H. D. POWNALL.

ICE MACHINE COMPRESSOR.

APPLICATION FILED SEPT. 28, 1918.

1,379,694.

Patented May 31, 1921.

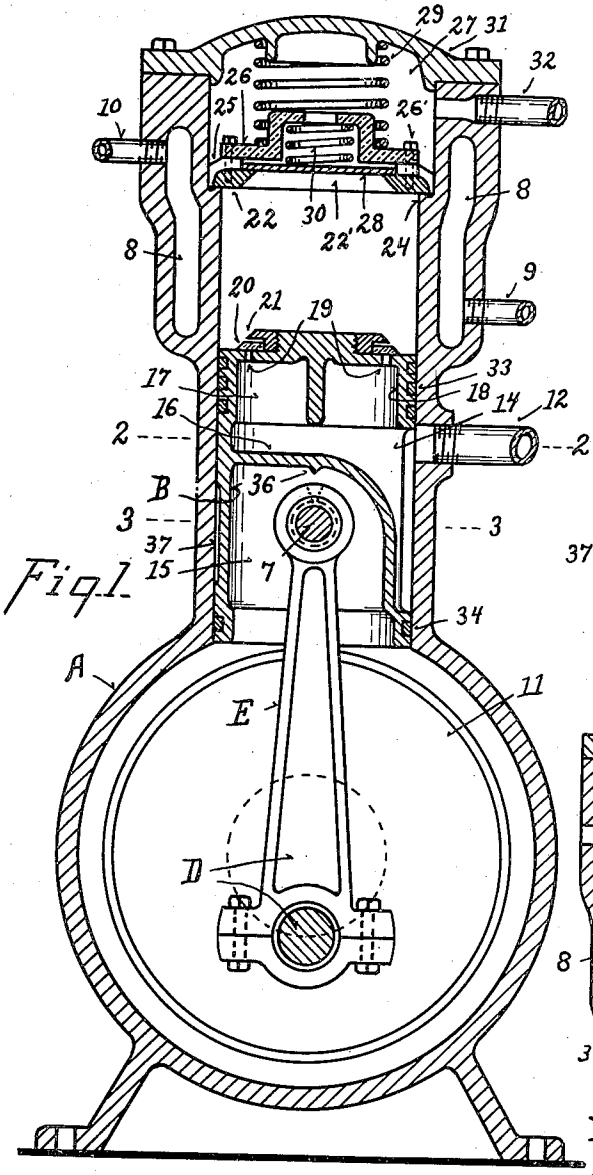


Fig. 1.

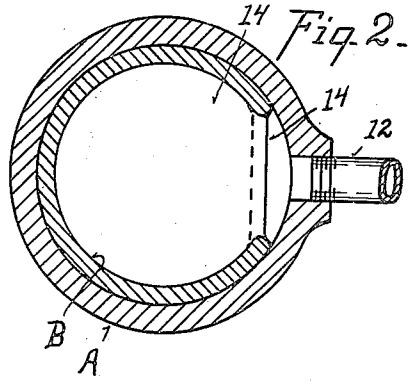


Fig. 2.

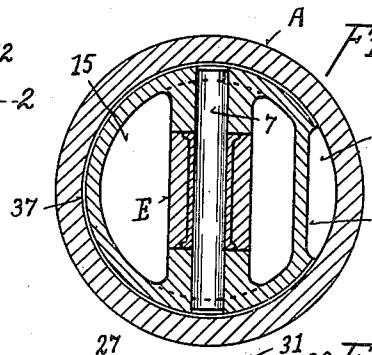


Fig. 3.

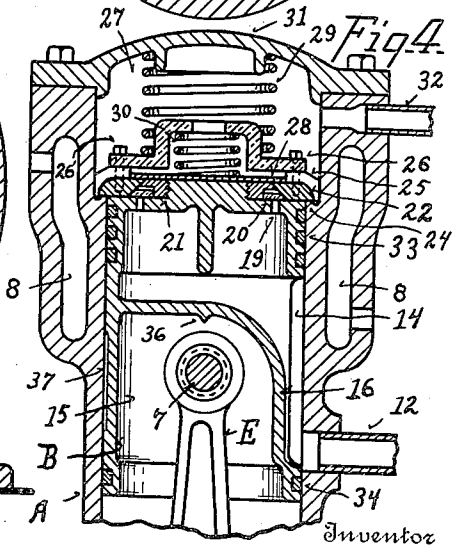


Fig. 4.

