C. H. FOSTER.

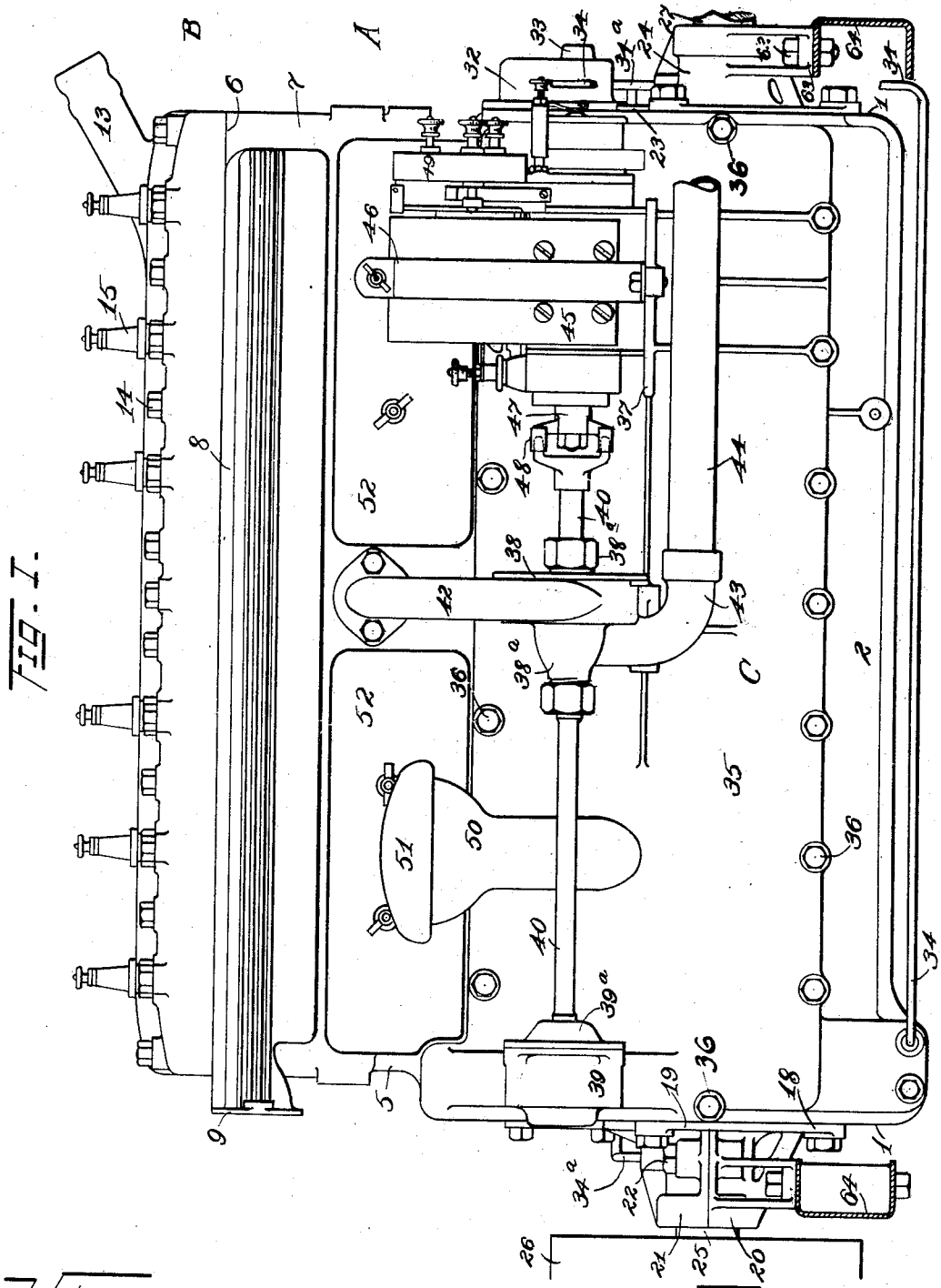
ENGINE.

APPLICATION FILED OCT. 17, 1912.

**1,120,803.**

**Patented Dec. 15, 1914.**

2 SHEETS—SHEET 1.




Witnesses:
Norman B. West
R. L. Bruck

Inventor.
Claud H. Foster
By Hull & Smith
Attys.

