May 17, 1938. R. STEVENS 2,117,521

PUMP OR COMPRESSOR

Filed Dec. 28, 1936 2 Sheets-Sheet 1

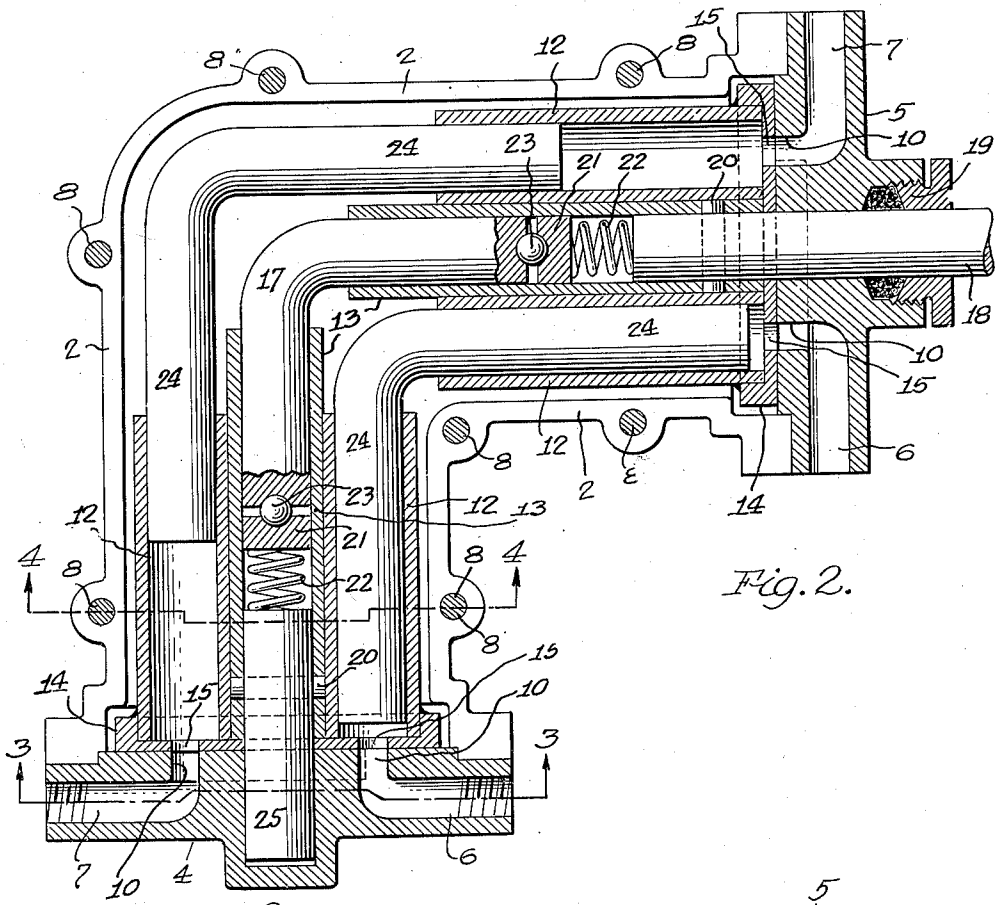


Fig. 2.