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ICE-MACHINE COMPRESSOR.

1,379,694. Specification of Letters Patent. Patented May 31, 1921.

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To all whom it may concern:

Be it known that I, HENRY D. POWNALL, a citizen of the United States, residing at Canton, in the county of Stark and State of Ohio, have invented certain new and useful Improvements in Ice-Machine Compressors, of which the following is a specification.

My invention relates to improvements in ice machine compressors. One of its objects is to provide a compressor of compact dimensions and with the requisite length of stroke. Another object is to provide in a single acting compressor for an intake through the side of the compressor cylinder and improved plunger and intake port mechanism to enable a compressor of compact proportions and relatively long stroke to be provided. Another object is to provide improved intake and discharge port arrangements and valve mechanism. Another object is to provide improved plunger, connecting rod and intake port and valve mechanism. My invention also comprises certain details of form, combination and arrangement, all of which will be fully set forth in the description of the accompanying drawings, in which:

Figure 1 is a central vertical section through an ice machine compressor embodying my improvements.

Fig. 2 is a horizontal section on line 2 2 of Fig. 1.

Fig. 3 is a horizontal section on line 3 3 of Fig. 1.

Fig. 4 is a sectional detail similar to Fig. 1, with the plunger at the upper limit of its stroke.

The accompanying drawings illustrate the preferred embodiment of my invention in which A represents the main crank-case and cylinder, B represents the plunger, D represents the crank-shaft, and E the connecting rod or pitman pivotally connected by the pin 7 to the plunger at one end and at the other end to the crank of the crank-shaft.

A water jacket 8 is cored in the upper portion of the cylinder wall, and is supplied with cooling water through the pipe 9 and water therefrom escapes through the pipe 10. One or more cylinders may be cast integral or in one block as may be desired. Usually one or both ends of the crank case A are closed by detachable caps or heads 11, to facilitate introduction of the crank-shaft and to provide access to the crank-case.

To provide for carrying out the refrigerating operations under most favorable conditions, that is introducing the vaporous refrigerant into the cylinder without introducing air or other impurity therewith, and without introducing the refrigerant directly through the crank-casing, securing a long single acting stroke in the compressor and a full supply of refrigerant to the cylinder at each stroke, with a minimum length of cylinder and plunger, I introduce the vaporous refrigerant at an intermediate point in the cylinder through the cylinder wall by means of a port to which a valve controlled refrigerant supply pipe 12 is connected, and which is ready to discharge the refrigerant at all phases of the plunger stroke to the cylinder, and through practically the entire stroke of the plunger into an intermediate compartment 14 of the plunger which is elongated at the side of the plunger next to the intake port, and which compartment is separated from the wrist pin compartment 15 of the plunger by a partition wall 16. The compartment 14 communicates with the chamber 17 in the main plunger head 18 from which an annular port 19 leads through the plunger head to the interior chamber of the cylinder above the plunger. The annular port 19 has valve seats at opposite sides of its upper face and is closed by a gravity actuated inlet valve 20, which is held in place and limited in movement by means of a keeper 21, threaded and keyed to a projection on the plunger head. The valve and keeper have beveled or inclined outer faces which at the upper limit of the plunger movement enter and closely fit a correspondingly inclined recess 22′ through the main exit valve 22. The valve 22 seats at its lower face upon an annular ledge 24 formed in the upper portion of the cylinder.

