Jan. 4, 1927. 1,613,038

J. KOENIG

HOT AIR ENGINE

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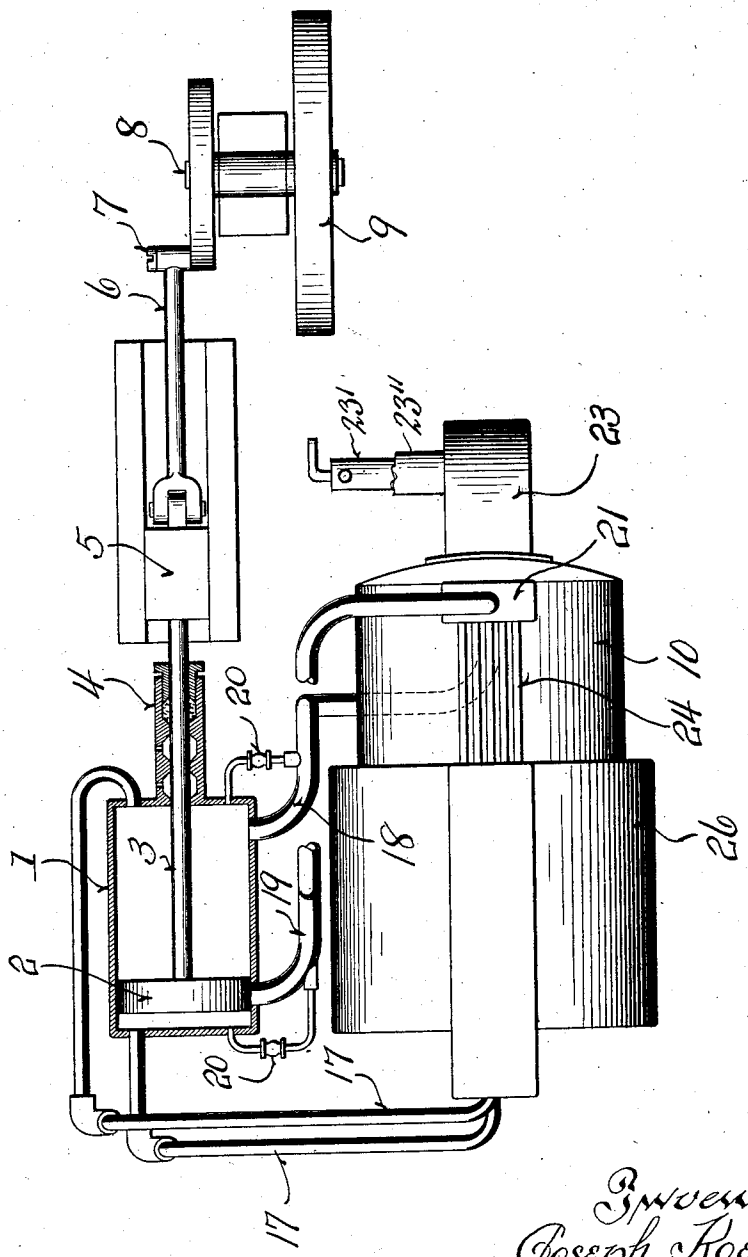
Fig. 1



Inventor:
Joseph Koenig
By
Attorneys:

