Nov. 23, 1943. T. JACKSON 2,335,186

INTERNAL COMBUSTION ENGINE

Original Filed April 7, 1941 2 Sheets-Sheet 1

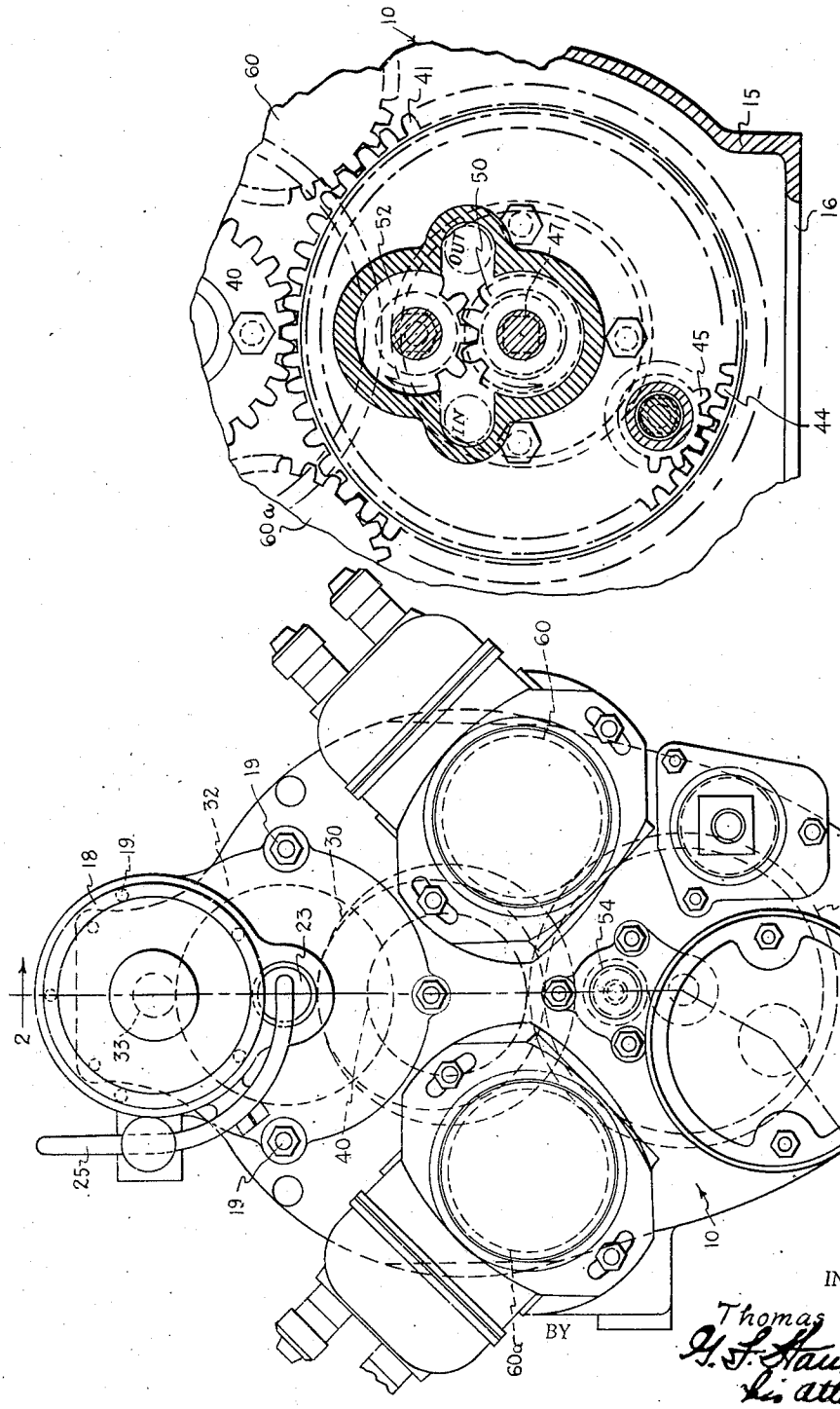


Fig. 3.

Fig. 1.

