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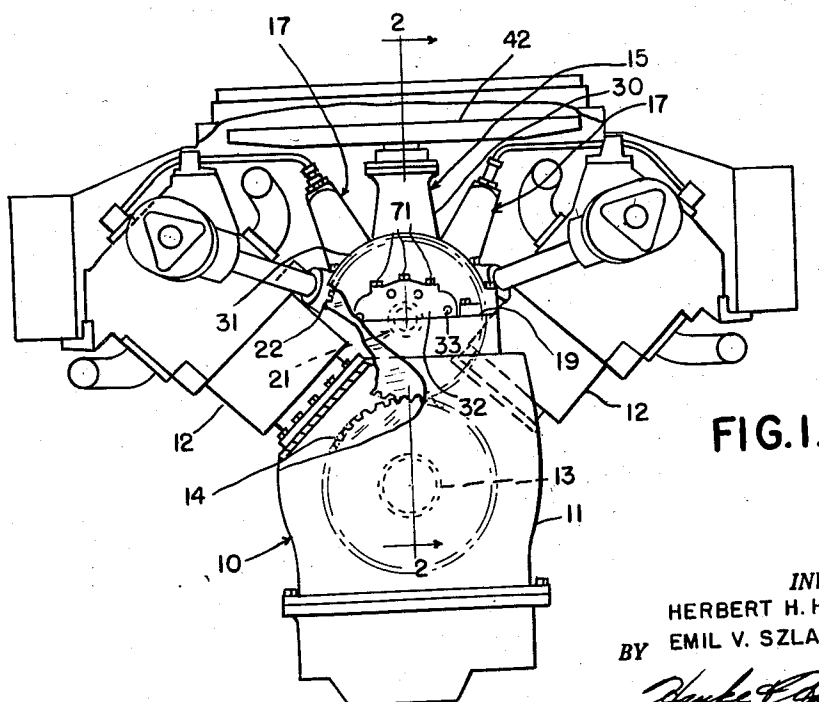
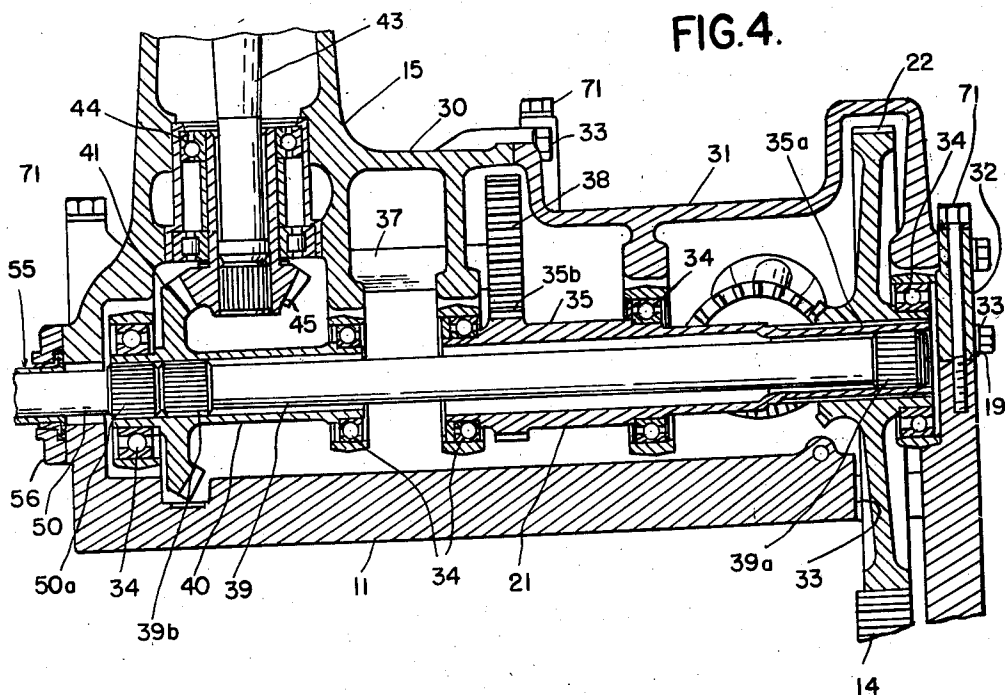
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2,862,484

