

Dec. 20, 1949

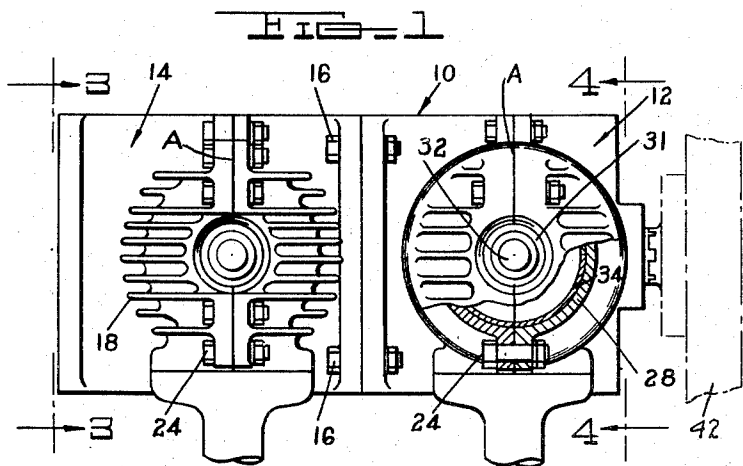
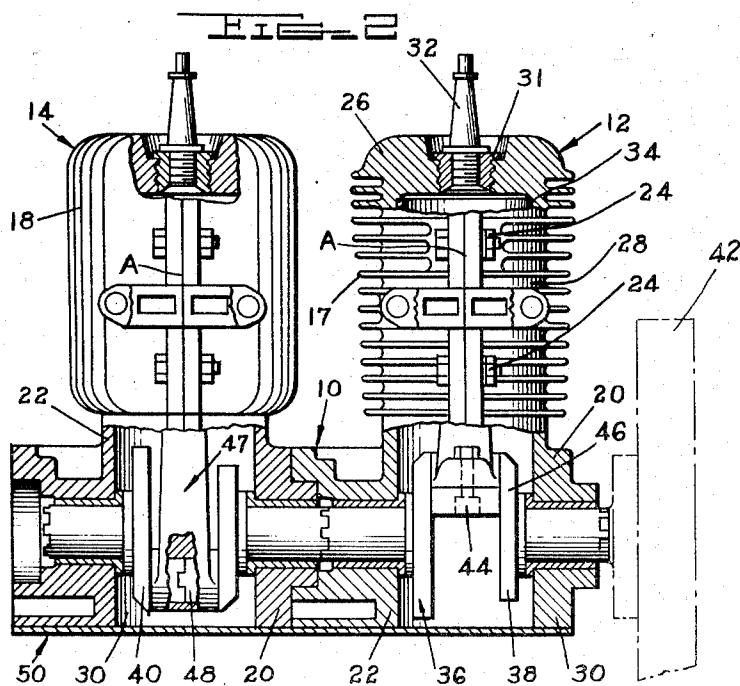
C. VOORHIES

