Sept. 1, 1959 C. B. LEACH 2,902,021

CYLINDER BLOCK

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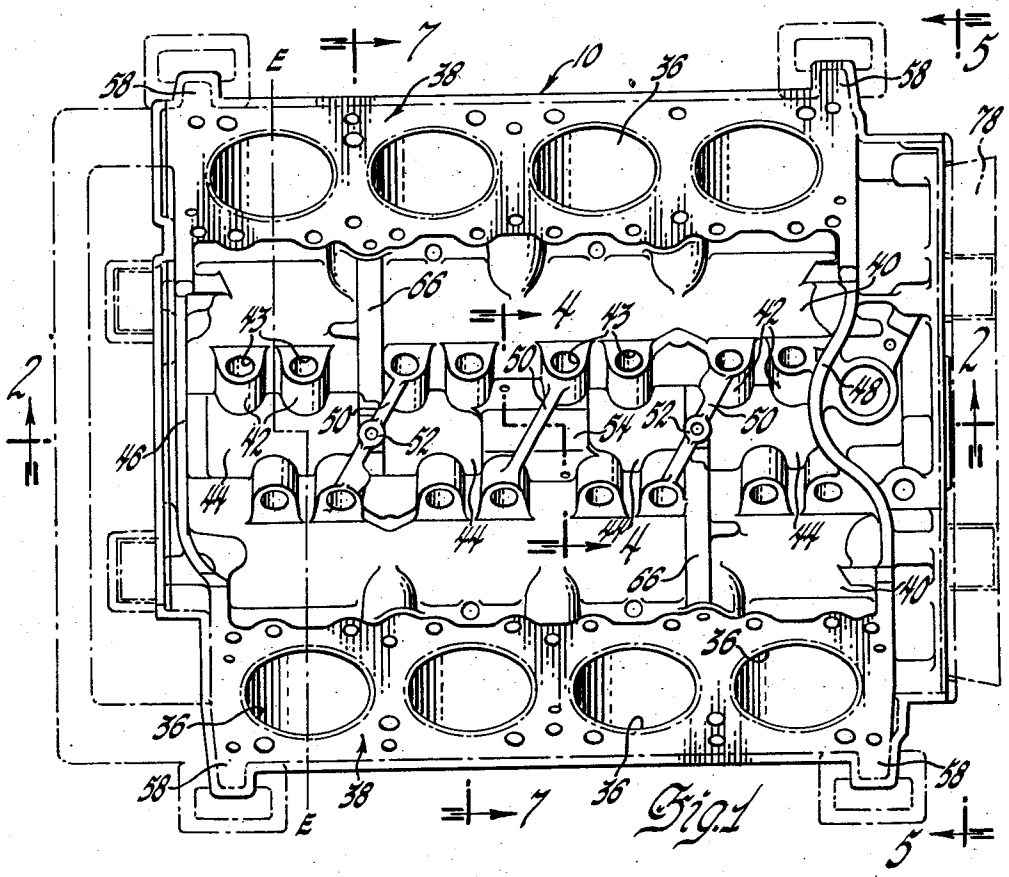


Fig. 1

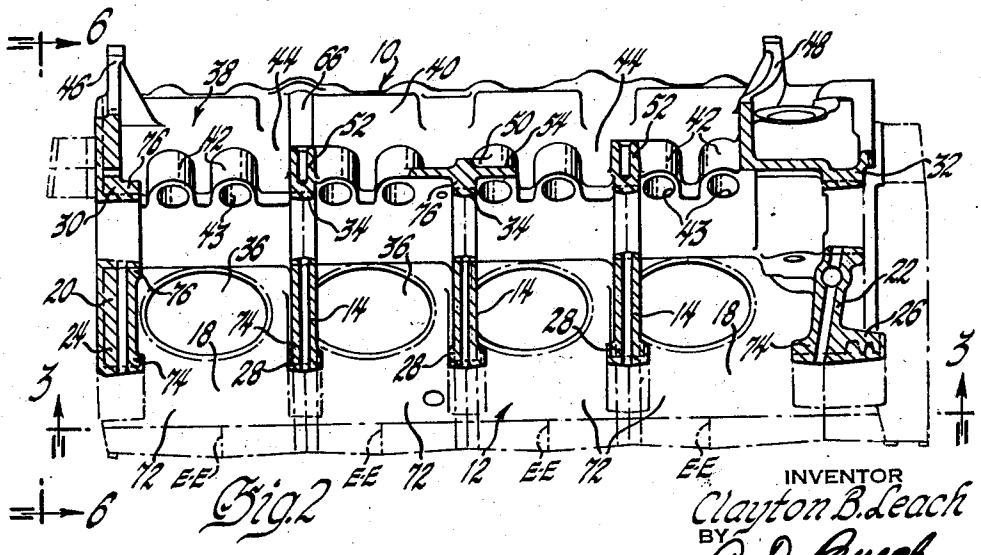


Fig. 2

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Sept. 1, 1959 C. B. LEACH 2,902,021