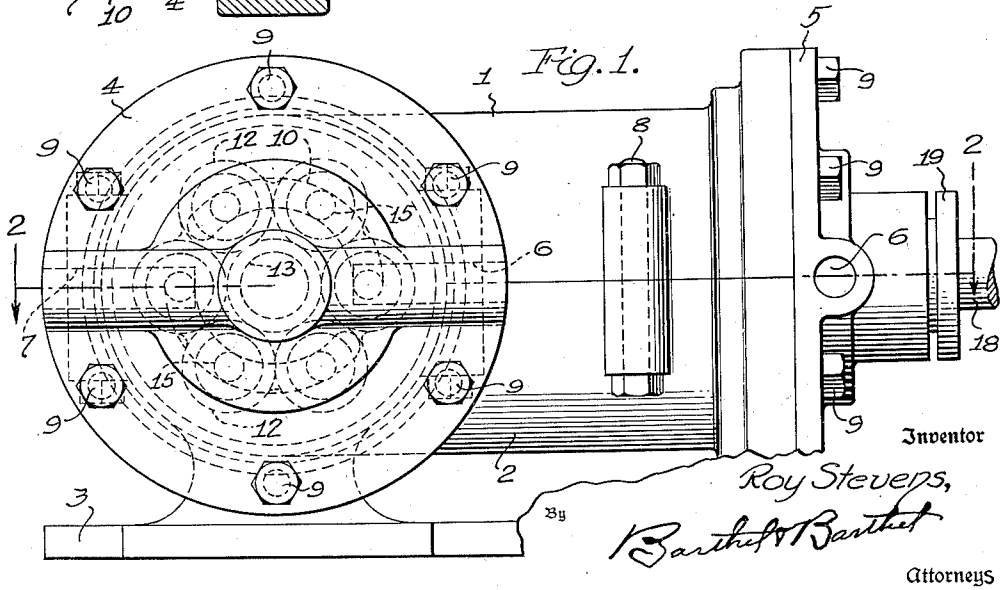


Fig. 1.

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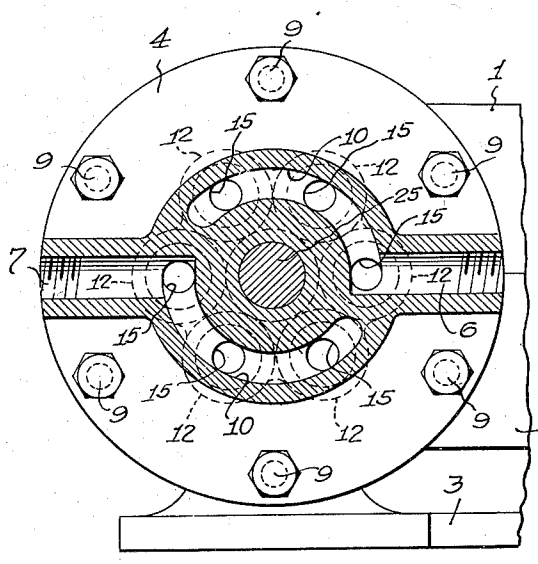


Fig. 3.

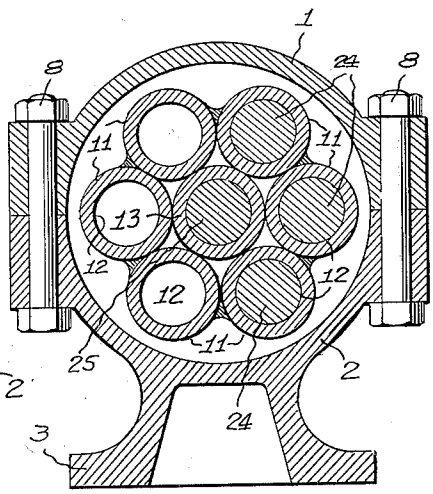


Fig. 4.

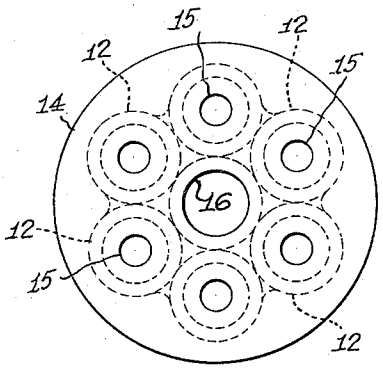


Fig. 6.

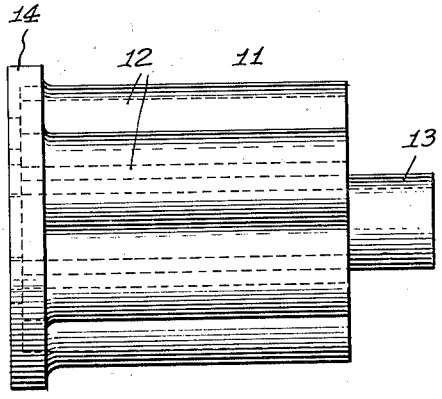


Fig. 5.

