Oct. 19, 1926.

1,603,779

J. KOENIG

HOT AIR MOTOR

Filed Dec. 10, 1925

3 Sheets-Sheet 1

Fig. 1

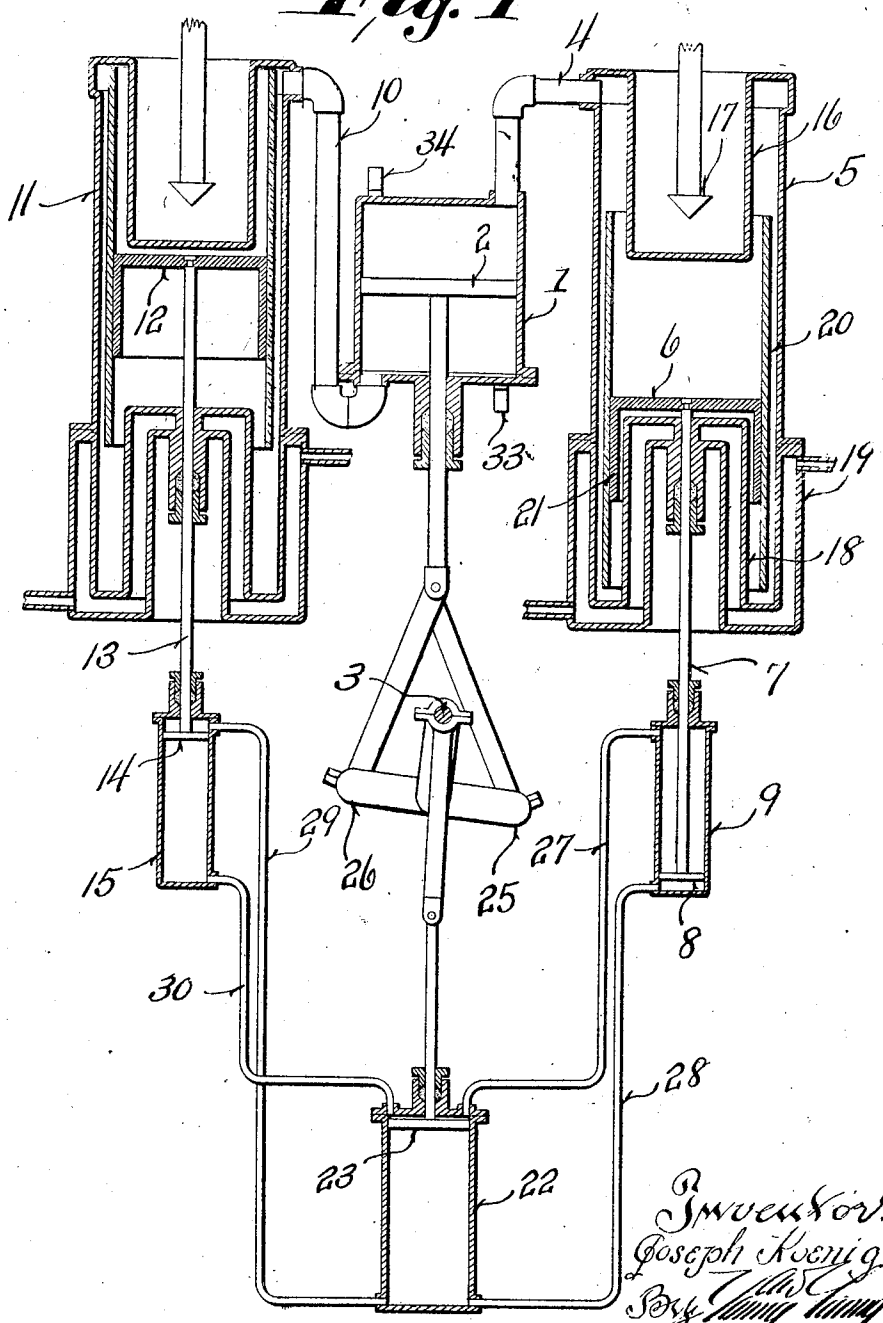

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Fig. 2

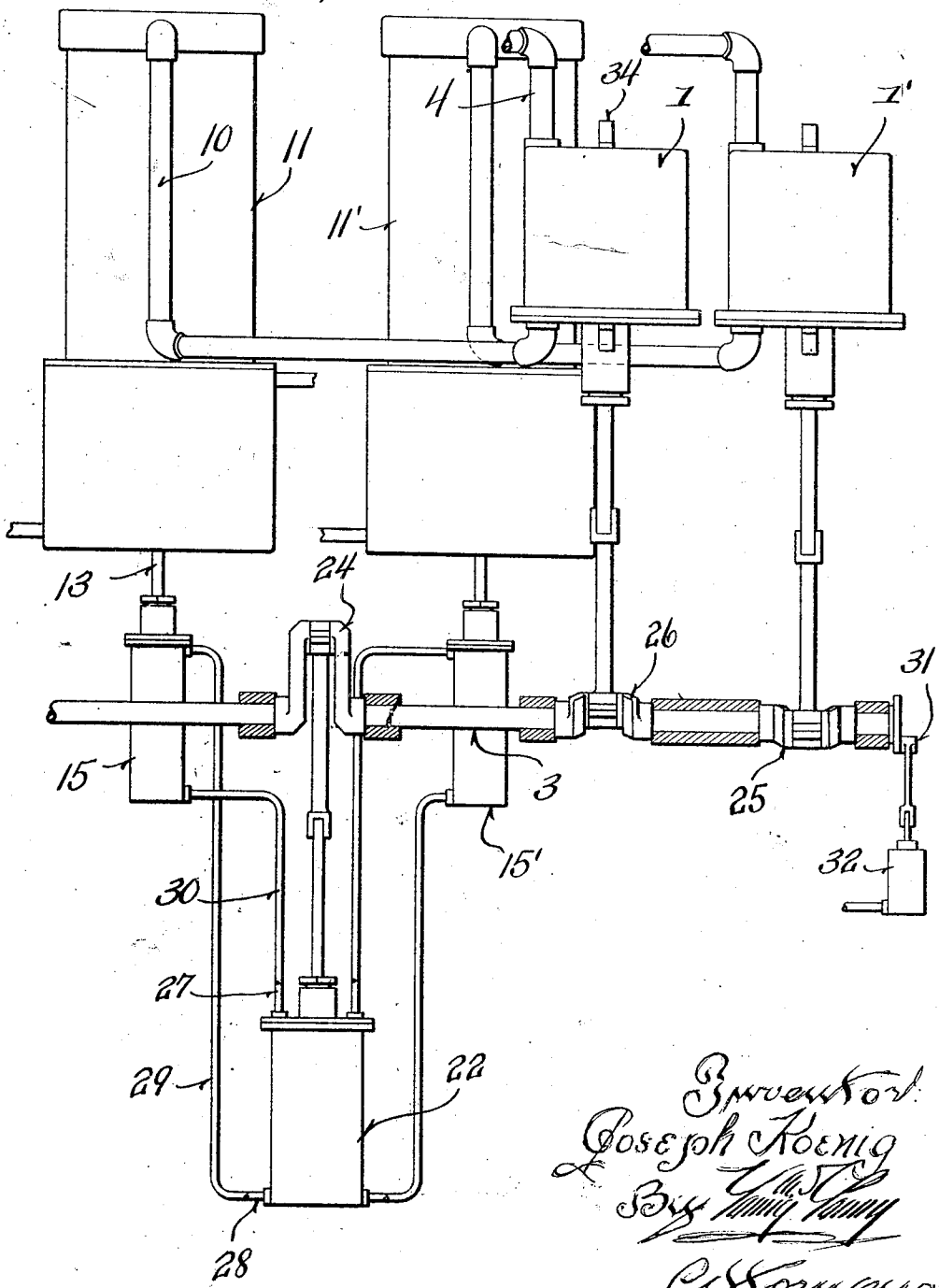

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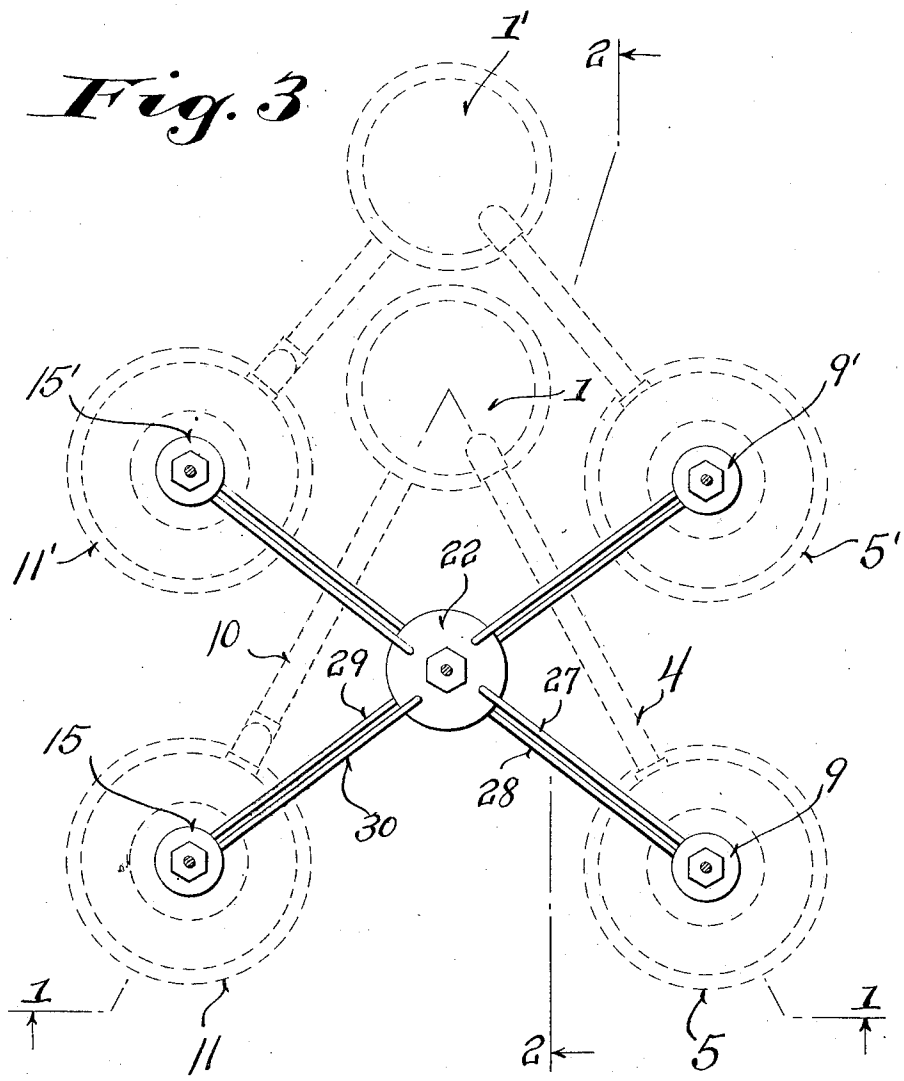
Fig. 3



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Patented Oct. 19, 1926. 1,603,779

UNITED STATES PATENT OFFICE.

JOSEPH KOENIG, OF MANITOWOC, WISCONSIN.

HOT-AIR MOTOR.

Application filed December 10, 1925. Serial No. 74,560.

This invention relates to hot air motors.

Objects of this invention are to provide a hot air motor which is adapted to deliver a relatively large amount of power for its size, as compared with the usual hot air motor, and which may be made of any desired capacity.

Further objects are to provide a hot air motor which has a high degree of efficiency and which provides for quick interchanges of heat, and which is automatic in its action and devoid of valves which control the flow of the air to and from the working cylinder and the air conditioning or treating cylinders.

In general, this invention is an improvement over that disclosed in my copending application for hot air motors filed Dec. 1, 1925, Serial Number 72,506.

Further objects are to provide a hot air motor in which the cams, levers, and walking beams used in my prior construction, as identified above, are wholly avoided, and in which a single pump is employed for actuating a number of small pistons which in turn actuate the pistons in the air chilling and heating cylinders or air conditioning cylinders.

It is, therefore, a further object to provide a very much simplified type of motor over prior constructions, and in which a quieter operation is secured and one having a fewer number of exposed moving parts, so that the device may be relatively compactly built, and in which the different members will operate in perfect relative timing.

A further object is to so position the several cylinders that access may be more freely had to the different cylinders than has heretofore been possible.

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

Figure 1 is a sectional view through a portion of the motor, such view corresponding to a section on the line 1—1 of Figure 3.

Figure 2 is a sectional view on the line 2—2 of Figure 3.