C. H. FOSTER.

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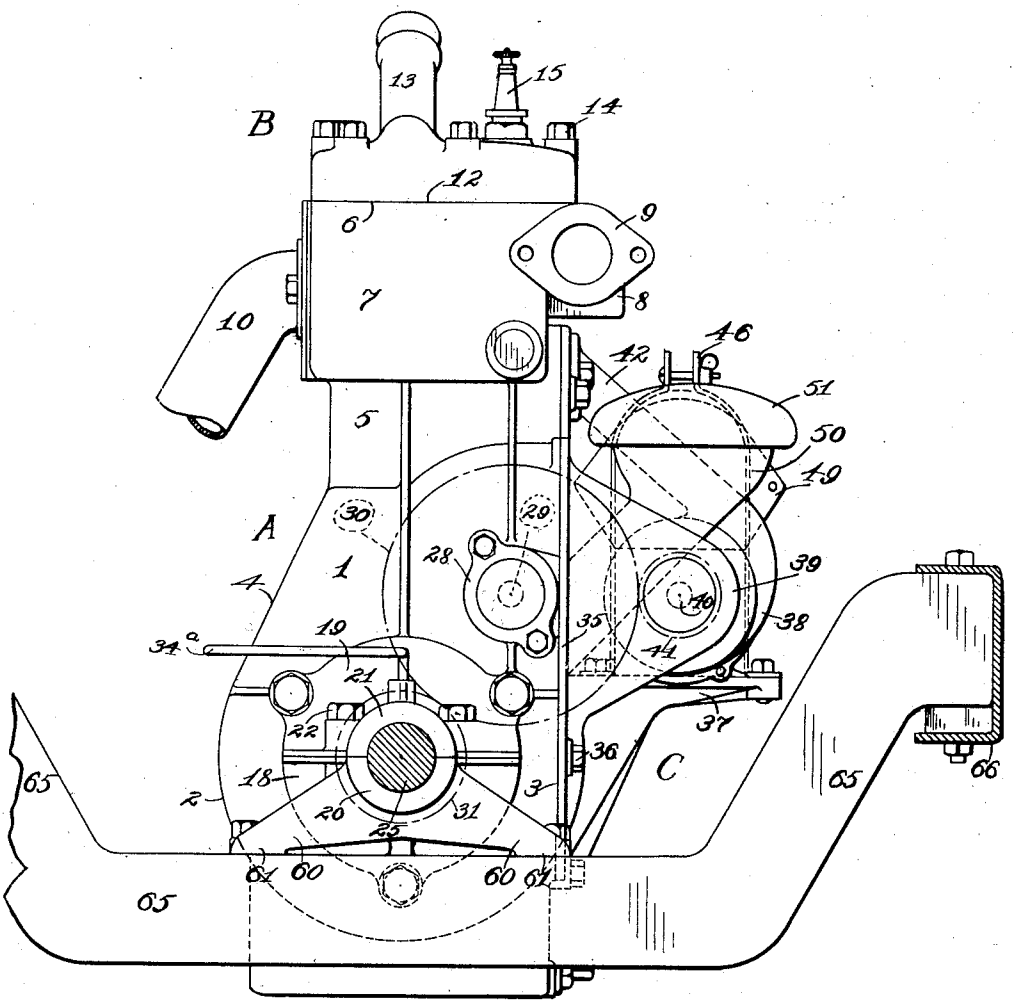



Fig. 2.

Witnesses -

Brennan B. West

P. L. Bruck

Inventor -

Claud H. Foster

By Hull & Smith

Attys.

# UNITED STATES PATENT OFFICE.

CLAUD H. FOSTER, OF CLEVELAND, OHIO.

## ENGINE.

1,120,803. Specification of Letters Patent. Patented Dec. 15, 1914.

Application filed October 17, 1912. Serial No. 726,299.

*To all whom it may concern:*

Be it known that I, CLAUD H. FOSTER, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to internal combustion engines particularly of the type employed in connection with automobiles, although many of the features thereof can be employed to advantage in connection with boat engines and other installations.

