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INTERNAL COMBUSTION ENGINE

Filed June 16, 1924

2 Sheets-Sheet 1

FIG. 2.

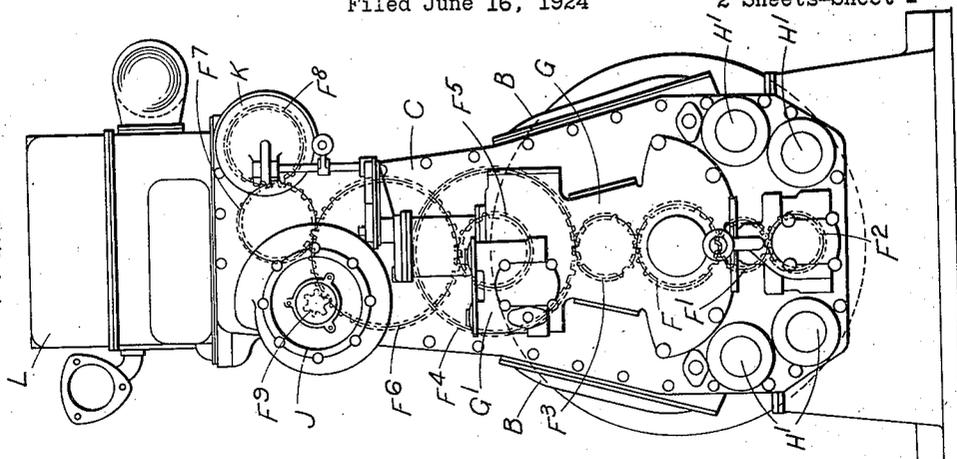
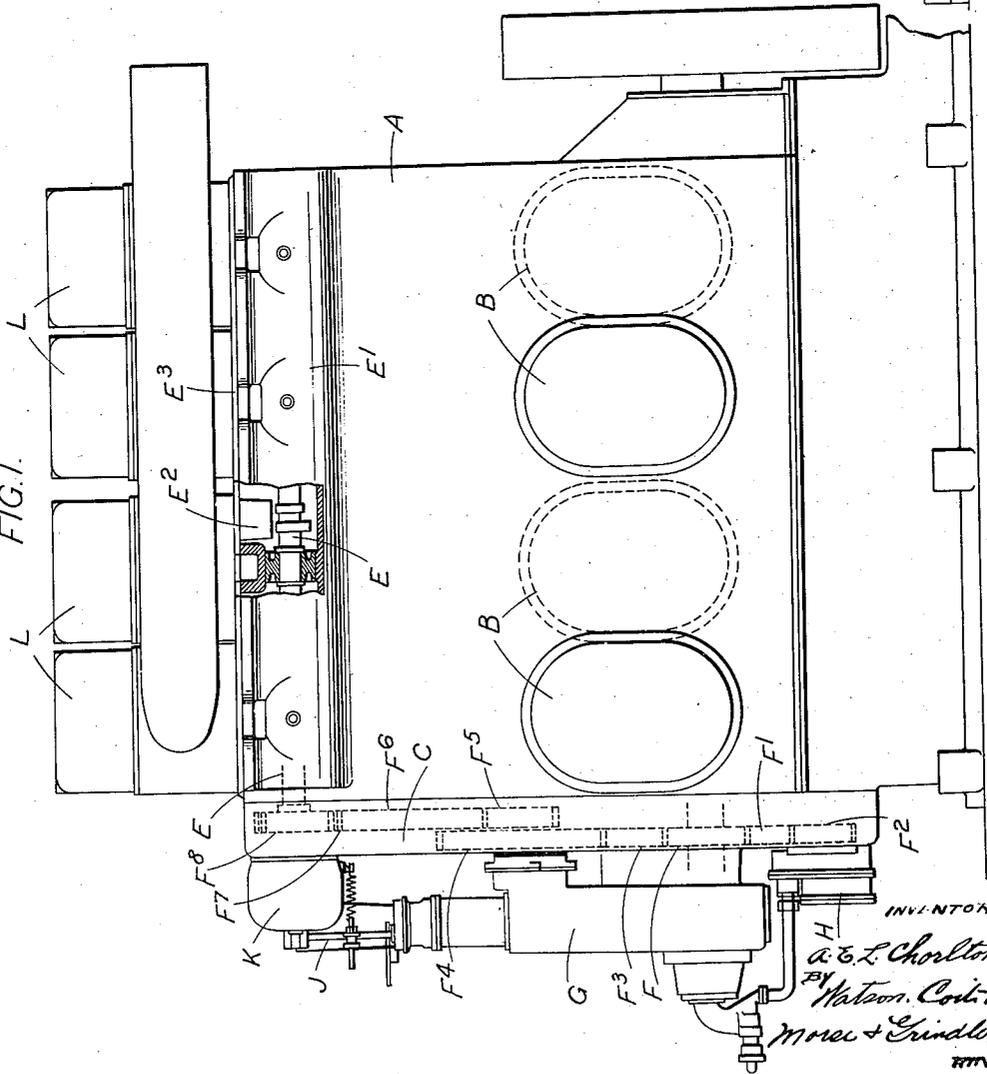