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Patented May 17, 1938

2,117,521

UNITED STATES PATENT OFFICE

2,117,521

PUMP OR COMPRESSOR

Roy Stevens, Detroit, Mich., assignor, by direct and mesne assignments, of one-third to Everett E. McGuire, Royal Oak, Mich., and one-third to Hanford C. Cuddeback, Detroit, Mich.

Application December 28, 1936, Serial No. 117,686

3 Claims. (Cl. 103—162)

This invention relates to a pump or compressor of the angle piston type wherein a plurality of cylinders is provided within which cylinders both ends of all of the pistons reciprocate, and an object of the present invention is to provide a device for the purpose which is of simple construction, cheap to manufacture and efficient in operation, and in which there are no valves, the cylinder structures having ports and being rotatable in contact with fixed heads formed with inlet and exhaust passages to control the inlet to and outlet from the cylinders.

It is also an object to provide a central guide and support for the cylinder structures, and to provide means for yieldingly holding said cylinder structures in firm contact with said fixed heads to prevent leakage; a further object being to reduce friction and provide a very compact construction which is light in weight and in which all moving parts are enclosed, making the device especially adapted for use in connection with household mechanical refrigerators.

A further object is to provide certain other new and useful features, all as hereinafter more fully set forth and shown in the accompanying drawings, wherein—

Figure 1 is a side elevation of a pump or compressor illustrative of an embodiment of the present invention;

Fig. 2 is a longitudinal section substantially upon the line 2—2 of Fig. 1;

Fig. 3 is a cross section upon the line 3—3 of Fig. 2;

Fig. 4 is a similar cross secetion upon the line 4—4 of Fig. 2;

Fig. 5 is a detail showing one of the cylinder assemblies detached, and

Fig. 6 is an end elevation of Fig. 5.

As shown, the device includes an outer fixed casing formed with two halves 1 and 2, the lower half being provided with a base 3 for supporting the structure and the ends of this casing are closed by heads 4 and 5, each formed with an inlet passage 6 and an outlet passage 7. The two halves of the casing are firmly secured together by means of vertical bolts 8 and the heads 4 and 5 are secured to the ends of the casing by cap screws 9. The inner end portions of the inlet passages 6 and the outlet passages 7 are formed with extensions 10 each of which extends in a semi-circular path concentric with the axis of the head, opening through the inner side of each head.

The casing which is formed by the halves 1 and 2, is of right angular construction, one end portion extending substantially at right angles to that of the other end portion, and within these ends of this casing are cylinder structures, each indicated as a whole by the numeral 11 and each comprising a plurality of tubes each forming a separate cylinder 12 and these cylinders are arranged about an axial guide tube 13 and all of these tubes are welded together with one end of each tube firmly welded in end abutting relation to a suitable head or disk 14 with a plurality of ports or holes 15, one opening axially into the end of each of the cylinders 12, and each head 14 is formed with a larger axial opening 16 forming a continuation of the bore of the tube 13.

To center each of the cylinder assemblies 11 within the ends of the casing and support each with the outer face of its end disk or head 14 firmly seated upon the inner face of each of the heads 4 and 5 and with the ports 15 opening into the semi-circular extensions 10 of the passages 6 and 7 in the heads, is a central guide shaft 17 which is bent substantially at right angles intermediate its ends and these ends extend into the guide tubes 13 of the cylinder assemblies. A drive shaft 18 extends through a stuffing box 19 on the head 5 and through this head and through the opening 16 in the disk 14, into the outer end of the center guide tube 13 with its inner end fastened to the guide tube by means of a transverse pin 20 for driving the cylinder assembly by power applied to the outer end of the drive shaft. Between the inner end of the drive shaft and a block 21, is a coiled spring 22 in the guide tube, and interposed between this block 21 and the adjacent end of the angle shaft 17 is an anti-friction ball 23. Power is thus applied to rotate the cylinder assembly within the outer casing and the spring 22 exerts an endwise pressure upon the drive shaft and through the pin 20 to the cylinder assembly, to hold this assembly with its end disk 14 in firm contact with the inner face of the fixed head 5 so that leakage between the cylinder assembly and the end head 5 will be prevented and as the assembly is rotated, the ports 15 will be brought into registry with the semi-circular inlet and outlet ends of the passages 6 and 7 to open and close these ports as the cylinder assembly is rotated.