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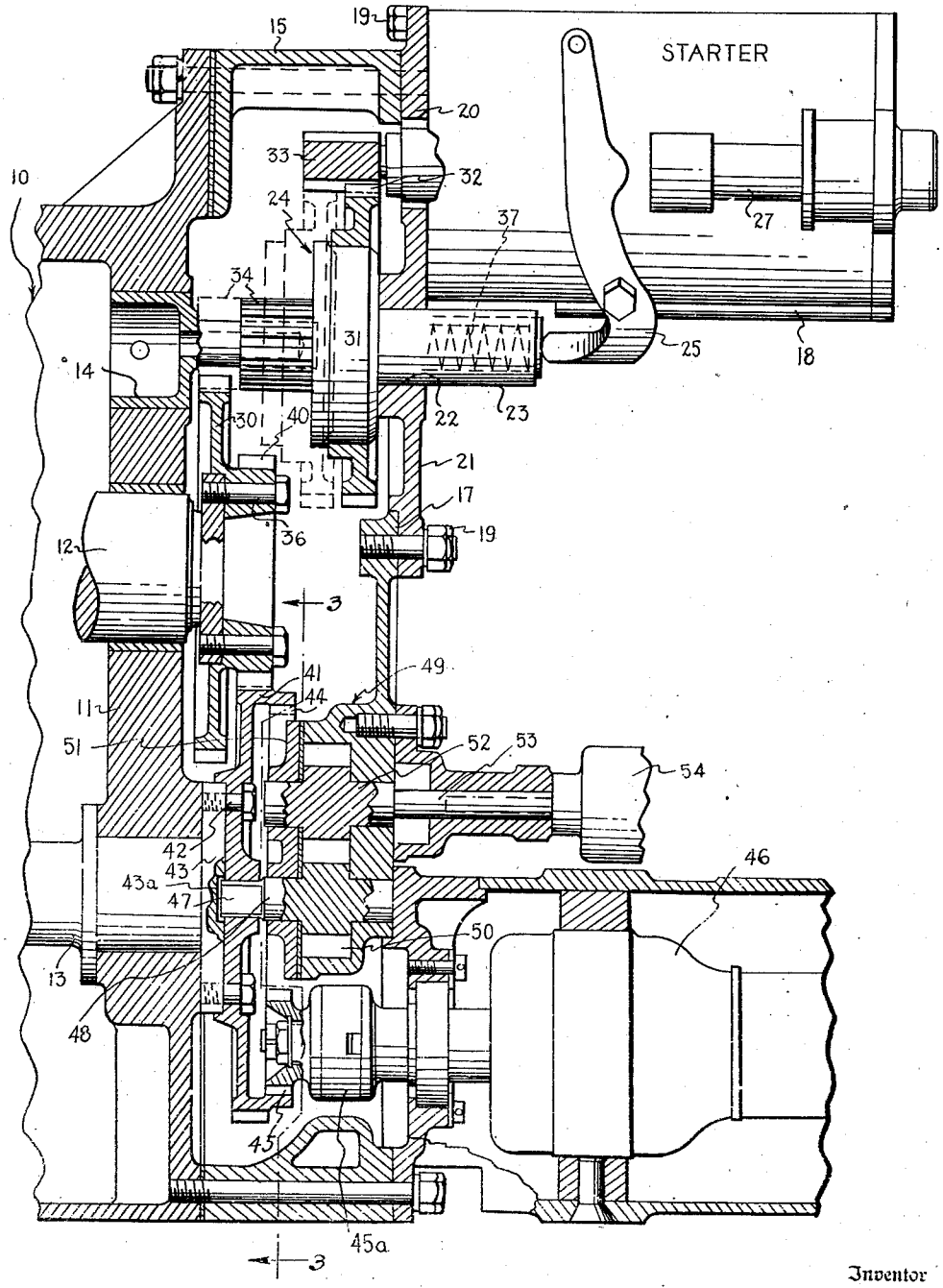


Fig. 2.

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UNITED STATES PATENT OFFICE

2,335,186

INTERNAL COMBUSTION ENGINE

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Original application April 7, 1941, Serial No. 387,146, now Patent No. 2,311,944, issued February 23, 1943. Divided and this application December 8, 1941, Serial No. 422,078

6 Claims. (Cl. 123—195)

My invention relates to aircraft internal combustion engines and more particularly to the accessory gear mechanism and assembly.