INTERNAL COMBUSTION ENGINES

Filed Aug. 10, 1956

4 Sheets-Sheet 1



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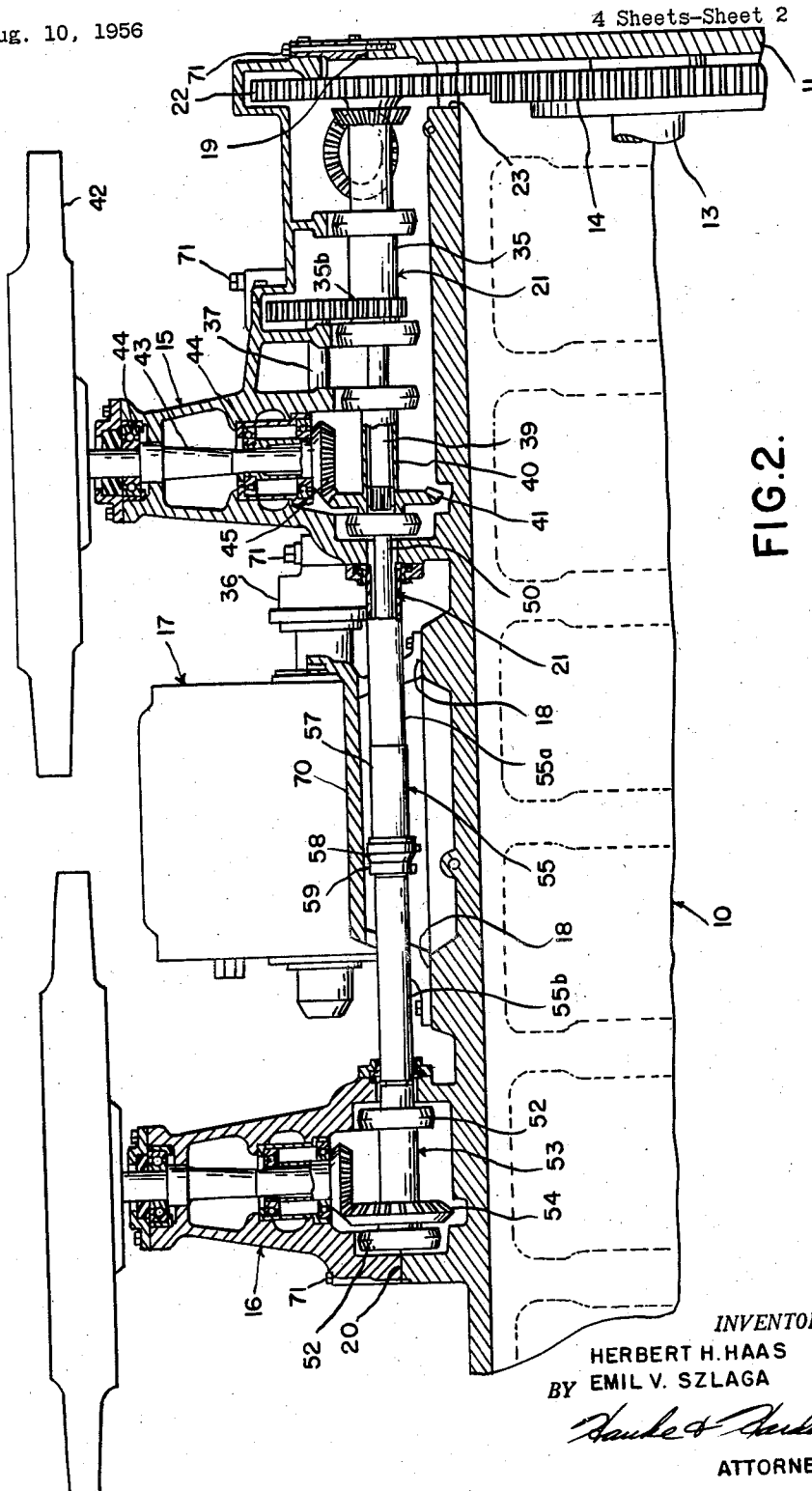
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Filed Aug. 10, 1956