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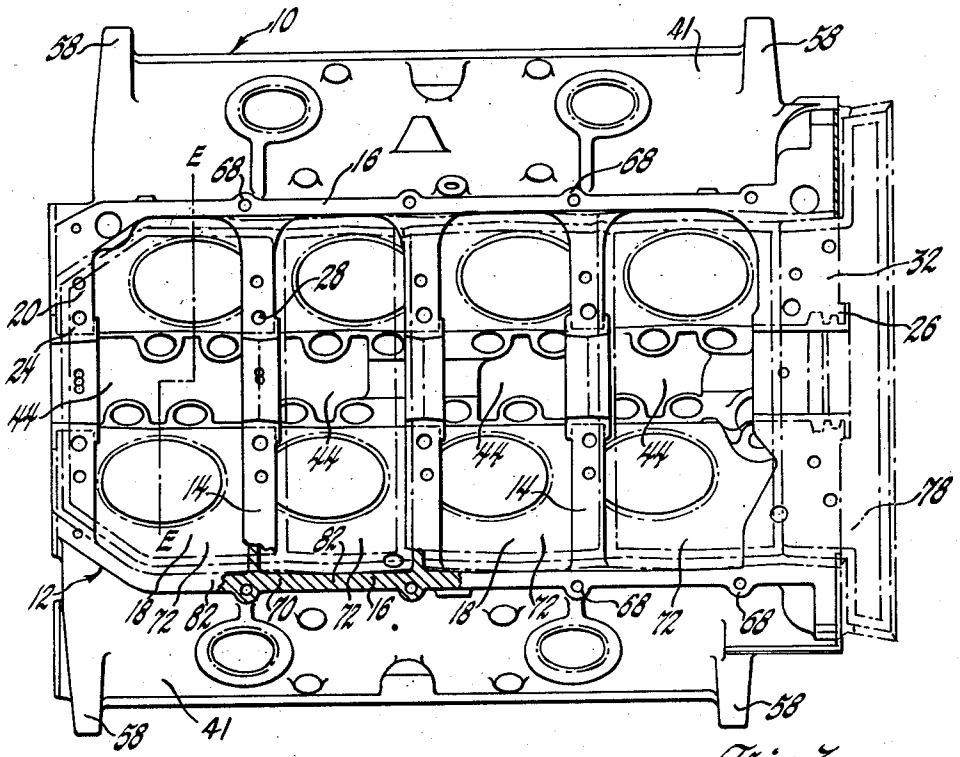


Fig. 3

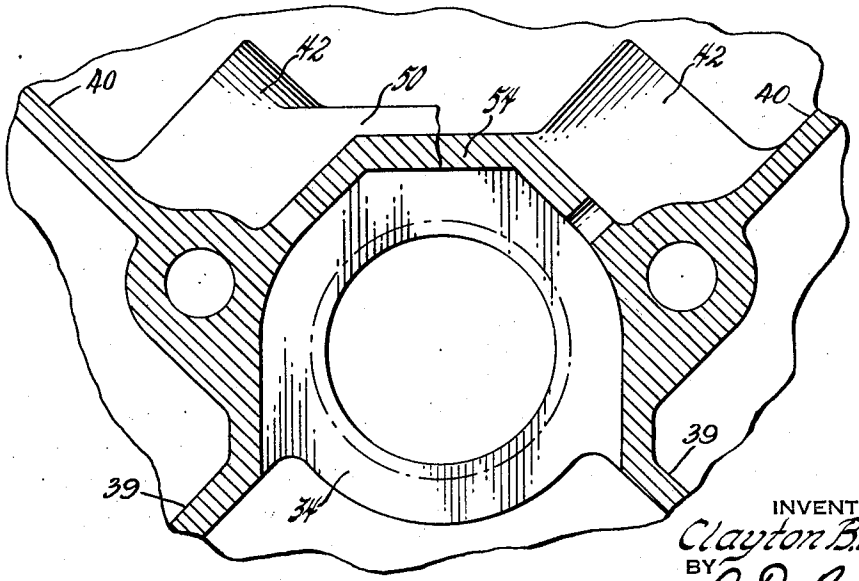


Fig. 4

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Filed Sept. 29, 1954 5 Sheets-Sheet 3