A plurality of angle pistons 24 is provided, one for each of the cylinders 12, each of these pistons comprising a shaft or rod of uniform diameter with its angularly extending end portions fitting closely within the bores of the cylinders 12, one end within the cylinder of one of the cylinder assemblies and the other end within the cor-

responding cylinder of the other assembly. Therefore as the cylinder assembly at one end is rotated by power applied through the shaft 18, these several pistons will be carried about the axis of that assembly and will transmit driving power to rotate the corresponding assembly at the other end of the device which assembly is guided in its rotation by the central guide shaft 17 and at its outer end by a short shaft 25 which is mounted in a hub bearing at its outer end within the head 4 and extends through the cylinder head or disk 14 into the outer end of the guide tube 13 to which it is made fast by means of a pin corresponding to the pin 20 so that this central guide shaft 25 is caused to turn with the cylinder assembly and a spring corresponding to the spring 22 is interposed between the inner end of this shaft 25 and a block corresponding to the block 21, with an anti-friction ball corresponding to the ball 23 interposed between the end of the central guide shaft 17 and said block to yieldingly hold this cylinder assembly in firm end contact with the inner face of the head 4 and with these ports 15 in register with the semi-circular extensions 10 of the inlet and outlet passages 6 and 7 of this head 4.

Rotation of the cylinder assembly which is driven by the drive shaft 18 therefore imparts rotation to the other cylinder assembly through the pistons 24 by the movement of these pistons about the axis of the two cylinder assemblies and during such rotation, the ends of the pistons are thereby caused to reciprocate within the several cylinders of both cylinder assemblies to alternately draw in air or liquid into the several cylinders during substantially one-half of their rotation about the axis of the shafts 17, 18 and 25, and discharge this fluid through the ports 15 into the outlet passages in the heads 4 and 5 during the other half of such rotation.

With this arrangement all of the moving parts are enclosed within the split casing formed by the two halves 1 and 2 and the assembly of the device is greatly facilitated by thus splitting the casing longitudinally so that the two cylinder assemblies with the angle pistons in place, may be readily placed within the outer casing and then the heads 4 and 5 secured in place upon the ends of the casing. The springs 22 exert a force to hold the cylinder assemblies firmly seated against the inner surfaces of the heads 4 and 5 and the balls 23 take this end thrust against the ends of the central guide shaft 17 to eliminate friction and consequent resistance to the rotation of the cylinder assemblies relative to the central guide shaft 17. The arrangement of the several ports 15 for the several cylinders of each cylinder assembly provides for the free escape of fluid and its inlet to each cylinder when its port comes into registry with one or the other of the segmental end portions 10 of the inlet and exhaust passages in the adjacent casing head and such port remains open through the length of such segmental passage so that throughout the major portion of each exhaust stroke of each piston the fluid will freely escape and in a like manner, substantially throughout the length of the intake stroke of each piston, its port 15 will remain open. Therefore each piston will draw in fluid as it passes about the axis of rotation of the cylinder assembly at one side and will exhaust fluid as it passes around the other side of the assembly, the intake and exhaust being cut off as its port passes over the spaces between the adjacent ends of the segmental end portions of the inlet and exhaust passages.

