Oct. 4, 1927. 1,644,256

J. KOENIG

HOT AIR MOTOR

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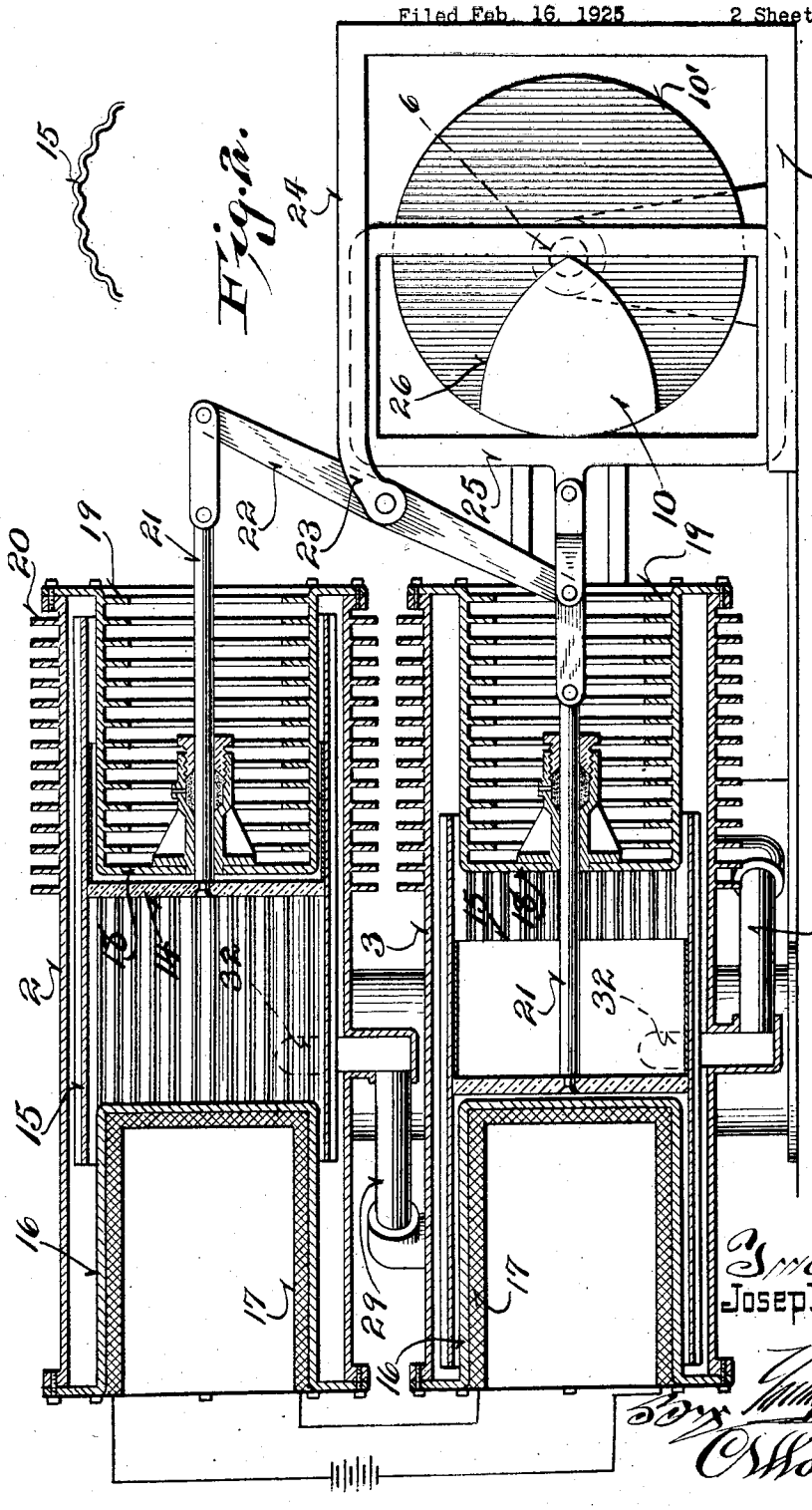

Fig. 2.

Fig. 1.

