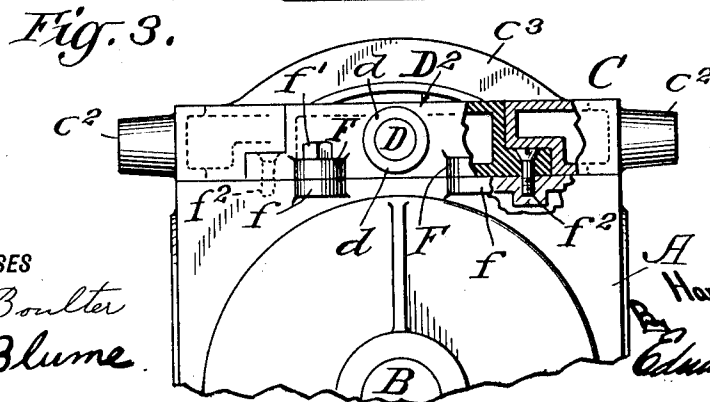
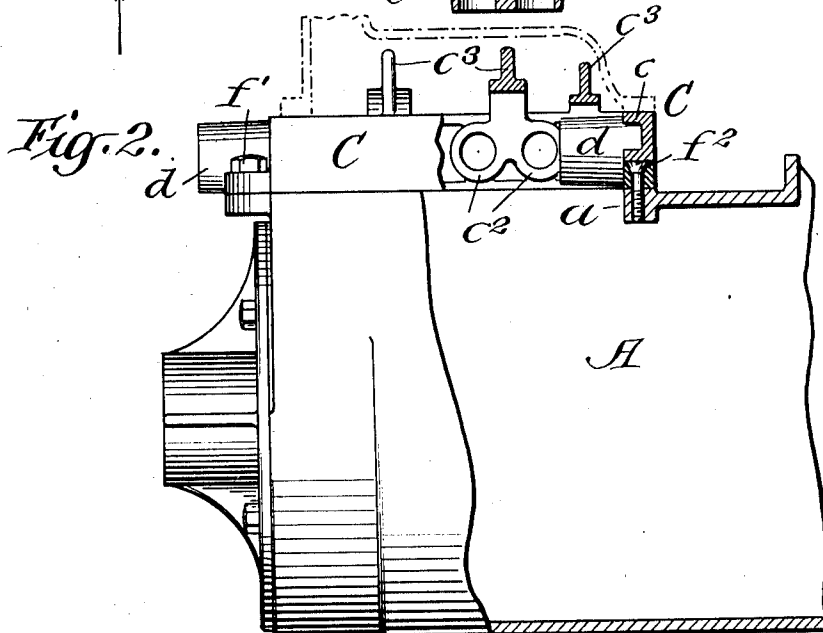
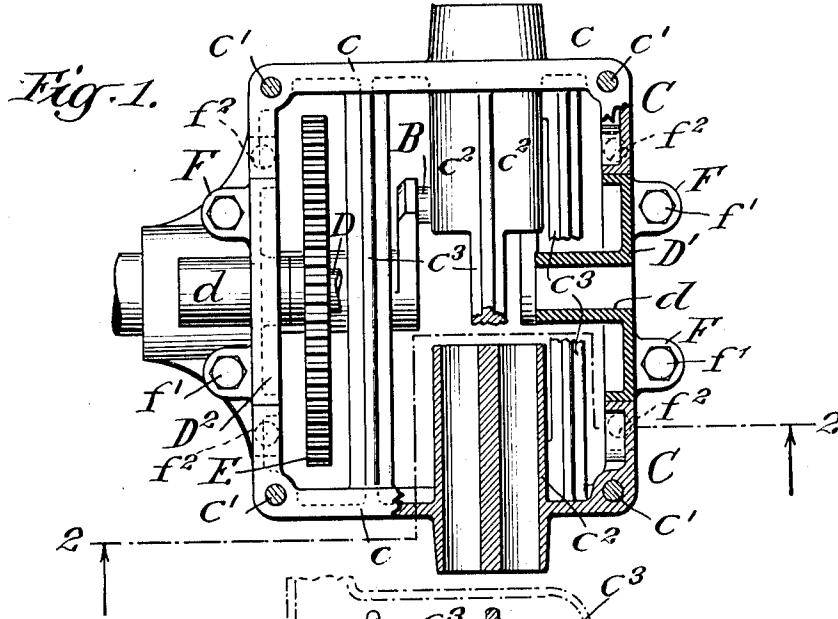


H. G. DAHL.
GAS ENGINE.
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1,020,081.

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GAS-ENGINE.