4 Sheets-Sheet 2



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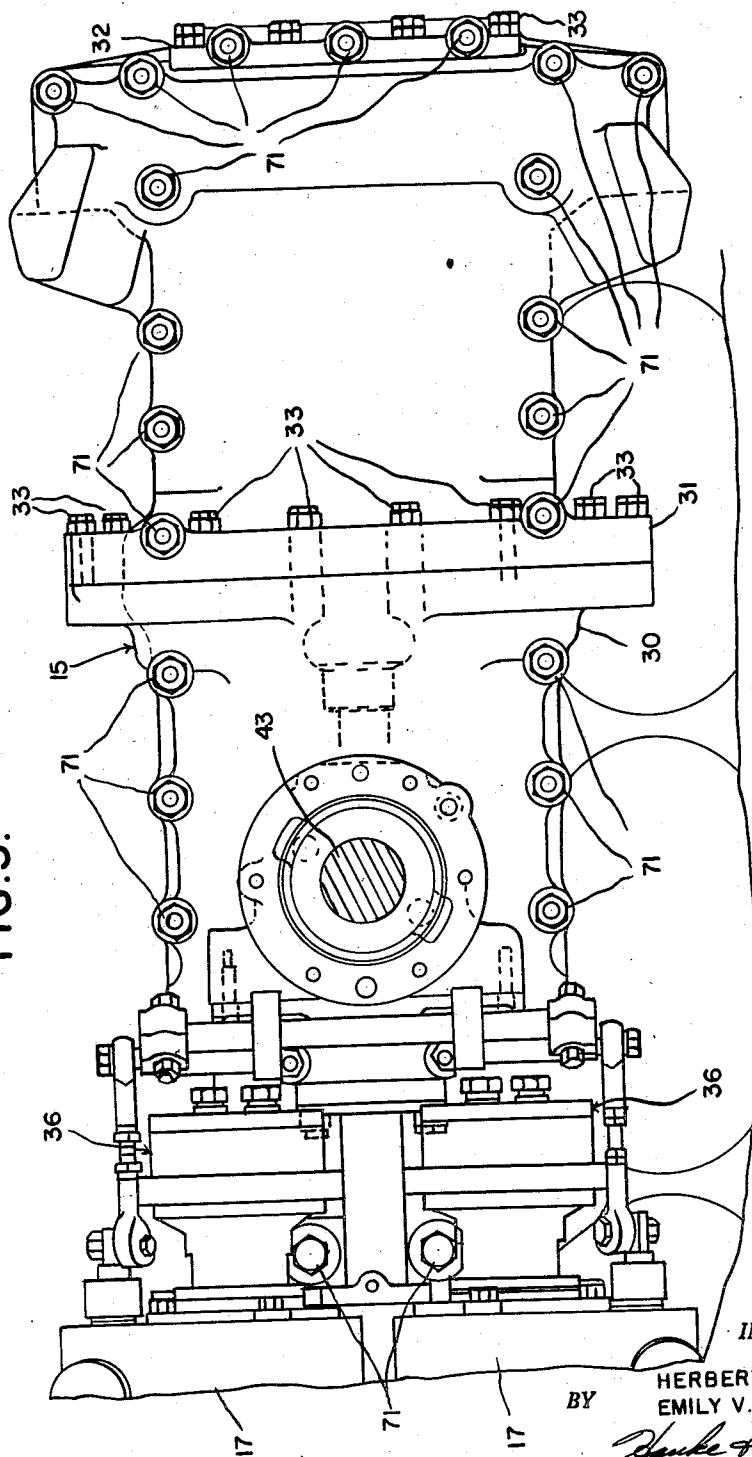
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FIG. 3.



