Feb. 10, 1925. 1,525,971

V. H. WINQUIST

TWO-CYCLE ENGINE

Filed March 5, 1923

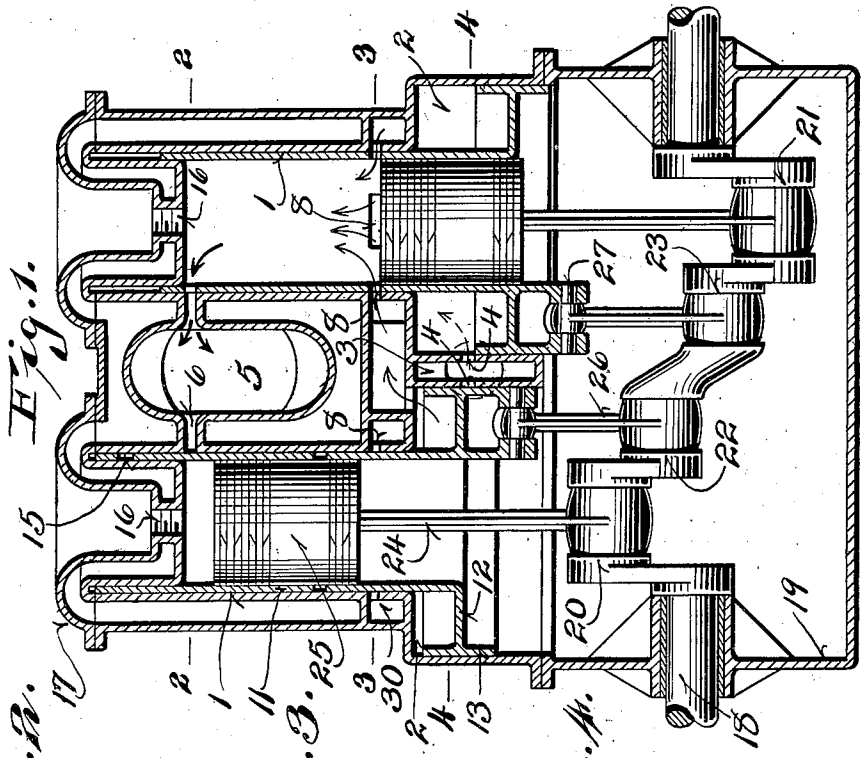


Fig. 1.

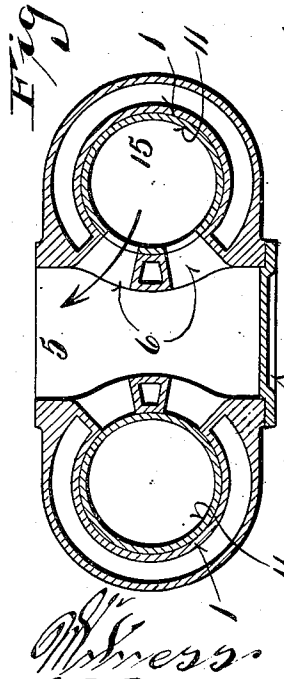


Fig. 2.

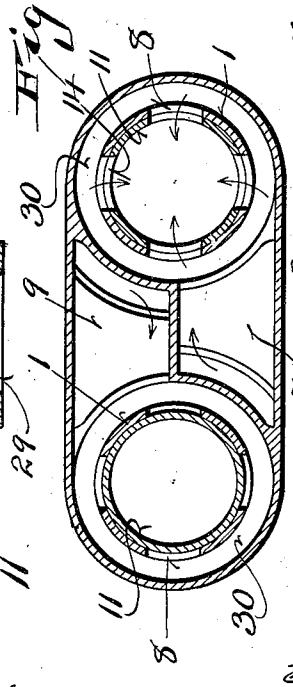


Fig. 3.

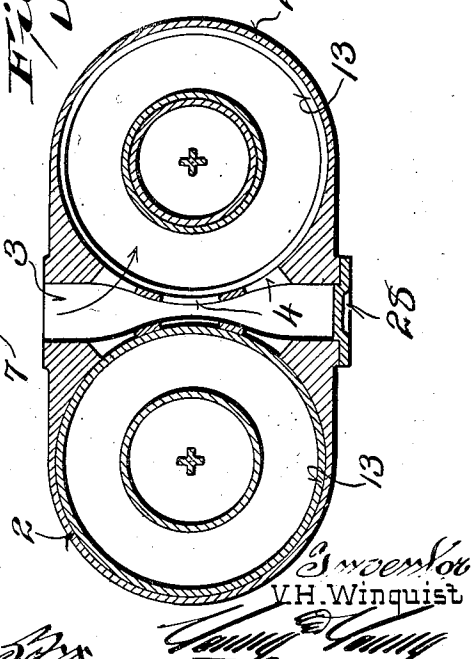


Fig. 4.