2,491,630

ENGINE CONSTRUCTED OF SECTIONS BOLTED TOGETHER
ALONG VERTICAL PLANE TO FORM AN ENTIRE
HEAD, BLOCK, AND CRANKCASE THEREOF

Filed Aug. 5, 1946

3 Sheets-Sheet 1



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FIG. 3

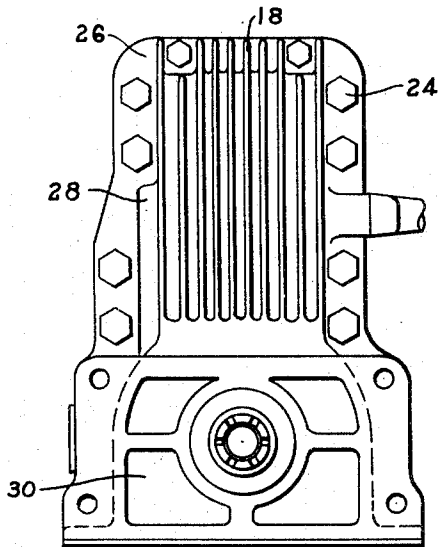


FIG. 4

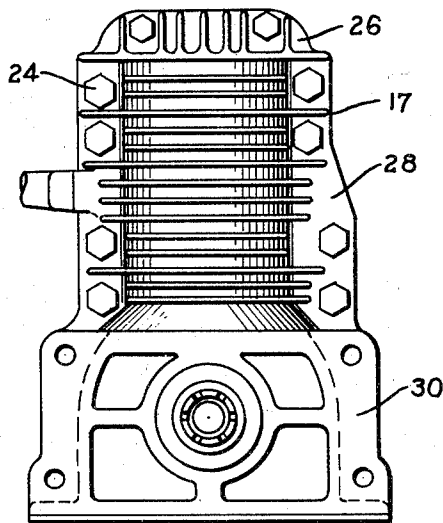


FIG. 5

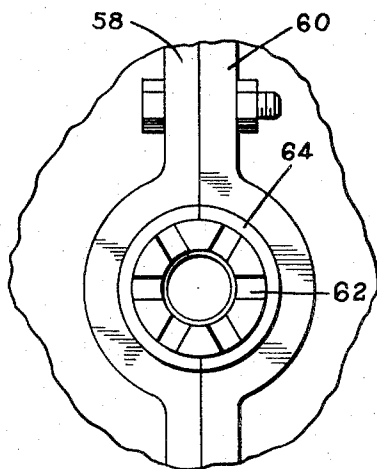
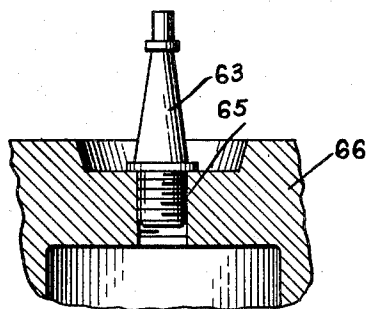


FIG. 6



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FIG. 7

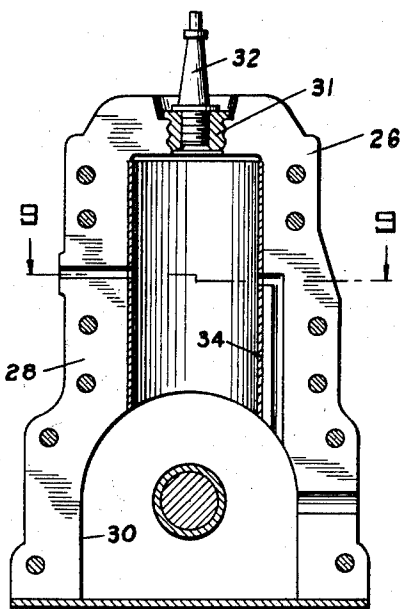


FIG. 11

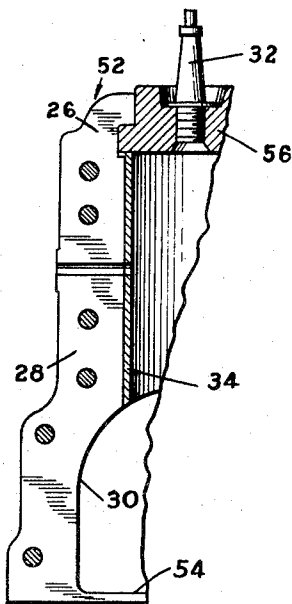


FIG. 8

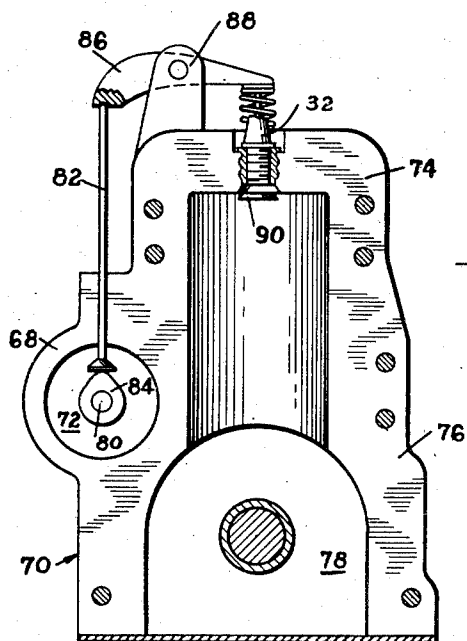


FIG. 10

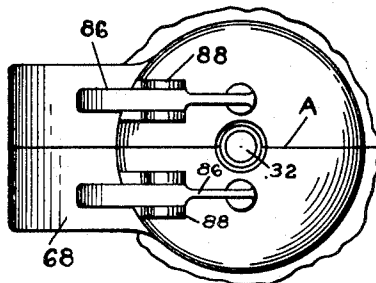
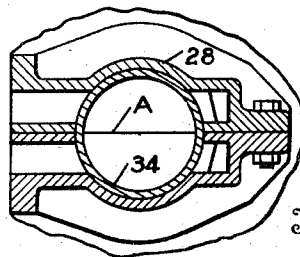


FIG. 9



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ENGINE CONSTRUCTED OF SECTIONS
BOLTED TOGETHER ALONG VERTICAL
PLANE TO FORM AN ENTIRE HEAD,
BLOCK, AND CRANKCASE THEREOF

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Application August 5, 1946, Serial No. 688,485

5 Claims. (Cl. 121—194)

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This invention relates to engines and more particularly to a novel form of construction thereof.