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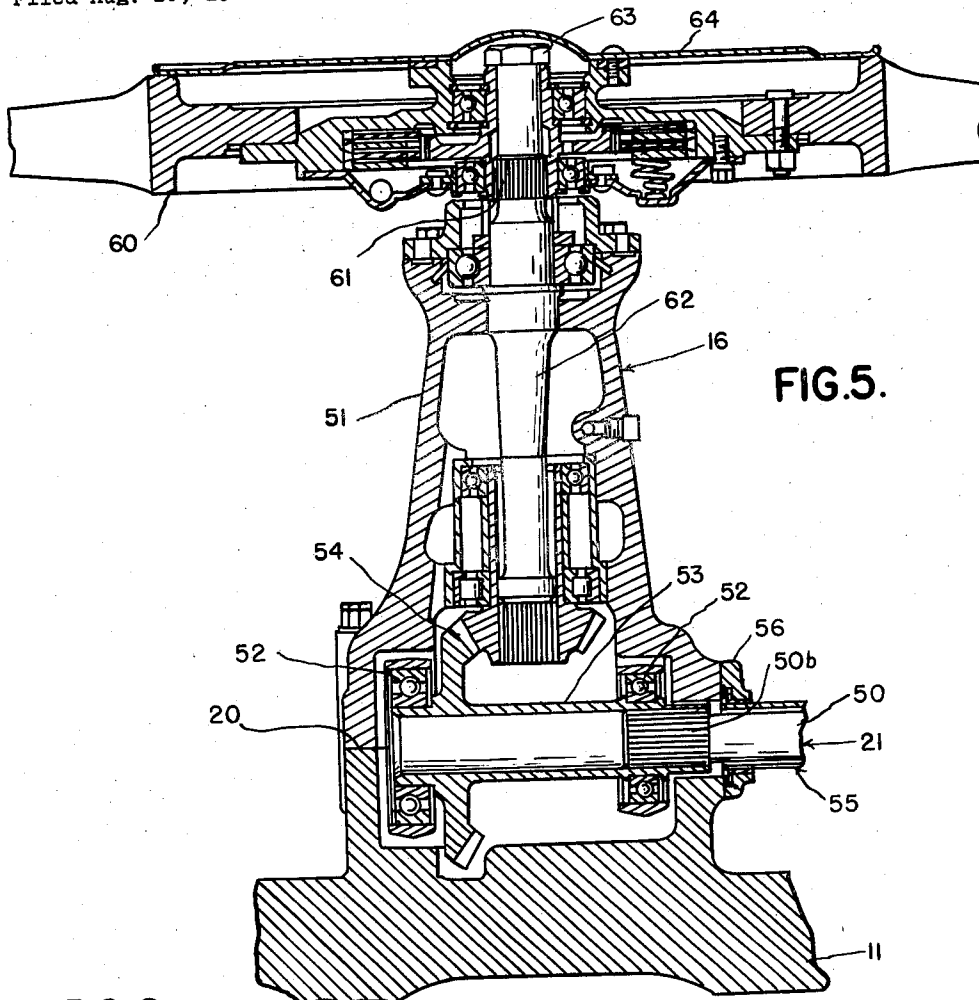


FIG. 5.

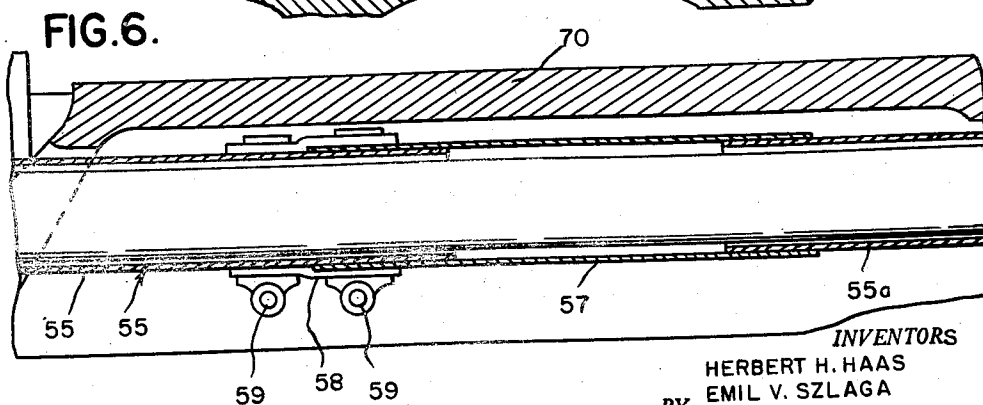


FIG. 6.

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2,862,484

INTERNAL COMBUSTION ENGINES

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Application August 10, 1956, Serial No. 603,251

9 Claims. (Cl. 123—55)

Our invention relates to internal combustion engine construction and more particularly to the mounting and assembly of accessories and accessory driving means on a generally V-type internal combustion engine.

