May 30, 1933. H. BECKER 1,911,220

INTERNAL COMBUSTION ENGINE

Filed Oct. 7, 1929

Fig. 1.
A-B

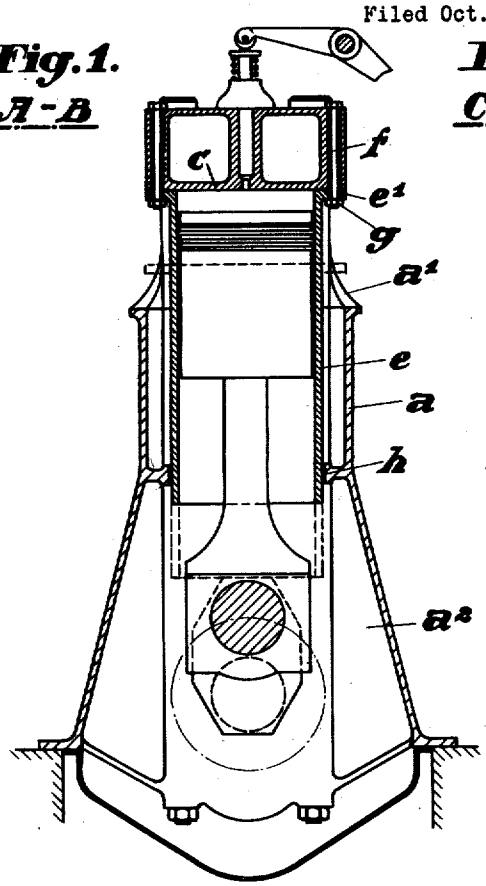


Fig. 3.
C-D

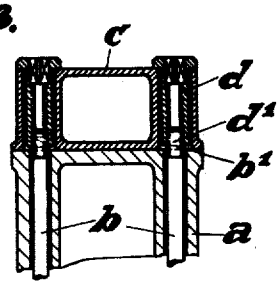


Fig. 2.

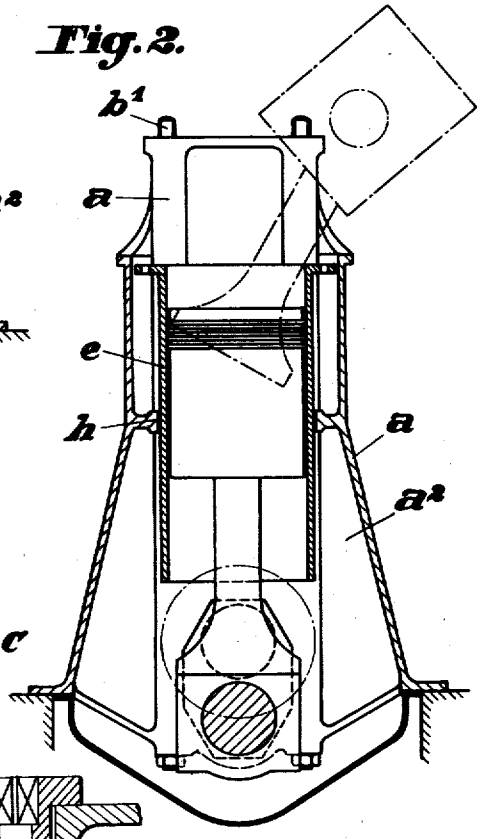
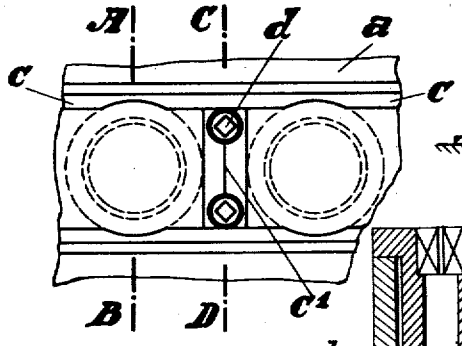


Fig. 4.



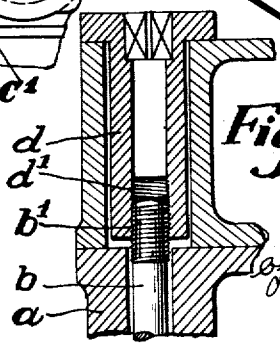


Fig 5

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Patented May 30, 1933 1,911,220

UNITED STATES PATENT OFFICE

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INTERNAL COMBUSTION ENGINE

Application filed October 7, 1929, Serial No. 397,914, and in Germany October 8, 1928.

This invention relates to internal combustion engines.

