P. KUEHN.

AIR PUMP.

APPLICATION FILED DEC. 15, 1919.

1,375,160. Patented Apr. 19, 1921.

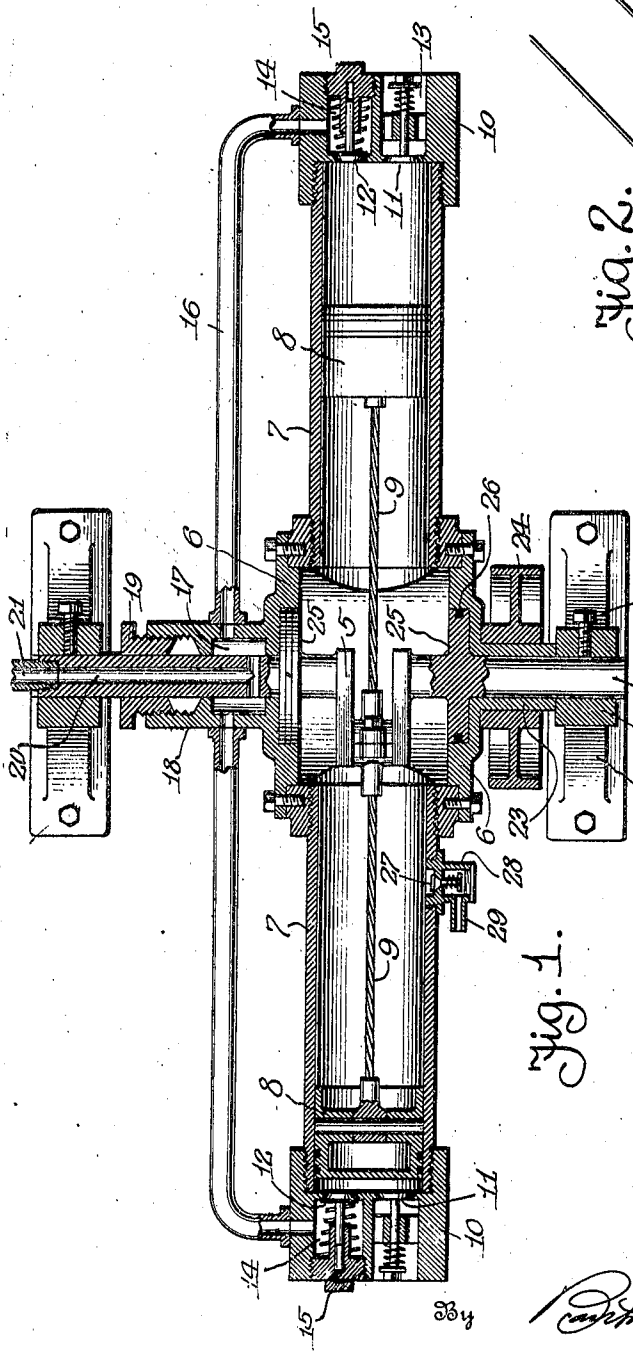


Fig. 1.

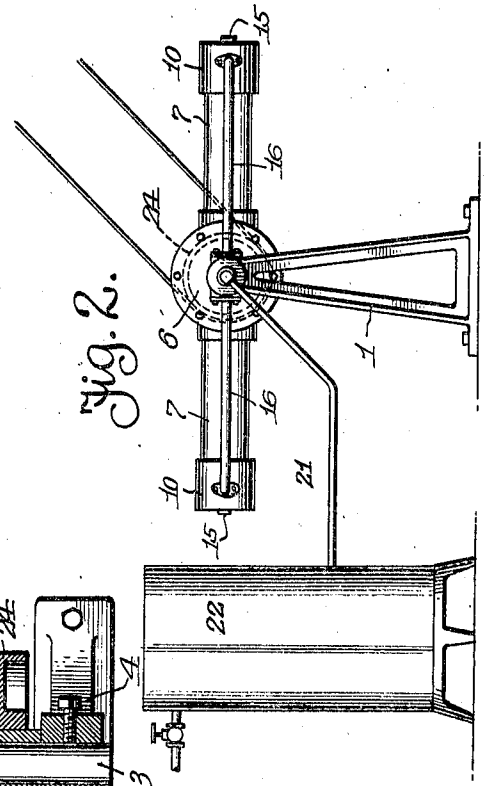


Fig. 2.