One of the objects of my present invention is to improve engine performance and facilitate engine assembly and maintenance by providing an improved compact accessory drive assembly wherein the driving means are so positioned and assembled together as to comprise a compact assembly which is very readily put together in a gear case of compact overall dimensions.

A further object of my present invention relates to the accessory mechanism in general and more particularly to an improved oil pump assembly and drive.

Still further objects of my present invention relate to various features and structural details, which result in the construction of an accessory gear case assembly of minimum size and weight.

A still further object of my invention is to construct an improved oil pump drive by providing a structure wherein the oil pump is axially aligned with the engine camshaft and directly driven thereby.

For a more detailed understanding of my invention reference may be had to the accompanying drawings illustrating the various features of my improved accessory gear mechanism and assembly, and in which:

Fig. 1 is a rear elevational view of the engine showing the various accessories assembled therewith,

Fig. 2 is a vertical sectional view through the rear end engine construction and taken substantially on the line 2—2 of Fig. 1, and

Fig. 3 is a sectional view illustrating the oil pump construction and drive, taken substantially on the line 3—3 of Fig. 2.

This application for patent is a division of my co-pending application, Ser. No. 387,146, filed April 7, 1941 now Patent No. 2,311,944, issued February 23, 1943 for Internal combustion engines.

I have chosen for purposes of illustration to illustrate my present invention in connection with a conventional aircraft internal combustion engine having a crankcase structure 10, which includes a rear transverse wall portion 11 provided with suitable bearing means for supporting the engine crankshaft 12, cam shaft 13 and other associated devices such as the stub shaft or pilot shaft 14. An accessory gear housing, is bolted or otherwise secured to the crankcase 10 and it will be noted that this gear housing is preferably secured to the rear end face of the crankcase, and is of a minimum thickness by reason of the compact assembly of the various accessory gears housed therein.

Said accessory gear housing 15 is preferably open as at 16 for the drainage of lubricant into an oil sump (not shown) attached to the underside of the engine and gear housing. The rear face of the gear housing is machined in accordance with predetermined design to provide a starter pad 17, to which a conventional 6 or 12 volt starter 18 is secured by means of bolts or other suitable fastening devices 19.

It will be observed that the starter preferably carries the end plate 20 secured against the pad 17, and which is provided with a depending ear portion 21 that carries a bearing 22 for supporting the shank 23 of the shiftable intermediate compound reduction gear 24. The shank 23 of this compound gear is engaged by an arm 25, which is actuated in timed relation with the electric starter control 27. The arm 25 is manually shifted or rocked to push on said shank 23 and to then cut in the electric switch or control 27. Thus, on starting the said starter, the compound gear 24 is shifted axially into engagement with the crankshaft starter gear 30. More particularly, this compound gear comprises a hub 31 preferably formed integral with the shaft or shank 23, and carries the large diameter gear 32 which is in mesh with the starter gear 33. As the intermediate compound gear is axially shifted to the dotted position shown in Fig. 2, it will be noted that the large diameter gear 32 remains in mesh with the starter gear 33. Said hub 31 of the compound gear carries a small gear extension 34 which is recessed to receive the stub shaft or pilot shaft 14. As this compound gear is shifted to the left into the dotted line position (see Fig. 2) the small gear 34 is moved into meshing engagement with the crank shaft starter gear 30, which is preferably secured to the crankshaft 12 by means of bolts 36. A spring or other suitable resilient means of conventional construction, which is designated 37, is operable to retract the compound gear or move the same out of engagement with the crankshaft starter gear when the electrical current to the starter is switched off.

The crankshaft starter gear is of the compound type, and also provides a gear 40 of smaller pitch diameter than gear 30, this gear 40 meshing with a gear 41 secured by bolts 42 to the flange 43 carried by the cam shaft 13. This cam shaft gear 41 carries integrally therewith an internal gear 44, to which may be meshed the driven gear 45 associated with the generator 46

and preferably connected with the generator armature shaft by a flexible coupling 45a.

Axially located on the cam shaft gear is a recess 43a which is flattened or squared to receive the end 47 of the oil pump driving shaft 48 incorporated with the oil pump structure 49, and preferably formed integral with the driving gear 50 of the oil pump and supported in usual bearings in the oil pump housing 51. The driven gear 52 of the oil pump is provided with a shaft extension 53 projecting rearwardly through the housing 15 and constructed for driving connection with an engine accessory, such as the tachometer 54.

