

H. E. B. BLOMGREN.
ENGINE.

APPLICATION FILED JAN. 27, 1906.

Patented June 29, 1909.

926,540.

4 SHEETS—SHEET 1.

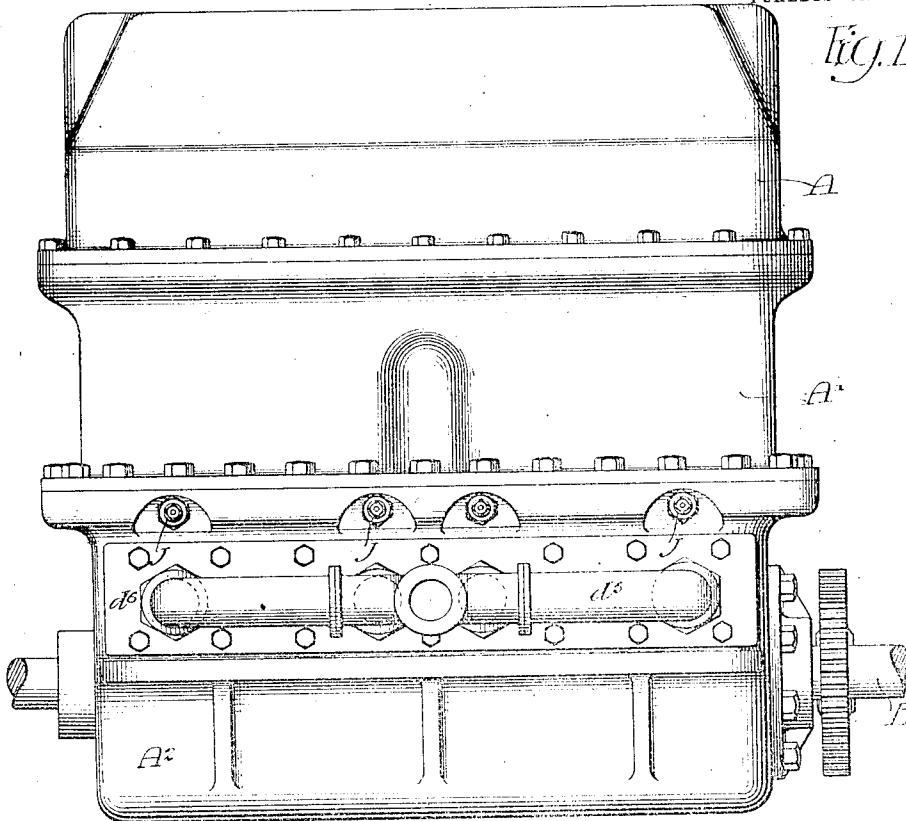


Fig. 1.

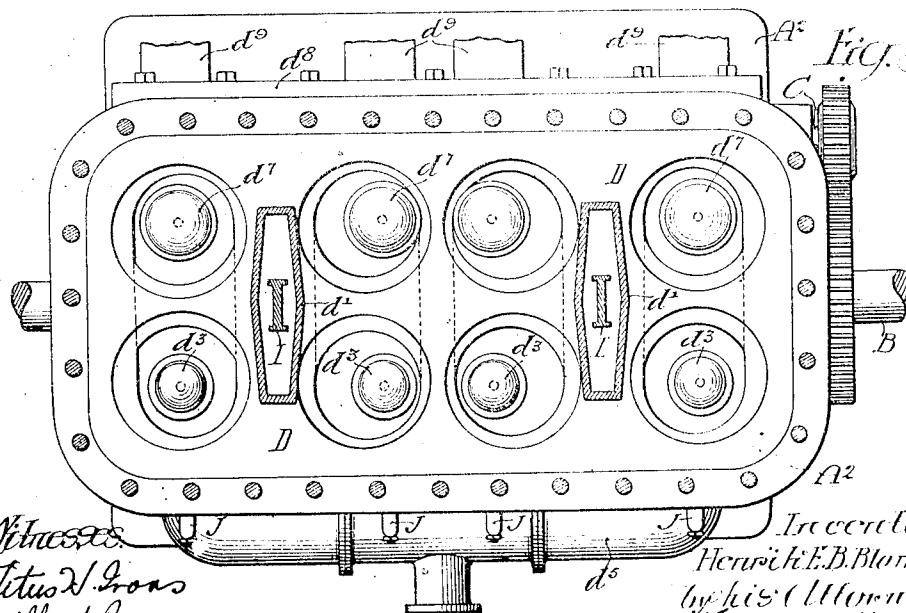


Fig. 5.

