Jan. 21, 1930. M. TRECHSEL 1,744,249

TWO-STROKE INTERNAL COMBUSTION ENGINE

Filed May 21, 1928

Fig.1.

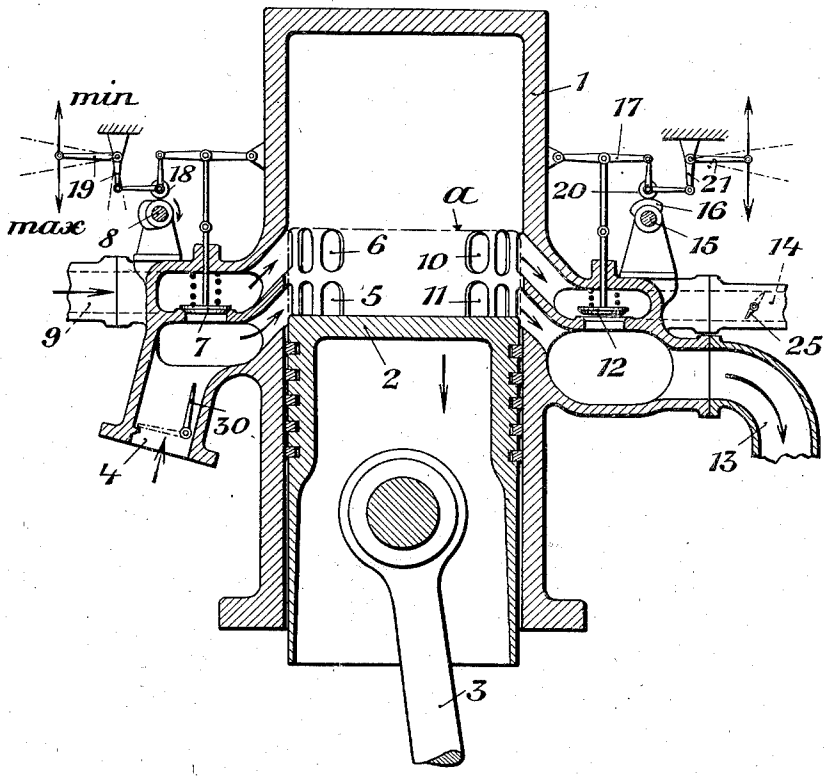


Fig.2.

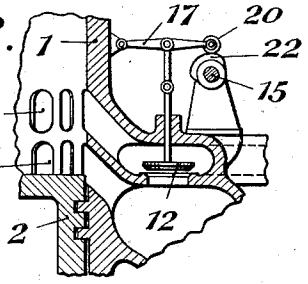
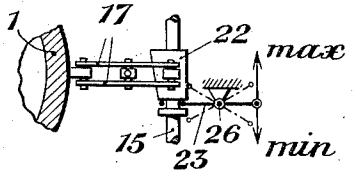


Fig.3.



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TWO-STROKE INTERNAL-COMBUSTION ENGINE

Application filed May 21, 1928, Serial No. 279,427, and in Switzerland May 28, 1927.

This invention relates to two-stroke internal-combustion engines and has for its object to provide an engine in which the discharge of the exhaust gases can be more efficiently controlled than hitherto.

According to this invention the exhaust is divided into two or more ports or groups of ports which are successively opened or closed by the piston, and the ports in the upper group or groups are provided with one or more closing members. This not only enables a step-by-step or progressive discharge of the exhaust gases to take place but further permits a step-by-step or gradually variable increase in the duration of the air charging period while the exhaust ports are closed.

The valve or valves controlling the upper exhaust ports may be positively operated and the ports through which air is admitted to the cylinder may also be provided with a valve, and, like the exhaust ports, are preferably divided into two groups, the upper group at least being provided with one or more closing members.

If the exhaust gases are to be used elsewhere, the valve controlling the upper exhaust ports may be closed earlier or later, according to the use to which these gases are to be put and the the volume of the exhaust gases to be carried away. The gases escaping through the upper and lower exhaust ports may be carried away through separate pipes.

The gear controlling the exhaust valve or valves may cooperate with the gear controlling the supply of air to the inlet ports in such a manner that a change in the period during which the exhaust ports are open or closed brings about a corresponding change in the opening or closing of the valve controlling the admission of air.