The objects of the invention are the provision of an engine having a frame of minimum weight and maximum strength; the provision of an engine wherein the possibility of relative movement between the cylinders and the crank shaft is entirely absent; the provision of an engine having the cylinders, crank case, and lubricating chamber formed as an integral casting; the provision of an engine wherein the water pump, magneto, etc., together with their shaft, are carried on a single plate so as to be removable from the remainder of the engine as a whole and without dismounting; the provision of a new and improved form of suspension for engines of this type whereby the crank shaft may be maintained in proper alinement with the remaining rotative parts of the vehicle, and with a minimum of strain on the crank case; the provision of an engine which can be assembled, inspected, and repaired with greater facility than other engines now in use; while further objects and advantages will become apparent as the description proceeds.

In the drawings accompanying and forming a part of this application I have illustrated one form which my invention may take, although it will be understood that the embodiment there illustrated is only one of a great many by means of which the advantages of my improvement can be realized.

In these drawings Figure 1 is a side elevational view of a six cylinder automobile engine constructed in accordance with my invention, although it will be understood that a six cylinder engine is chosen merely for purposes of illustration, the invention being equally applicable whether a smaller or larger number of cylinders be employed, and Fig. 2 is a left-hand elevation of the same, the fly wheel being omitted.

Describing the parts by reference characters, A represents generally what I will term the body part of my improved engine, B the head part and C the plate part. The body part consists of a single hollow casing, the lower portion thereof being formed as an interiorly unobstructed elongated chamber having upright parallel ends 1, 1 and a semi-cylindrical bottom 2, 2 connecting said ends. Each of the end plates 1, 1 is formed with an aperture substantially concentric with the semi-cylindrical bottom and constructed for the reception of a bearing plate wherein the crank shaft is journaled. The side of this casing which faces toward the right in the construction illustrated in Fig. 2 (which side will hereafter for purposes of convenience be referred to as the front side of the casing) is left entirely open, the edges of the aperture so formed lying preferably in a single plane which plane is, in this embodiment, substantially vertical as indicated at 3 in Fig. 2. The rear side of the casing is completed by a substantially flat wall portion 4 which preferably slopes inwardly from the point of tangency with the semi-cylindrical bottom above described to the portion of the body wherein are formed the engine cylinders. These cylinders are formed as vertical cylindrical apertures located at longitudinally spaced points throughout the length of the portion 5 of the body part A, said apertures being strictly perpendicular to the axis of the semi-cylindrical portion 2 and intersecting the same. The upper end of the body part is squared off as indicated at 6 for the reception of the head part, the portion of the body part adjacent to the top 6 being formed with a water jacket 7 surrounding the cylinders. The forward side of the cylinder containing portion 5 is thickened, as shown in Fig. 2, for the reception of the inlet and outlet valves as in the usual practice, said outlet valves communicating with an outlet manifold 8 formed integral with the forward side of the casting and terminating in an attaching flange 9. The opposite or rear side of the casting is formed for the reception of the inlet pipe 10 whereby explosive mixture is conveyed to the engine, the part of the casting between the cylinders being formed with suitable ports

whereby this mixture is conveyed to the several valves in the manner well understood in the art.

The head part B consists preferably of a substantially flat and comparatively uniform casting having its lower face squared or otherwise formed as at 12 for close engagement with the top 6 of the body part. The head part is also formed with a water jacket space communicating with the water jacket 7 by suitable registering apertures (not shown) as will be well understood by those skilled in the art, this water space being also in communication with a nipple 13 whereto may be connected the hose or other connection leading to the radiator. The head part is secured to the body part by means of suitable bolts 14 and is also provided with suitable apertures receiving spark plugs 15 in the usual manner.

Secured to the rear end of the body part A and covering the aperture therein is a transversely divided circular plate, the lower half thereof being indicated at 18 and the upper half at 19. The part 18 is provided on its outer face with a projecting, upwardly-opening, semi-cylindrical bearing member 20, while the part 19 is provided with a similar, mating bearing member 21 complementary to the member 20 and secured thereto by means of bolts 22. Secured to the opposite end of the crank casing and covering the aperture therein is a circular plate 23 similar in all respects to the plate 18, 19, excepting that it is made in a single piece. This plate carries on its outer face an integral projecting cylindrical bearing 24 alined with the bearing formed by the members 20, 21. Journaled in these bearings is the usual crank shaft 25 having at its rearward end the usual fly-wheel 26 and having its forward end extending through the bearing, as at 27, where it may be connected to the usual radiator fan (not shown).