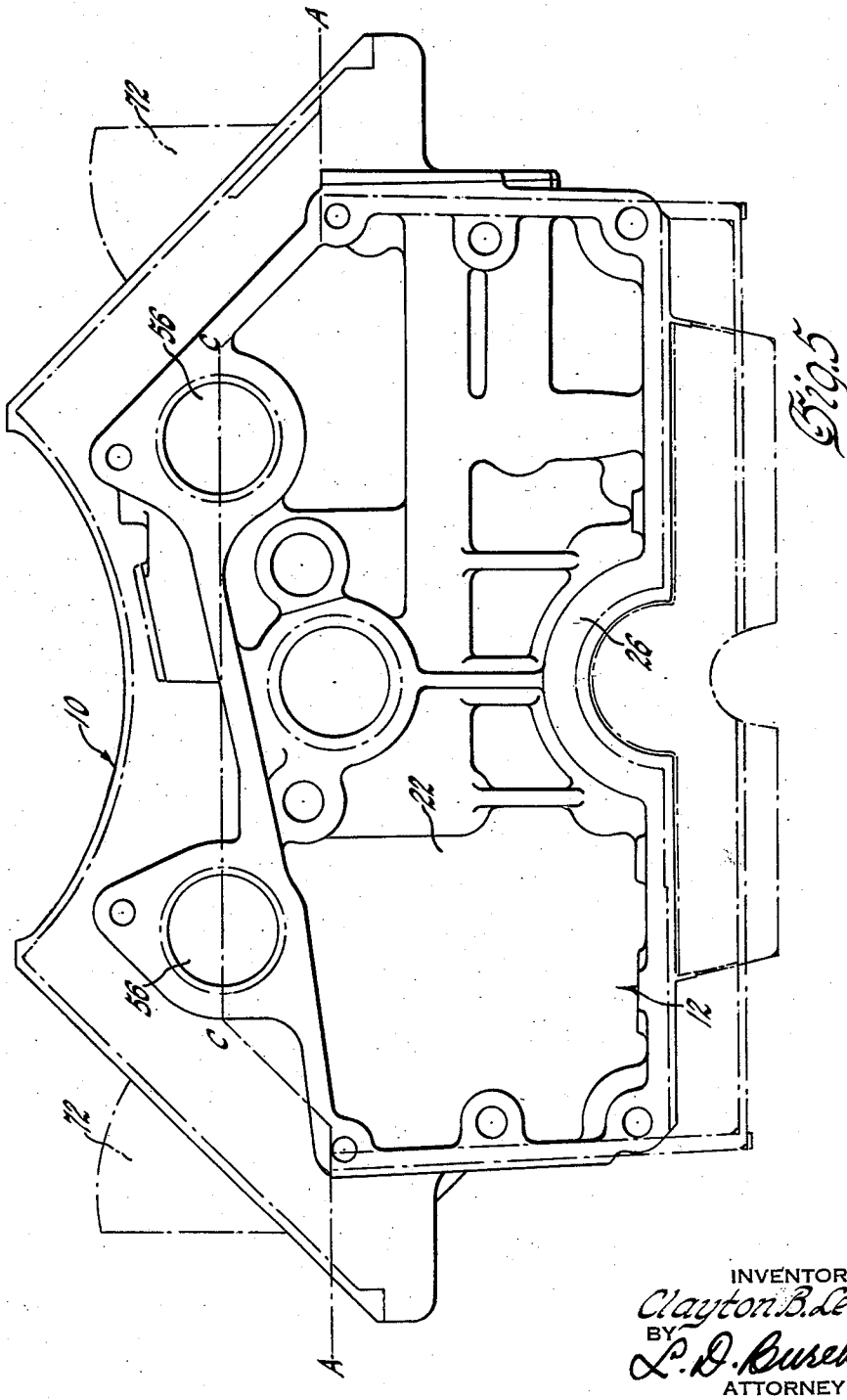


Fig. 5

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Sept. 1, 1959 C. B. LEACH 2,902,021

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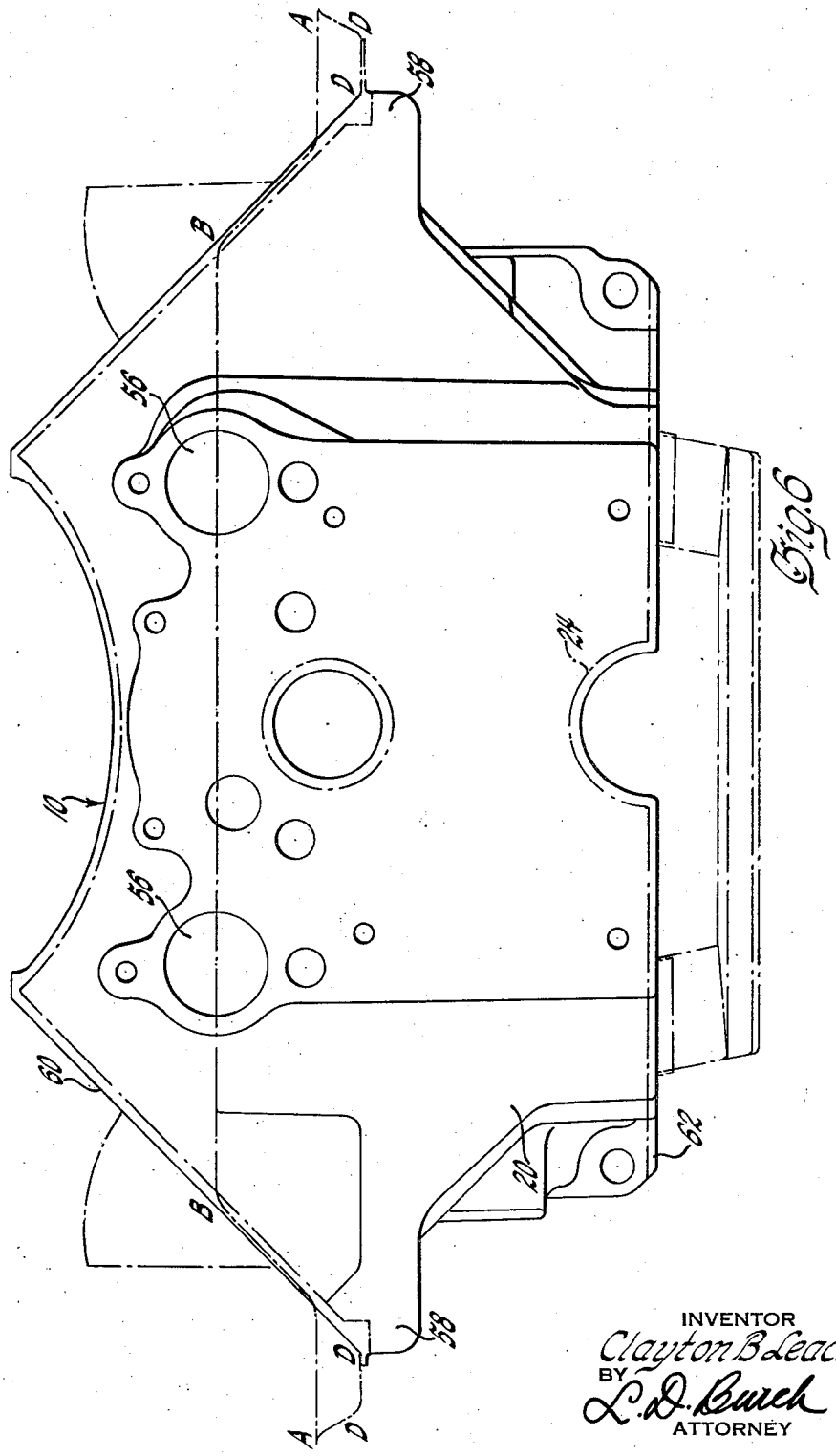