One of the principal objects of this invention is to provide an engine of this character which is simple and economical in construction, and in which parts are constructed for ready removal with a minimum of head room for their disassembly.

Another object of the invention is to provide a cylinder structure for an engine of this character in which the cylinder liner may be readily detached from the cylinder head and moved within the supporting frame to a position such as to expose the piston.

Still another object of the invention is to provide a cylinder structure for an engine of this character having tie rods connecting the parts in assembled relation, in which the cylinder head is removably attached to the tie rods in a manner to permit lateral removal of the head.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawing and appended claims.

In the drawing, in which like characters of reference designate like parts throughout the several views thereof—

Fig. 1 is a central vertical sectional view through an engine constructed in accordance with this invention, the section being taken on the plane of the line A—B of Fig. 4;

Fig. 2 is a view similar to Fig. 1 showing the parts with the cylinder head removed and the cylinder liner in lowered position;

Fig. 3 is a partial vertical sectional view taken on the plane of the line C—D of Fig. 4, showing the securing means for the cylinder head; and

Fig. 4 is a fragmentary plan view of a multi-cylinder engine of this character.

Fig. 5 is a detail view similar to Fig. 3 on an enlarged scale.

Referring to the drawing which discloses a preferred embodiment of the invention, an upstanding engine supporting frame is indicated at a, this frame being formed to provide a crank shaft housing a^2. Tie rods b pass through the frame from the lower portion thereof and terminate substantially at the level of the upper edge of the engine frame as indicated at b'. A cylinder head c is mounted upon the upper end of the frame, and has openings in alignment with the said tie rods. Through these openings pass nuts d which have tubular internally threaded portions d' threadedly engaging the upper ends b' of the tie rods, substantially at the level of the upper edge of the machine frame, thereby securing the cylinder head securely to the frame. This construction permits the lateral removal of the head from the machine frame after loosening of the nuts d, without requiring the head to be lifted or moved axially of the cylinder.

Removably secured to the cylinder head c is a cylinder shell or casing e which is suspended within an opening formed by the annular flange h of the machine frame a. The cylinder shell e is provided with an attaching flange e'. Bolts f are inserted downwardly through aligned openings in the head c and the flange e' and these parts are secured in place by nuts g which are threaded onto the end of the bolts beneath the cylinder wall flange.

By removing the nuts g, the cylinder shell e may be lowered axially within the frame down into the crankcase housing from the position shown in full lines in Fig. 1 to the position shown in dotted lines in Fig. 1 and in full lines in Fig. 2. The machine frame a is open at the top as indicated at a' so that the piston head will be exposed when the cylinder shell is lowered, as is evident from the dotted line position of the cylinder liner e in Fig. 1. Thus the piston rings are easily accessible as well as the other portions of the piston.

If it is desired to remove the piston, the cylinder head c is then removed laterally by loosening and removing the nuts d. This permits the cylinder head to be moved sideways from operative position without substantial upward lift or axial movement. The piston, and connecting rod after removal from the crankshaft, may then be lifted upwardly out of the lowered cylinder shell and completely removed as indicated in dot-

ted lines in Fig. 2. As shown clearly in this figure, the overall height required for these operations is not materially more than the overall height of the entire engine. The engine is thus particularly adapted for installations where small head room is available, such as in stationary combustion engines for power plants and the like. In the previously known installations, the exposure of the piston, particularly at the top, is obtained with difficulty because of the cramped quarters, and it may happen that such exposure cannot be provided at all without complete removal of the entire engine. The present invention provides a simple and compact cylinder structure in which the parts may be readily disassembled with a head room which is only sufficient to accommodate approximately the overall height of the engine.

As shown clearly in Fig. 4, this construction is adapted for a multicylinder internal combustion engine, in which a single framework *a* accommodates all the cylinders. Each cylinder is provided with a separate cylinder head *c* mounted on the frame *a*, the respective cylinder heads having adjacent contacting surfaces indicated at *c'* which permit a single set of through bolts *b* and nuts *d* being used to connect two adjacent cylinder heads to the frame *a*. Each cylinder shell *e* is suspended from its respective cylinder head *c* in the manner previously described. Lowering of any cylinder shell *e* from its respective cylinder head to expose the piston therein may be had by the removal of the nuts *g* without interfering with the other cylinders; similarly the entire piston may be removed by the removal of the respective cylinder head without tearing down the other cylinders.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. An internal combustion engine of the character described, comprising a supporting frame and a cylinder head, a cylinder carried in operative position by said cylinder head, a piston within said cylinder, said frame having a portion provided as a permanent part thereof receiving said cylinder and providing for the movement of said cylinder within the frame for a substantial distance from its operative position to a second position such as to expose said piston, and means for removably fastening said cylinder in operative position to said cylinder head to provide for ready detachment thereof and for movement of the cylinder to the said second position and to provide for ready removal of the piston through the cylinder without requiring large head room.