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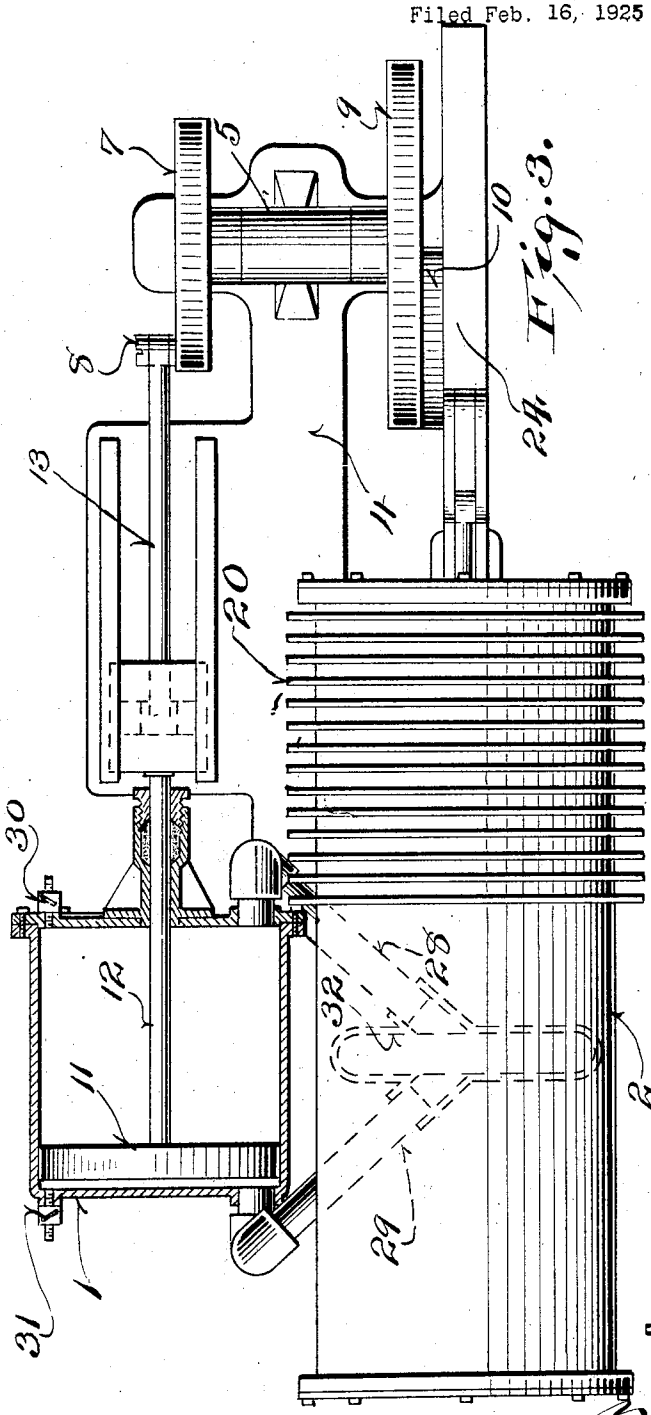

Fig. 3.

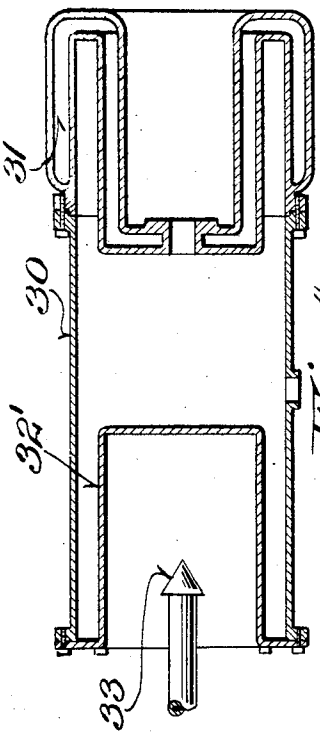

Fig. 4.

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Patented Oct. 4, 1927. 1,644,256

UNITED STATES PATENT OFFICE.

JOSEPH KOENIG, OF MANITOWOC, WISCONSIN.

HOT-AIR MOTOR.

Application filed February 16, 1925. Serial No. 9,499.

This invention relates to hot air engines, and is an improvement over that disclosed in my copending application for hot air motors, Serial Number 741,634, filed October 4, 1924.

