March 27, 1928. 1,664,086

S. D. OLSEN

TWO-STROKE INTERNAL COMBUSTION ENGINE

Filed Aug. 19, 1925 2 Sheets-Sheet 1

Fig. 1.

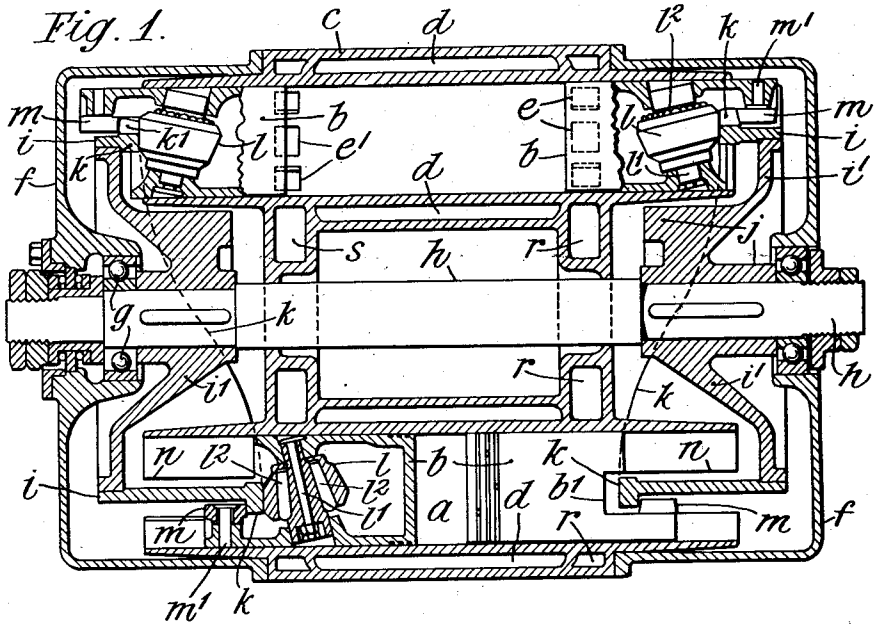

Fig. 2.