Broadly the invention comprehends the provision of an engine of vertically split cylinder construction wherein the entire head, block, and crankcase thereof are formed of as few as two half sections bolted or otherwise suitably secured together.

Although numerous engines of partially split or sectionalized cylinder construction have been devised, none have previously provided a structure such as the instant invention wherein the engine cylinder is split entirely through the head, block, and crankcase.

An object of the invention is the provision of simple and economical sectionalized engine.

Another object of the invention is the provision of an engine of sectionalized cylinder construction comprising a minimum number of parts and of lightweight construction.

A further object of the invention is the provision of an engine of vertically split cylinder construction permitting of the bolting together of a multiple of cylinders in accordance with requirements.

A still further object of the invention is the provision of an engine cylinder that can be formed of die cast sections bolted together along a vertical plane to form the entire head, block, and crankcase thereof.

Other objects and advantages of the invention will appear from the following description taken in connection with the drawings, forming a part of the specification; and in which:

Fig. 1 is a top plan, partially sectionalized view of an engine of split cylinder construction comprising a pair of cylinders bolted together;

Fig. 2 is a side plan view of Fig. 1 partially sectionalized;

Fig. 3 is an end plan view taken along line 3—3 of Fig. 1;

Fig. 4 is an end plan view taken along line 4—4 of Fig. 1;

Fig. 5 is a modified form of split engine cylinder having its vertical split running in a plane through the axis of the crankshaft of the engine;

Fig. 6 is a modified form of engine cylinder head from that shown in Fig. 2 with regards to the spark plug installation;

Fig. 7 is a face plan view of one-half cylinder section of a two cycle engine looking into the interior of the head, block, and crankcase thereof;

Fig. 8 is a face plan view of one-half cylinder section of a four cycle engine looking into the in-

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terior of the head, block, and crankcase thereof; Fig. 9 is a cross sectional view taken along line 9—9 of Fig. 7;

Fig. 10 is a top plan view of a completely assembled engine of the four cycle type shown by Fig. 8; and

Fig. 11 is a fragmentary face plan view of one-half cylinder incorporating a modified form of head and crankcase structure.

The instant invention is the result of the fervent desire in engine construction to provide an engine of lightweight and economical construction capable of high horsepower output per cu. in. of displacement.

The engine construction herein presented provides basically of the formation of an engine cylinder of two main die cast or otherwise suitably produced sections or halves bolted or otherwise suitably secured together along a vertical plane and including therewithin the entire head, block, and crankcase of a complete engine. It is suggested also that a cylinder liner of good material can be employed in the assembly of the half cylinder sections thus permitting of higher compression ratios than those ordinarily permissible in small engines. The cylinder liner will also assist in the proper alignment of the sections of the engine in the clamping of them together about the liner. By the manufacture of engines of split cylinder construction as herein taught, it is possible in addition to the lightweight and economical construction thereof to provide engines of air or liquid cooled and two or four cycle design with equal simplicity and feasibility. Furthermore, it is preferably desired to construct single cylinder units that can be so arranged and bolted together to provide two, three, or more cylinder engines as requirements may be. Several other innovations resulting from this type of engine cylinder construction will present themselves in the detailed description to follow.

Referring to the drawings for more specific details of the invention wherein like numerals refer to like parts, 10 represents an engine of two cylinder construction comprising separate cylinders 12 and 14 bolted or otherwise suitably secured together, as indicated, by bolts 16. The cylinders 12 and 14 might each in themselves be separate engines but are here shown in joined relation to illustrate the feasibility of joining any number of cylinders 12 and 14 together as may be desired. Cylinders 12 and 14 differ from one another merely in the provision of horizontal cooling fins 17 on cylinder 12 as compared to the vertical cooling fins 18 on cylinder 14. Cylinders

12 and 14 are each formed or constructed of two main sections or halves 20 and 22 joined in a vertical plane "A" and bolted or otherwise suitably secured together as by bolts 24. The cost of construction of an engine of this type may, if desired, be minimized by securing the sections 20 and 22 together with any suitable metallic bonding agent, such as Cycleweld. The sections 20 and 22 as shown in assembled relation by Figs. 1 and 2 provide an entire engine cylinder in itself in the provision of a complete head 26, block 28, and crankcase 30, wherein the head 26 has arranged in clamped relationship therein between the sections 20 and 22 a spark plug socket 31 for the threaded reception of a spark plug 32. The block 28 secures therein between the sections a cylinder liner 34 of sheet steel or other good material effective to assist in the alignment of the sections as well as permit of the use of higher compression ratios in the engine through the strengthening effect the liner 34 affords the cylinder.