FIG. 1.



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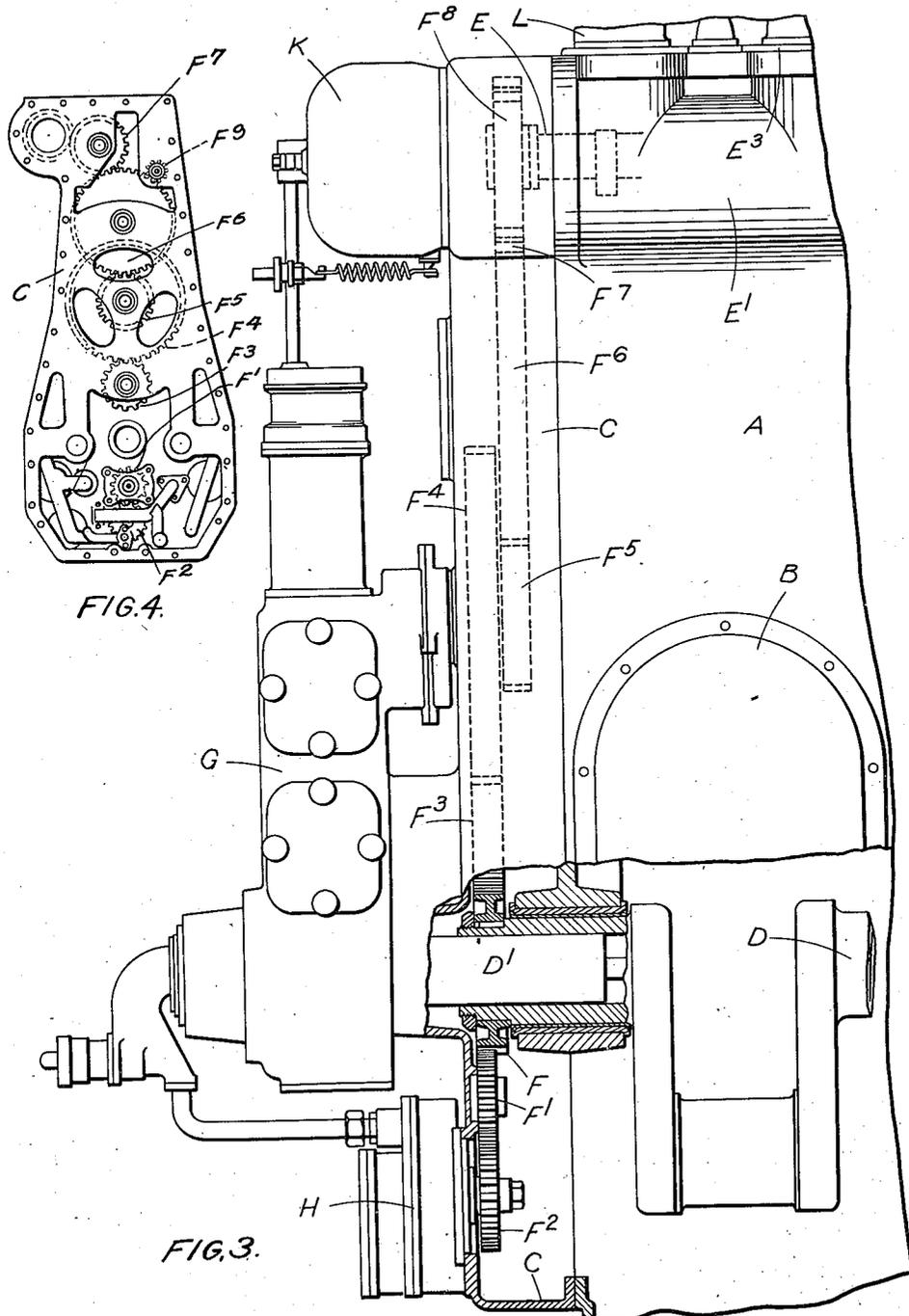


FIG. 4.