This invention has the same general objects as those set forth in my above noted application.

Further objects are to provide a hot air engine which has a double acting working cylinder and consequently has greater power than the usual hot air engines, and which is so constructed that energy is imparted to the rotating parts throughout substantially the entire revolution.

Further objects are to provide a hot air engine which is devoid of valves and complicated parts, but which is strong and simple in construction and reliable in operation.

Further objects are to provide a hot air engine in which a quick motion is imparted to the pistons in the heating and cooling cylinders to quickly transfer the air and in which these pistons are allowed a period of dwell to insure effective heating or cooling of the air before the working piston has travelled any material distance.

Further objects are to secure an increase in cooling and heating surfaces by providing fins or flutes on the shifting piston in the heating and cooling cylinders.

Embodiments of the invention are shown in the accompanying drawings, in which:—

Figure 1 is a vertical sectional view through the air heating and cooling cylinder and showing the quick motion drive.

Figure 2 is a fragmentary edge view of the sleeves carried by the circulating pistons.

Figure 3 is a plan view with the working cylinder in section.

Figure 4 is a sectional view through a modified form of air heating and cooling cylinder.

Figures 1, 2 and 3 showing the first form of the invention will be described. The hot air engine comprises a double acting working cylinder 1 (see Figure 3) which is connected to a pair of heating and cooling cylinders 2 and 3, as shown in Figures 1 and 3. Preferably, the working cylinder is mounted on one side of a base 4 (see Figure 3) and the heating and cooling cylinders are mounted one above the the other on the opposite side of the base. The base carries a suitable bearing 5 within which the crank shaft 6 (see Figure 1) is mounted. This crank shaft carries a crank plate 7 at one end which is provided with a crank pin 8 and carries a cam plate 10′ at its other end which is provided with a cam 10 (see Figures 1 and 2).

The working cylinder 1 has a working piston 11 therein provided with a piston rod 12 and connected with the crank pin 8 by means of a link 13, a suitable crosshead being provided as shown. The heating and cooling cylinders 2 and 3 are of identical construction and are each provided with a circulating piston 14 which carries a sleeve 15. This sleeve, as shown in Figure 2, is corrugated or fluted longitudinally to stiffen the sleeve in each case, and to provide free air passages around such sleeve.

Further, this fluting is provided in order to secure a very large surface which acts as a cooling surface when the air shifts from the hot end of the cylinders to the cool end, and as a heating surface, or regenerative surface when the air shifts from the cool end to the hot end of the cylinders. The purpose of the sleeves is to keep the air moving in small channels when shifting, and thereby bring the air into close contact with the heating and cooling surfaces.

It is to be noted from Figure 1 that the pistons 14 are of heat insulating material and that the sleeves 15 are spaced from the cylinder walls. The heat insulating piston keeps the heat from passing to the cool portion of the sleeves.

The cylinders 2 and 3 are each provided with an inwardly extending rear portion 16 which is hollow, and which carries an electric heater 17 of any suitable type,—the electric heaters being slipped from the outer side of the apparatus into the hollow inwardly projecting portions 16 and adapted to heat such portions. At the other end of the cylinders inwardly projecting portions 18 are provided and are equipped with inwardly extending radiating fins 19. Further, this end of the cylinders is also provided with external radiating fins 20 thus maintaining such ends cool.

From Figure 1 it is to be noted that the pistons 14 each carry piston rods 21 which pass through any suitable type of stuffing box and which are joined by means of links to a rocking beam or lever 22 carried by any fixed portion of the machine, such as the projecting arm 23 of the upper guide 24 hereinafter described.

One end of the beam 23 is connected by means of a suitable link with a cross-head 25, such cross-head receiving between it the triangular cam 10. It is to be noted that the cam 10 is provided with curved faces 26 which are formed on the arcs of circles whose centers are at the apexes of the triangular cam. This cam is rigidly carried by the cam plate 10′ and as such cam plate rotates, the cam will impart a quick forward and rearward motion to the lever 22 followed in each case by a quiet period or dwell.