In any engine, accurate alignment of accessories with their drives is a vital factor. Precise machining of the mounting pads and accessory bases is required, and the more machining of parts, the more costly the engine.

Another problem to be considered in engine manufacture is the adaptability to maintenance work, particularly the complexity of procedure involved in removing, testing, and adjusting the various accessories. Obviously, the more difficult this procedure is, the higher the maintenance costs, the longer an engine remains out of service, and the more experienced the personnel must be who are doing the work.

An object of our invention is to improve internal combustion engine construction by providing a crankcase and accessory structures adapted to be independent of each other for disassembly purposes.

Another object of our invention, therefore, is to simplify internal combustion engine maintenance by providing accessory structures adapted for either unitary or individual disassembly from the crankcase.

Another object of the invention is to simplify accessory alignment by providing an accessory drive shaft carried solely by the accessory structures mounted on the crankcase.

A further object of the invention is to provide for a minimum amount of accessory mounting pad machining by constructing a crankcase having a plurality of accessory mounting pads disposed in a common plane.

Yet another object of the invention is to construct a compact V-type engine adapted for easy maintenance by providing a plurality of accessory mounting pads intermediate the engine cylinder banks and a plurality of accessories adapted for either unitary or individual disassembly.

A still further object of the invention is to simplify assembly and alignment of accessories in the V of a V-type internal combustion engine by constructing separable accessory components mountable on mounting pads disposed in a common longitudinal plane and carrying a disconnectable accessory drive shaft assembly disposed in the aforesaid plane.

Still another object of the invention is to provide for easy disassembly of accessories mounted in a longitudinal plane by providing a drive shaft assembly interconnecting the accessories and comprising disconnectable telescoping parts.

For a more complete understanding of our invention, reference may be made to the accompanying drawings illustrating a preferred embodiment of the invention in which like characters refer to like parts throughout the several views and in which

Fig. 1 is an elevational end view, partially cut away, illustrating a preferred type of internal combustion

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engine having the accessory structure of the present invention,

Fig. 2 is a longitudinal cross-sectional view of the engine taken substantially on the line 2—2 of Fig. 1,

Fig. 3 is a fragmentary top view of the engine,

Fig. 4 is an enlarged fragmentary view of one accessory structure shown in Fig. 2,

Fig. 5 is an enlarged fragmentary view of another accessory structure shown in Fig. 2, and

Fig. 6 is an enlarged fragmentary section of the drive shaft connected between the aforesaid accessory structure.

Referring to Fig. 1, a preferred type of internal combustion engine 10 is illustrated as having a crankcase 11, an oil pan, and two longitudinal banks of engine cylinders 12 preferably mounted on the crankcase 11 in a V as shown, although the cylinders 12 may be at any angle or even horizontally opposed, depending on the particular engine design desired. A crankshaft 13 supported in the crankcase 11 carries a driving gear 14 preferably at the flywheel end.

As seen in Fig. 2, various accessory structures, such as a flywheel end fan structure 15, a damper end fan structure 16, and fuel injection pump assemblies 17, are mounted on the upper side of the crankcase. The fuel pumps 17 are preferably mounted in bosses 18, and the fan structures 15 and 16 are mounted respectively on mounting pads 19 and 20. A longitudinally disposed accessory drive shaft assembly 21 is supported by the fan structures 15 and 16 and carries a driven gear 22 which projects downward through a slot 23 in the crankcase and engages with the crankshaft driving gear 14.

The accessory mounting pads 19 and 20 are preferably integrally cast with the crankcase, and the mounting surfaces are disposed in a common plane parallel to the crankshaft axis so they may be machined in a single planing operation. The accessory drive shaft assembly axis also lies in this same plane, so that the distance between the mounting pad plane and the crankshaft axis is all that requires accurate tolerance machining.

Referring to the enlarged details of Fig. 4, it will be seen that the flywheel end accessory structure 15 preferably comprises a fan tower housing portion 30, a gear housing portion 31, and an end plate 32, secured together by bolts 33 or other means. The accessory drive shaft assembly 21 is supported by bearings 34 all carried by the accessory structure housing portions 30 and 31.