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# UNITED STATES PATENT OFFICE.

VICTOR HERMAN WINQUIST, OF MILWAUKEE, WISCONSIN.

## TWO-CYCLE ENGINE.

Application filed March 5, 1923. Serial No. 622,938.

*To all whom it may concern:*

Be it known that I, VICTOR HERMAN WINQUIST, a citizen of Sweden, and resident of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Two-Cycle Engines; and I do hereby declare that the following is a full, clear, and exact description thereof.

This invention relates to two cycle internal combustion engines.

Objects of this invention are to provide a two cycle internal combustion engine with a sleeve valve, to provide a two cycle engine in which crank case compression is avoided, to provide a unidirectional flow two cycle internal combustion engine, and to provide a sleeve valve, two cycle engine in which initial compression is secured by means of the sleeve and associated parts.

Further objects are to provide a two cycle, sleeve valve engine in which the side twist or distortion of the sleeve is reduced to a minimum, in which two cylindrical bearings are provided for the sleeve, and to provide an engine in which an auxiliary valve operating shaft and cams are avoided.

Further objects are to provide a multiple cylinder, two cycle engine in which rotary gas-tight bearings are avoided, in which a direct and relatively short route is afforded the initially compressed charge when passing to the cylinder, and to provide a two cycle, multiple cylinder engine which is compact and sturdy in design, which is simple in construction, and which is efficient in operation.

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

Figure 1 is vertical longitudinal sectional view through the engine.

Figure 2 is a sectional view on the line 2—2 of Figure 1.

Figure 3 is a sectional view on the line 3—3 of Figure 1.

Figure 4 is a sectional view on the line 4—4 of Figure 1.

Referring more particularly to the drawings, it will be seen that the engine comprises a pair of compound cylinders, each consisting of a main cylinder 1, and an auxiliary charge compressing cylinder 2. Between the auxiliary cylinders 2, the inlet duct 3 is located and communicates with such cylinders by means of the piston-controlled ports 4. Between the main cylinders the exhaust outlet 5 is located and communicates with such main cylinders through the ports 6, such ports being controlled by a sleeve valve hereinafter described. The auxiliary cylinder 2 for the left-hand compound cylinder is adapted to communicate with the right-hand main cylinder by means of a duct 7 and a port 8, such port being controlled by the sleeve valve. The auxiliary right-hand cylinder 2 similarly communicates with the left-hand main cylinder by means of a duct 9 and port 8, controlled by the sleeve for the left-hand cylinder. It is to be noted that the ducts 7 and 9 communicate with annular recesses 30 (see Figures 1 and 3), which communicate with the multiple ports 8.

Within each of the main cylinders 1, a sleeve 11 is fitted and is so arranged that it extends or projects downwardly beyond the main cylinder. At its lower end the sleeve is provided with a circular outwardly projecting web 12, which carries a larger or outer sleeve 13, forming in effect a piston for the auxiliary cylinder. The sleeves 11 are each provided with ports 14 and 15, adapted to register at appropriate times with the ports 8 and 6, respectively, to control the flow of the initially compressed fresh fuel into the main cylinder, and to control the flow of the burnt gases from the main cylinder into the exhaust duct 5. The cylinders are suitably water-jacketed, as shown in the drawings, and are provided with spark plug receiving apertures 16, the cylinder head or member 17 being suitably depressed, as shown in Figure 1, to accommodate the spark plugs and to provide the necessary water-jacket.

The engine is provided with a single shaft 18, journalled in bearings carried by the crank case 19. This shaft is provided with a plurality of cranks, viz, two main oppositely disposed cranks 20 and 21, and two auxiliary cranks 22 and 23, having a lesser displacement than the main cranks and being offset in the same direction as the corresponding main crank, or in other words, lying in the same plane thereof.