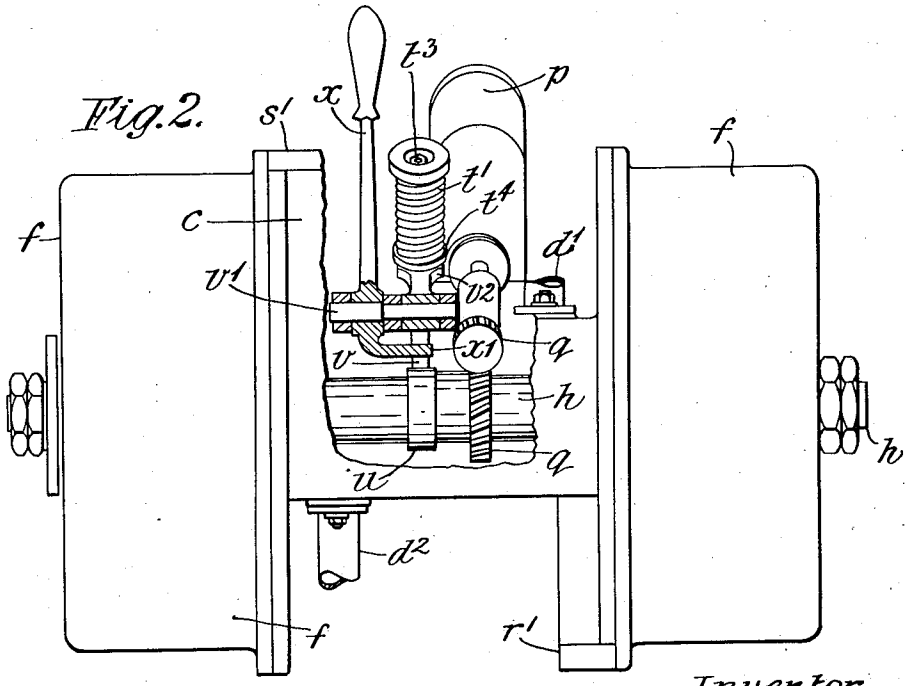

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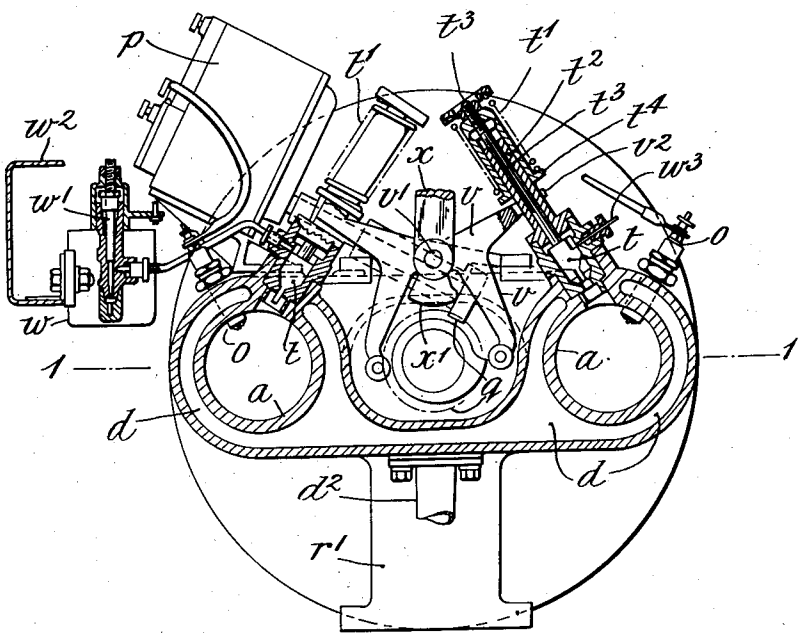
Fig. 3.



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UNITED STATES PATENT OFFICE.

SIMON DOKK OLSEN, OF LONDON, ENGLAND, ASSIGNOR TO THE OLSEN ENGINE SYNDICATE LIMITED, OF LONDON, ENGLAND, A BRITISH COMPANY.

TWO-STROKE INTERNAL-COMBUSTION ENGINE.

Application filed August 19, 1925, Serial No. 51,218, and in Great Britain September 5, 1924.

This invention has reference to internal combustion engines and is designed to provide an engine of the two-stroke "valveless" type with opposed pistons, which shall be very simple and cheap in construction as well as economical in fuel and be capable of working with a sparking plug and fuel injector instead of a carburettor.

The construction of engine to which the invention applies more particularly is that in which the opposed pistons or plungers, instead of operating through cranks act between the edges of cylindrical (or drum like) cams at the ends of the cylinders, and in which the main shaft lies parallel with and between the cylinders.

A feature of the invention is that these pistons also serve as the valves for controlling the inlet and exhaust ports of the cylinder, this being provided for by the suitable shaping of the cam-edges or surfaces, so dispensing with the use of both ordinary lift valves and timing gear, whilst however still allowing of a super-charge of air being introduced into the cylinder.

Another feature of the invention is that the mouths of the cylinders and pistons are deeply slotted to allow them to project as far as possible over the cylindrical cams at the ends of the cylinders.

A further feature of the invention is that the ports of the working chamber of the cylinder are very large and are practically completely annular or extend all round each end thereof, whilst they also lead out into large passages which act to a considerable extent to silence the exhaust.

In order that the invention may be clearly understood and readily carried into effect reference will now be had by way of example to the accompanying diagrammatic drawings, in which:

Fig. 1 is a horizontal section on the line 1—1 of Fig. 3, and

Fig. 2 is a side view of a two cylinder engine according to the invention, adapted to work on the two-stroke principle without a carburettor.

Fig. 3 is a central transverse section through Fig. 1.

