March 20, 1945. W. E. BRILL 2,371,797

ENGINE CRANKCASE CONSTRUCTION

Filed Nov. 13, 1942 2 Sheets-Sheet 1

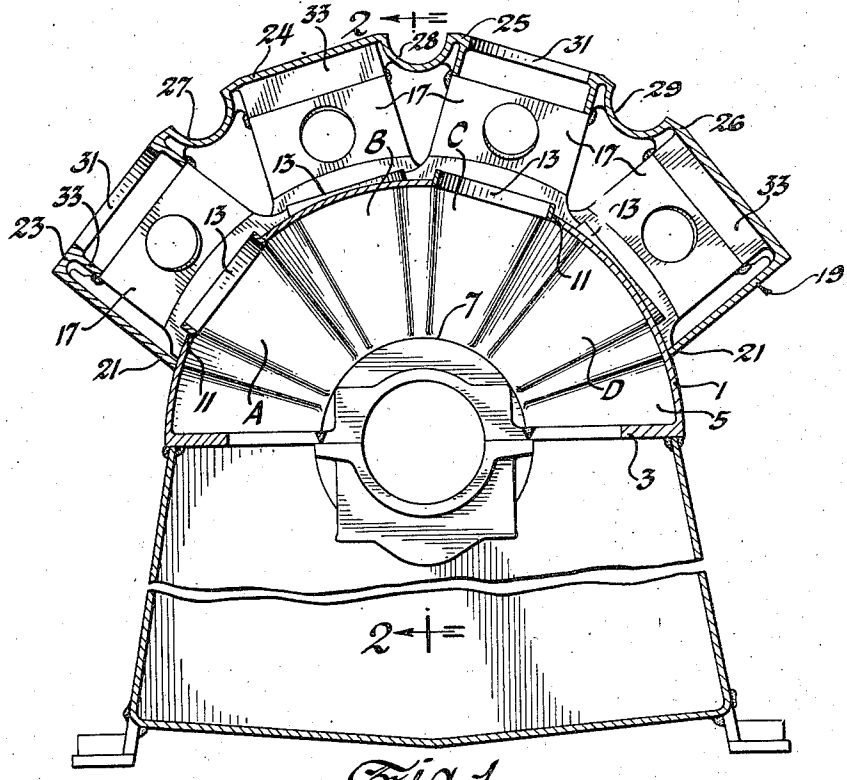


Fig. 1

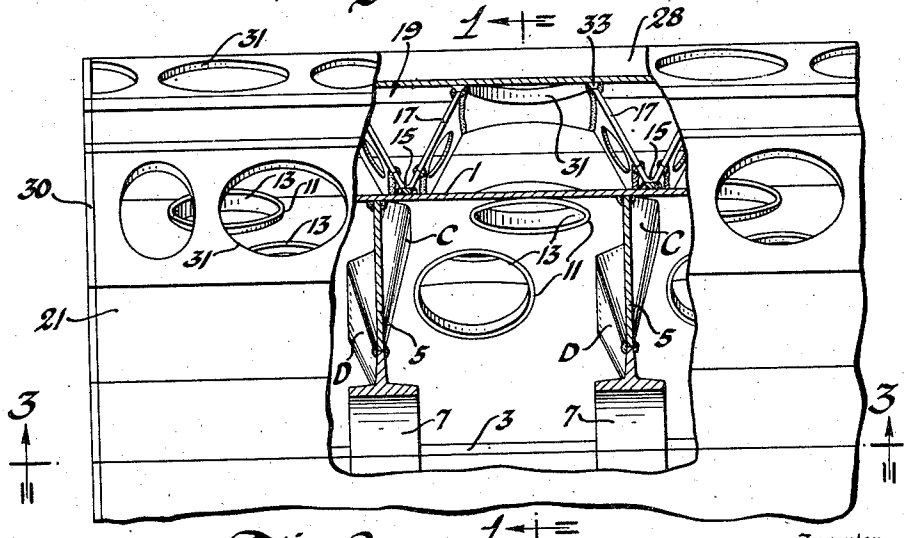


Fig. 2

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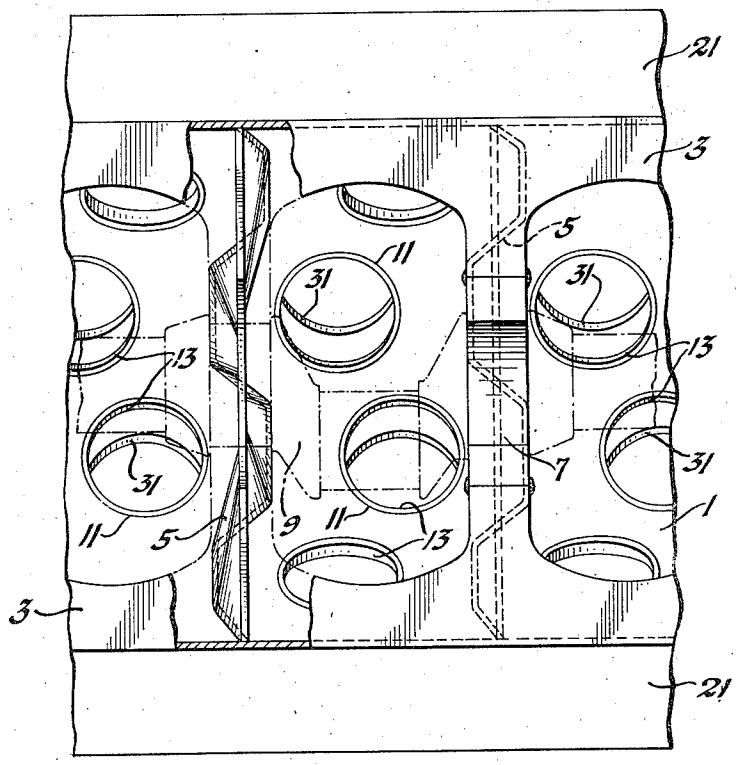


Fig. 3

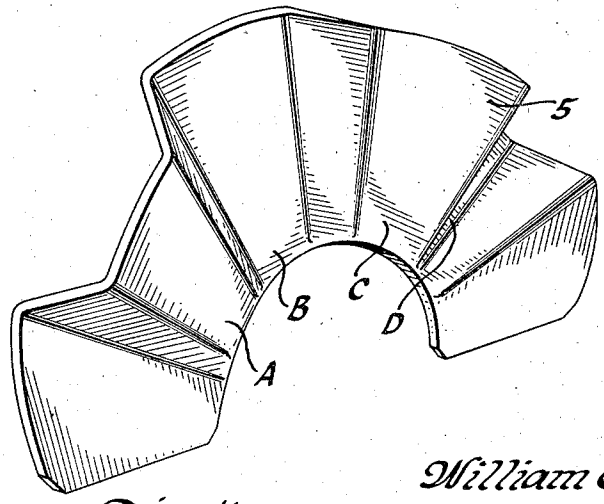


Fig. 4

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ENGINE CRANKCASE CONSTRUCTION

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7 Claims. (Cl. 121—194)

The present invention relates to internal combustion engines, more especially to a welded crankcase construction for engines of the multi-cylinder bank type.

In engines of the above type the cylinders and upper crankcase are usually cast en bloc and transverse webs are provided between each main crankshaft bearing and the cylinders of each bank whose conecting rods are connected to the crank throw between each main bearing to prevent deflection of the crankcase in the vertical, horizontal and longitudinal plane of the engine. These cast webs are of thick section in the longitudinal direction and the length of the engine is accordingly increased. In order to decrease the overall length and weight of the engine the cylinders of alternate banks are sometimes staggered but the difficulties in providing cast webs of suitable form to properly distribute the load between these staggered cylinders and the main bearings and to provide the necessary clearance therebetween for the crank throws and connecting rods does not materially decrease the length of the engine or its weight.

The principal object of the present invention is to provide a rigid light weight welded crankcase construction for a multi-cylinder engine in which the cylinders are arranged in a plurality of banks and the cylinders in adjacent banks may be greatly staggered to materially reduce the length of the engine and also the weight thereof.

The crankcase construction by which the above object is accomplished will be better understood by the reference to the following detailed description and drawings illustrating a construction for a light weight, multi-cylinder, compression ignition engine of the two stroke type having 4 banks of cylinders arranged at an angle for operating a single crankshaft, the cylinders of adjacent banks being arranged in staggered relation to reduce the length of the engine.

Figure 1 of the drawings is a transverse sectional view of the upper crankcase taken on line 1—1 of Figure 2.

Figure 2 is a longitudinal section taken on line 2—2 of Figure 1.

Figure 3 is a bottom plan view of the upper crankcase as indicated on line 3—3 of Figure 2.

Figure 4 is a perspective view of one of the corrugated webs welded between each main bearing and the upper portion of the crankcase.