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Fig. 2

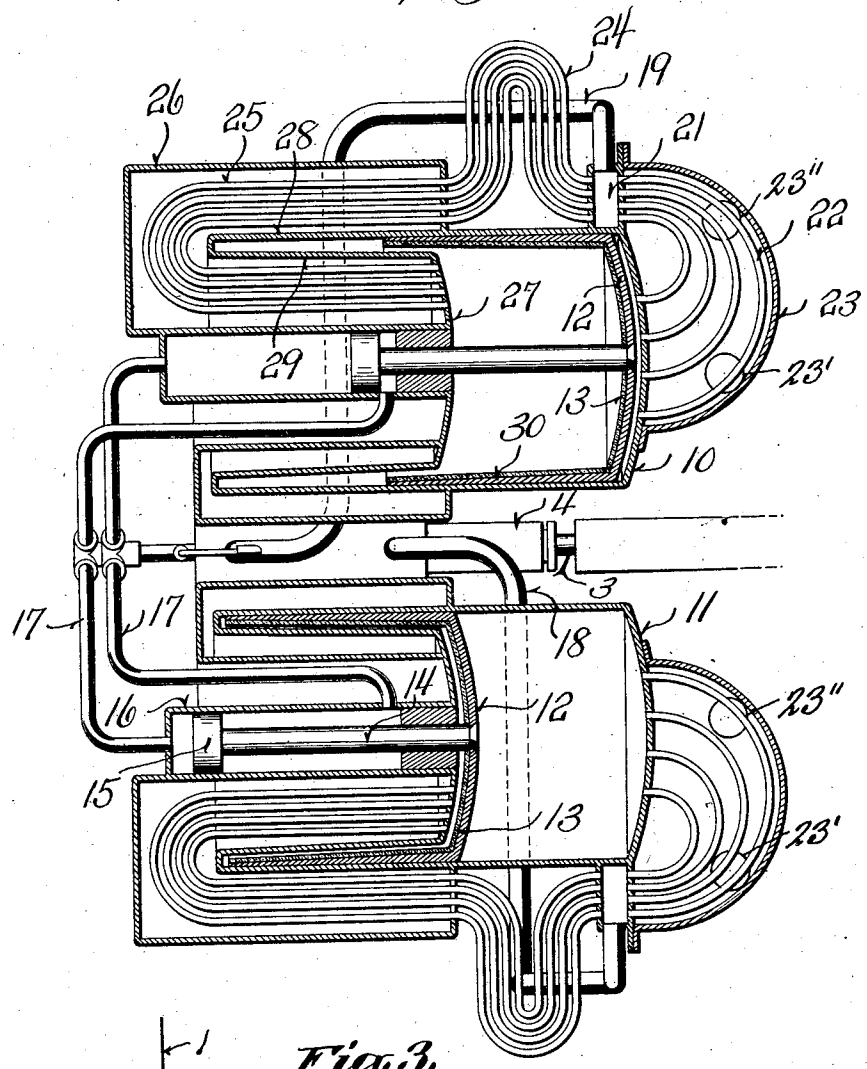
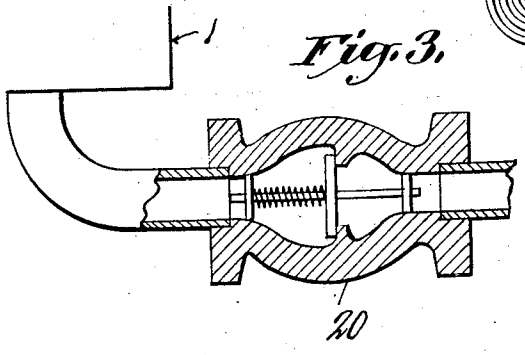


Fig. 3.



Inventor:
Joseph Koenig
By
Attorneys:

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UNITED STATES PATENT OFFICE.

JOSEPH KOENIG, OF MANITOWOC, WISCONSIN.

HOT-AIR ENGINE.

Application filed July 23, 1925. Serial No. 45,630.

This invention relates to hot air engines.

In general this invention is an improvement over that disclosed in my copending application for hot air engine, Number 28,839, filed May 8, 1925, and has the same general objects as those disclosed in such application.

Further objects of this invention are to provide a hot air engine in which a regenerator is employed between the heated and the cooled ends of the air conditioning cylinders, so that a conservation of heat is secured in a very simple and effective manner.

Further objects are to provide means for increasing the chilling and heating action of the apparatus and for improving the general efficiency of the machine while retaining the advantages disclosed in the above noted application.

An embodiment of the invention is shown in the accompanying drawings, in which:—

Figure 1 is a plan view of the engine with parts broken away, such view being diagrammatic.

Figure 2 is a vertical sectional view through the air conditioning cylinders, the remaining portion of the apparatus being omitted for the sake of clearness.

Figure 3 is an enlarged sectional view through one of the valves adjacent the end of the working cylinder.

Referring to Figure 1, it will be seen that the engine comprises a working cylinder 1 within which a piston 2 is fitted. The piston is provided with a piston rod 3 which extends through the stuffing box 4, such stuffing box being preferably provided with oil under pressure. The outer end of the piston rod 3 is connected to the guiding crosshead 5. A pitman 6 connects the crank 7 with the crosshead. The shaft 8 is carried in a suitable bearing and is provided with fly wheel 9.