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# UNITED STATES PATENT OFFICE.

PAUL KUEHN, OF DENVER, COLORADO.

## AIR-PUMP.

1,375,160. Specification of Letters Patent. Patented Apr. 19, 1921.

Application filed December 15, 1919. Serial No. 344,922.

*To all whom it may concern:*

Be it known that I, PAUL KUEHN, a citizen of the United States of America, residing at Denver, in the county of Denver and State of Colorado, have invented certain new and useful Improvements in Air-Pumps, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to pumps and more particularly to air pumps or compressors and its object is to provide a simple and efficient construction whereby high pressures may be secured with a minimum expenditure of power for driving the pump, and the parts are efficiently cooled without the necessity for providing water jackets or other external cooling means.

A further object is to automatically regulate the pressure which will be delivered by the pump and to provide an air cushion behind the piston to cause the pump to discharge with an even flow and to hold opposed pistons in spaced relation, obviating the necessity for a rigid connection between the pistons and the crank, and reducing friction.

It is also an object of the invention to provide certain other new and useful features in the construction and arrangement of parts, all as hereinafter more fully described.

With the above and other ends in view, the invention consists in the matters hereinafter set forth, and more particularly pointed out in the appended claims, reference being had to the accompanying drawing, in which—

Figure 1 is a longitudinal horizontal section through a pump embodying the invention, and

Fig. 2 is a side elevation of the pump in operative position and connected to an air pressure tank.

As shown in the drawing, 1 indicates suitable supporting brackets having bearings 2 at their upper ends for a crank shaft 3 which is secured in the bearings against rotation therein in any suitable manner as by set screws 4. The crank shaft 3 is formed with a crank 5 which, by being a part of the shaft 3, is also stationary, being held against rotation by the shaft. Mounted upon the shaft 3 is a suitable crank case 6 for the crank 5 and to this crank case is secured, in any suitable manner, cylinders 7 extending diametrically in opposite directions from the crank case 6. Within the cylinders 7 are suitable pistons 8 and these pistons are connected to the crank 5 by suitable flexible connections 9, such as steel cables or other suitable flexible members. The outer ends of the cylinders 7 are closed by heads 10 within which are suitable air inlet valves 11 and air outlet valves 12, chambers 13 for the air inlet valves 11 being open through the ends of the heads to admit air and the chambers 14 for the air outlet valves 12 being closed at their outer ends by suitable plugs 15, and the heads being provided with air outlet passages communicating with the chambers 14 and with suitable conduit pipes 16 leading longitudinally of the cylinders to a suitable air chamber 17 formed in an extension or sleeve 18 on the crank case through which sleeve the shaft 3 extends. The outer end of the sleeve 18 is provided with a suitable packing gland 19 to prevent the escape of air longitudinally of the shaft from the chamber 17 and the shaft 3 is formed with a longitudinal bore 20 communicating at its inner end with the chamber 17 to provide an air outlet for said chamber. Connected to the outer end of the shaft 3 and forming a continuation of the passage 20, is a pipe 21 leading to an air tank 22 for the storage of compressed air delivered thereto by the pump.

On the head or end of the crank case 6 opposite that which is provided with the sleeve 18, is a tubular extension 23 fitting the shaft 3 and forming a bearing for the crank case upon the shaft. Secured in any suitable manner upon this tubular extension 23 is a pulley 24 by means of which power may be applied to the crank case to turn it and the cylinders 7 carried thereby about the crank shaft 3. The crank shaft is preferably formed with disk portions 25 to fit within chambers provided therefor in the ends or heads of the crank case 6 and these disks are provided with peripheral grooves to receive packing rings 26 for the purpose of making a tight joint between the crank case heads and the crank shaft so that air under compression introduced into the crank case and cylinders 7 between the pistons 8 therein, cannot escape along the crank shaft 3 through the bearings of the crank case thereon. A check valve 27 is provided for the admission of air under pressure into the

cylinders and crank case, said check valve being located at any convenient point such as adjacent the inner end of one of the cylinders and the casing 28 containing this check valve is provided with an air inlet nipple 29 for the attachment thereto of an air hose or other suitable connection for delivering air under pressure to the casing 28, which air will be admitted through the check valve 27 into the inner ends of the cylinders 7 and the crank case 6.