Witnesses
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Wills A. Burrows

Inventor
Henrik E. B. Blomgren
by his Attorneys,
Howard & Howard

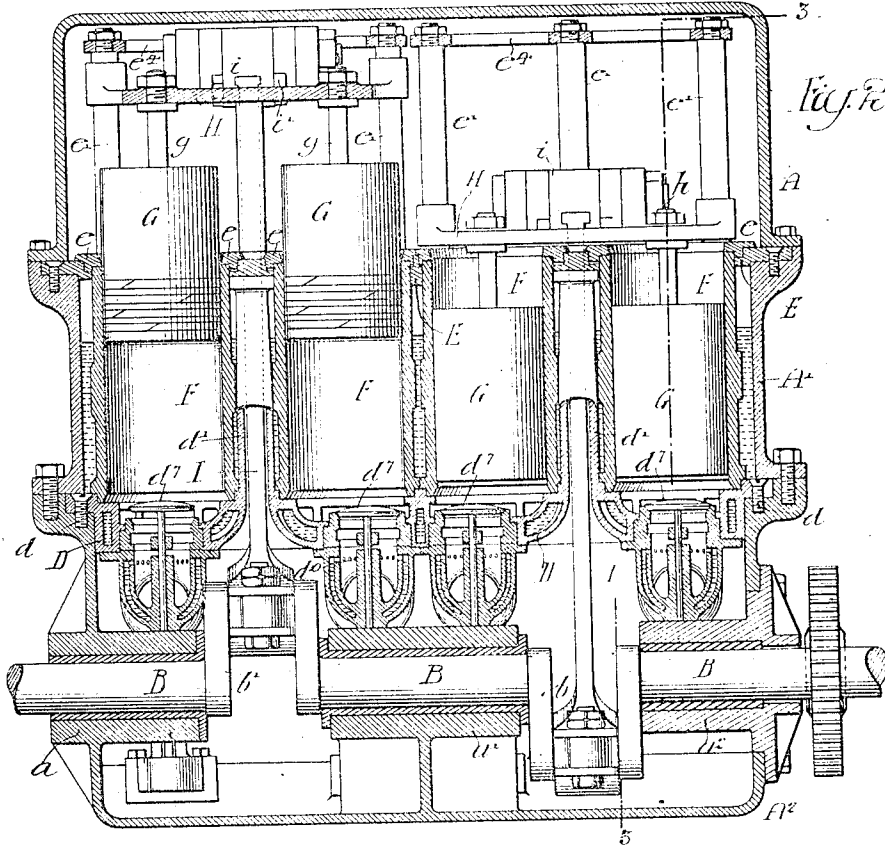
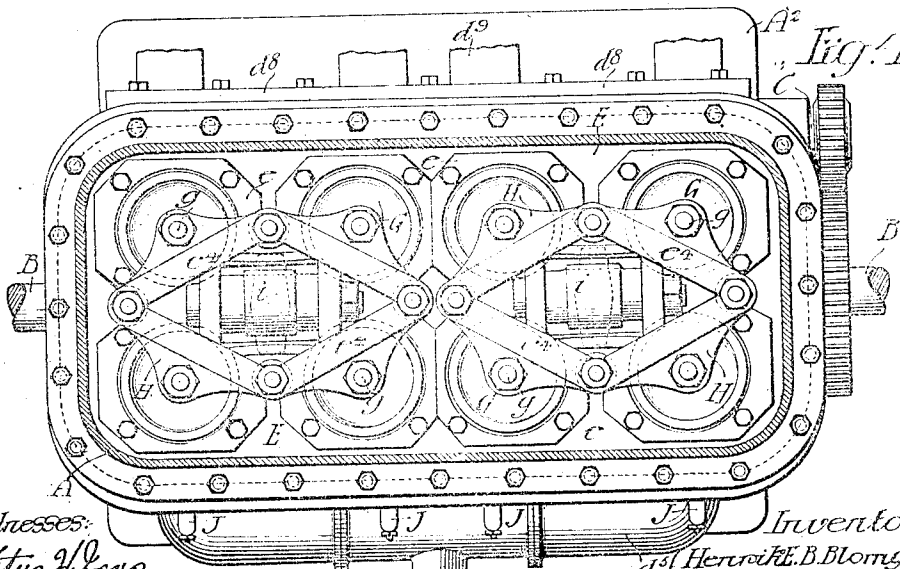
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4 SHEETS—SHEET 2.