Fig. 6

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Sept. 1, 1959 C. B. LEACH 2,902,021

CYLINDER BLOCK

Filed Sept. 29, 1954 5 Sheets-Sheet 5

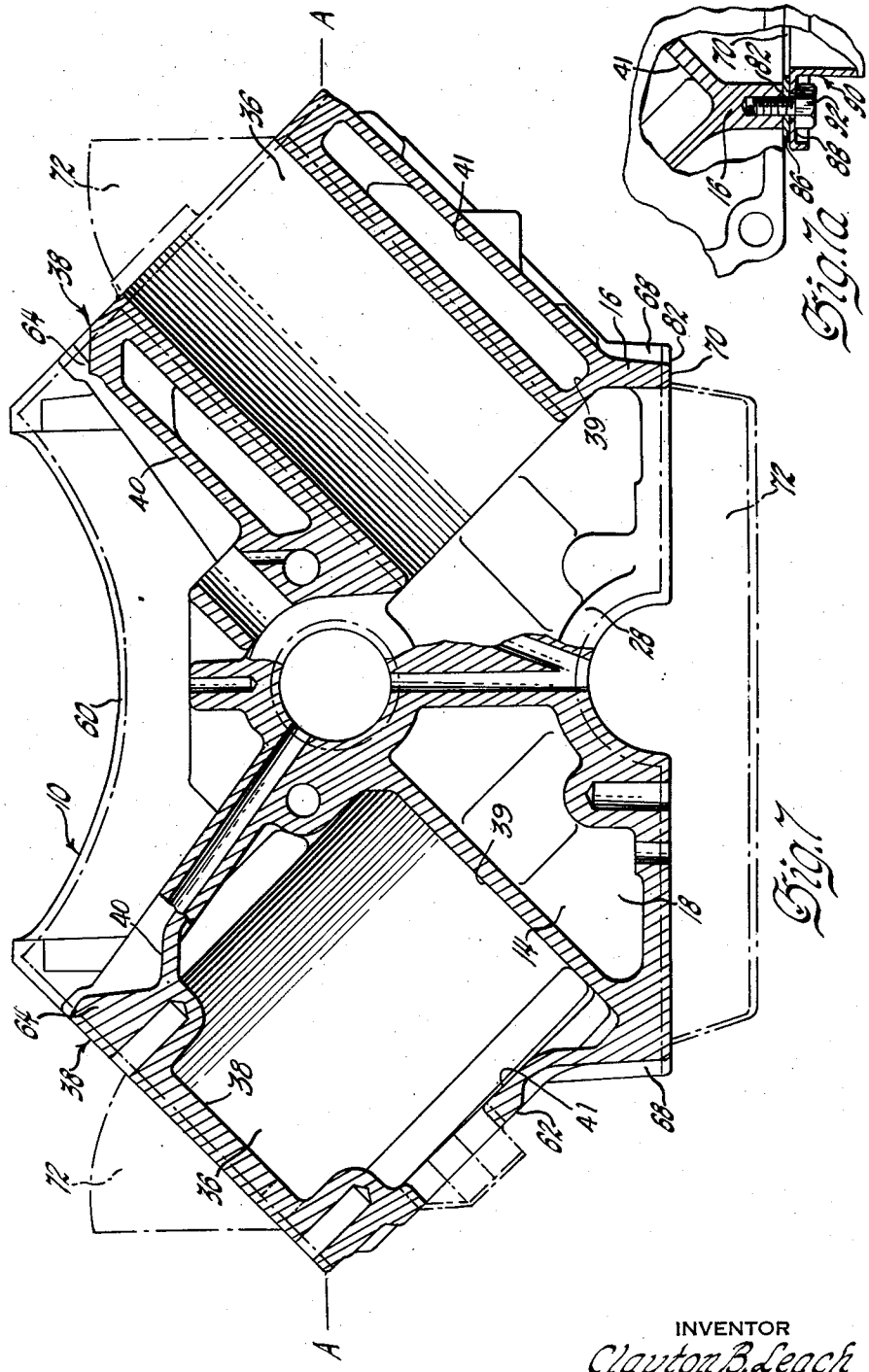


Fig. 1

Fig. 1a

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2,902,021

CYLINDER BLOCK

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Application September 29, 1954, Serial No. 459,143

10 Claims. (Cl. 123—195)

This invention relates to internal combustion engines and the like, and more particularly to an improved cylinder block for V-type and other engines.

It has been heretofore proposed to design cylinder blocks, with respect to the various projections extending therefrom, so that the blocks may be cast by different methods, including the method disclosed by U.S. application S.N. 339,098, now Patent No. 2,783,510 filed February 26, 1953 in the name of Dolza et al.