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To all whom it may concern:

Be it known that I, HARRY G. DAHL, a citizen of the United States, residing at Tarrytown, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

The invention is of particular utility in connection with internal-combustion engines and for the purpose of operating the valves and ignition system of such an engine.

Heretofore it has been the practice to some extent to mount the valve-gear of internal-combustion engines in a removable part, in some instances a cam-box and in others a cover-plate, such part being so arranged as to carry the cam-shaft and its cams, as well as the push-rods whereby the cams operate the inlet and exhaust valves of the engine. The removal of such cam-box or cover-plate from the crank-casing, therefore, involves removal of the cam-shaft and its cams, as well as the push-rods and certain parts connected therewith, as, for example, retracting springs, etc. The theory of these structures has been, apparently, that such removal is necessary to permit access to the interior of the crank-case for the purpose of making adjustments therein, as, for instance, in the bearings of the connecting-rods or the screws by means of which such bearings are commonly secured. The theory of the present invention, however, is that such removal of the valve-operating gear is not only unnecessary but also most undesirable, inasmuch as removal of the cam-shaft from the crank-case involves separation of the "half-time" gear carried by the cam-shaft and the driving-gear carried by the crank-shaft. Unless prior to such separation these gears are carefully and accurately marked, so as to permit them to be restored to coöperative position in their original relation, the correct "timing" of the ignition system is interfered with.

Under my invention, the parts are so constructed and arranged that the interior of the crank-case is sufficiently easy of access for all practical purposes, and while the cam-shaft and the "half-time" gear carried thereby are removable, yet they need not

necessarily be removed to permit such access to the interior of the casing, as is commonly found essential for the adjustment of the bearings, connecting-rods, etc., therein.

In carrying out my invention in a preferred form thereof, applicable to gas-engine construction, I provide the crank-case, immediately above the point at which the connecting-rods are secured to the crank-shaft, with a rectangular frame removably secured upon such crank-case and carrying the push-rods which coact with the cams on the cam-shaft to operate the valves. This frame may be secured in position in any suitable manner, as, for instance, by bolts passing through orifices in the corners thereof. The cam-shaft, carrying the "half-time" gear and cams, is mounted independently of said frame upon the crank-case, in bearings which, preferably, can be removed from the crank-case only as a separate and independent operation, after the removal of the rectangular frame carrying the push-rods. To gain access to the interior of the crank-case for the adjustment of connecting-rod bearings etc., it is only necessary to remove from the crank-case the frame which carries the push-rods and the sleeves in which they operate. This, therefore, involves no disturbance of the relation between the "half-time" gear upon the cam-shaft and the driving-gear upon the crank-shaft which coacts therewith. Consequently, the removal of the push-rods, incidental to readjustment of the connecting-rod bearings, has no effect whatever upon the "timing" of the engine, and therefore no readjustment of the ignition system is required.

In the accompanying drawings, a structure employing my invention is illustrated in the form in which it may be applied to an opposed engine of a type and construction now commonly in use.

In these drawings, Figure 1 is a top view of a portion of the engine casing broken away and sectioned in part to illustrate the construction employed; Fig. 2 is a section on the line 2—2 Fig. 1, illustrating such gearing applied to a portion of a crank-case (in this and Fig. 3 the cam-shaft and its operating gear are omitted); and Fig. 3 is an end elevation of the structure shown in Fig. 2.

Referring to these drawings, A designates the crank-case, in which is suitably mounted the crank-shaft B, to which is secured in the usual manner the connecting-rod or rods of the engine. Said crank-case is provided with an opening *a*, and over such opening is placed the push-rod frame C, comprising side-members *c*, *c*, provided at their corners with orifices through which project studs *c'*, the upper ends of which are threaded for coaction with suitable nuts. The frame C is provided with sleeves *c''*, preferably formed integral with the side-members *c*, *c*, and adapted to receive the push-rods (not shown) which operate the valves. For the purpose of giving the frame C strength and rigidity, I preferably provide the same with struts *c''* extending between and preferably formed integral with the side-members *c*, *c*. Said side-members, the sleeves *c''* and struts *c''*, may conveniently be formed as a single casting, detachably secured to the crank-case by means of the studs *c'*, as above described.

