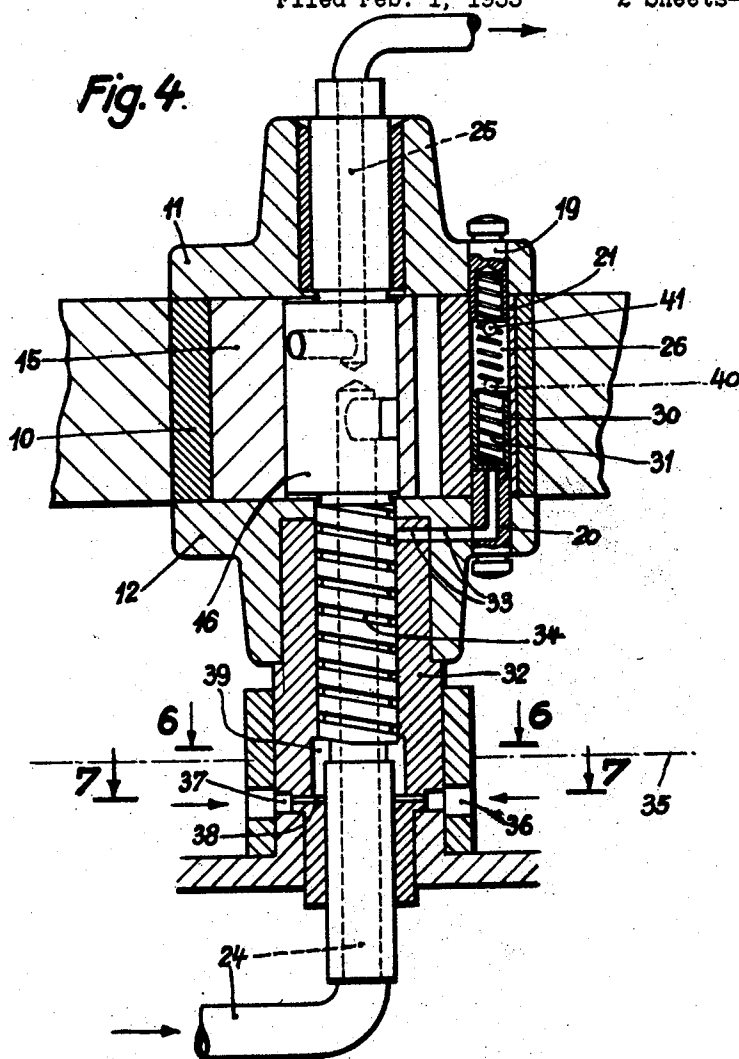
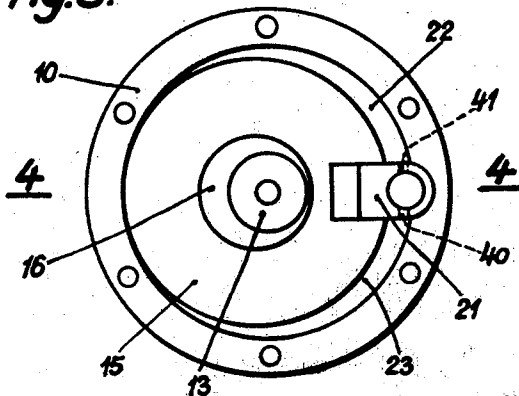


Fig. 5.



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UNITED STATES PATENT OFFICE

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COMPRESSOR

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Application February 1, 1933, Serial No. 654,718
In Germany February 9, 1932

4 Claims. (Cl. 230—24)

The present invention relates to compressors, the suction space or chamber of which is connected to the pressure space by a pipe or duct, the inlet to which is controlled by a pressure-controlled member, which opens the pressure equalization pipe on the stoppage of the compressor, so that the pressure on both sides of the piston is equalized, whilst it closes as soon as the driving motor of the compressor has attained a certain speed. The equalization of pressure on both sides of the piston facilitates the starting, so that a less powerful and therefore smaller motor can be employed than if the compressor had to start against the excess pressure prevailing on its pressure side, that is, under full load. It is already known to operate the valve controlling the equalization of pressure between the suction and the pressure spaces of the compressor by means of a current of pressure gas produced by the compressor, the current of pressure gas being controlled in its turn by an auxiliary valve which is brought into operation under the action of oil pressure produced by a lubricating oil pump connected with the compressor when the compressor is running. It is also known to control the valve controlling the pressure-equalization pipe by a piston which is moved by the pressure in the lubricating oil pipe after a valve operated by the centrifugal acceleration of the starting compressor has closed an open outlet of the lubricating oil pipe when the compressor is stopped.

In contradistinction to these known relief devices, the present invention consists in that a controlling member is provided in the pressure-equalization pipe or duct between the suction and the compressor spaces of the compressor, which is directly influenced by the pressure in the lubricating oil pipe (that is to say, without the intermediary of pressure gas pipes, auxiliary valves or the like), and opens the pressure-equalization pipe as soon as the lubricating oil pressure falls owing to the stoppage of the compressor and the lubricating oil pump, whilst it closes the pressure-equalization pipe as soon as the pressure in the lubricating oil pipe has attained a definite value.