The purpose of the heretofore proposed cylinder block design may be considered to be twofold. First, it is suggested that the projections and depressions embracing the exterior surfaces of the block may be designed in a manner so that cores are not necessary in shaping the exterior of the block and so that the pattern of the complete exterior of the block may be removed from the cope and drag molds. Second and contrary to previously employed methods of coring a cylinder block, the heretofore proposed design contemplates making the projections and depressions embracing the interior surfaces of the block so that a single core may be employed for each crankthrow compartment and associated cylinder cavity, with the core mold parting lines lying in planes passing transversely through the block and through the axes of the cylinders. In other words, the heretofore proposed design teaches that the surfaces of the projections and depressions embracing the various internal and external walls of the block need not and should not have reentrant angles or pockets with respect to any direction of separation of block or core molds.

This invention contemplates a block structure having projections and depressions so formed that the block may be cast by any desired method, including the method described above. However, the proposed block has additional improvements over blocks previously known. These improvements further facilitate the ease and economy with which such blocks may be made, regardless of the method of casting or other means of fabricating the same.

For example, it has been the usual practice in cylinder block construction to provide relatively deep side walls for the crankcase portion of the block, with a bolting flange extending laterally from the free ends of these walls to which an oil pan may be attached. These deep walls and the bolting flange thereon were thought essential to provide sufficient strength to the crankcase portion of the block, and to the block structure generally, which may be likened to a beam. Numerous bolts were used in securing the oil pan to the bolting flange in order to insure sufficient unit pressure on the oil pan gasket. However, the high side walls on the crankcase portion of the block result in an engine that is too high for the modern automobiles having low profiles, and the numerous oil pan securing bolts increase the cost of assembling the engine.

It has been found that it is not necessary to provide these high side walls for the crankcase portion of the block, and this constitutes one of the improvements of the proposed block over previous cylinder block structures. One reason why this is possible is that the upper portions of the block and other portions of the engine, such as the manifolds, subsequently applied to the block may be constructed in a manner to add sufficient strength in any direction to the block. Further, it has been found that it is not necessary to provide an oil pan bolting flange extending laterally, either inwardly or outwardly, from the free ends of the crankcase walls. This constitutes a second advantage of the proposed block over blocks now used or known. Some of the metal formerly comprising such a bolting flange may be added to the crankcase side walls to provide shorter, thicker walls, which additional thickness will then sufficiently increase the strength of the shorter side walls. Since the side walls at the oil pan line thus present a considerably narrower surface to the oil pan gasket than when a bolting flange is provided, the unit pressure on the oil pan gasket will be sufficient with the use of fewer bolts. This reduction in the number of bolts, which is a third advantage of the proposed block, has made it possible to provide less prominent bolt-receiving bosses on the thicker crankcase side walls, with the bosses being located only at the junction of the side walls with the transverse walls in the block forming the separate crankthrow compartments.

The thicker side walls permit still other advantages over the heretofore proposed block design discussed above and relating to the projections extending from the surfaces of the block. Not only may the usual but lesser number of bolting bosses at the oil pan line be made less prominent by locating the same at or near the junctions of the transverse walls in the crankcase portion of the block with the side walls thereof where there is more metal area due to the increased thickness of the side walls, but the bosses may be eliminated entirely where these side walls are made sufficiently thick to permit satisfactory location of the bolt hole. Thus the necessity of adding metal to fill in reentrant recesses between bosses and adjacent walls, as taught by the herefore proposed design, is either minimized or entirely eliminated, at least as far as these particular projections are concerned. This is equally true whether the less prominent bosses are provided in the interior or exterior sides of the crankcase side walls.

Still another advantage of the proposed block is the absence of a continuous top wall extending between the cylinder portions thereof. This provides a greater area on which the green sand in the cope mold may be supported by the inner cores in the event that the method of casting described in the above identified application is used. It also eliminates considerable metal in the block and thereby reduces ultimate engine weight.

The absence of the usual top wall need not weaken the cylinder block structure, however, if suitable members are provided connecting the cylinder portions thereof. In the proposed block structure, a wider tie or structural member extending between the inner walls of the cylinder portions is provided above the central transverse wall of the crankcase portion of the block. To further strengthen the crankcase transversely, additional stiffening ribs or tie members are provided at the top of each of the other transverse walls dividing the crankcase into the separate crankthrow compartments. These latter stiffening ribs extend diagonally of the block between pairs of oppositely disposed and offset push rod guide bosses and can thus be made shorter and more compact than if they extended transversely of the block.

The proposed block structure contemplates reducing the thickness of the rear end wall of the block to a minimum where possible to save metal and weight and so that a minimum of subsequent machining of such

wall will be required. The rear wall of the block therefore contains depressions, as around the rear bearing support, which may be provided by utilizing a rear end slab core if the casting method heretofore proposed and described above be employed. This end slab core does not interfere with the placement of the other cores, however, and the rear end projections on the block may be shaped so that the slab core may be just as easily made as the other cores.

These and other advantages of the proposed block will become evident when the structure is further considered in greater detail.

In the drawings:

Figure 1 is a top plan view of a cylinder block embodying the invention. In Figure 1 and the succeeding figures, core and mold lines are represented lines. The solid lines represent the as-cast surfaces of the block, while broken lines running parallel to and spaced from solid lines represent subsequently machined surfaces of the block.

Figure 2 is a longitudinal cross-section view taken on the plane of line 2—2 of Figure 1 and looking in the direction of the arrows.

Figure 3 is a bottom plan view of the block shown by Figures 1 and 2. Figure 3 is taken in the plane of line 3—3 of Figure 2 and looking in the direction of the arrows.

Figure 4 is a fragmentary transverse cross-sectional view taken in the plane of line 4—4 of Figure 1 and looking in the direction of the arrows.

Figure 5 is an end elevational view taken in the plane of line 5—5 of Figure 1 and looking in the direction of the arrows.