To prevent the exhaust gases from entering the air supply pipe in the event of the valve controlling the upper exhaust ports failing to open, the air supply pipe may be provided with a safety device which will prevent admission of air until the lower exhaust ports are opened.

One construction according to the invention is illustrated somewhat diagrammatically by way of example in the accompanying drawings, in which—

Figure 1 is a vertical section of the cylinder of a two-stroke internal combustion engine, and

Figures 2 and 3 show in sectional elevation and plan respectively a special construction of the gear controlling the valve in the exhaust pipe.

The engine cylinder 1 has a piston 2 provided with a connecting rod 3, air being supplied by the pipe 4 to ports 5 and 6 arranged in superimposed groups. The ports 6 are provided with a closing member 7 which is controlled by the camshaft 8, and if desired the air admitted through the upper ports 6 may be supplied through a separate pipe 9.

The exhaust ports are divided into upper and lower groups 10 and 11 which are successively covered by the engine piston 2, the upper ports 10 being provided with a closing member 12. The exhaust gases which escape through the upper ports 10 may be discharged through a separate pipe 14 which may have a valve or throttle 25. The member 12 is controlled by a shaft 15, having a cam 16 which actuates a lever 17 connected to the valve 12. The cam 16 operates the lever 17 through a roller 20 and the setting of this can be changed by moving a bell crank lever 21 connected to the governor (not shown). In the air supply pipe 4 a safety device in the form of a check valve 30 is provided to prevent admission of exhaust gases into the air supply pipe, should for instance the upper exhaust valve 12 fail to close in time.

If the combustion gases are to be fully utilized in any desired manner, for instance in a waste gas turbine, the valve 12 opens to allow the exhaust gases to pass through the ports 10

to the pipe 13 as soon as the piston 2 begins to uncover the exhaust ports 10 (position *a*). If the exhaust gases are to escape from the cylinder later, for instance when the exhaust gases are only to perform the minimum amount of work, no gases will pass through the ports 10 as the control gear 16, 17 will not actuate the valve 12 which thus remains closed.

The gear controlling the valve 7 in the air supply pipe is adjustable by means of a bell crank lever 19. The valve 7 in the air supply pipe opens later in the cycle than the exhaust ports, i. e. during the descent of the piston. The point at which the cam 8 engages the roller 18 of the lever controlling this valve can be adjusted by means of a bell crank lever 19 and any known connection may be provided between the gears controlling the valves 7 and 12 to ensure the later closing of the valve 7 should the exhaust valve 12 open earlier and vice versa.

Instead of varying the point at which the rollers 18 and 20 engage their respective cams as in the arrangement shown in Figure 1 and above described, a conical cam 22 longitudinally adjustable on a camshaft 15 may be employed as shown in Figure 2. This adjustment of the cam is conveniently effected by a lever 23 pivoted at 26 (Figure 3) and controlled by the governor (not shown).

The division of the exhaust ports as above described into two groups which are successively uncovered by the piston, has this further special advantage over engines with one set of valve controlled exhaust ports, that in the event of the valve controlling the upper exhaust ports failing to open, the lower ports still provide a means of escape for the exhaust gases.

I claim:

1. In an internal combustion engine, the combination of a cylinder having spaced sets of inlet ports adapted to be placed in communication and spaced sets of exhaust ports adapted to be placed in communication, a piston movable in said cylinder and controlling said ports, a valve member for controlling the communication between said sets of inlet ports, a valve member for controlling the communication between said sets of exhaust ports, and control means for said valves adapted to provide inlet and exhaust periods in accordance with the load on the engine.

2. Apparatus according to claim 1, characterized by the provision of control means for the valves adapted to provide reciprocal displacement of the inlet and exhaust periods.

3. Apparatus according to claim 1, characterized by the provision of control means for the valves adapted to provide variation of the length of the inlet and exhaust periods.

4. Apparatus according to claim 1 characterized by the provision of a separate exhaust conduit for each set of exhaust ports.

5. Apparatus according to claim 1, characterized by the provision of a separate supply conduit for each set of inlet ports.

6. Apparatus according to claim 1, characterized by the provision of a safety valve adapted to close the inlet ports when the exhaust port valve member fails to open.

In testimony whereof I have affixed my signature.

MAX TRECHSEL.