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928,540.

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4 SHEETS—SHEET 3.

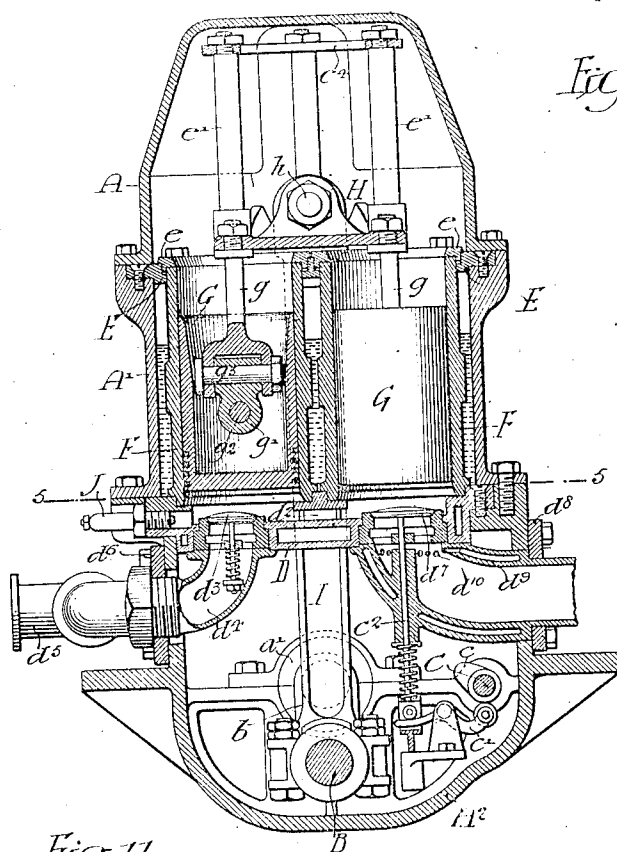
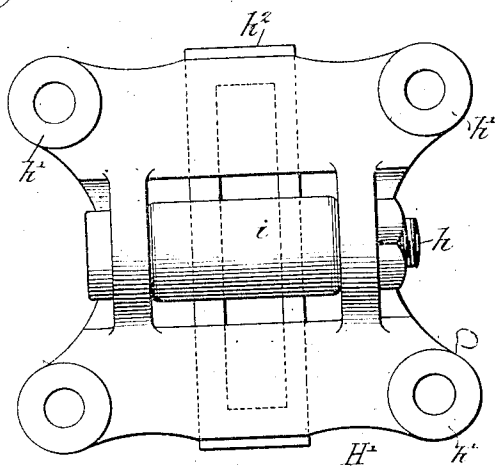


Fig. 5.

Fig. 11.



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926,540.