It is to be noted from Figure 1 that the cross-head is carried between the upper guide 24 mentioned above and a lower guide 27 so that it is free to slide in a securely guided manner back and forth as the cam disk 10′ rotates. Any suitable means may be employed for connecting the opposite ends of the working cylinder 1 with the other cylinders. For instance a pipe 28 may extend from the forward end of the working cylinder to the cylinder 3 and a pipe 29 may extend from the rear of the working cylinder to the cylinder 2.

It is to be noted that no valves are provided in this hot air engine and that the circulatory air system is completely closed, suitable stuffing boxes being provided for the several piston rods.

The operation of the apparatus is as follows:—Assuming that the parts are in the position shown in the Figures 1 and 3, it will be noted that the forward portion of the working cylinder 1 is in communication with the cylinder 3 and consequently the air is chilled by being brought into contact with the cool end of such cylinder, thus cooling the air. Further, as the piston 11 of the working cylinder moves forward in view of this contacted condition, the air from the cylinder 2 which is in contact with the heated end of such cylinder, expands and pushes against the rear of the piston thus transmitting energy thereto. This state of affairs continues for a brief period until the cross-head 25 commences to move forwardly and, thereafter, the air in the cylinders 3 and 2 is circulated to the hot and cool ends, respectively, of such cylinders, thus preparing the system for a reverse stroke of the working piston. This cycle of operations continues indefinitely as long as heat is supplied the hot end of the cylinder, the fins maintaining the cool ends of the cylinders 2 and 3 in a cool condition, as stated above.

It is to be noted from Figure 3 that the working cylinder 1 is provided with check valves 30 and 31 at opposite ends and that these check valves open inwardly and are carried in projecting tubular members. The purpose of these valves is to permit the introduction of air under pressure to each part of the working system, and to thus place the air throughout the system under initial pressure. It has been found from actual experiments conducted with these hot air devices that their efficiency or output is vastly increased by initial compression for the entire system.

It is to be found from Figure 3 that elongated apertures 32 are provided for the points where the pipes 28 and 29 open into the cylinders. These elongated apertures prevent constriction of the air in its passage into and out of the cylinders 2 and 3.

In the modified form of heating and cooling cylinders such as shown in Figure 4, the same principle is employed. However, this cylinder as indicated at 30, is provided with a double walled casing at its forward end to provide a water passage 31 for cooling purposes. The heated inwardly projecting portion 32′ is provided with a burner 33 which replaces the electric heater in the other form of the invention.

It is to be distinctly understood that if desired the fins disclosed in the first form of the invention may be replaced by the water cooled end, as disclosed in Figure 4, and also that the water cooled end of Figure 4 may be replaced by the fins if desired.

It will be seen that a hot air engine has been provided which is of extreme simplicity, and which is devoid of working valves or complicated parts.

It will be seen further that a hot air engine has been provided in which the working piston has two working strokes for each revolution of the crank shaft, and it will thus be seen that a more powerful and a more compact hot air engine has been provided than has heretofore been possible.

It is to be noted further that the engine is substantially fool proof and does not require the supervision of a skilled operator.

It is to be noted that the electric heating elements for the hot ends of the cylinders 2 and 3 make the device very safe as a toy.

Although the invention has been described in considerable detail, it is to be understood that the invention may be variously embodied and is, therefore, to be limited only as claimed.

I claim:

A hot air engine comprising a working cylinder, a piston mounted therein and having a projecting piston rod, a shaft provided with a crank and a flywheel, a link connecting said crank and piston rod, a pair of air conditioning cylinders having inwardly recessed ends, means for heating and cooling opposite ends of each of said air conditioning cylinders, a heat insulating air shifting piston located in each of said air conditioning cylinders, means driven from said shaft for imparting a quick stroke in opposite directions to the air shifting pistons, sleeves supported at their centers and

carried by said air shifting pistons, said sleeves overhanging the recessed ends and having longitudinally extending corrugations for both stiffening such sleeves and increasing their exposed surfaces, pipes leading from the front and rear end of the working cylinder and opening approximately centrally into the air conditioning cylinders, with one pipe opening into one air conditioning cylinder and the other pipe opening into the other air conditioning cylinder, and means permitting the placing of the entire system under initial compression.

In testimony that I claim the foregoing I have hereunto set my hand at Miami Beach, in the county of Dade and State of Florida.

JOSEPH KOENIG.