Referring to Figures 1, 2 and 3 it will be observed that the upper crankcase is made up of a semi-cylindrical plate member 1 having diametrically extending flanges 3 and a plurality of longitudinal spaced corrugated web plates 5 extending transversely with respect to and welded to the inner surface of the member 1 and flanges 3. The corrugated web plates 5 are of generally semiannular shape as best shown in Figure 4. The outer semicircular corrugated edge of each web plate 5 is welded to the inner cylindrical surface of the member 1, and the upper half of the engine main bearings shown generally at 7 are welded to the central semicircular edge of the web plates 5 and also to the vertical edge of the flanges 3 of the member 1. The diametral edges of the web plates 5 are also welded to the upper diametrical surface of the flanges 3. The above described light weight welded upper crank is thus adequately reinforced against vertical, horizontal, transverse and torque stresses imposed by the forces between the engine cylinders, pistons and conecting rods not shown, and the crankshaft 9, shown in dash and dot lines in Figures 3, which is rotatably supported in the main bearings 7.

In order to rigidly fix the cylinder liners, not shown, to the crankcase the following means are employed; the semicylindrical crankcase member 1 is provided with a plurality of circular openings 11 arranged in 4 parallel longitudinal rows, the axis of the openings in each row extending radially with respect to the center line of the main bearings 7 and crankshaft 9, and in each of these openings 11 a cylinder liner mounting collar 13 is welded. The openings 11 in alternate rows are staggered as best shown in Figures 2 and 3, and four of these openings are located between adjacent transverse web plates. Each pair, of each of these four openings, located in alternate rows and between adjacent web plates 5 are displaced on opposite sides of a vertical transverse plane midway between the mid-plane of the adjacent web plates 5 a distance substantially equal to the one half the internal diameter of the cylinder liner collars 13. The web members as best shown in Figures 2, 3 and 4 have four corrugations A, B, C and D extending alternately on both sides of its mid-plane to points half way between the circular openings 11 in each of the four longitudinal rows. It will be noted that the outer edges of the corrugations A, B, C and D extend transversely with respect to the member 1 and are welded to the inner surface thereof at points midway between each of the openings 11. Transversely extending V shaped members 15, as best shown in Figure 2, are welded at their apex to the outer surface of the member 1 at points directly opposite to where

the corrugations A, B, C and D of each of the web plates 5 are welded to the inner surface of the member 1, and plates 17 extending transversely and in the plane of each leg of the V members are welded to each of these legs to act as stools for attaching a forged hollow air box member 19 to both the plates 17 and upper surface of the member 1. The air box member is provided with substantially radial side walls 21 which are welded to the outer surface of the member 1 and a top thin walled portion having four longitudinal extending bosses 23, 24, 25 and 26 separated by depressed portions 27, 28 and 29 serving as pockets for the engine camshafts, not shown. The opposite ends of the air box member 19 and the semi-cylindrical crankcase member are closed off by plates welded thereto, one of which 30 is shown in Figure 2. Each of the bosses 23, 24, 25 and 26 have outer plane surfaces normal to the radial axes of the openings 11 in each of the rows in the member 1 and are likewise provided with circular openings 31 extending therethrough in axial alignment with the four rows of circular openings 11 in the member 1. Inwardly extending flange portions 33 on the inner surface of the bosses 23, 24, 25 and 26 immediately adjacent the openings 31 are provided to which the upper edge of the plates 17 are welded, as best shown in Figures 1 and 2. The above crankcase construction enables insertion of cylinder liners through the aligned circular openings 13 and 31 in the member 1 and bosses 23, 24, 25 and 26 of the air box member 19 enables the upper portion of the liners and cylinder heads, not shown, to be attached directly to the bosses by any well known means so that the forces between the engine cylinders, pistons, connecting rods, and cranks operated thereby are equally distributed through the plates 17 and corrugations ABCD of adjacent transverse webs 5 to which the main bearings 7 are welded, even though the cylinder liners are staggered or offset longitudinally with respect to the main bearing 7 and webs 5. The above rigid, light weight crankcase construction for a multi-cylinder engine enables the connecting rods operated by the staggered cylinders located between adjacent webs 5 to be connected to one or more crank pins of the crankshaft located between the main bearings, and permits the forces between each staggered cylinder and its crank to be distributed equally between adjacent main bearings. The above structure likewise enables the length and weight of a two-stroke compression ignition engine to be reduced materially and provides an air box superstructure to be rigidly welded thereto for supporting the cylinder liners and the central portion of the web members not being corrugated allows the accessibility to the main bearing bolts and nuts and provides ample clearance for the crank throws of the crankshaft rotatable on either side of the webs.

I claim:

1. A crankcase for a multicylinder engine comprising a longitudinal plate member having a plurality of longitudinal rows of openings for engine cylinders, the openings in alternate rows being staggered, a plurality of transverse plate members having alternate corrugations at one edge thereof, said corrugations extending angularly outward from the mid-plane of the other edge of the transverse members, said alternate corrugations being secured to said longitudinal plate member midway between adjacent openings in each of said staggered rows of openings therein, and crankshaft bearings secured to the other edges of said transverse plate members.