4 SHEETS--SHEET 4.

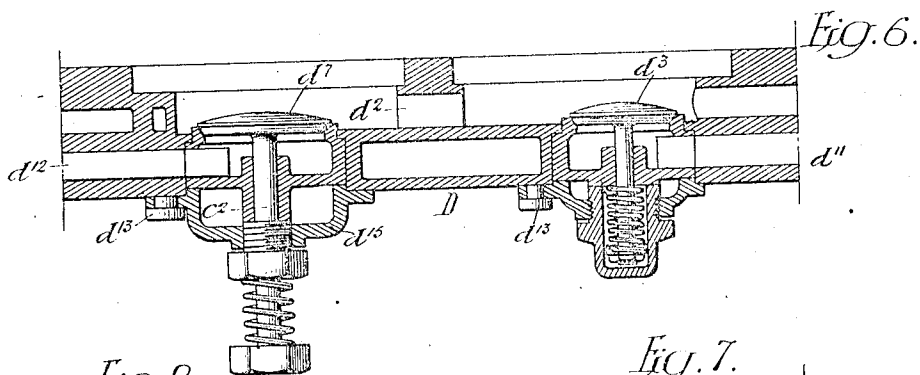
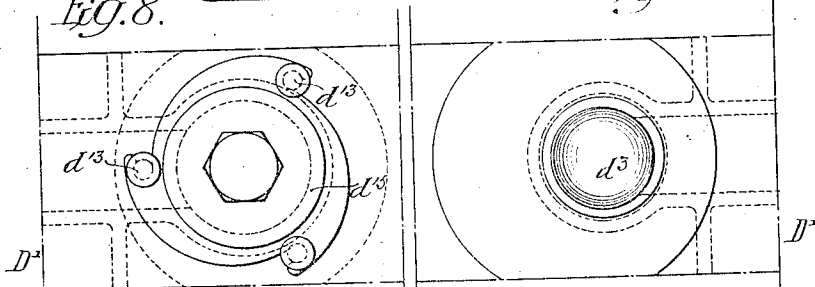
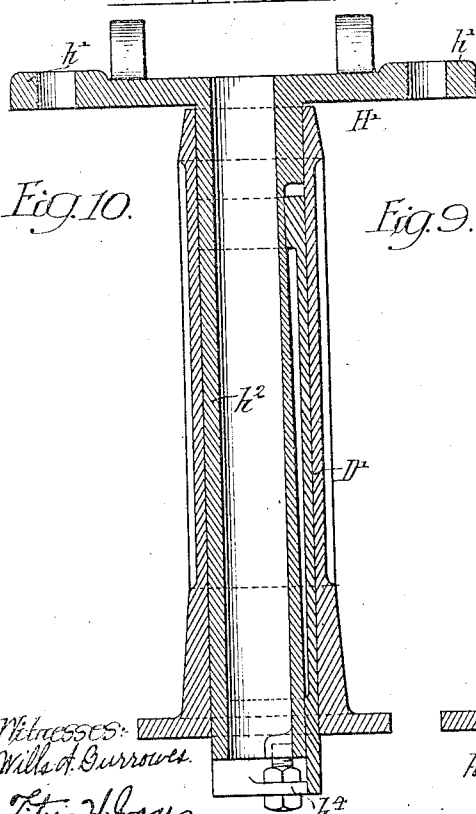
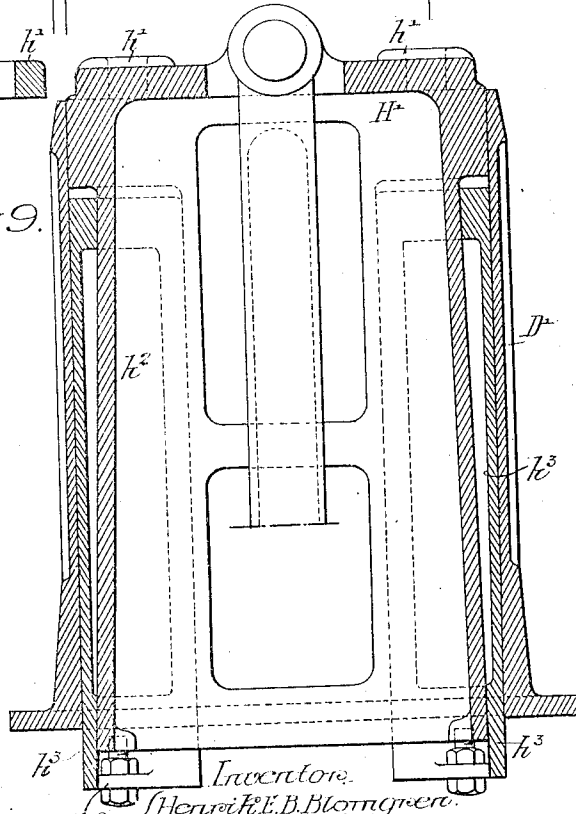


Fig. 8.