Figure 6 is an end elevational view taken in the plane of line 6—6 of Figure 2 and looking in the direction of of the arrows.

Figure 7 is a transverse cross-sectional view taken in the plane of line 7—7 of Figure 1 and looking in the direction of the arrows.

Figure 7*a* is an enlarged fragmentary view partly in cross-section illustrating in detail the structure of the crankcase side walls of the block and the manner of securing the oil pan thereto.

Referring to the drawings in greater detail, a cylinder block **10** embodying the invention comprises a block for a V-type engine having eight cylinders. However, in regard to various individual features thereof, the proposed block **10** may just as well comprise a block for any type of engine, such as in-line engine having any desired number of cylinders for example. The proposed block has the usual crankcase **12** having transverse walls **14** therein extending between the side walls **16** and dividing the crankcase into separate crankthrow compartments **18**. The transverse walls **14** and the end walls **20** and **22** of the block are formed according to normal practice to provide end main bearing supports **24** and **26** and intermediate main bearing supports **28**, as well as end camshaft supports **30** and **32** and intermediate camshaft supports **34**. The block may have the usual rows of cylinders **36** extending obliquely from the crankcase **12**, with the cylinders **36** being slightly offset in a direction lengthwise of the cylinder block. The rows of cylinders **36** may have outer upper or outer end walls **38**, lower or inner end walls **39**, inner side walls **40** and outer side walls **41**. The outer side walls **41** extend from and form continuations of the side walls **16** of the crankcase **12**. The front and rear walls **20** and **22** of the block **10** also provide the front and rear end walls for the rows of cylinders **36**. Extending from the inner side walls **40** of the rows of cylinders **36** are pairs of annular bosses or projections **42** having subsequently machined therein axial openings **43** which constitute guides for the valve lifters.

It will be noted that the inner side walls **40** of the rows of cylinders **36** are not connected by a top wall of the crankcase **12** extending between these inner side walls of the rows of cylinders **36** but that these inner side walls are separated by substantial openings **44** running lengthwise of the cylinder block between the front end wall **20** of the block which may be extended upwardly to provide a laterally extending web or stiffening rib **46** for the front of the block. A similar laterally extending web or stiffening rib **48** spaced somewhat inwardly from the rear wall **22** of the block is also provided.

In any method of casting blocks it has usually been thought necessary to suitably prevent upward floatation of the crankcase cores by the green sand in the cope half of the mold, and where the usual top wall connecting the inner walls of the cylinder portions has been provided, necessary openings of limited size have resulted in this top wall due to portions of the cores forming the inner cavities of the cylinder block extending upwardly from such inner cavities. The relatively large openings **44** in the upper part of the crankcase **12** considerably reduce the amount of metal in the block and provide greater area for the prevention of core floatation.

Openings **44** at the top of the crankcase **12** in addition to providing the advantages mentioned above, necessarily weaken the cylinder block structure to some extent in a transverse direction, and it is therefore necessary to provide stiffening members or ribs, in addition to the end ribs **46** and **48** already mentioned, to make up for the absence of the usual top wall. Such transverse strengthening may be accomplished by the use of a number of different structural members which will now be pointed out in detail and some of which constitute further novel features of the proposed block.

One type of transverse support for the block are the ribs or struts **50** extending diagonally between the offset push rod guide bosses **42**. These struts are tied in with the lower portion of the block in that they are formed integrally with the top of the transverse walls **14**, and they are shortened and strengthened by the fact that they extend from the offset bosses **42**. The two outermost of the struts **50** are provided with enlargements **52** adapted to be subsequently drilled or tapped to receive threaded fasteners to secure a cover for the chamber thus formed between the rows of cylinders **36**. It has already been pointed out that the end wall **20** at the front of the block is extended upwardly to provide a laterally extending web **46**, and that a similar laterally extending web **48** is provided at the top of the rear of the block. Another stiffening member for the cylinder block **10** is the platelike web **54** joining the inner walls **40** of the rows of cylinders **36** near the center thereof, with the web **54** extending both rearwardly and forwardly from the central transverse wall **14**. This web is best shown by Figure 4, which also indicates that the web **54** may have an arched shape and may be formed integrally with the central transverse wall **14** and the central diagonally extending stiffening rib **50**.

In the drawings the mold parting lines and the cores for the particular casting method previously referred to are indicated by broken lines. In this connection it will be noted that the cylinder block mold parting line lies generally on a horizontal plane extending through the widest portion A—A of the block, as shown by Figure 7. Exceptions may be made at localized areas, such as at lines B—B and C—C to include the prints for the water jacket cores **56** and at line D—D to include the machining locating pads **58** at the corners of the block. This location of the mold parting line indicates that a block such as the one proposed may be cast in a manner so that the green sand cope **60** and drag **62** molds may form the entire outer surfaces of the cylinder block without the use of external cores. To facilitate such a method, it is to be noted that as to the projections extending from the exterior of block **10** in either half of the block above or below the block mold parting line, except the pro-

jections on the front and rear faces of the block, are formed in a manner to eliminate any reentrant recesses which would prevent the removal of a pattern representing the complete as-cast surface of the block from the mold. This general condition of the design of the various projections is evident from an examination of typical prominent projections such as the transverse end webs **46** and **48**, diagonal ribs **50**, valve lifter guide bosses **42**, cylinder end flanges **64**, camshaft lubricant passages **66**, and the central platelike web **54** on the top half of the block and the downwardly extending crankcase **12** in the lower portion of the block, including the bolt receiving bosses **68** at the oil pan line **70**.