By so forming cylinders 12 and 14 of half sections 20 and 22, it is possible to economically die cast the sections of strong and lightweight materials, thereby providing for the production, manufacture and assembly of engines of lightweight, high-strength characteristics, durability, and of low cost. Furthermore by employing die casting or other similar methods in the making of cylinder sections 20 and 22, the amount of machining required for finishing the interior of the head 26, block 28, and crankcase 30 can be held to a minimum thereby further emphasizing the cost saving as compared to the conventional form of engine construction.

The crankcases 30 of cylinders 12 and 14 have arranged therein a crankshaft 36 of split or built-up construction permitting of ease in assembly upon and within the crankcases 28 of the respective cylinders 12 and 14. Crankshaft 36 consists of one portion 38 disposed in crankcase 28 of cylinder 12 and another portion 40 disposed in crankcase of cylinder 14, and has a flywheel 42 splined or fitted to the free end of portion 38 thereof. The portions 38 and 40 of crankshaft 36 are varied in construction merely for the purpose of illustrating that a connecting rod 44 of the type having a cap might be assembled on a full throw section 46 of portion 38 of the crankshaft; or a connecting rod 47, without a split cap design, could be assembled upon a split or joined throw section 48 of portion 40 of crankshaft 36. The two cylinder engine 10 as shown by Figs. 1 and 2 is adapted to have a crankcase plate 50 secured to the base of the engine so as to permit of the proper machining of the interior of cylinders 12 and 14 prior to their final assembly with the plate in place as shown by Fig. 2. As an alternative to having a plate 50 mounted upon the crankcase of the cylinder, reference is had to Fig. 11 wherein a half cylinder section 52 of similar appearance as sections 20 and 22 of cylinders 12 and 14 is provided having a bottom or base member 54 as an integral part of the crankcase; whereas a separate head plate 56 is provided adapted to be fitted between a pair of cylinder sections, as shown by Fig. 11, or otherwise suitably secured to the sections of the cylinder, said head plate construction likewise as plate construction 50 of cylinders 12 and 14 serving the purpose of permitting of whatever machining is necessary to the head 26, block 28, and crankcase 30 of the engine prior to the securing of the head plate 56 in place in the final assembly of the engine.

Although Figs. 1 and 2 illustrate the formation and assembly of the cylinder sections 20 and 22 along a vertical plane perpendicular to the axis of the crankshaft of engine 10, it may be preferable and more convenient from a production assembly standpoint to split the engine in a vertical plane that passes through and along the axis of the crankshaft as shown by Fig. 5 wherein two half sections 58 and 60 are secured together in a vertical plane passing through the axis of an engine crankshaft 62 similar to crankshaft 36 thereby providing the bearing mounting 64 of the crankshaft 62. It is conceivable that this manner of splitting the cylinder has far reaching production assembly benefits and advantages over the structure shown by Figs. 1 and 2 in that the sections 58 and 60 after the completion of the necessary machining operations thereon and just prior to final assembly wherein all inclusive engine parts are to be assembled can be laid in a manner along parallel conveyor lines whereby it shall only be necessary to place one section upon the other section containing all the working mechanism of the engine and then secure said sections together without changing the position of the engine.

Fig. 6 illustrates an alternative to the threading of the spark plug 32 in a socket 31 secured between cylinder sections 20 and 22, shown by Fig. 2, in the threading of a plug 63 directly into a threaded hole 65 of the head 66 of an engine 10. This is shown merely as a possibly more economical plug installation without the necessity of employing an additional plug socket 31.