Figure 3 is a plan view of the apparatus with the crank shaft and upper cylinders omitted to more clearly show the small cylinders and pump.

Referring to the drawings, it will be seen that the hot air motor is equipped with a plurality of units. In the form shown, two units have been employed although it is to be understood that any number may be used. Each unit comprises a working cylinder which has its upper and lower end connected to air conditioning cylinders. One unit has been shown in section, such section corresponding substantially to that taken along the line 1—1 of Figure 3 and being illustrated in Figure 1. From this view, it will be seen that the working cylinder 1 is provided with a piston 2 connected by a suitable connecting link or pitman with the crank of a main or crank shaft 3.

This working cylinder has its upper end connected by means of a pipe 4 with the upper end of the air conditioning cylinder 5, such air conditioning cylinder having a piston 6 joined by means of a piston rod 7 with a small piston 8 working in an operating cylinder 9 hereinafter described in detail. Similarly, the lower end of the working cylinder 1 is connected by means of a pipe 10 with the upper end of the air conditioning cylinder 11. This cylinder is provided with a piston 12 connected by means of a rod 13, with a smaller piston 14 in the operating cylinder 15.

The other unit comprises a working cylinder 1′ and air conditioning cylinders 5′ and 11′, the pistons in such latter cylinders being worked by means of the operating cylinders 9′ and 15′, as shown in Figure 3. However, it is thought necessary to describe only one unit as the other is a duplicate.

Referring again to Figure 1, it will be seen that the two air conditioning cylinders are of duplicate construction and each has a heated upper end and a chilled lower end. The heated upper end includes a downwardly extending shell 16 within which a burner 17 operates. The chilled lower end is provided with an upwardly extending portion 18 similar to the portion 16. This portion 18 and the lower end of the cylinder 5 is water jacketed, as indicated at 19, so that it may be maintained in a cool condition. However, it is obvious that other chilling fluid than water may be used.

The pistons of the air conditioning cylinders carry elongated shells 20 which are slightly out of contact with the walls of the cylinder and are rigidly carried by the piston 6, it being noted that such piston has a downturned insulating portion 21 and is itself composed of or provided with heat insulating material.

Further, it will be noted that the shells 20, forming a portion of the pistons, serve

to deflect the gases discharged through the pipe 4 or 10 from contact with the heated portion of the cylinder and direct such gas, when passing inwardly, downwardly towards the chilled end of the cylinder, as shown in the left hand side of Figure 1.

The cylinders 9 and 15 of a unit, each are provided with pistons, as described and the upper and lower end of each of these actuating cylinders are connected to the upper and lower ends of a main actuating pump or cylinder 22. In fact, for the form shown, all of the actuating cylinders are operated from this main pump. This is provided with a piston 23 which is connected by means of a link with a crank 24 on the main crank shaft, as shown in Figure 2. The cranks for the working cylinders 1 and 1' are indicated by the reference characters 26 and 25. It is, of course, to be understood that the drawings in this case are primarily diagrammatic to avoid the defect of needlessly complicating the showing with parts commonly known in all engine constructions.

Further, in Figure 2, the exact arrangement of the pipes from the pump 22 has been slightly varied from that shown in Figures 1 and 3 to avoid needless confusion, as these pipes would necessarily obscure the disclosure if arranged in their exact position, for instance, as shown in Figures 1 and 3.

Referring again to Figure 1, it will be seen that the upper end of the cylinder 9 is connected by means of a pipe 27 with the upper end of the pump 22 and the lower end of the cylinder is connected by means of a pipe 28 with the lower end of the pump. However, the cylinder 15 has its upper end connected by means of a pipe 29 with the lower end of the pump 22, and the lower end of the cylinder 15 is connected by means of a pipe 30 with the upper end of the cylinder 22, so that a reverse operation of the pistons 8 and 14 (see Figure 1) with the corresponding reverse operations of the pistons in the air conditioning cylinders of this unit is attained. Further, it is to be noted from Figure 2 that the cranks 25 and 26 are set opposite.

At one end of the crank shaft or main driving shaft 3, a small crank 31 is positioned and is connected to a small air compressor 32 of any desired type. This air compressor is adapted to be connected by means of hose or other means which has been omitted from the drawings to avoid confusion with the inwardly opening check valves 33 and 34, as needed, to put the entire air system under initial compression. The details of these valves play no part in this invention and are fully illustrated in my above noted application.

