July 1, 1930. N. KOEHN 1,769,372

OSCILLATING AIR ENGINE

Filed Aug. 17, 1925

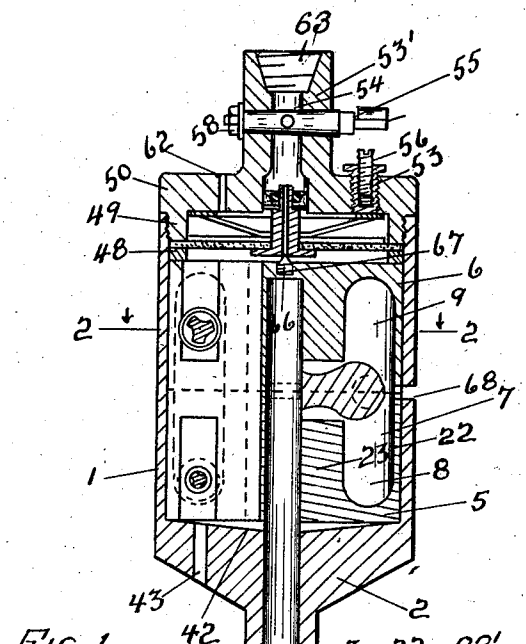


FIG. 1.

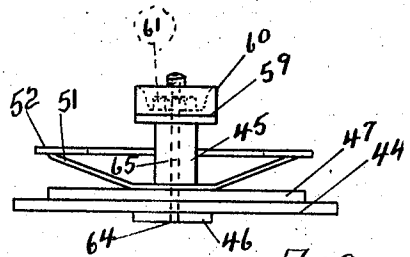


FIG. 8

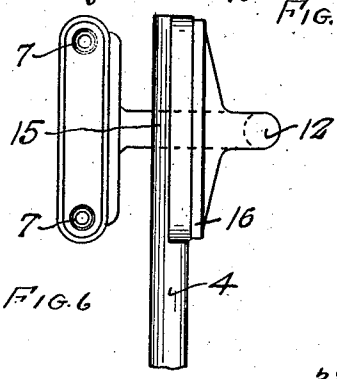


FIG. 6

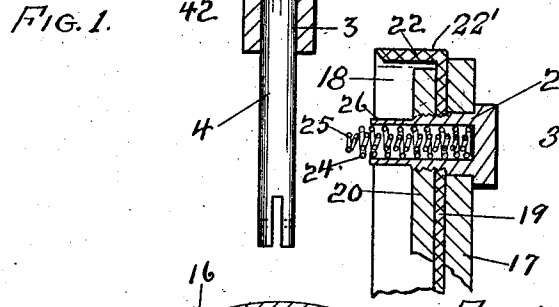


FIG. 7

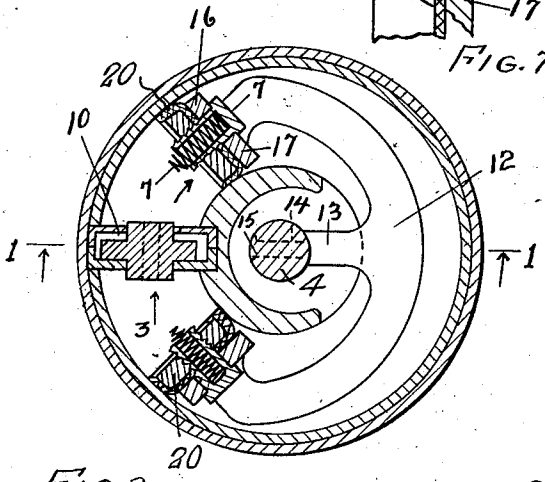


FIG. 2

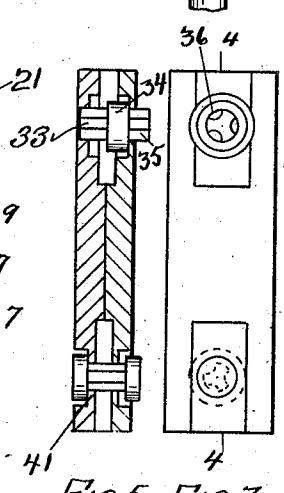


FIG. 5

FIG. 3

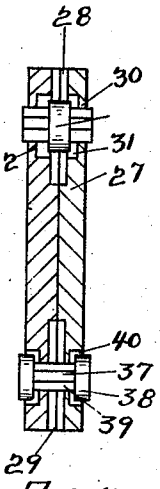


FIG. 4

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OSCILLATING AIR ENGINE

Application filed August 17, 1925. Serial No. 50,661.

My invention is an oscillating air engine particularly adapted to form a hand tool. The engine oscillates through a partial circle and the speed can, to a certain extent, be regulated by the resistance to the oscillation. My invention is particularly adapted for use to operate valve grinding or similar tools.