Figs. 8 and 10 represent a half cylinder section 68 of similar structural nature as sections 20 and 22 of engine 10 wherein section 68 comprises one half of a cylinder of a four cycle type engine 70. Cylinder section 68 is formed to provide a camshaft chamber 72 in addition to head 74, block 76, and crankcase 78 as an integral part thereof and has associated therewith the conventional operating mechanism of a four cycle engine, namely, a camshaft 80 disposed in chamber 72, a push rod 82 mounted in section 68 directly actuated by a cam 84 of camshaft 80, a rocker arm 86 journaled upon a post 88 forming a part of cylinder section 68 having one end engaged by push rod 82 and its other end engaging a spring pressed valve 90 for the movement thereof as a result of the motion transmitted to the rocker arm 86 by the push rod. The engine 70 as a complete unit resembles the engine 10 and comprises two half sections such as section 68 bolted or otherwise suitably secured together and containing in association therewith all of the operating parts of a four cycle engine as represented by the detailed description directed to cylinder section 68. In viewing Fig. 8, it is to be noted that no cylinder liner such as shown by Fig. 2 of engine 10 is included as an illustration that it may not be necessary in the construction of an engine of this sort to employ a cylinder liner should the cylinder material be capable of withstanding high or moderate operating compression pressures. The omission of the cylinder liner 34 from engine 10 can also be made depending upon the operating conditions required of said engine.

Although cylinders 12 and 14 and cylinder section 68 represent air-cooled type of construction, they could likewise be of the liquid cooled variety merely through the appropriate manufacture thereof with water cores in place of heat radiating or air cooling fins such as the fins 16 and 18 of engine 10.

While this invention has been described in connection with certain specific embodiments, the principle involved is susceptible of numerous other applications that will readily occur to persons skilled in the art. The invention, therefore, is limited only as indicated by the scope of the appended claims.

What I claim is:

1. An engine comprising a pair of mating half sections joined along a common plane in opposed relation to one another forming the cylinder and crankcase of the engine, each having a semi-circular surface throughout the cylinder section and annular internal grooves near one end opposite and axially disposed from the crankcase section mating with one another so as to form a continuous annular groove, and a circular cylinder head received in the annular groove in clamped relation between the sections, said plane along which the sections are joined passing medially through the head, block, and crankcase of the engine.

2. An engine comprising a pair of substantially alike semi-circular sections secured together in opposed relation to one another in a common plane passing through the center thereof and providing the cylinder and crankcase of the engine, each of said sections having internal semi-circular openings throughout the cylinder portion thereof with internal annular grooves cooperating therewith near one axial extremity thereof mating with one another to form a continuous annular groove, a cylinder liner retained in clamped relation in the cylinder formed by the sections, and a cylinder head received in the annular groove in clamped relation between the sections.

3. An internal combustion engine comprising a pair of similar semi-cylindrical sections secured together in a common plane lying perpendicular to the axis of the engine crankshaft bearing supports formed in the sections, said sections providing therebetween the engine cylinder block and crankcase and each having a semi-circular internal annular groove near the one extremity of the cylinder block matching to form a continuous annular groove, a cylinder head received in the annular groove extending across the cylinder block opening and securely clamped between the sections, and a smooth surfaced relatively thin cylinder liner firmly embraced by the sections therebetween having one end in axial abutting relation to the cylinder head, said plane along which the sections are joined passing medially through the head, block, and crankcase of the engine.

4. An engine comprising a pair of substantially identical half sections joined along a common plane, each section having mating semi-circular openings therebetween constituting the engine cylinder, mating openings axially disposed from the semi-circular openings constituting the engine crankcase therebetween and mating internal annular grooves near the open end of the cylinder, a relatively thin cylinder liner clamped between the cylinder portions of the half sections having a radially extended annular collar on one end received in the groove formed between the sections, and a cylinder head clamped between the cylinder portions of the half sections having an annular collar received in axial wedged relation against the collar of the cylinder liner within the annular groove formed between the sections, said plane along which the sections are joined passing medially through the head, block, and crankcase of the engine.

5. An engine comprising a pair of substantially identical half sections joined along a common plane, each section having mating semi-circular openings therebetween constituting the engine cylinder, mating openings axially disposed from the semi-circular openings constituting the engine crankcase therebetween and mating internal annular grooves near the opened end of the cylinder, a circular head clamped between the cylinder portions of the half sections having an annular collar received within the annular groove formed between the sections, a relatively thin cylinder liner clamped between the cylinder portions of the half sections having one end in axially abutting relation upon the circular cylinder head, said plane along which the sections are joined passing medially through the head, block and crankcase of the engine.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,402,695	Wall	Jan. 3, 1922
1,423,365	Smith	July 18, 1922
1,540,172	Green	June 2, 1925
2,337,661	Ireland	Dec. 28, 1943
2,383,065	Lehman	Aug. 21, 1945
2,397,434	Ricart	Mar. 26, 1946

FOREIGN PATENTS

Number	Country	Date
246,209	Germany	Apr. 26, 1912