It will thus be observed that the oil pump projects inwardly of the internal ring gear 44 and the driving gear of the oil pump has a shaft extension which is directly driven by the cam shaft gear. The oil pump driving gear is thus axially aligned with the cam shaft and is assembled relatively closely adjacent to the cam shaft gear thus providing a very compact assembly, and the whole accessory gear assembly and housing is thus of minimum weight and size and particularly applicable to an aircraft engine.

The particular assembly, also incorporated gear mountings which support the various accessory mechanisms, are located in such a way that the accessory gears all rotate about axes extending parallel to the crankshaft axis. Incidentally, it will be observed that the magneto gears 60 and 60a (Fig. 3) are in constant mesh with and driven by the cam shaft gear 41.

Although I have illustrated but one form of my invention and have described in detail but a single application thereof, it will be apparent to those skilled in the art to which my invention pertains, that various modifications and changes may be made therein without departing from the spirit of my invention or from the scope of the appended claims.

I claim:

1. Accessory gear mechanism for an aircraft internal combustion engine having a crankshaft carrying a crankshaft driving gear, a camshaft gear drivingly connected with the crankshaft driving gear and carrying an internal ring gear, a generator gear drivingly connected with said internal ring gear, and an oil pumping instrumentality adjacent to said cam shaft gear and extended in part axially within the internal ring gear, said oil pumping instrumentality including a driving gear and a driven gear, said driving gear axially aligned with said camshaft gear and directly drivingly connected therewith.

2. Accessory gear mechanism for an aircraft internal combustion engine having a crankshaft carrying a crankshaft driving gear, a camshaft gear drivingly connected with the crankshaft driving gear and carrying an internal ring gear, a generator gear drivingly connected with said internal ring gear, and an oil pumping instrumentality adjacent to said camshaft gear and extended in part axially within the internal ring gear, said oil pumping instrumentality including a driving gear and a driven gear, said driving gear axially aligned with said camshaft gear and directly drivingly connected therewith, said oil pump driven gear having a shaft extension axially aligned with and drivingly connected with an engine accessory.

3. Accessory gear mechanism for an aircraft internal combustion engine having a crankshaft carrying a crankshaft driving gear, a camshaft gear drivingly connected with the crankshaft driving gear, and a plurality of engine accessories drivingly connected with said camshaft gear and including an oil pump supported adjacent to the rear face of said camshaft gear and including a driving gear and a driven gear, said oil pump driving gear axially aligned with said camshaft gear and directly driven thereby.

4. Accessory gear mechanism for an aircraft internal combustion engine having a crankshaft carrying a crankshaft driving gear, a camshaft gear drivingly connected with the crankshaft driving gear, and a plurality of engine accessories drivingly connected with said camshaft gear and including an oil pump supported relatively closely adjacent to the rear face of said camshaft gear and including a driving gear and a driven gear, said oil pump driving gear axially aligned with said camshaft gear and provided with an axially extended stub shaft directly connected with said camshaft gear.

5. Accessory gear mechanism for an aircraft internal combustion engine having a crankshaft carrying a crankshaft driving gear, an accessory gear housing, a camshaft, a camshaft gear drivingly connected with the crankshaft driving gear and including an internal ring gear, a generator supported by said housing and including a driven shaft extended within the housing, a pinion meshing with the internal ring gear, and a flexible coupling connecting said pinion with the driven shaft of said generator.

6. Accessory gear mechanism for an aircraft internal combustion engine having a crankshaft carrying a crankshaft driving gear, a camshaft extending parallel to said crankshaft and carrying a concentric camshaft gear drivingly connected with the crankshaft driving gear, said camshaft driving gear comprising a structure having a hub portion and constructed to provide an internal ring gear concentric to said camshaft driving gear, and a plurality of engine accessories driven by said structure and including a generator drive gear drivingly connected with said internal ring gear, and an oil pump instrumentality including an oil pump driving gear aligned with said camshaft, and having an axially extending shaft directly drivingly connected with the said hub portion of said camshaft driving gear structure.

THOMAS JACKSON.