The drive shaft assembly 21 preferably comprises an outer hollow drive shaft member 35 to which the driven gear 22 is splined as at 35a and which carries a fuel pump drive gear 35b. The fuel pumps 17 are driven through a disconnect coupling 36 (see Fig. 2) and a shaft 37 which extends into the tower housing portion 30 and carries a driven gear 38 engaged with the gear 35b. An inner torsion bar type drive shaft 39 is splined as at 39a inside the hollow shaft 35.

A hollow fan drive shaft member 40 is splined as at 39b to the other end of the drive shaft 39 and carries a fan drive gear 41. As seen in Figs. 2 and 4, a fan 42 is driven through a shaft 43 supported by bearings 44 and carrying a driven gear 45 engaged with the fan drive gear 41.

A second torsion bar type drive shaft 50 is splined as at 50a inside the hollow shaft member 40 and extends from the accessory structure 15 to the accessory structure 16 shown in Fig. 5. The accessory structure 16 comprises a fan tower housing 51 supporting shaft bearings 52. The drive shaft 50 is splined as at 50b inside one

end of a hollow fan drive shaft member 53 carrying a fan drive gear 54.

That portion of the shaft 50 extending between the accessory structures 15 and 16 is enclosed by a shaft housing assembly 55, secured to the housings 30 and 51 by any suitable means such as retainer fittings 56. Fig. 6 shows a portion of the housing assembly 55 as comprising housing members 55a and 55b telescopically connected with a tube 57, preferably secured to one member 55a and slidable on the other member 55b. A stepped tubular clamp fixture 58 fits on the tube 57 and the member 55b as illustrated, being provided with annular clamps 59 which may be tightened to retain the shaft housing assembly 55 in its extended position.

The fan structure illustrated in Fig. 5 is typical of the type utilized, comprising a fan 60 splined as at 61 to a drive shaft 62 and retained by a nut 63 accessible upon removing a cover plate 64.

Preparatory to removing the accessory structures, the fans 42 and 60 are removed. The fuel pumps are mounted on a bracket 70 which straddles the shaft housing assembly 55 and is removed from the bosses 18 without disturbing the rest of the accessories, the fuel pumps being readily disconnected at the coupling 36. After disconnecting any other attached parts the accessory structure 15 and 16, carrying the shaft assembly 21 and shaft housing assembly 55 may then be unitarily removed from the crankcase by removing the necessary bolts 71 shown in Fig. 3 and lifting the accessories upward.

The accessory structures 15 and 16 may also be individually removed by first disconnecting the shaft housing fitting 56 at the accessory structure 15, loosening the shaft housing clamps 59, collapsing the shaft housing assembly and then telescoping the drive shaft 50 into the hollow drive shaft member 53. The accessory structures being thus separated may then be singly removed from the crankcase as desired.

It will be noted that any type of accessory may be used with this type of construction, any number being arranged in series with interconnected splined shaft members and telescopic shaft housing assemblies. The accessories being adapted to carry the shaft members make it easy to accomplish bench testing and adjustment procedures. The major accessory units are thus completely independent of the crankcase. The crankcase itself is of relatively simple construction, and the machining operations are materially reduced.

Although we have described but one preferred embodiment of our invention, it will be apparent to one skilled in the art to which the invention pertains that various changes and modifications may be made therein without departing from the spirit of the invention or the scope of the appended claims.

We claim:

1. An accessory mounting structure and driving means for a generally V-type internal combustion engine having a crankcase, a crankshaft carried thereby, and longitudinal banks of engine cylinders, said mounting structure comprising a plurality of separate mounting bosses integrally formed with said crankcase intermediate said banks of cylinders and having upper mounting faces disposed in a common plane and defining a parting plane between the housings and the crankcase, a plurality of spaced accessory housing structures each individually removably mounted on one of said mounting faces, driven accessory elements carried solely by said housing structures, accessory drive shaft bearings carried solely by said housing structures, said driving means comprising a single accessory drive shaft assembly supported by said bearings, the axes of said drive shaft assembly and said bearings being disposed in the plane of said mounting faces, and means operably connecting said drive shaft assembly with said crankshaft.