Preferably, the pressure-equalization pipe and the member controlling it are arranged in a constructional part which separates the pressure space from the suction space or chamber (in rotary piston compressors preferably in the abutment) so that the dimensions of the compressor may be kept small, an advantage which is particularly important for small refrigerating machines.

Two examples of construction of the invention

are shown in the accompanying drawings, in which:—

Figure 1 is an axial section on the line 1—3—1 of Fig. 2 through an eccentric piston rotary compressor adapted more especially for small refrigerating machines.

Figure 2 is a top plan view of the compressor, with the upper bearing cover removed.

Figure 3 is a partial section on the line 1—3—3 of Fig. 2.

Figure 4 a section through a second form of construction taken on the line 4—4 of Figure 5, which is a top plan view, with the upper bearing cover removed.

Figure 6 is a section on the line 6—6 of Figure 4, and

Figure 7 a further cross-section on the line 7—7 of Fig. 4.

Referring to the example of the construction shown in Figs. 1—3 inclusive, the casing of the compressor consists of a cylindrical wall 10 which is closed at the two ends by bearing covers 11, 12, by means of which it is revolvably mounted on the stationary shaft 13. The casing 10 is driven preferably by an electric motor, into the armature 14 of which it is built. In the casing 10 is located the piston 15, which is mounted loosely on an eccentric 16 fixedly connected with the stationary shaft 13, and which contains an inlet passage 17 and an outlet passage 18. By the eccentric positioning of the piston 15 a crescent-shaped working chamber results between its periphery and the inner wall of the casing, which is divided into a suction space 22 and a pressure space 23 by an abutment 21 guided in the piston 15 and pivotally connected by rotary pins 19, 20 with the bearing covers 11, 12. The medium to be compressed flows into the suction space 22 through a passage 24 in the stationary shaft 13 and the inlet passage 17 in the piston whilst the compressed medium can escape through the outlet passage 18 in the piston and an outlet pipe 25 provided in the hollow shaft 13. The piston 15 is pivotally connected with the rotary casing 10 by the abutment 21, the outer rounded end of which engages with a tight joint in a corresponding recess in the casing wall 10. The abutment can thereby oscillate on the pins 19 and 20 corresponding to the eccentric movement of the rolling piston 15 in the compressor casing, these pins being fastened in the bearing covers 11, 12 and projecting into a passage 26 traversing the abutment 21. A connecting duct (pressure-equalization duct) is provided between the suction space 22 and the pressure space 23 separated

from it by the abutment 21. This pressure-equalization duct is formed in the case of Figures 1 to 3 by a groove 27 starting from the suction space 22 and formed in the end face of the compressor casing 10, which groove opens into a passage 28 traversing the compressor casing and running parallel to the axis of rotation of the compressor, and an opening or a short passage 29 leading from the passage 28 into the pressure space 23. The passage 29 is controlled by a piston valve 30, provided in the passage 28. This controlling member stands under the influence of at least one loading spring 31, which is supported at one end on the bottom of the hollow piston valve 30 and at the other end in a recess in the bearing cover 11. The spring has a tendency to press the controlling member away from the passage 29 and thus to keep open the passage through the pressure-equalization duct 27, 28, 29. The piston valve 30 is moved against the action of the spring 31 into the closing position by a suitable pressure medium e. g. oil under pressure, which is supplied from below through a passage 33 provided in the bearing cover 12 and its bush 32 by a conveying device which is dependent on the drive of the compressor. For this purpose, the part of the stationary shaft 13 situated in the bush 32 of the bearing cover 12 is provided with helical threads 34, which form a conveyor worm for the pressure oil. The pressure oil is preferably taken from an oil sump 35 surrounding the shaft 13. It enters at 36 into an annular space 37, which is connected by cross ducts 38 cut in the lower end of the bush 32 of the bearing cover 12 (Figure 7) to a second annular space 39 into which the conveyor worm 34 dips. As soon as the conveyor casing 10 revolves, a like motion is imparted to the bushing 32 by reason of the fact that it is fixedly secured to the bottom plate 12 of the rotary casing or cylinder element of the compressor and oil is conveyed upwards by the screw-threads 34 due to the revolution of the bushing about the stationary screw threads. A part of the oil serves for lubricating the rolling piston 15, whilst a further part is compressed into the passage 33 below the bottom of the controlling member 30. Only after the compressor has been started for a certain time does the pressure of the liquid acting on the controlling member 30 become so great that it is able to overcome the force of the spring 31. As soon as this takes place, the piston valve 30 is moved upwards until it covers the opening 29, so that the free passage of the pressure-equalization duct 27, 28, 29 is closed. The compressor only becomes effective in this position of the controlling member 30. The retractive force of the spring 31 and the quantity of oil conveyed by the oil pump 34 are so proportioned that the controlling member 30 only closes the pressure-equalization duct when the driving motor of the compressor has attained its full speed. It is possible by this means to employ a motor having a small starting torque and correspondingly small dimensions.