My invention comprises in brief a casing having upper and lower stationary cylinders mounted therein with an oscillating shaft extending axially through the lower end of the casing and the lower and upper cylinders. The cylinders have an annular recess and support an air duct which is provided with air inlet and outlet valve seats in which are positioned loosely operating valves. A pair of pistons are supported by curved arms from the central shaft and are adapted to oscillate in the recesses or air chambers in the upper and lower cylinders. The air pressure for operating the pistons is developed on opposite sides of the air duct, or passage, and on the opposite sides of the valve seats so that the pistons are turned through a certain angle by the air acting on one piston and then on the other.

The air inlet from a compressor is controlled by a diaphragm valve which is normally spring pressed against a needle to close a needle valve and on a slight retarding of the shaft air pressure builds up sufficient to raise the diaphragm and thus open the needle valve to a greater extent.

Various details and features of improvement will appear from the following description considered with the drawings, in which:

Figure 1 is a vertical section of Figure 2 on the line 1—1 in the direction of the arrows.

Figure 2 is an enlarged horizontal section of Figure 1 on the line 2—2 in the direction of the arrows.

Figure 3 is an elevation of the air ducts in the valve plates as if taken in the direction of the arrow 3 of Figure 2.

Figure 4 is a vertical section of Figure 3 on the lines 4—4 showing the valves in the neutral position.

Figure 5 is a view similar to Figure 4 showing the upper valve in the position of inlet to the left side of the valve plates and the outlet valve in the position of outlet from the right hand side.

Figure 6 is an elevation of the pistons and their carrying yokes attached to the drive shaft.

Figure 7 is an elevation of one end of a piston as if taken on the line 7—7 of Figure 2 indicating the attaching socket screw and the duplex springs housed therein to actuate the valves.

Figure 8 is a side elevation of the diaphragm needle valve.

Referring particularly to Figures 1 and 2 my oscillating air engine is illustrated as formed with an outside casing 1 which is preferably knurled on the outside to form a hand grip and made circular on its exterior face. The casing has a closure 2 formed integral therewith and is also provided with an aperture 3 extending therethrough for the drive shaft 4. The casing is preferably cylindrical on its inside surface and forms the housing for lower and upper cylinders 5 and 6 and also forms a piston chamber 7 by the annular lower and upper recesses 8 and 9. These cylinders are stationary in relation to the casing 1 and in practice made to have a tight pressed fit. The cylinders are formed with a vertical slot 10 extending from the upper surface of the upper cylinder to the lower surface of the lower cylinder. In this slot there is inserted a pair of valve plates 27 both made identical which contain the air ducts, valve seats, and hold the inlet and outlet valves as will be hereafter described.

The pistons are constructed and mounted as follows: The shaft 4 has a yoke 12 secured thereto by a stem 13 which passes through an aperture 14 in the shaft and has a riveted head 15. The pistons 16 are secured to the ends of the yoke 12 which latter on the ends of the yoke have elongated plates 17 preferably formed integral therewith. As shown particularly in Figure 7 a piston cup 18 preferably formed of leather has its base 19 positioned against the plates 17 and held

thereagainst by removable plates 20 having a screw threaded connection with the socket screws 21. The lips 22 of the piston cups are preferably quite long and flexible to form a bearing on the outside 22′ of the piston chamber and also against the inside surface 23 formed concentric with the outside surface. Each of the pistons has an upper and lower socket screw containing two coiled springs, the outer coil 24 being stiffer than the inner spring 25, which projects therefrom. These springs and the inner projection 26 of the socket screw are to positively actuate the inlet and outlet valves as will be hereafter described.

The valve plates including the air ducts and valves are constructed as follows: Having reference particularly to Figures 3, 4, and 5 a pair of plates 27 are both of similar construction and are so formed that when placed face to face they have a rectangular air inlet duct 28 at the upper end and a rectangular air outlet duct 29 at the lower end. Preferably annular apertures 30 extend through the upper portions of the plates and have on the inside an annular recess 31 forming opposite inlet valve seats 32. An inlet valve 33 having a central solid block 34 preferably cylindrical and stems 35 extending in opposite directions therefrom and having a sliding fit in the apertures 30 is thus supported in the upper part of the valve plates and situated in the inlet duct. It is preferable to form flutings 36 on the stems 35 to allow sufficient air to pass from the inlet duct to the piston chamber 7.

The outlet valves 37 comprise two valve blocks 38 mounted on the end of a fluted stem 39. These blocks seat in annular recesses 40 formed on the outside of the plates 27. The flutings allow the air to pass around the annular apertures 41 in the plates and to follow an outlet path from the piston chamber 7 through the recesses 40 and flutings to the outlet duct 29. This duct discharges into an open counter-bore 42 and thence through an exhaust passage 43 formed in the closure 2 of the casing 1.