FIG. 3.

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# UNITED STATES PATENT OFFICE.

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## INTERNAL-COMBUSTION ENGINE.

Application filed June 16, 1924, Serial No. 720,414, and in Great Britain September 28, 1923.

This invention relates to internal combustion engines and is more especially applicable to high speed multicylinder internal combustion engines. In such engines as commonly used, many of the parts, which often require inspection or renewal, are not easily accessible, with the result that it is necessary to withdraw the whole engine from its mounting and remove it to a workshop when even small repairs are required. The maintenance costs of such engines are therefore very high.

The primary object of the present invention is to overcome this difficulty by so arranging the engine as to allow of the ready inspection and removal of parts.

More specific objects of the invention are:—

(1) to arrange that the auxiliary engine elements, such for example as the engine governor and the water, oil and fuel pumps, and the gearing necessary for driving these elements are readily detachable from the engine;

(2) to provide means whereby the pistons and their connecting rods can be easily inspected or removed;

(3) to arrange for the inspection of a cylinder head and the valve gear and other parts associated therewith without disturbing the other cylinders.

Further objects of the invention will be apparent from the following description of the accompanying drawings, which show a preferred arrangement according to the invention as applied to a multicylinder internal combustion engine. In these drawings,

Figure 1 is a side elevation of the engine.

Figure 2 is an end elevation thereof showing the detachable gear frame,

Figure 3 is an enlarged view partly in section of the left-hand portion of Figure 1; and

Figure 4 is an elevational view of the detachable gear frame, showing the gears in position therein.

In these drawings the cylinders are arranged in line and the engine casing A is provided with doors B in the side walls, these doors being made large enough to allow of the removal of a piston and its connecting rod and also serving for inspection purposes or for the adjustment of the bearings and bearing surfaces. A door is provided only on one side of the casing opposite each crank so that the strength of the walls will not be

materially reduced and there will be continuous metal on one side of each crank throw. In order not to weaken one side wall of the engine casing A more than the other, the doors B are placed in staggered relationship to one another, so that in the case of a four-cylinder engine, as shown, there will be two doors B on each side arranged alternately to one another.

A frame C shaped to fit the engine casing A is bolted to one end thereof, and supports all the gearing necessary for the transmission of the drive from the crank shaft D to the cam shaft E and to a number of auxiliary engine elements carried on the frame. The frame is preferably in the form of a box or casing which encloses as well as supports the gearing. This arrangement allows of the complete removal of the frame C together with the gearing and auxiliary elements for inspection or renewal of parts or for the substitution of a new frame.

The gearing box or frame C contains a gear wheel F mounted on the end of the crank shaft D, which is internally splined to engage with a detachable extension D' of the shaft D, this extension being utilized to drive the fuel pump G. The gear wheel F meshes on one side with a gear wheel F' which in turn meshes with another gear wheel F<sup>2</sup>. This wheel F<sup>2</sup> is utilized to drive the lubricating oil pump H. On its other side the gear wheel F drives through a train of gearing F<sup>3</sup> F<sup>4</sup> F<sup>5</sup> F<sup>6</sup> F<sup>7</sup> another gear wheel F<sup>8</sup> which is mounted on a sleeve surrounding the splined end of the cam shaft E. The gear wheel F<sup>8</sup> also meshes with another gear wheel F<sup>9</sup> by means of which the cooling water pump J is driven. The gear wheels F<sup>1</sup>, F<sup>2</sup>, F<sup>3</sup>, F<sup>4</sup>, F<sup>5</sup>, F<sup>6</sup>, F<sup>7</sup>, and F<sup>9</sup>, are all supported by the frame C as shown in Figure 4. The gear wheels F, and F<sup>8</sup> being carried respectively by the crankshaft D, and by the camshaft E.