A pair of air conditioning cylinders 10 and 11 are provided and are of identical construction. Each of the air conditioning cylinders has an air displacing piston 12 positioned therein and preferably provided on its inner side with a heat insulating lining 13. The pistons 12 are connected by piston rods 14 with small pistons 15, such small pistons working in cylinders 16. The inner end of one cylinder 16 is connected to the outer end of the other cylinder by means of the pipes 17 (see Figure 2).

The pipes 17 extend outwardly and connect to opposite ends of the working cylinder 1, as described in my copending application noted above.

It is to be noted that pipes 18 and 19 preferably open into the ends of the cylinder 1 from points adjacent the ends thereof but spaced a slight distance from such ends, and these pipes pass to the air conditioning cylinders, as shown in Figure 2.

It is to be noted that when the working piston 2 is approaching one end of its stroke, as shown in Figure 1, it cuts off communication through the pipe 19 and compresses the air behind it, thus compressing the air in one of the pipes 17. This causes operation of the pistons 12 in a reverse direction, one of the pistons moving outwardly, as shown in Figure 2, and the other one inwardly.

In order to prevent the immediate motion of the pistons 12 when the working piston starts forward due to the suction created in the cylinder 1 a check valve 20 is provided at each end of the cylinder and controls communication between such end and the pipes 18 or 19, respectively. These check valves open towards the cylinder 1 and prevent the formation of suction when the piston starts on its forward travel.

Referring to Figure 2, it will be seen that the pipe 19 communicates with a chamber 21, and that this chamber is connected with the outer end of the cylinder by means of a plurality of pipes 22. These pipes are preferably positioned within a housing 23, and are heated in any suitable manner, as by means of a burner 23′, a vent pipe 23″ being provided to carry away the products of combustion. The other side of the chamber 21 is equipped with a plurality of pipes 24 which are preferably bowed outwardly to increase their extent. These pipes 24 constitute regenerators, as will be hereinafter described, and conserve heat. The pipes 24 communicate with a set of pipes 25 which are positioned within the jacket 26, such jacket completely surrounding the rear end of the cylinder 10. It is to be noted that the pipe 25 extends forwardly and opens through the rear end 27 of the cylinder 10. The pistons 12 are preferably provided

with elongated sleeves which are tapered and fit between the outer portion 28 of the cylinders and the inner portion 29, such portions being also divergent so that the tapered sleeves 30 of the pistons 12 will displace substantially all of the air in these portions.

Any suitable cooling medium may be passed through the jackets 26 in order to maintain the pipes 25 in a cool condition.

The operation of the apparatus is as follows:—When the piston 2 is traveling towards one end of its stroke, the air behind the piston is discharged into the appropriate air conditioning cylinder, and passes into the chamber 21, and from thence passes through the regenerator 24 and the cooling pipes 26, the piston 12 being moved outwardly by means of the small piston 15. When the work piston 2 is very close to the end of its stroke, the air behind the piston is compressed and passes through the appropriate pipe 17 to the cylinders 16 and causes quick reverse motion of the pistons 12. The air is then passed through the pipes 25, through the regenerator 24 where it picks up some of the heat previously stored therein, and passes through the heated pipes 22, such air increasing in volume and being supplied the working cylinder 1.

It is to be noted that any heat carried by the air prior to its arrival at the cooling pipes 25 is absorbed by the regenerator 24 and is again delivered to the air when the air flow is reversed.

It will thus be seen that a hot air engine has been provided which is of novel construction, which conserves the heat, and which is equipped with a very simple and effective type of regenerator.

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, a pair of air conditioning cylinders connected with opposite ends of said working cylinder, each of said air conditioning cylinders having an air circulating piston therein provided with a piston rod and having heating and cooling means at opposite ends thereof, a pair of auxiliary cylinders into which said piston rods project, pistons fitting said auxiliary cylinders and carried by said last mentioned piston rods, the ends of one auxiliary cylinder being connected to the reverse ends of the other auxiliary cylinder by means of pipes, other pipes joining said first mentioned pipes to opposite ends of the working cylinder, a plurality of pipes leading from the heated end of each air conditioning cylinder to its cooled end, said pipes being looped outwardly intermediate their ends to provide a regenerator, and being looped adjacent their lower ends and associated with the cooling means.

In testimony that I claim the foregoing I have hereunto set my hand at Manitowoc, in the county of Manitowoc and State of Wisconsin.

JOSEPH KOENIG.