Fig. 7.



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$\frac{1}{2}$  Inventor, 
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 by his Attorneys, Howard Howard

UNITED STATES PATENT OFFICE.

HENRIK E. B. BLOMGREN, OF PALMYRA, NEW JERSEY.

ENGINE.

No. 926,540.

Specification of Letters Patent.

Patented June 29, 1909.

Application filed January 27, 1906. Serial No. 298,250.

To all whom it may concern:

Be it known that I, HENRIK E. B. BLOMGREN, a subject of the King of Sweden, residing in Palmyra, New Jersey, have invented certain Improvements in Engines, of which the following is a specification.

One object of my invention is to so arrange the various parts of a multiple cylinder explosion engine that while being relatively simple and therefore not likely to get out of order or require frequent repairs, it shall be light and compact for a given power.

It is further desired to so arrange the parts of the engine that they shall be easy of access for purposes of assembly, inspection or repair.

These and other advantageous ends, I secure as hereinafter set forth, reference being had to the accompanying drawings, in which:—

Figure 1, is a side elevation of an engine constructed according to my invention; Fig. 2, is a vertical section of the engine shown in Fig. 1, illustrating the arrangement and construction of certain of its parts:—the section being taken through the main shaft and through the center lines of the four cylinders on one side; Fig. 3, is a vertical section on the line 3—3, Fig. 2; Fig. 4, is a plan view of the engine, the cover being shown in section; Fig. 5, is a plan view taken on the line 5—5, Fig. 3; Fig. 6, is a vertical section illustrating the preferred arrangement of one set of the inlet and exhaust valves and their adjacent parts; Fig. 7, is a plan view of the inlet valve shown in Fig. 6; Fig. 8, is an inverted plan view of the structures adjacent to the exhaust valve shown in Fig. 6; Figs. 9 and 10, are vertical sections, taken at right angles to each other, illustrating the preferred arrangement and construction of the cross head guide; and Fig. 11, is a plan view of the structure illustrated in Fig. 9.

Referring to the above drawings, it will be seen that the engine is contained within an inclosing casing formed by a top, an intermediate, and a bottom casting respectively indicated by the reference letters A, A' and A², of which the first usually has no other function than to merely inclose the upper moving parts of the engine.

The lower casting A² is provided with three bearings a, a' and a² of ample surface for the reception of the main crank shaft B; the last

bearing a² being made removable and being held in position within the casting A² in any desired manner.

The shaft B is provided with two cranks b and b' and, as shown best in Fig. 3, has extending parallel with it an auxiliary shaft C having cams, of which one is shown at c, for operating the exhaust valves of the engine.

Completely covering the top opening of the bottom casting A² is a cast plate D set in the recessed upper edges of said casting so that its top surface is flush with the same and held in place by screws d. Similarly set in the recessed upper end of the intermediate casting A' and flush with the top thereof is a second plate E, and between this and the plate D are placed the eight engine cylinders, arranged in two rows of four each. The lower ends of these cylinders F are tightly fitted, or if desired, screwed, into suitable circular recesses in the top surface of the plate D, while their upper ends fit more loosely in the circular openings in the plate E, being held therein rigidly in place by nuts e attached in any suitable manner to said plate.

There is a piston G in each of the cylinders F and, as shown in Fig. 3, each of these pistons has a rod g made in two sections connected to each other by a universal joint or coupling; this consisting, in the present instance, of a piece g' connected to the piston by a pin g² so as to be movable in one plane and to turn connected to the piston rod g by means of a pin g³ extending in a line at right angles to the line of the pin g².

The piston rods g are rigidly connected in sets of four to cross heads H, which in turn may, in one form of my invention, be slidably mounted on guide rods e' which project upwardly from the plate E and are braced or tied together by bars e². Each cross head plate is connected by a suitable pin h to the head i of one of the two connecting rods I, whose opposite ends are respectively connected to the cranks b and b' of the main shaft B. From Fig. 2, it will be seen that each of the connecting rods I has its upper end formed in an approximate T-shape, and fitted into a correspondingly shaped recess in the head piece i; being held in position by means of a bolt i'.