As to the interior of the proposed cylinder block, it will be noted that the block **10** may be cast by the use of single cores **72** forming each of the separate crankthrow and associated cylinder cavities, with the mold parting line E—E for the cores **72** passing through the axes of the individual cylinders **36** and transversely of the block near the center of the separate crank throw compartments **18**. To facilitate this method of casting it will likewise be apparent that the surfaces of the projections such as the various flanges **74** and **76** surrounding the main bearing and camshaft supports and the slope of the inside surfaces of the side walls **82** are formed so that the above cores may be freely removed from core molds having parting lines as described above. Though the proposed cylinder block may be cast by the above described method, it is emphasized that the structure, both internal and external, of the proposed block **10** is such that the block may be cast by any desired method, and that it is in no way limited to the above described method or any other method.

It is to be noted, however, that whatever method of casting is employed, the metal in the rear wall **22** of the block and the amount of subsequent machining thereof may be reduced to a minimum by the use of a slab core **78** to form the rear end of the block with reentrant recesses immediately around the rear main bearing support **26** and at other portions thereof. Considerable savings may be made in this manner, despite the use of the extra core. Such a slab core may be inserted into the drag mold **62** without interfering with the placement of the other cores and, in addition, provides more suitable prints **80** for receiving the ends of the water jacket cores **56**.

It is further apparent from Figures 2, 5, 6, and 7 that prints may be provided in the greens and drag mold **62** to accurately position the internal cores **72** and the end slab core **78** at the bottom of the drag mold.

Another important novel feature of the proposed cylinder block involves the free edges **82** of the side walls **16** of the crankcase **12** of the block at the oil pan line **70**, as best shown by Figures 7 and 7*a*. As described above, it has been found that it is not necessary to provide the usual high side walls for the crankcase portion of the cylinder block but that relatively short side walls **16** may be provided which permit the advantage of a considerably more compact final engine assembly having a considerably shorter vertical dimension. Closely associated with this advantage is still another advantage to be gained by removing the usually laterally extending oil pan bolting flange at the bottom of the crankcase. Thus some of the metal which ordinarily constitutes such a flange may be employed to provide crankcase side walls **16** having a thickness greater than the average wall thickness of the block, which thicker wall has been found to provide sufficient strength to provide a rigid block structure. As shown by Figure 7*a*, the oil pan gasket **86** between the bolting flange **88** on the oil pan **90** and the free edges **82** of the crankcase side walls has lesser pressure or sealing area than if a wider bolting flange were provided on the crankcase side walls. With the use of this lesser area and with the same number of oil pan securing bolts **92** as previously employed, the unit pressure on the gasket **86**, and thus the sealing effect of the gasket, would be greater than that heretofore provided. However, the higher sealing pressure is not necessary, and it is therefore apparent that the narrower free edges **82** at the oil pan line permit the use of fewer oil pan securing bolts **92**. This further permits the use of fewer less-prominent bosses **68** located only at the junctions of the transverse walls **14** with the side walls **16** of the crankcase **12** where there is already more metal, with the resulting advantage of quicker more economical assembly of the oil pan **90** to the crankcase **12**. The bosses **68** may be provided at the outside of the crankcase side walls **16** which eliminates the necessity of providing a core to form such bosses at the inside of the crankcase walls and which permits the easier removal of the cores **72** from the cylinder block casting.

From the foregoing description and drawings it is apparent that there has been provided a cylinder block which may not only be cast by any known method, but which may be cast more easily and economically regardless of the method of casting.

What is claimed is:

1. A cylinder block for V-type engines and the like, comprising a hollow body having a crankcase portion and spaced cylinder portions having adjacent sloping walls, said crankcase portion terminating in walls of sufficient thickness to receive means for securing an oil pan to said crankcase portion, said cylinder portions being separated by spaced non-circular openings at the top of said crankcase portion and between said adjacent walls, spaced rows of oppositely disposed and offset pairs of valve lifter guide bosses protruding from said adjacent walls of said cylinder portions and partially defining the edges of said spaced openings between said adjacent walls of said cylinder portions, and structural members extending diagonally between said oppositely disposed and offset pairs of said push rod guide bosses, said members further defining said spaced openings.

2. A cylinder block for V-type engines and the like, comprising a hollow body having a crankcase portion and spaced cylinder portions, said crankcase portion terminating in walls of sufficient thickness to receive means for securing an oil pan to said crankcase portion, said cylinder portions being separated by spaced non-circular openings at the top of said crankcase portion and between said adjacent walls, spaced rows of oppositely disposed and offset pairs of valve lifter guide bosses protruding from said adjacent walls of said cylinder portions and partially defining the edges of said spaced openings between said adjacent walls of said cylinder portions, structural members extending diagonally between said oppositely disposed and offset pairs of said valve lifter guide bosses, said members further defining said spaced openings, and a single additional tie member integrally associated with one of said structural members and extending between said cylinder portions.

3. A cylinder block such as that defined by claim 1 and further characterized by said hollow body having projections extending from the exterior surfaces thereof, all of said projections except those extending from the rear end surface of said body increasing in cross-section as the cross-sectional planes parallel to horizontal reference planes passing through the widest portion of said body approach said reference planes.

4. A cylinder block such as that defined by claim 1 and further characterized by said hollow body having projections extending from the interior surfaces thereof, all of said projections decreasing in cross-section as the cross-sectional planes parallel to vertical transverse reference planes passing through the axes of the cylinders in said cylinder portions approach said reference planes.