It will be noted, therefore, that a main

and an auxiliary crank are provided for each compound cylinder, and that all of the cranks lie in the same plane, including the axis of the shaft 18. The main cranks are connected by means of star-shaped pitmen 24 with the main or working pistons 25, and the sleeves are connected with the auxiliary cranks by means of the pitmen 26. It is to be noted in connection with the pitmen 26 that they are operatively joined to the sleeves by means of bearing pins 27 extending through bosses formed upon the inner and outer sleeves 11 and 13, respectively. This provides bearings for connecting the auxiliary pitmen 26 to the sleeves, which are located between the inner and outer sleeves. It will be seen, therefore, that the sleeves are so joined to the appropriate cranks that side twist or distortion of the sleeve is minimized, as the bearing is located inside of the outermost sleeve and between such sleeve and the inner sleeve.

It is intended that one side of each of the ducts 3 and 5 shall be closed by appropriate plates 28 and 29, respectively, (see Figures 2 and 4), and that the plates be so designed that they may be used upon either side of the engine, thereby providing the utmost flexibility in connecting the engine to the inlet and exhaust pipes.

The operation of the apparatus is as follows: A charge is drawn into one of the auxiliary cylinders and compressed—in the position shown in the drawings—into the right-hand cylinder 2. As the engine operates, this charge is initially compressed until the cranks lie in a vertical plane, at which time the initially compressed charge is admitted to the working cylinder, as shown on the right-hand side of Figure 1, such working cylinder 1 being in communication with the left-hand auxiliary cylinder and the gases flowing in the manner indicated by the arrows.

It is to be noted that the pistons or sleeves 13 cooperate with the ports 4 to control the initial admission of the charge to the auxiliary cylinder.

It is to be noted, also, from an inspection of Figure 1, that the sleeve for the right-hand cylinder is moved to its lowest position, and consequently ports 8 and 6 are open, thereby allowing the fresh charge to flow into the main cylinder immediately above the piston and to displace the burnt gases which flow through the port 6.

It will be seen by this construction that the necessity for crank case compression is wholly avoided, and consequently the gas-tight joints usually essential to two-cycle engines are thus also avoided.

It is further to be noted that the flow of gas is always in the same direction in the main cylinders and that therefore such engine constitutes, in effect, a unidirectional flow engine, thereby adding to the general efficiency of the apparatus.

It will be seen that an internal combustion two cycle engine has been provided in which the flow of gas is positively controlled by the valve sleeves, and it will further be seen that an extremely efficient, simple and cheaply constructed type of internal combustion two cycle engine has been provided.

It is to be noted that each piston and its corresponding sleeve travels in the same direction, and the resultant actual travel of a piston with reference to the sleeve is correspondingly less than the actual travel of the piston with reference to the stationary portion of the cylinder. In this manner the friction is lessened and the wearing surface internally of the sleeve is reduced.

I claim:

1. A two cycle, multiple cylinder, internal combustion engine comprising a plurality of compound cylinders each including a main cylinder and an auxiliary larger cylinder concentric therewith, a sleeve mounted in such main cylinder and having a piston portion cooperating with said auxiliary cylinder to initially compress the charge, smaller pistons fitting within said sleeves, a multiple crank, and a plurality of pitmen connecting the cranks with said sleeves and with said pistons, said sleeves and cylinders having cooperating ports to control the flow of gases, said engine having ports for leading the compressed charge from the larger cylinder of one pair to the smaller cylinder of the other pair.

2. A two cycle internal combustion engine comprising a pair of compound cylinders each having a main cylinder and an auxiliary larger cylinder concentric therewith, a sleeve mounted within each main cylinder and having a piston portion fitting said auxiliary cylinder, a piston fitting within said sleeve, said sleeves and cylinders having cooperating ports for controlling the flow of gas, a shaft having a plurality of cranks, and pitmen connecting cranks with said pistons and with said sleeves, said engine having ducts connecting the auxiliary cylinder of one of said compound cylinders with the main cylinder of the other of said compound cylinders.

3. An internal combustion engine comprising two similar cylinders, each cylinder comprising a working portion and a larger charge compressing portion, a working piston located in the working cylinder and a charge compressing piston located in the larger cylinder, a pair of cranks for each cylinder, said pairs of cranks extending in opposite directions with each crank of a pair extending in the same direction, and pitmen joining said cranks and pistons, said engine having delivery ports con-

necting the charge compressing cylinder of one pair of cylinders, with the working cylinder of the other pair of cylinders, said larger pistons having sleeves extending upwardly into said working cylinders, said sleeves and working cylinders having cooperating ports adjacent their upper ends to control the exhaust from said working 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.

VICTOR HERMAN WINQUIST.