In order to stiffen and strengthen the frame structure, I form integral with the

plate D two upwardly extending tubular structures d' , through each of which passes one of the connecting rods I and whose upper ends engage the under side of the plate E. In addition, the said plate D is so formed that each of the four cylinders on one side of the engine is respectively connected by means of passages d^2 to one of the four cylinders on the other side thereof, so that, under operating conditions, said cylinders will act in pairs. Moreover, each pair of these connected cylinders is provided with but a single inlet valve d^2 operating upon a suitable seat set in the plate D and connected through a pipe d^4 with common inlet or supply pipes d^5 . Said inlet pipes d^5 are held in position by means of a plate d^6 bolted to one face of the lower engine casting A^2 ; being held in position by suitable nuts, as shown. Similarly, each pair of connected cylinders has a single exhaust valve d^7 operating in a seat set in the plate D; there being, in addition, an exhaust pipe d^9 for each exhaust valve, held in position by means of a plate d^8 bolted to the exhaust side of the lower casting A^2 and engaging said pipes.

While I have found the above described construction of valves and passages to be very satisfactory, I preferably construct them, as shown in Figs. 6 to 8 inclusive, so that each valve and its supporting structure may be quickly and easily removed. For this purpose, I form the inlet and exhaust passages d^{11} and d^{12} in the plate D, and provide, projecting from the under side of said plate, three or more studs or screws d^{13} . The valve supporting structure d^{15} is provided with a corresponding number of recessed lugs, so that by being rotated through a small angle after being inserted in its opening in the plate D, said lugs may be brought into engagement with said screws or studs and thereby made to hold the valve structure in place. By merely turning the said structure in a reverse direction it is disengaged from the studs and may be removed.

In the plate D are channels for cooling water, which extend completely around the valves and the exhaust pipes; finally opening into said pipes through a series of relatively small passages d^{10} whereby the heated water may be discharged.

The cylinders F are cooled by water which circulates within the spaces formed by plates E and D, the cylinders, and the intermediate engine casting A^1 ; it being understood that under operating conditions the cooling water is first permitted to circulate within these spaces, from whence it passes to the water spaces of the plate D and is finally discharged into the exhaust pipes d^9 .

The exhaust valves d^7 are actuated from the cams of the cam shaft C by means of levers c' each acting upon one of the valve rods c^2 . In order to ignite the explosive

mixture in the various cylinders, I provide spark plugs J, of any desired construction, which may be screwed into portions of the plate D extending through suitable openings in the upper portion of the lower engine casting A^2 ;—each plug entering the space common to a pair of communicating engine cylinders.

Under operating conditions, I so time the sparking and exhaust mechanism and so arrange the pistons that when, for example, the extreme right hand pair of pistons, shown in Fig. 2, is just beginning an upward stroke by reason of an explosion in their cylinders, the next adjacent pair of pistons connected to the same cross head H is just beginning a suction stroke. At the same time, since the two cranks b and b' are 180° apart, the extreme left hand pair of pistons is just beginning an inward or exhaust stroke to remove the products of combustion of the last explosion, while the other pair of pistons connected to the same cross head is just beginning a compression stroke. As a consequence of this arrangement, there are two explosions for each revolution of the main shaft, so that since the engine is of the four cycle type each pair of communicating cylinders has an explosion once for every two revolutions of said shaft.

If desired, the sparking and valve mechanism may be so timed that explosions occur simultaneously in the four cylinders whose pistons are connected to a single cross head, so that in the engine shown a single impulse is given to the main shaft in each revolution.

While in Figs. 2, 3 and 4, I have shown the cross heads H as slidable upon guide rods e' , I preferably dispense with these rods and form said cross heads as shown at H' in Figs. 9 to 11 inclusive, the four piston rods g being, as before, bolted to the surface of the flat top portion of the cross head, which, for this purpose, is provided with bosses h' .

Extending from the middle of the under side of the top of the cross head and preferably formed integral therewith is a hollow rectangular portion h^2 constructed to fit into and be guided by a hollow rectangular casting D' confined between the plates D and E.