5. A cylinder block for V-type engines and the like, comprising a hollow body having a crankshaft receiving portion and spaced cylinder portions having adjacent sloping walls, said cylinder portions and said adjacent sloping walls extending obliquely from said crankshaft receiving portion, said crankshaft receiving portion terminating in walls of sufficient thickness to receive means for securing

an oil pan to said crankcase portion, said cylinder portions being separated by spaced non-circular openings at the top of said crankshaft receiving portion and between said adjacent walls, spaced camshaft supporting means including central camshaft supporting means extending lengthwise of said body between said cylinder portions and said adjacent walls, spaced rows of valve lifted guide bosses protruding from said adjacent walls of said cylinder portions and partly defining the edges of said spaced openings, stiffening ribs extending diagonally between oppositely disposed and offset pairs of said valve lifter guide bosses, said ribs further defining said spaced openings, and a single additional tie member integrally associated with the central rib of said diagonal stiffening ribs and extending between said cylinder portions and covering said central camshaft supporting means.

6. A V-type cylinder block for internal combustion engines and the like, comprising a hollow body having a lower crankcase portion and cylinder portions extending obliquely from said crankcase portion, said crankcase portion being open at the bottom thereof and having side walls extending the length thereof and spaced lateral walls connecting said side walls intermediate the ends thereof to provide separate crankthrow compartments, said lateral walls being formed to provide lower main bearing and upper camshaft supports, said cylinder portions each having spaced outer and inner walls extending the length of said body, said inner walls being substantially spaced from one another at the edges thereof adjacent said camshaft supports to provide an elongated opening at the top of said crankcase portion and between said cylinder portions, said crankcase and said cylinder portions being enclosed at the ends thereof by walls constituting the end walls of said body, a portion of the front wall of said end walls extending beyond said cylinder portions to provide a substantial stiffening rib between said cylinder portions, spaced rows of valve lifter guide bosses extending from said inner walls of said cylinder portions, other stiffening ribs extending diagonally across said elongated opening between offset pairs of said valve lifter guide bosses, and an additional tie member extending between said inner walls of said cylinder portions, said tie member being integrally associated with one of said diagonal stiffening ribs and extending from both sides thereof to partially cover said elongated opening near the center thereof.

7. A cylinder block for V-type internal combustion engines and the like, comprising a hollow body including an upper cylinder portion having rows of spaced cylinders and a lower crankcase portion having side walls and transverse walls, said transverse walls extending between said side walls to provide separate crankthrow compartments, said side walls being of substantially greater thickness than the average wall thickness of said body and of slightly lesser thickness at the oil pan line thereof than at any other portion thereof and said side walls having wider portions at the outside surfaces thereon only at points opposite the junctions of said transverse walls with said side walls.

8. A cylinder block for V-type internal combustion engine, comprising a hollow body having a lower crankcase portion having side walls and transverse walls extending between said side walls to divide said crankcase portion into separate crankthrow compartments, said transverse walls being formed to provide main bearing and camshaft supports, spaced cylinder portions extending obliquely from said crankcase portion and having spaced cylinder openings therein communicating with said separate crankthrow compartments, and different other projections extending from the external and internal surfaces of said body, all of said projections extending from the exterior surfaces of said body except at the rear end face thereof increasing in cross-section as the cross-sectional planes parallel to horizontal reference planes passing through the widest portion of said body approach said horizontal reference planes, said projections extending from said rear face of said body sometimes decreasing in cross-section with respect to said reference planes, and all of said projections extending from the interior surfaces of said body decreasing in cross-section as the cross-sectional planes parallel to vertical transverse reference planes passing through the axes of said cylinder openings approach said vertical reference planes.

9. A cylinder block for internal combustion engines and the like and comprising, a hollow body including an upper cylinder portion and a lower crankcase portion, said upper cylinder portion having a row of spaced cylinders therein, said lower crankcase portion having side walls and transverse walls therein extending downwardly from said upper cylinder portion, said transverse walls being formed to extend between said side walls to provide crankthrow compartments in said lower crankcase portion, said side walls being formed to provide bolt receiving bosses extending across and projecting from the outer side surfaces of said side walls and outwardly of said crankthrow compartments, said bolt receiving bosses being formed to extend outwardly of said side walls substantially to the same extent from said cylinder portion to the lower edges of said side walls, said side walls and certain of said transverse walls and said bolt receiving bosses being formed to terminate in a common and continuous lower edge forming an opening in said lower crankcase portion and over which an oil pan is adapted to be secured, said side walls and said certain of said transverse walls and said bolt receiving bosses being not greater in thickness adjacent said edges than between said edges and said cylinder portion.

10. A cylinder block for an internal combustion engine and the like and comprising, a hollow body including an upper cylinder portion and a lower crankcase portion, said side upper cylinder portion having a row of spaced cylinders therein, said lower crankcase portion having side walls and transverse walls therein extending downwardly from said upper cylinder portion, said transverse walls being formed to extend between said side walls to provide crankthrow compartments in said lower crankcase portion, said side walls being formed to provide bolt receiving bosses extending across and projecting from the outer side surfaces of said side walls and outwardly of said crankthrow compartments, said bolt receiving bosses being formed in said side walls in opposed relation to said transverse walls and to provide in said lower crankcase portion approximate continuations of said transverse walls outwardly of said side walls, said side walls and certain of said transverse walls and said bolt receiving bosses being formed to terminate in a common and continuous lower edge forming an opening in said lower crankcase portion and over which an oil pan is adapted to be secured, said side walls and said certain of said transverse walls and said bolt receiving bosses being not greater in thickness adjacent said edges than between said edges and said cylinder portion.

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