In the example illustrated, *a a*, are the cylinders which are provided with oppositely moving pistons *b*. These cylinders are formed or fitted parallel with each other in a suitable casing *c*, provided with water-jackets *d*, and have inlet and exhaust ports *e* and *e'*. The casing has two hollow end covers *f* to enclose or house the cams at the centres of which covers are provided ball-bearings *g* for the main shaft *h*, that is to say the shaft carrying the cylindrical end cams *i* which serve to set up rotary motion instead of cranks.

d^1 d^2, are the inlet and outlet pipes for the cooling water for the jackets *d*.

The main cams *i* situated in the ends of the casing, somewhat resemble two cups facing each other, each having a web i^1 and a hub *j* mounted on the shaft *h*. The said cams in fact form cylindrical flanges around these hubs *j* being wide at one side and narrow at the other, so that their shape corresponds to (or provides for) a single in-and-out stroke of the pistons *b* in each revolution. The hubs *j* are thickened at one side to counterbalance the wider sides of the cams.

Each of the cylindrical or drum-like end cams has an upstanding lip *k*, the inner side of which forms the main or working cam-track, while the outer side forms a shallower parallel auxiliary track. The pistons *b* are of the ordinary hollow-type, and each carries a pair of bevelled anti-friction rollers *l*, *m* between which the aforesaid lip *k* of the cam lies, so that they act on both sides of the latter.

These rollers are carried by axle pins l^1, m^1 secured in the mouth of the pistons, as shown, the axle l^1 being inclined and the rollers *l* having anti-friction bearings l^2.

The outer roller *m* is smaller than the other or main roller as it is merely to enable the cam to guide or draw the piston along when starting up the engine.

A small gap, "key-way" or gate k^1 is formed in the lip *k*, for instance at the neutral or flat portion of the cam track where it will not effect the running. This gap need only be as wide as the smaller or auxiliary roller. It is to enable this latter roller to pass through if it be desired to take the cam off the end of the shaft to permit the pistons to be drawn out or for other purposes.

The cylinders *a* are open at both ends, and their mouths are slotted as at *n* to allow them to extend nearly up to the end disc or hubs of the main cams, and thus afford steady and effective guiding for the pistons

b. Corresponding recesses b^1 are formed in the mouths of the pistons.

The pistons come fairly close together (see bottom of Fig. 1) when forced inward by the main cam i, and the space between them forms the compression and explosion chamber, a sparking plug o and an injector device t being inserted through the side wall of each cylinder into the compression chamber. The plugs are connected to a magneto which may be worked by a skew-gear q as shown.

The fuel injector t is similar to the double acting injector described in my pending United States patent application Serial No. 16,457 filed 18 March 1925.

Each of these injectors is operated by a cam u on the main shaft, acting counter to a spring t^1, through a bell-crank lever v pivoted on a short axle v^1. The injectors t draw the fuel oil from the float chamber w through a regulating valve w^1 and inject it into the cylinders practically as vapour. The injection takes place after the piston has closed the outlet and inlet ports. The float chamber w may be mounted in any suitable way. For instance it may be secured to a part of the chassis w^2 as shown, or to a bracket on the engine frame. The regulating valve has a separate pipe connection w^3 leading to each injector.

A hand-lever x pivoted also on v^1 is provided for working the levers v and so operating the injectors at starting. To this end the lever x has a heel x^1 adapted to engage and operate the levers v alternately.

The upper end v^2 of each lever v is forked, the tubular guide t^2 of the injector stem t^3 passing through such fork.

The said fork acts against the lower end of the spring-barrel t^4 in order to lift the injector plunger t and compress the spring.

The group of ports e e^1 at each end of the cylinder form practically one large annular port. The inlet ports e (on the right) open into an annular chamber or compartment r in communication with a main inlet or flanged opening r^1 leading in from the air compressor or blower. The exhaust ports e^1 (on the left) communicate with a similar chamber s leading to the discharge outlet s^1 which chamber owing to its large capacity acts as a silencer.

The main or end cams i are so shaped that the pistons uncover the exhaust ports in such a way as to allow the spent gases to escape and a fresh supply of air from the blower to take their place, after which said exhaust ports are closed whilst the supercharge is being admitted through the inlet ports, which remain open later than the exhaust ports.