D designates the cam-shaft carrying suitable cams (not shown) for operating the push-rods. Said shaft is mounted in suitable bearing-blocks D', D², these being provided with the bearings *d*. In addition to the cams, the shaft D also carries the "half-time" gear E, which meshes with a driving-gear (not shown) carried by the crank-shaft, these gears having the usual relation of two to one. The bearing-blocks D', D² are provided with integral ears F, and adjacent thereto the crank-case is provided with corresponding ears *f*. With these ears coact cap-screws or bolts *f'*, whereby the bearing-blocks D' D² are secured in position. An additional securing means, clearly illustrated in Figs. 2 and 3, comprises countersunk screws *f''*. These pass through orifices formed in steps at the ends of said bearing-blocks, their threaded ends being received in threaded apertures in the crank-case. As best shown in Fig. 3, the ends of the side-members *c*, *c*, of the frame C, overlie these steps, so that it is impossible to remove the screws *f''* until after the removal of the frame C and the parts carried thereby.

In practice, I prefer to place a gasket or packing between the frame C and bearing-blocks D', D², at their meeting parts, and also between both and the crank-case, so as to prevent the leakage of lubricant from the interior of said case. This, however, is a well-known practice, and a gasket is, therefore, not illustrated in the accompanying drawings.

The rectangular push-rod-carrying frame C may be provided with a cover of any suitable form, secured in position in any desired manner. In Fig. 2, I have illustrated in dotted lines a suitable cover (including a housing for the upper part of the "half-

time" gear), which may be secured in position by means of the studs *c'* passing through orifices in the corners of said cover, the threaded ends of said studs being provided with nuts outside said cover, which nuts, therefore, lock the cover and frame C rigidly to the crank-case.

As will be seen from the construction described, access to the interior of the crank-case and adjustment of the connecting-rods therein involves no interference with the cam-shaft and, in particular, no disturbance of the preëxisting relation between the "half-time" gear E of said shaft and the driving-gear therefor carried by the crank-shaft. As a rule, these parts are properly adjusted, and said gears put in the proper relation, before the engine leaves the factory. For all practical purposes, it is true that the original relation of said gears is designed to persist during the life of the engine. By the construction above described, practically under no circumstances, certainly under none which frequently recur, is it necessary to remove the cam-shaft at all. This is regarded as an important feature of the present improvement, particularly when coupled with the further feature above referred to and which is of importance when it is considered that gas-engines employed in automobiles usually find their way into unskilled hands, *i. e.*, that only after the removal of the push-rod-carrying frame can the bearings of the cam-shaft be made accessible for detachment from the crank-case. The removal of the push-rod-carrying frame at once demonstrates the accessibility of the interior of the crank-case and the lack of necessity, therefore, as well as the undesirability, of removing the cam-shaft and its bearings as an incident to the adjustment of connecting-rods, or, in fact, of any other accessible part which the crank-case contains.

Having now described my invention, what I claim as new therein and desire to secure by Letters Patent is as follows:—

1. The combination with a crank-case having an opening therein, of a frame detachably secured over said opening and comprising two side-members provided with push-rod-carrying sleeves and with struts extending between and connecting said members, and a cam-shaft for operating said push-rods, said frame and the parts carried thereby being removable from said case independently of the cam-shaft, substantially as set forth.

2. The combination with a crank-case having an opening therein, of a frame detachably secured over said opening and provided with push-rod-carrying sleeves, a cam-shaft for operating said push-rods, detachable bearings on said crank-case for said cam-shaft, and means for precluding detachment

of said bearings until after detachment and removal of said frame, substantially as set forth.

3. The combination with a crank-case having an opening therein, of a frame detachably secured over said opening and carrying push-rods, and a cam-shaft for operating said push-rods, the same having detachable bearings, said bearings being secured to said

crank-case by means which are accessible only after removal of said frame, substantially as set forth. 10

This specification signed and witnessed this 17th day of August, 1911.

HARRY G. DAHL.

Witnesses:

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MARK C. MANSHIP.