In the construction illustrated the frame C carries the lubricating oil pump H, lubricating oil filters H', the fuel pump G, fuel oil filters G', the cooling water pump J, and the governor K, but it will be understood that other auxiliary engine elements (such for example as a magneto or magnetos, a mixture distributor for starting purposes, a revolution indicator or the operating mechanism therefor, etc.) may be carried on the frame either in addition to or instead of these elements. Any or all of such elements

may be driven directly from one or other of the gear wheels  $F$   $F'$  . . .  $F^n$  or from other gear wheels connected thereto.

The various connections from these elements to other parts of the engine may be made externally or may pass through the box into the engine casing, suitable joints being provided to allow of the removal of the whole frame  $C$  together with the members carried thereon, when desired.

The housing  $E'$  for the cam shaft  $E$  is made integral with the engine casing  $A$  and is provided with a number of openings  $E^2$  (normally covered by a cover plate  $E^3$ ) through which pass the various tappet rods or the like for operating the valves in the cylinder heads.

The cylinders also have separate detachable cylinder covers  $L$ , so that any cylinder head may be inspected or repaired without disturbing the other parts of the engine.

It will be understood that this construction has been described by way of example only and that modifications may be made without departing from the scope of the invention.

What I claim as my invention and desire to secure by Letters Patent is:—

1. In an internal combustion engine, in combination, an engine casing, a crankshaft rotatably mounted in the casing, a camshaft rotatably mounted in the casing, parallel to said crankshaft but having its axis removed a considerable distance from the axis of the crankshaft, a frame detachably mounted on the end of the engine casing, a train of intermeshing gear wheels having their axes parallel to the axis of said crankshaft and camshaft, spindles for the gear wheels, bearings for the spindles carried by the frame so that the gear wheels are carried by and removable with the frame, said gear wheels serving to connect the crankshaft to the camshaft, and auxiliary devices such as governor, oil or water pump, magneto and the like, one at least of which is carried upon the frame and driven from the spindle of one of the intermeshing gear wheels, said casing with all parts carried thereby being immediately removable when unbolted from the engine casing.

2. In an internal combustion engine, in combination, an engine casing, a crankshaft rotatably mounted in the casing, a camshaft rotatably mounted in the casing but at some distance from said crankshaft, a frame detachably mounted on the end of the casing, a train of intermeshing gear wheels having their axes parallel to the axis of said crankshaft, spindles for the gear wheels, bearings for the spindles carried by the frame so that the gear wheels are carried by and removable with the frame, said gear wheels serving to connect the crankshaft to the camshaft,

and a plurality of engine auxiliary devices driven from said spindles, one at least of said devices being carried upon the frame so as to be removable therewith, said casing with all parts carried thereby being immediately removable when unbolted from the engine casing.

3. In an internal combustion engine, in combination, an engine casing, a crankshaft rotatably mounted in the casing, a camshaft rotatably mounted in the casing, said crankshaft and camshaft having ends projecting beyond the end of the casing, gears secured to the projecting ends of said shafts, a frame detachably mounted on the end of the casing, a train of intermeshing gear wheels connecting the gear wheels on said shafts and having their axes parallel to the axis of said crankshaft, spindles for the gear wheels, bearings for the spindles carried by the frame so that the gear wheels are carried by and removable with the frame, and a plurality of engine auxiliary devices driven from said spindles, one at least of said devices being carried upon the frame so as to be removable therewith, said casing with all parts carried thereby being immediately removable when unbolted from the engine casing.

4. In an internal combustion engine, in combination, an engine casing, a crankshaft rotatably mounted in the casing, a camshaft rotatably mounted in the casing, said crankshaft and camshaft having ends projecting beyond the end of the casing, gears secured to the projecting ends of said shafts, a frame detachably mounted on the end of the casing, a train of intermeshing gear wheels connecting the gear wheels on said shafts and having their axes parallel to the axis of said crankshaft, spindles for the gear wheels, and bearings for the spindles carried by the frame so that the gear wheels are carried by and removable with the frame, said casing with all parts carried thereby being immediately removable when unbolted from the engine casing.

5. An internal combustion engine including in combination, a plurality of engine cylinders, pistons reciprocating therein, a connecting rod for each piston, a crank shaft on which the connecting rods act, an engine casing enclosing the cylinders and the parts cooperating therewith, and a door disposed in the engine casing opposite to each crank and of such a size as to permit the inspection and removal of a piston and its connecting rod, the inspection doors for adjacent cranks being on opposite sides of the engine casing as set forth.

In testimony whereof I have signed my name to this specification.

ALAN ERNEST LEOFRIC CHORLTON.