The upper face of the valve 22 has a plurality of projections 25 which support a cap 26. The cap 26 is held to the valve 22 by bolts 26′ with gas exit ports between said valve 22 and cap 26 vertically and between the respective projections 25 laterally, to lead the refrigerant from the cylinder to the exit valve chamber 27 above the exit valve. On the upper face of the main exit valve 22 is a valve seat on which rests a light

weight disk shaped auxiliary exit valve 28. The valve 28 is held in place laterally by the projections 25, and may be gravity actuated or spring actuated, and limited in vertical movement by the cap 26. As illustrated the cap 26 and valve 22 are yieldingly held in place by means of a spring 29 and the valve 28 is held yieldingly in place by a relatively lighter or more resilient spring 30. In practice the main exit valve 22 does not ordinarily lift from its seat at each stroke of the plunger, instead the gas pressure within the cylinder causes the auxiliary valve 28 to more readily lift from its seat due to its light weight and more resilient spring, and hence to lift at each stroke of the plunger, and at the extremity of the upward stroke the plunger comes close to the under face of the valve 22 and its conical projection enters and fills the conical recess or opening through valve 22 thus forcing practically all the gas from the cylinder through the valve 28. In the event however that the valve 28 should fail to open, or that liquid or other foreign matter should by accident be introduced into the cylinder above the plunger, then the main valve would lift from its seat and thereby avoid injury to the compressor. A cylinder head 31 closes the upper end of the exit valve chamber 27 and holds the spring 29 in position.

The compressed gas passes from the exit valve chamber to a condenser through a valve controlled pipe 32. The plunger is provided with a series of packing rings 33 at its upper end above the plunger compartment 14, and with one or more packing rings 34 at its lower end below the compartment 14. The compartment 14 is thus separated from the compression chamber of the cylinder by the rings 33 and also from the crank case by the packing ring 34. The projections 25 serve to guide the valve 22 vertically in the chamber 27. The drip point 36 and recess 37 provide for an automatic oil feed to and from the wrist pin bearing.

By providing a gas intake through the side wall of the cylinder continuously in communication with a chamber located at one side of the wrist-pin compartment, or at one side and above the wrist-pin compartment, I am enabled to accomplish a number of desirable results, due to the harmonious combination and operation of the compressor elements. The length of the cylinder is reduced to a minimum for a given length of stroke, thereby providing a compact strong compressor with a minimum of vibration, a minimum of material, and less weight. The wrist-pin may thus be located midway of the length of the plunger and so as to pass beyond the cylinder gas intake port, thereby balancing or distributing the lateral thrust equally from the wrist-pin to opposite ends of the plunger and reducing the injurious wear on the plunger and cylinder resulting from an unbalanced distribution of the lateral thrust of the connecting rod on the plunger to a minimum, and at the same time providing room for the movement of the pitman laterally within the plunger, and for connecting the wrist-pin to the plunger and pitman with sufficient thickness of metal and bearing surface to safely support the strain and wear on said parts. An ample and unobstructed intake gas port is provided at all times. The partition 16 separates the wrist-pin compartment of the plunger from the intake compartment 14 and thus provides for lubrication by the splash system without introducing any considerable lubricant into the refrigerating system, and the intake gas is excluded from the crank case compartment below the plunger.

The mechanism herein illustrated and described is capable of considerable modification without departing from the principle of my invention.

Having described my invention, what I claim is:

1. A single-acting compressor comprising a cylinder having an exit-port at one end, a check-valve to control said cylinder-exit-port, a gas-inlet-port through the cylinder side-wall, a piston to reciprocate in said cylinder having a port through its inner end and a channel in its periphery parallel with the piston axis and of approximately the length of the piston stroke, a check-valve to control said piston port, said piston having a packing-ring at its inner end and a packing-ring at its outer end, said channel communicating continuously with said cylinder inlet port and communicating with the compression chamber of the cylinder through said check-valve-controlled port in the inner end of the piston, a wrist-pin located in said piston in a compartment separate from and at one side of said piston channel and located at a point intermediate of said inner and outer piston rings, and means engaging said wrist-pin to drive said piston, whereby a long piston stroke is attainable with a relatively short cylinder.