2. An accessory mounting structure and driving means for a generally V-type internal combustion engine having a crankcase, a crankshaft carried thereby, and longitudinal

banks of engine cylinders, said mounting structure comprising a plurality of separate mounting bosses integrally formed with said crankcase intermediate said banks of cylinders and having upper mounting faces disposed in a common longitudinal plane parallel to the crankshaft axis and defining a parting plane between the housings and the crankcase, a plurality of spaced accessory housing structures each individually removably mounted on one of said mounting faces, driven accessory elements carried solely by said housing structures, accessory drive shaft bearings carried solely by said housing structures, said driving means comprising a single accessory drive shaft assembly supported by said bearings, the axes of said drive shaft assembly and said bearings being disposed in the plane of said mounting faces and parallel with said crankshaft axis, and means operably connecting said drive shaft assembly with said crankshaft.

3. An accessory mounting structure and driving means for a generally V-type internal combustion engine having a crankcase, a crankshaft carried thereby, and longitudinal banks of engine cylinders, said mounting structure comprising bosses integrally formed with said crankcase intermediate said banks of cylinders and having upper mounting faces disposed in a common longitudinal plane parallel to the crankshaft axis, a plurality of spaced accessory housing structures individually removably secured on said mounting faces, bearings carried solely by said housing structure, said driving means comprising an accessory drive shaft assembly supported by said bearings, the axis of said drive shaft assembly being disposed in the plane of said mounting faces and parallel with said crankshaft axis, and means operably connecting said drive shaft assembly with said crankshaft, said drive shaft assembly constructed and arranged to be selectively disconnected from said accessory housing structures while same are secured to said crankcase bosses whereby to provide for selective individual disassembly of said housing structures from said bosses.

4. An accessory mounting structure and driving means for a generally V-type internal combustion engine having a crankcase, a crankshaft carried thereby, and longitudinal banks of engine cylinders, said mounting structure comprising bosses integrally formed with said crankcase intermediate said banks of cylinders and having upper mounting faces disposed in a common longitudinal plane parallel to the crankshaft axis, a plurality of spaced accessory housing structures individually removably secured on said mounting faces, bearings carried solely by said housing structures, said driving means comprising an accessory drive shaft assembly supported by said bearings, the axis of said drive shaft assembly being disposed in the plane of said mounting faces and parallel with said crankshaft axis, and means operably connecting said drive shaft assembly with said crankshaft, said drive shaft assembly comprising a plurality of axially aligned interconnected shaft elements constructed and arranged to be selectively disconnected while said accessory housing structures are secured to said crankcase bosses, whereby to provide for selective individual disassembly of said housing structures from said bosses.

5. An accessory mounting structure and driving means for a generally V-type internal combustion engine having a crankcase, a crankshaft carried thereby, and longitudinal banks of engine cylinders, said mounting structure comprising bosses integrally formed with said crankcase intermediate said banks of cylinders and having upper mounting faces disposed in a common longitudinal plane parallel to the crankshaft axis, a plurality of spaced accessory housing structures individually removably secured on said mounting faces, bearings carried solely by said housing structures, said driving means comprising an accessory drive shaft assembly supported by said bearings, the axis of said drive shaft assembly being disposed in the plane of said mounting faces and parallel with said

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crankshaft axis, and means operably connecting said drive shaft assembly with said crankshaft, said drive shaft assembly comprising a plurality of hollow shaft elements respectively supported by the bearings of said housing structures, and a connecting shaft element extending between adjoining housing structures and removably secured in said hollow shaft elements, said connecting shaft element arranged to be selectively withdrawn from the hollow shaft element of one housing structure and telescoped into the hollow shaft element of the adjoining housing structure thereby disconnecting said shaft assembly while said housing structures are secured to said bosses, whereby to provide for selective individual disassembly of said housing structures from said bosses.