In order to take up any wear which may occur, I provide adjustable angle pieces h^3 , each extending along one end and a portion of one side of the part h^2 of the cross head and adjustable longitudinally by means of stud bolts entering said portion and passing through lugs h^4 at the lower ends of the angle pieces h^3 . The adjacent surfaces of said angle pieces and the portion h^2 of the cross head are inclined to each other or beveled, so that by moving said parts relatively to each other, the angle pieces are either forced outwardly or permitted to move inwardly so as to bear more or less tightly upon the guiding surfaces of the castings D'.

One of the material advantages of the construction above described is due to the fact that the universal joint in the piston rods of the different pistons permits the assembling of the various parts coöperating with the cross heads and pistons without the necessity for such exact and, therefore, costly construction as would otherwise be necessary, while under operating conditions such construction permits of the proper movement of the various parts without the likelihood of dangerous or objectionable strains being set up due to lack of alinement or wear of the parts. It will further be noted that the construction of the device as a whole is relatively compact, and while highly efficient, has but few movable parts when the number of cylinders and power for a given weight of material are taken into consideration.

I claim as my invention:

1. The combination in an engine of an inclosing casing made in a plurality of parts, one of said parts having plates extending across it parallel to each other, a plurality of cylinders extending between said plates, a hollow extension on one of the plates extending between the cylinders to the other plate, pistons for the cylinders, a cross head, and piston rods connecting a plurality of the pistons to said cross head, a shaft, and a rod connecting the cross head and the shaft and extending through the hollow extension between the cylinders, substantially as described.

2. The combination in an engine of two substantially parallel structures having four cylinders extending between them, a casing also extending between said structures and surrounding the cylinders, a hollow piece extending between the central portions of said structures, a shaft, a connecting rod passing through said hollow piece, a cross head attached to said connecting rod, guides for the cross head, pistons in the cylinders, and piston rods connecting said pistons to said cross head, with means for admitting and exhausting motive fluid, substantially as described.

3. The combination in an engine of an inclosing casing made in a plurality of parts, plates extending across said casing, cylinders extending between said plates, a shaft, pistons in the cylinders operatively connected to said shaft, inlet and exhaust valves in one of the plates, said plate being made hollow for the reception of cooling liquid, and connections for supplying said liquid to said hollow plate and to the space

within the casing and surrounding the cylinders, substantially as described.

4. The combination in an engine of an inclosing casing made in a plurality of parts, a hollow plate extending across the casing, cylinders in the casing, pistons for the cylinders, a shaft, means for connecting the pistons to the shaft, inlet and exhaust pipes carried by the casing and entering openings in the hollow plate, inlet and exhaust valves for said pipes, means for supplying cooling fluid to the hollow plate, and a connection between the hollow of the plate and the interior of the exhaust pipe to permit of the discharge of the cooling fluid, substantially as described.

5. The combination in an engine of a frame having two substantially parallel plate-like structures, cylinders extending between said structures, a guideway piece also supported between the structures, a shaft, pistons for the cylinders, a cross head, piston rods connecting the pistons to the cross head, a rod connecting the cross head and the shaft, said cross head having extensions operative upon the guideway between the cylinders, substantially as described.

6. The combination in an engine of an inclosing casing made in a plurality of parts, a plate extending across the casing between two of the parts, and a second plate at one end of one part, a plurality of cylinders extending between said plates, pistons in said cylinders, a main shaft extending through the casing and having two cranks, two cross heads respectively connected to said cranks, said pistons being connected to the cross heads in sets of four, and the cylinders being permanently connected to each other in sets of two, inlet and exhaust mechanism for each pair of cylinders, and igniting mechanism timed to operate so that when one pair of pistons is beginning its explosion stroke the other two pistons connected to the same cross head are beginning a suction stroke, while two other pistons are beginning their clearing stroke, when the remaining pair of pistons connected to the same cross head is beginning a compression stroke, substantially as described.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

HENRIK E. B. BLOMGREN.

Witnesses:

WALTER CHISM,
JOS. H. KLEIN.