A heavy air pressure is thus maintained in the crank case and cylinders between the pistons 8 to hold the pistons in spaced relation, their outward movement in the cylinders being limited by the flexible connections 9 of the pistons with the crank 5 of the crank shaft 3. Power being applied to the pulley 24, the crank case with the cylinders 7 attached thereto is rotated as a unit about the axis of the fixed or stationary crank shaft 3 and as the crank 5 of the crank shaft is also stationary, the rotation of the cylinders about the crank shaft will cause the piston and cylinders to move relatively in a longitudinal direction. This movement of the pistons within the cylinders relatively thereto will cause air to be drawn in through the inlet valves 11 and to be discharged through the valves 12 and out through the pipes 16, conduit 20 and pipe 21 into the tank 22. Rapid rotation of the crank case and cylinders about the stationary crank shaft 3 will deliver a volume of air under pressure to the tank 22 and the extent of compression of this volume of air will be dependent upon the height of the compression of the air contained within the crank case and inner ends of the cylinders between the pistons 8. As soon as the compression in the tank rises to a point above that of the air cushion between the pistons, this air cushion will be compressed and the pistons will be moved toward the crank shaft to a point concentric with the axis of said shaft, such a movement being permitted by the flexible connections 9 of the pistons with the crank 5. The cylinders will then rotate about the fixed crank shaft without relative movement between the pistons 8 and cylinders and the pumping action will be automatically discontinued until such time as the pressure upon the heads of the pistons falls to a point below the pressure of the air cushion between said pistons.

By connecting the pistons 8 with their crank by means of the flexible connections 9, the pumping action of the pump is not only automatically stopped but side thrust and consequent friction of the pistons against the cylinder walls is obviated. Further, the air cushion provided between the pistons to hold them in spaced relation also permits the pistons to yield under heavy pressure, providing an air cushion which allows the pistons to yield during their impulse strokes and thus give an even continuous flow of air or other fluid which is being discharged under pressure by the action of these pistons in their movements relative to the cylinders.

It will be understood that the device as shown in the drawing is merely illustrative of an embodiment of the invention and that changes in the construction and arrangement of parts may be made within the scope of the appended claims without departing from the spirit of the invention, and I do not therefore limit myself to the construction shown.

Having thus fully described my invention, what I claim is:

1. In a device of the character described, the combination of a non-rotatable crank shaft, cylinders extending radially from and rotatable about the crank shaft, pistons within the cylinders, flexible connections connecting the pistons and a crank of the crank shaft, and means for holding the pistons in spaced relation.

2. In a device of the character described, the combination of a non-rotatable crank shaft having a crank, a crank case and a radially extending cylinder rotatable about the axis of the shaft, a piston in the cylinder, a flexible connection between the piston and the crank of the crank shaft, and means for holding the piston spaced from the crank, said spacing being limited by said flexible connection.

3. In a device of the character described, the combination of a non-rotatable crank shaft having a crank, an air tight crank case rotatable about the longitudinal axis of the crank shaft, a cylinder carried by and opening into the crank case, a piston in the cylinder, and a flexible connection between the piston and crank of the crank shaft, said crank case and inner end of said cylinder being adapted to contain air under pressure for holding the flexible connection extended and the piston spaced from the crank of the crank shaft.

4. In a device of the characer described, the combination of a non-rotatable crank shaft having a crank, an air tight crank case rotatable about the axis of the shaft, opposed cylinders extending radially from the crank case with their inner ends opening into the crank case, pistons in the cylinders, a flexible connection between each piston and said crank, and means for maintaining air under pressure within the crank case and inner ends of the cylinders between the pistons therein.

5. In a device of the character described, the combination of a non-rotatable crank shaft having a crank, a crank case rotatable about the longitudinal axis of the shaft, cylinders carried by the crank case and ex-

tending radially therefrom and opening into the crank case at their inner ends, pistons in the cylinders, means forming a flexible connection between each piston and the crank of the crank shaft, means for rotating the crank case and cylinders carried thereby, and means for maintaining an air pressure within the crank case and inner ends of the cylinders to hold the flexible connections extended and the pistons in spaced relation.

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

PAUL KUEHN.

Witnesses:
ANNA M. DORR,
CHAS. W. STAUFFIGER.