In more detail the action of the pistons with regard to the ports at each end of the cylinders is as follows;

(a) Starting with the pistons b in the innermost position (see bottom of Fig. 1) explosion takes place between them by means of a sparking plug and the cams are caused to revolve by force of the pistons as they separate. One piston, say the left-hand one at or near the end of this stage (see top of Fig. 1) opens the exhaust ports e^1, the inlet or scavenging ports e at the other end being still covered and closed however by the right-hand position.

(b) After the pressure in the cylinder is relieved both pistons separate a little further, and the right-hand piston completely uncovers the inlet or "scavenging" ports so that the scavenging air can enter and "scavenge" the cylinder.

(c) At the next instant the left-hand piston advances and completely closes the exhaust ports, but the right-hand piston still uncovers the inlet or scavenging ports so as to allow the supercharge to be admitted.

(d) The inlet ports are then closed, fuel is injected into the cylinder and both pistons advance towards each other; at their innermost position the charge is compressed and ready for the next explosion, and so on.

Obviously the arrangements above referred to may be modified in various ways in carrying the invention into practice without departing from the general nature thereof.

I claim:

1. In an internal-combustion engine, the combination of stationary cylinders open at both ends and parallel with the main shaft, opposed pistons in said cylinders acting also as valves to control the air inlet and the exhaust ports, revolving cams fast on the main shaft opposite the ends of the cylinders, slotted mouths on the cylinders and pistons, which mouths overlap the cams, rollers mounted at the mouths of the pistons and engaging opposite sides of the cam-tracks, a casing comprising a water-jacket portion for the cylinders and end-covers enclosing the cams, and bearings in said end-covers for the main shaft, substantially as described.

2. In a two-stroke internal-combustion engine, the combination of a main shaft, end cams thereon, cylinders open at both ends parallel therewith and overlapping the cams, large inlet and exhaust ports extending practically all round the cylinders, pistons in said cylinders, and cams on said shaft between which said pistons work so as to approach and recede from each other simultaneously, a water-jacketed casing with covers for the cams at each end thereof, bearings in said covers for the main shaft, and accessible gearing on said shaft for controlling the admission of the fuel charges, substantially as described.

3. In a two-stroke internal-combustion engine, the combination of a main shaft,

end cams co-axial therewith, cylinders parallel therewith and having slotted mouths overlapping the cams, opposed pistons working counter to each other in said cylinders and acting as valves to control the air-inlet and the exhaust ports, rollers carried on inclined axles in the mouths of said pistons and engaging the inner sides of tracks on the cams, said cam tracks being formed by upstanding lips on the cams, outer rollers also carried by the projecting mouths of the pistons and engaging the outer sides of the cam tracks, and slots or gaps in said tracks through which the rollers can pass when withdrawing the pistons, substantially as described.

4. In a two-stroke internal-combustion engine, the combination of a revolving main shaft, revolving cams fast on said shaft, stationary cylinders parallel with said main shaft and having their mouths overlapping the cams, large ports in both ends of the cylinders extending practically all round said ends, opposed pistons in said cylinders, bevelled rollers on inclined shafts in the mouths of said pistons, housing covers for the cams secured to the opposite ends of the cylinders, a water-jacketed casing between said end covers, gearing on the shaft for controlling the fuel supply, and a hand-lever for operating the fuel-supply devices at starting, substantially as described.

5. In an internal-combustion engine, the combination of a main shaft, end cams thereon, cylinders arranged parallel with the main shaft and open at both ends, which ends are slotted and project beyond the cams, pistons with slotted mouths to permit them also to overlap said cams, two sets of rollers carried in the mouths of said pistons and engaging opposite sides of the cam-tracks, a water-jacketed casing containing said cylinders and having spaces in it to receive the exhaust gases, end-covers on said casing to house the cams, bearings at the centres of said covers to carry the main shaft, and accessible gearing on said shaft for working the magneto and the fuel injectors, substantially as described.

In testimony whereof I affix my signature.

SIMON DOKK OLSEN.