The cycle of operation of each unit is the same and consequently such cycle will be described with reference to one unit only, such for instance as shown in Figure 1. In the position of the parts shown in this figure, the piston 6 of the air conditioning cylinder 5 has moved downwardly and caused the air to circulate around the heated upper end of the cylinder. This air consequently expands and drives the piston 2 of the working cylinder downwardly. This causes the air beneath the working piston 2 to pass into the air conditioning cylinder 11, such air being deflected, as described in greater detail in my above noted application, downwardly to the chilled end and being kept substantially out of contact with the heated end. The chilled end of the cylinder 11, therefore, causes a contraction of the air and allows the working piston to execute its stroke. Before the ending of this stroke and the beginning of the upstroke, the piston 23 is moved downwardly consequently causing the pistons 6 and 12 of the cylinders 5 and 11 to reverse their positions, thus positioning the parts correctly for causing an upstroke of the working piston 2.

This cycle of operations will be repeated indefinitely as long as the air conditioning cylinders are heated at one end and chilled at the other.

It will be noted that the device is free from cams, levers and other devices of this nature, and that a compact and simple arrangement has been provided for shifting the pistons in the air conditioning cylinders in proper timing with the pistons in their associated working cylinders.

It is to be noted from reference to Figure 3 that the working cylinders are positioned forwardly with respect to the air conditioning cylinders. This provides greater freedom of access to the several cylinders, making adjustments and repairs easier than has heretofore been possible.

It is to be understood that the pump 22 and the cylinders actuated thereby may be filled with any suitable fluid, preferably, however, oil or some relatively non-compressible liquid is employed.

Further, it will be seen that due to the novel association and arrangement of parts and of their peculiar construction, that a very serviceable and practical hot air engine or motor results from this invention.

Although the invention has been described in considerable detail, such description is intended as illustrative rather than limiting as the invention may be variously embodied and as the scope of such invention is to be determined as claimed.

I claim:

1. A hot air motor comprising a crank shaft, a working cylinder having a piston connected to said crank shaft, a pair of air conditioning cylinders having hot ends and cold ends, pistons in said air conditioning cylinders controlling the flow of air to

said hot and cold ends, a pump connected to said crank shaft, small cylinders supplied from said pump and having pistons therein connected to the pistons in said air conditioning cylinders.

2. A hot air motor comprising a working cylinder having a working piston therein, a pair of air conditioning cylinders connected to opposite ends of said working cylinder and each air conditioning cylinder having a hot end and a cold end, an air circulating piston in each of said air conditioning cylinders, a pump connected operatively with the piston in said working cylinder, said pump comprising a cylinder having a piston therein, a pair of small cylinders positioned beneath said air conditioning cylinders, and having pistons connected to the pistons of said air conditioning cylinders, a pair of pipes connecting the upper end and lower end of said pump cylinder, to the upper and lower end of one small cylinder and to the lower and upper ends of the other small cylinder, respectively, whereby when the piston in said pump cylinder is actuated, the pistons in said small cylinders will be moved in reverse directions.

3. A hot air motor comprising a plurality of working cylinders, a crank shaft mounted below said cylinders, pistons in said cylinders connected to said cranks, a pair of air conditioning cylinders associated with each of said working cylinders and connected to opposite ends thereof, small cylinders mounted below said air conditioning cylinders, pistons in said small cylinders, and in said air conditioning cylinders connected directly by rods, a pump operated from said crank shaft and having a cylinder with its ends connected to each of said small cylinders in a manner to cause reverse operation of each pair of the pistons in said small cylinders, and a piston in said pump cylinder connected to said crank shaft.

4. A hot air engine comprising a crank shaft, a plurality of working cylinders mounted above said crank shaft, pistons within said cylinders connected to said crank shaft, a pair of air conditioning cylinders associated with each of said working cylinders and connected to opposite ends thereof, said air conditioning cylinders being mounted rearwardly of said working cylinders, small cylinders located below said air conditioning cylinders and having pistons therein, said air conditioning cylinders having pistons therein controlling the flow of air within such cylinders and directly connected to the pistons of said small cylinders, a pump operatively connected to said crank shaft and controlling the motions of the pistons in each of said small cylinders, said pump having a cylinder whose ends are reversely connected to the ends of said small cylinders.

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

JOSEPH KOENIG.