2. A vertical internal combustion engine of the character described, comprising an upstanding supporting frame forming a crankshaft housing, a cylinder head removably mounted upon said frame, a cylinder shell removably suspended from said cylinder head, a piston within said cylinder shell, said frame having an opening therein receiving said cylinder shell and providing for the lowering of said shell from operative position to a second position within said crankshaft housing of said frame such as to expose said piston, and means for removably connecting said cylinder head to said frame at a point adjacent the bottom of the cylinder head and the top of the frame so as to provide for lateral removal of said cylinder head with only a limited axial movement thereof.

3. An internal combustion engine of the character described, comprising a supporting frame, a cylinder, a cylinder head for said cylinder supported from said frame, tie rods extending through said frame and terminating substantially at the lower end of said cylinder head, and means for securing said cylinder head directly to said tie rods to provide for lateral removal of said cylinder head from said frame with only a limited axial movement thereof.

4. An internal combustion engine of the character described, comprising a supporting frame, a cylinder head therefor, tie rods extending through said frame and terminating approximately at the level of an end of said frame, said cylinder head seating on said end of the frame and extending beyond said tie rods, and means engaging said tie rods for removably securing said cylinder head on said frame end in a manner to provide for lateral removal of said cylinder head with only a limited axial movement.

5. An internal combustion engine of the character described, comprising a supporting frame, a cylinder, a cylinder head therefor, tie rods extending through said frame and terminating substantially at the level of an end of said frame, said cylinder head seating on said end of said frame and having openings in alignment with said tie rods, the adjacent end of said tie rods being screw threaded, and nuts extending through the said openings in said cylinder head having tubular internally threaded portions engaging the threaded portions of said tie rods to secure the parts in assembled relationship.

6. An internal combustion engine of the character described, comprising a supporting frame, a cylinder head removably mounted on said frame, nuts extending substantially through said cylinder head, threaded members extending toward and

terminating adjacent said nuts, said parts cooperating to secure said cylinder head in place and providing for lateral removal of said cylinder head with only a limited axial movement thereof, a cylinder shell, a piston within said shell, and removable bolts passing through said cylinder head into said shell to connect said shell in operative positon, said frame having an annular flange forming an opening therein providing for the axial movement of said shell within said frame when said bolts are removed away from said cylinder head so as to expose the said piston.

7. An internal combustion engine of the character described, comprising a supporting frame, a cylinder head mounted on said frame, tie rods extending through said frame and terminating adjacent said cylinder head, means for removably securing said cylinder head to said tie rods at a point adjacent an end of said frame in a manner to provide for lateral removal of said cylinder head with only a limited axial movement thereof, a cylinder shell, a piston therein, means for removably fastening said cylinder shell to said cylinder head, said frame having an opening therein receiving said cylinder shell and providing for the movement of said shell within said frame when detached from said head to a position such as to expose said piston through the opening in said frame.

In testimony whereof I have affixed my signature.

HEINRICH BECKER.

CERTIFICATE OF CORRECTION.

Patent No. 1,911,220. May 30, 1933.

HEINRICH BECKER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, line 101, claim 4, after "frame," insert "a cylinder,"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 1st day of August, A. D. 1933.

M. J. Moore.

(Seal) Acting Commissioner of Patents.

terminating adjacent said nuts, said parts cooperating to secure said cylinder head in place and providing for lateral removal of said cylinder head with only a limited axial movement thereof, a cylinder shell, a piston within said shell, and removable bolts passing through said cylinder head into said shell to connect said shell in operative positon, said frame having an annular flange forming an opening therein providing for the axial movement of said shell within said frame when said bolts are removed away from said cylinder head so as to expose the said piston.

7. An internal combustion engine of the character described, comprising a supporting frame, a cylinder head mounted on said frame, tie rods extending through said frame and terminating adjacent said cylinder head, means for removably securing said cylinder head to said tie rods at a point adjacent an end of said frame in a manner to provide for lateral removal of said cylinder head with only a limited axial movement thereof, a cylinder shell, a piston therein, means for removably fastening said cylinder shell to said cylinder head, said frame having an opening therein receiving said cylinder shell and providing for the movement of said shell within said frame when detached from said head to a position such as to expose said piston through the opening in said frame.

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