With this arrangement and construction, all moving parts are housed within a fluid tight casing so that no fluid which may pass by the pistons can escape, the only possible place of escape being through the stuffing box 19, and all parts may be well lubricated and as there are no gears or reciprocating valves, the operation is substantially noiseless and is very efficient in operation as it may be run at high speeds to produce the desired volume without setting up material vibration or undue friction.

Having thus fully described my invention what I claim is:

1. In a device of the character described, the combination of a casing having end portions extending in angular relation to each other and provided with end heads formed with inlet and exhaust passages, a cylinder structure rotatable within each end of said casing in end contact with said casing heads, each cylinder structure comprising a plurality of cylinders arranged about the longitudinal axis of the structure, each structure being also formed with a longitudinal axial bore, a central angular guide shaft with its ends projecting into the axial bores of said cylinder structures to support and guide said structures, straight shafts mounted within said casing heads with their inner ends extending into the outer ends of the axial bores of the cylinder structures and secured thereto, and coiled springs in said axial bores interposed between the ends of said central and straight shafts for yieldingly holding each of said cylinder structures in end abutting relation with the adjacent casing head.

2. A pump or compressor comprising a casing, end heads for said casing formed with inlet and exhaust passages, a cylinder structure rotatable within each end of said casing and each provided with a head formed with ports opening into the outer ends of said cylinders and adapted to register with said passages in said heads, a plurality of rigid pistons having end portions extending in angular relation to each other, one end portion of each piston being adapted to engage within a cylinder of one of the cylinder structures and its opposite end portion being adapted to engage within a corresponding cylinder of the other cylinder structure, said pistons being arranged for rotation about the longitudinal axes of said cylinder structures, each of said cylinder structures having a longitudinal axial bore, a central guiding and supporting shaft having end portions extending in angular relation and engaging within said central bores of said cylinder structures to support and guide the adjacent ends of said structures, a drive shaft extending into the outer end of the axial bore of one of said cylinder structures, means for securing the inner end portion of said last named shaft to said cylinder structure to rotate the same, a short shaft mounted at its outer end within a bearing in the casing head for free rotation therein and extending into the axial bore of the adjacent cylinder structure and secured thereto to rotate therewith and guide the outer end of said structure in its rotation within the casing, and a coiled spring within the central bore of each cylinder structure and interposed between the ends of said center guide shaft and the ends of said drive shaft and short shaft to yieldingly hold said cylinder structures in end abutting relation with said casing heads.

3. A pump or compressor comprising an outer

casing having end portions extending at right angles to each other, a head for each end of said casing, said heads being each formed with inlet and outlet passages having inner end portions curved concentrically with the axis of each head, a cylinder structure mounted within each end of said casing and formed with a plurality of cylinders arranged concentrically about the longitudinal axis of each structure, a disk forming a head for each cylinder structure and provided with ports, one for each of said cylinders adapted to register with said curved end portions of said passages in said casing heads, a plurality of pistons each having end portions extending at right angles to each other and adapted to reciprocate within corresponding cylinders of said cylinder structures and adapted to rotate about the axes of said structures within said cylinders, said cylinder structures being each provided with a longitudinal extending central axial tube about which said cylinders are arranged in parallelism therewith, an angle shaft having end portions extending into the adjacent ends of said central tubes of said assemblies for guiding and supporting the inner ends of said assemblies, a driving shaft mounted in an axial bearing of one of the casing heads with its inner end extending into said central tube of said adjacent cylinder assembly, means carried by the inner end of said drive shaft for connecting the same to said cylinder assembly to rotate said assembly and through said assembly to transmit rotation by means of said pistons, to rotate the other of said cylinder assemblies, a short guide shaft mounted within a bearing in the casing head adjacent the other of said assemblies and secured to said central tube of said assembly to rotate therewith, a coiled spring within said central tube of each assembly to bear at each end upon an end of one of the said shafts extending into the outer ends of said tubes for yieldingly holding each assembly in end abutting contact with said heads of said casing, and anti-friction means interposed between the ends of said angle shaft and said springs.

ROY STEVENS.