6. An accessory mounting structure and driving means for a generally V-type internal combustion engine having a crankcase, a crankshaft carried thereby, and longitudinal banks of engine cylinders, said mounting structure comprising bosses integrally formed with said crankcase intermediate said banks of cylinders and having upper mounting faces disposed in a common longitudinal plane parallel to the crankshaft axis, a plurality of spaced accessory housing structures individually removably secured on said mounting faces, bearings carried solely by said housing structures, said driving means comprising an accessory drive shaft assembly supported by said bearings, the axis of said drive shaft assembly being disposed in the plane of said mounting faces and parallel with said crankshaft axis, and means operably connecting said drive shaft assembly with said crankshaft, said drive shaft assembly comprising a plurality of hollow shaft elements respectively supported by the bearings of said housing structures, and a connecting shaft element extending between adjoining housing structures and removably secured in said hollow shaft elements, said connecting shaft element arranged to be selectively withdrawn from the hollow shaft element of one housing structure and telescoped into the hollow shaft element of the adjoining housing structure thereby disconnecting said shaft assembly while said housing structures are secured to said bosses, whereby to provide for selective individual disassembly of said housing structures from said bosses, a tubular housing enclosing said connecting shaft element and removably secured to said housings.

7. An accessory mounting structure and driving means for a generally V-type internal combustion engine having a crankcase, a crankshaft carried thereby, and longitudinal banks of engine cylinders, said mounting structure comprising bosses integrally formed with said crankcase intermediate said banks of cylinders and having upper mounting faces disposed in a common longitudinal plane parallel to the crankshaft axis, a plurality of spaced accessory housing structures individually removably secured on said mounting faces, bearings carried solely by said housing structures, said driving means comprising an accessory drive shaft assembly supported by said bearings, the axis of said drive shaft assembly being disposed in the plane of said mounting faces and parallel with said crankshaft axis, and means operably connecting said drive shaft assembly with said crankshaft, said drive shaft assembly comprising a plurality of hollow shaft elements respectively supported by the bearings of said housing structures, and a connecting shaft element extending between adjoining housing structures and removably secured in said hollow shaft elements, said connecting shaft element arranged to be selectively withdrawn from the hollow shaft element of one housing structure and telescoped into the hollow shaft element of the adjoining housing structure thereby disconnecting said shaft assembly while said housing structures are secured to said

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bosses, whereby to provide for selective individual disassembly of said housing structures from said bosses, a tubular housing enclosing said connecting shaft element and removably secured to said housings, said tubular housing comprising a plurality of selectively telescoped sleeve elements, and means selectively retaining said sleeve elements in an extended position.

8. An accessory mounting structure and driving means for a generally V-type internal combustion engine having a crankcase, a crankshaft carried thereby, and longitudinal banks of engine cylinders, said mounting structure comprising bosses integrally formed with said crankcase intermediate said banks of cylinders, a plurality of spaced accessory housing structures individually removably secured on said bosses, bearings carried by said housing structures, said driving means comprising an accessory drive shaft assembly supported by said bearings, and means operably connecting said drive shaft assembly with said crankshaft, said drive shaft assembly comprising a plurality of hollow shaft elements respectively supported by the bearings of said housing structures, and a connecting shaft element extending between adjoining housing structures and removably secured in said hollow shaft elements, said connecting shaft element arranged to be selectively withdrawn from the hollow shaft element of one housing structure and telescoped into the hollow shaft element of the adjoining housing structure thereby disconnecting said shaft assembly while said housing structures are secured to said bosses, whereby to provide for selective individual disassembly of said housing structures from said bosses.

9. An accessory mounting structure and driving means for a generally V-type internal combustion engine having a crankcase, a crankshaft carried thereby, and longitudinal banks of engine cylinders, said mounting structure comprising bosses integrally formed with said crankcase intermediate said banks of cylinders, a plurality of spaced accessory housing structures individually removably secured on said bosses, bearings carried by said housing structures, said driving means comprising an accessory drive shaft assembly supported by said bearings, and means operably connecting said drive shaft assembly with said crankshaft, said drive shaft assembly comprising a plurality of hollow shaft elements respectively supported by the bearings of said housing structures, and a connecting shaft element extending between adjoining housing structures and removably secured in said hollow shaft elements, said connecting shaft element arranged to be selectively withdrawn from the hollow shaft element of one housing structure and telescoped into the hollow shaft element of the adjoining housing structure thereby disconnecting said shaft assembly while said housing structures are secured to said bosses, whereby to provide for selective individual disassembly of said housing structures from said bosses, a tubular housing enclosing said connecting shaft element and comprising a plurality of selectively telescoped sleeve elements, and means retaining said sleeve elements in an extended position.

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