2. A crankcase for a multicylinder engine comprising a longitudinal member of arcuate section having a plurality of longitudinal rows of cylinder openings, alternate rows of said openings being staggered and the axis of each opening extending radially with respect to said longitudinal member, transverse main bearing web plates having an arcuate outer edge with corrugations therein, the alternate corrugations of said web plates extending either side of the center plane thereof and secured to the inner surface of said longitudinal member midway between the adjacent openings in each of said staggered rows of openings therein.

3. A welded crankcase for a multicylinder engine comprising a crankcase plate of arcuate section having a plurality of staggered longitudinal rows of cylinder openings extending radially therethrough, a plurality of transversely extending webs having arcuate outer edges, said webs being spaced longitudinally with respect to said plate, main bearings welded to the central portion of each said webs, each of said webs being corrugated at the outer arcuate edge and the alternate corrugations therein, extending an equal distance either side of the central plane thereof and welded to the internal arcuate surface of said plate midway between adjacent cylinders opening in each of the staggered rows of openings in said crankcase plate.

4. A welded crankcase for a multicylinder engine comprising a crankcase plate of arcuate section having a plurality of staggered longitudinal rows of cylinder openings extending radially therethrough, a plurality of web plates spaced longitudinally with respect to said outer member, said web plates extending transversely with respect to said member and having an outer arcuate edge portion having corrugations welded to the inner surface of said outer member, the alternate corrugations of said web plates extending longitudinally an equal distance either side of the center transverse plane thereof, each of said alternate corrugations being welded to points in said arcuate member equi-distant between adjacent openings therein in each of said staggered rows of openings.

5. A welded crankcase for a multicylinder engine having a longitudinal member of arcuate section having a plurality of longitudinal rows of cylinder liner openings, the openings in alternate rows being longitudinally staggered and each opening extending radially through said arcuate member, a hollow member welded to the outer arcuate surface of said longitudinal member having a plurality of longitudinally extending cylinder liner support bosses, each of said bosses having cylinder liner openings in radial alignment with the openings in said longitudinal member and inwardly extending flanges adjacent said openings in each of said bosses, a plurality of transverse web members spaced longitudinally within said longitudinal member, each of said web members having an arcuate outer edge having corrugations therein which are welded to the inner surface of said arcuate member, the alternate corrugations extending in equal and opposite directions from the mid-plane of the web members and welded to points midway between the openings in each longitudinal row of openings in said longitudinal member, plate members welded between the upper surface of said longitudinal member, at points directly opposite that where the alternate

corrugations of said web members are welded, and the adjacent flanges of said hollow member, and main bearings welded to the central portion of each of said transverse web members.

6. A crankcase for a multicylinder engine comprising a crankcase member of arcuate section, a plurality of transverse main bearing webs longitudinally spaced with respect to said member, each of said webs having a corrugated arcuate outer edge portion, main bearings secured to the central portion of said webs, the corrugations of each of said webs extending longitudinally either side of the mid-plane of the central portion of said webs and secured to the inner arcuate surface of said crankcase member, a hollow cylinder liner support member secured to the outer arcuate surface of said crankcase member, said cylinder liner support member and said crankcase member having aligned openings therein extending radially with respect to the arcuate surface of the latter, the axis of each pair of said aligned openings being located longitudinally midway between the alternate corrugations of adjacent webs, and transverse plates secured to the upper arcuate surface of said crankcase member opposite that where said alternate corrugations of said webs are secured and also secured to points immediately adjacent the openings in the cylinder liner support member.

7. A welded crankcase for a multicylinder engine comprising an arcuate shaped crankcase member, a plurality of longitudinally spaced transverse bearing supporting webs of semiannular form having corrugations in the outer arcuate edges welded to the inner arcuate surface of said crankcase member, the alternate corrugations of said webs extending longitudinally either side of the mid-plane of the central portions of said webs, a crankshaft main bearing welded to the central portion of each of said webs, said arcuate crankcase member having a plurality of staggered circular openings extending transversely between adjacent webs, the axis of each opening extending radially with respect to said arcuate crankcase member and equidistant between adjacent alternate corrugations of adjacent webs, a hollow airbox welded to the outer arcuate surface of said crankcase outer member having circular openings in radial alignment with said openings in said crankcase member and plates welded transversely between the openings in said air box to points in the outer surface of said crankcase member directly opposite the points where the alternate corrugations of said web members are welded.

WILLIAM ELMER BRILL.