The construction shown in Figures 4 and 5 differs from that just described only by the fact that the controlling member 30 is arranged in the passage 26 of the abutment 21 for the pins 19, 20, whereby the construction is simpler and cheaper because a special recess for the controlling member 30 is dispensed with. The piston valve 30 moves in the free space in the passage 26 situated between the ends of the rotary pins 19, 20, whereby it controls a cross hole 40 which

connects this space with the pressure space 23. 41 is a second cross hole, which connects the space between the two pins 19, 20 with the suction space 22, and preferably has such a position in regard to the controlling member 30 that it remains permanently open. During the stoppage and the starting of the driving motor the piston valve 30 is pressed downwards by the loading spring 31 acting upon it, so that the passage 40, 26, 41 from the suction space to the pressure space is free, and the same pressure prevails in these two spaces. The piston valve 30 is also operated as in the first described construction by pressure oil, which is conveyed by the viscosity pump already described, and penetrates through the hollow pin 20 below the bottom of the piston valve 30. The other pin 19, which also is partly hollow, serves for receiving one end of the loading spring 31. The mode of action of this second construction is the same as in the first one.

The second construction is, however, to be preferred to the first, because a special recess for the arrangement of the controlling member 30 is dispensed with, and because, furthermore, the pressure-equalization between the suction and the pressure spaces of the compressor can be established by two simple cross holes 40, 41, which open into the passage 26 in the abutment 21 for the pins 19, 20.

The invention is, for the sake of simplicity, illustrated only in connection with a rolling piston or rotary abutment compressor. It may however also be employed in other compressors.

We declare that what we claim is:

1. A rotary compressor comprising a casing, an eccentric piston and an abutment engaging in a slot in the piston to form a suction space and a pressure space in the casing, said abutment having a pressure equalizing duct formed therein between the suction space and the pressure space and a controlling member in said duct, lubricating oil supplying means for said compressor producing an oil supply pressure varying directly with the rotational speed of said compressor, and oil conduit means subjecting said controlling member to the oil supply pressure whereby said controlling member is influenced directly by the pressure of the lubricating oil of the compressor and adapted to close said duct after the compressor has been started up and when the lubricating oil pressure has reached a given value.

2. A rotary compressor comprising a casing, an eccentric piston and an abutment engaging in a slot in the piston to form a suction space and a pressure space between the casing and piston, said abutment having a guide pin passage therein, guide pins engaging in said casing and in said opening in the abutment for pivoting the abutment to the casing, said abutment also having ports extending from said passage to the suction and pressure spaces to form with said passage an equalizing duct between the suction and pressure spaces, and a piston movable in said passage to open and close one of said ports to isolate the suction and pressure spaces, lubricating oil supply means for said compressor producing an oil supply pressure varying directly with the rotational speed of said compressor and oil conduit means subjecting said piston to the oil supply pressure whereby said piston is influenced directly by the pressure of the lubricating oil of the compressor.

3. A rotary compressor comprising a casing, an

- eccentric piston and an oscillatable abutment engaging in a slot in the piston and pivoted to the casing to form a suction space and a pressure space in the casing, said abutment having a pressure equalizing duct formed therein coaxial with the axis of oscillation of the abutment adapted to connect the suction space with the pressure space and a controlling member in said duct, lubricating oil supplying means for said compressor producing an oil supply pressure varying directly with the rotational speed of said compressor, and oil conduit means subjecting said controlling member to the oil supply pressure whereby said controlling member is influenced directly by the pressure of the lubricating oil of the compressor and adapted to close said duct after the compressor has been started up and when the lubricating oil pressure has reached a given value.
4. A rotary compressor comprising a cylinder element open at its opposite ends, covers detachably secured to said opposite ends of said cylinder element, an eccentric piston in said cylinder element, an oscillatable abutment element engaging in a slot in the piston and pivotally journaled in a side wall of said cylinder element to form a suction space and a compression space in the chamber formed by said cylinder element, said piston and said covers, one of said elements having a bore through its wall from end to end parallel with the rotational axis of the compressor and ducts in its wall connecting said bore on opposite sides of said abutment element with said suction and compression spaces, a piston valve slidably movable in said bore to open and close one of said ducts, said piston valve having a loading means tending to move said valve to position uncovering said one duct, lubricating oil supply means for said compressor producing an oil supply pressure varying directly with the rotational speed of said compressor and oil conduit means connecting said oil supply means with said bore on the side of said piston valve effective in moving said valve to position closing said one duct whereby said piston valve is influenced directly by the pressure of the lubricating oil of the compressor to close said one duct after the compressor has been started and upon the lubricating oil pressure reaching a given value.
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- 35 110
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