The diaphragm needle valve, its support, and operative parts are constructed as follows: Having reference particularly to Figures 1 and 8:—A flexible diaphragm 44 is secured to a small bore tube 45 having a solid head 46 on the lower face of the diaphragm and a clamping disc 47 bearing against the upper face of the diaphragm. The diaphragm is clamped at its periphery between a clamping ring 48 and a screw threaded sleeve 49 of the cap 50, this cap being secured to the casing 1 by the screw threaded sleeve. A spring 51 presses against the clamping disc 47 and a light flat annular ring 52 which latter is thereby positioned against the lower surface of the cap 50. A spring tensioning screw 53 is threaded through the cap and may be adjusted to bear on one side of the ring 52 and thereby be utilized to increase or decrease the tension on the spring.

The cap has an upward extension 53′ with a socket 54 therethrough for the air inlet which latter has a valve 55 to control the opening. A valve shut off screw 56 is threaded into the interior of the spring tensioning screw and may be positioned at different elevations to engage the curved finger grip of the valve 55 and therefore hold the valve for different positions of opening.

The lower end of the air duct 54 has a small bore 58 in which is situated a piston 59 preferably formed of leather with upturned lips 60. This piston is secured to the end of the small bore tube 45 by means of a nut 61 screwed on the end of said tube. An aperture 62 is formed in the cap to allow the free passage of any air which may leak past the piston 59. An air hose will be connected to the screw threaded end 63 of the extension 53 of the cap.

The lower end 64 of the bore 65 of the tube 45 is formed in proper shape to make a valve seat when co-operating with the needle 66, which may be inserted through the upper cylinder 6 and adjusted therein by means of the screw threads 67 as shown in Figure 1.

An oil aperture 68 is bored through the casing and preferably at the junction point of the lower and upper cylinders into the piston chamber 7.

The operation of my oscillating air engine is as follows: Presuming that the device is connected to a source of air and a tool such as a valve grinder being attached to the lower end of the shaft 4 the tension of the spring 51 is so adjusted that the air pressure from the source of supply after the valve 55 is open the desired amount is such that the diaphragm will be slightly lifted at a pressure of the air on the needle 66 thereby opening the valve seat 64. This allows a certain amount of air to pass through the engine and will cause it to idle. When resistance is brought against the shaft 4 by utilizing a tool thereon the diaphragm will be elevated to a greater extent on account of the pressure in regard to the diaphragm building up to substantially the pressure in the pipes or leading to the engine.

The air passes downward from below the diaphragm through the inlet 28 and will act on one of the pistons 16. When the air passes through the inlet 28 and out one side of the upper opening in the valve plate 27, the inlet valve block 34 is forced or seated in the opening in the other valve plate 27. The pressure of air causes the outlet valve 37 to seat in the opposite manner. As the piston is driven to oscillate in one direction for instance in a clockwise direction, as in-

dicated by the arrow in Figure 2, at the end of the stroke the inner springs 25 will strike both the upper and lower valves, that is, the inlet and outlet valves and force them into the opposite positions. The valves are kept closed on their seat by the air pressure. The spring 25 by itself is not sufficient to fully move the valve but when the spring 24 also strikes the valves and if they still do not move the inner projection 26 of the socket screw positively forces the valves into the opposite seat, thereby causing the inlet air to flow out of the opposite sides of the valve plates 11. It is apparent that the alternate movement of the inlet and outlet valves will cause a corresponding exhausting of the air from said valves.

It will thus be seen that the pistons will be driven alternatelv in opposite directions and at the end of each stroke the springs and the projection on the face of the pistons cause a positive movement of the valve which is executed very rapidly. Within certain limits which are ascertained by experiment and depending on the pressure of the air supply, the greater the resistance to the oscillation of the shaft 4 the faster will be its speed, and when the grinding, or other tool, is removed from the work the device will idle slowly until the air valve is closed.

My invention may be materially modified in main construction and in detail to suit special requirements and for different sized air engines. Moreover if delicacy of operation is not required some of the elements may be eliminated or simplified in construction.

Having described my invention, what I claim is:

In a device of the class described, a cylinder, partition plates disposed in said cylinder, said partition plates adapted to rest in parallel engagement with each other to form a single partition wall within said cylinder, inlet and outlet passage ways formed in said partition plates and adapted to aline with each other for admitting air, valves positioned in said alined passage ways, a rockable shaft, pistons carried by said shaft and being oscillatable in said cylinder, piston cups secured to said pistons, said securing means comprising hollow members externally screw threaded and having the inner ends thereof projecting inwardly beyond said piston cups, a plurality of springs positioned within said hollow members, said springs extending beyond the ends of said hollow members and adapted to cooperate therewith to successively engage said valves and operate same during operation of the pistons.

In testimony whereof I affix my signature.

NATHANIEL KOEHN.