2. A single-acting compressor comprising a cylinder having an exit-port at one end, a check-valve to control said cylinder-exit-port, a gas-inlet-port through the cylinder side wall, a piston to reciprocate in said cylinder having a channel in its periphery parallel with the piston axis and of substantially the length of the piston stroke, and a separate wrist-pin compartment overlapping said channel in the piston and communicating with the crank-case-chamber, said channel maintaining constant communication with the cylinder-inlet-port and communicating with the compression-cham-

ber of the cylinder through a port in the end of the piston, a check-valve carried by the piston to control the piston-inlet-port, a wrist-pin located in said piston wrist-pin compartment intermediate of opposite ends of said channel and substantially midway of the piston length, and means engaging said wrist-pin to drive said piston, whereby a long piston stroke is attainable with a relatively short cylinder.

3. A gas compressor comprising a plunger having a conical projection extending into the compression chamber of the cylinder, a cylinder having a compression chamber section in which the plunger reciprocates, and a section of greater diameter than the compression chamber and an annular valve seat between said cylinder sections, a main valve guided by and movable in said cylinder section of larger diameter and provided with a conical perforation to receive the conical projection of the plunger, an auxiliary exit valve seated upon said main valve to close said conical perforation, a valve cage attached to said main valve and serving to retain and limit the movement of said auxiliary valve, a stationary cap to close the enlarged cylinder section, and a spring interposed between the main valve and said cap.

4. A gas compressor comprising a plunger having a conical projection upon its upper face, a cylinder having a lower section in which said plunger reciprocates and an upper section of greater diameter than its lower section and an annular shoulder between said sections to support a main valve, a main valve seated on said shoulder and provided with a conical perforation a substantial counterpart of the conical projection on said plunger, a valve seat on the upper face of said main valve, an auxiliary exit valve seated upon the upper face of said main valve and closing said conical perforation, a valve cage mounted upon said main valve to retain said auxiliary valve against lateral displacement and to limit its lift from its seat, a cap to close the end of said enlarged cylinder section, and a gas exit port from said enlarged cylinder section above said valves.

5. A gas compressor comprising a plunger having a conical projection upon its upper face, a cylinder having a lower section in which said plunger reciprocates and an upper section of greater diameter than its lower section and an annular shoulder between said sections to support a main exit valve, a main exit valve seated upon said shoulder and provided with a conical perforation the counterpart of the conical projection on the plunger and a valve seat on its upper face surrounding said perforation, a disk shaped auxiliary exit valve seated upon the upper face of said main valve and closing said perforation, means to retain said auxiliary valve laterally in place, means to limit the vertical movement of said auxiliary valve, a cap closing the enlarged section of the cylinder, and a gas exit port from said enlarged section of the cylinder.

6. A gas compressor comprising a compressor cylinder having a gas intake port through its side wall and a gas exit port and valve at one end, a hollow single acting plunger having a gas port and valve in its head and divided by an imperforate partition longitudinally and transversely, to form a gas intake passage from the cylinder intake port to the plunger valve port long enough to maintain communication between said cylinder intake port and said plunger port through practically all of the plunger stroke, and forming a gas supply passage to the plunger port extending transversely across substantially the entire area of the plunger at the upper end thereof and to form a wrist-pin chamber in the central and lower part of said plunger, and means to operate the plunger through a wrist-pin in said wrist-pin compartment.

7. A gas compressor comprising a compressor cylinder having a gas intake port through its side wall and a gas exit port and valve at one end, a hollow single acting plunger having a substantially annular gas port of nearly the diameter of the plunger and a valve to close said plunger port located at the head of said plunger, an imperforate partition dividing said plunger longitudinally and transversely to form a wrist-pin compartment in the central and lower portion of said plunger and a gas passage above and at one side of the wrist-pin compartment of substantially the diameter of said plunger port above said wrist-pin compartment and extending longitudinally of said plunger to maintain communication between said cylinder intake port and said plunger port through substantially the entire plunger stroke, a wrist-pin in said wrist-pin compartment at substantially midway of the length of said plunger, and means to operate said plunger through said wrist-pin.

In testimony whereof I have affixed my signature in the presence of two witnesses.

HENRY D. POWNALL.

Witnesses:
GRACE A. MCCLURE,
WALTER D. TOWNSEND.