Journaled in a suitable bearing 28 carried by the rearward end plate 1 is a lay-shaft shown in dotted lines at 29, and carrying a gear wheel 30 meshing with the usual gear wheel 31 carried by the crank shaft. This lay shaft is mounted substantially parallel with the crank shaft and above and at one side of the same, being preferably spaced substantially directly beneath the outlet valves and carrying the cams whereby the same are operated. The forward end of this lay shaft projects through the forward casing plate into a pump casing 32 and is journaled in a bearing 33 carried by the outer wall of this casing, the shaft being provided with suitable blades (not shown) whereby an oil pump is formed. The intake side of this pump is put into communication with the interior of the semi-cylindical bottom 2 by means of a pipe 34, while the discharge side thereof is connected to the crank shaft bearings by pipes 34ª and to any other parts which require forced lubrication.

By referring to Fig. 2 it will be seen that this lay shaft 29 is mounted immediately within the opening defined by the edges 3 so that the same together with all the cams thereon and the associated parts are immediately accessible for purposes of repair, replacement, adjustment or inspection. For covering this opening, I provide a flat metal plate 35, which forms a part of the plate part above mentioned, and is tightly secured to the open side of the case by means of suitable bolts 36. Secured to the outer face of this plate is a bracket 37, a pump casing 38, and a gear casing 39, the faces of the pump casing and of the gear casing being formed with journal boxes 38ª and 39ª respectively. Mounted within these boxes is a rotatable jackshaft 40 having at the end within the casing 39 a gear 41 meshing with the gear 30. The casing of the pump is connected by means of a suitable duct 42 with the intake connection of the cylinder water-jacket, the other side of the pump being provided with a conduit connection 43 to which is secured the pipe 44 leading from the radiator. Mounted upon the bracket or shelf 37 is the magneto 45, held in place in any suitable manner, as by the clip 46, and having a shaft 47 in substantial alinement with the shaft 40 and connected thereto by means preferably of a flexible or universal joint 48. The magneto may also carry a timing box 49 as is customary in such cases. Part of the plate 35 is also illustrated as furnished with a hollow funnel-shaped connection 50 provided with a cap 51 which at the same time provides a filling opening, whereby lubricant may be supplied to the crank case, and a breather-outlet whereby variations in the internal pressure of the crank case may be compensated. In the present embodiment I have illustrated the side of the crank case immediately above the plate 35 as formed with a pair of spaced, oblong openings covered by plates 52—52 whereby access may be permitted to the stems of the valves. This is the preferred construction, although it is obvious that these plates could with equal facility be made as extensions from the plate 35. Owing to the fact that access to these stems is needed more frequently than access to the rest of the crank case, it is preferred that these plates be separate so as to necessitate the smallest possible amount of manipulation.

Even if it be necessary to obtain access to the interior of the crank case, it is not necessary to unship the main crank shaft as is true in so many engines, or to remove the lubricant pan with its attendant grease or

in any way to disturb the adjustment of the engine. The loosening of the screws 36 immediately permits the plate 35 to be taken away as a whole with only the disconnection of the gears 30 and 41. The bottom portion 2 has sufficient upward sweep at its forward side to retain all the lubricant normally carried in the crank case, notwithstanding the removal of the plate 35. Free access is now permitted to the interior of the engine without the necessity of assuming an awkward or inconvenient position or without the difficulty and necessity of working in the dark as in most other engines. If it be desired to remove the piston, the head part B can be removed, the pitmen disconnected from the crank shaft, and the pistons immediately withdrawn through the upper end of the cylinders.

For the purpose of supporting my improved engine, I provide the bearing member 20 with a pair of laterally projecting integral arms 60, 60 forming together a bracket having downturned feet 61, 61. The bearing 25 is likewise formed with laterally projecting arms 62 having similar feet 63. Both pairs of feet are supported upon cross beams 64, 64 supported at opposite sides of the vehicle. In the present case, since the vehicle in question is an automobile, the beams 64, 64 are formed with upwardly deflected ends 65, 65 whose upper ends are secured to the side sills 66 of the chassis. In case the vehicle in question were a boat a similar mode of suspension would be employed as is obvious. The advantages of this mode of suspension are numerous. The bearings carrying the main shaft being secured to cross beams of the chassis similarly to the transmission gear and propeller shaft, the same are efficiently maintained in alinement; the weight and stress of the crank shaft being carried immediately by the frame work of the car, this load is taken off the engine frame, therefore permitting the same to be made light and less liable to become fractured; while a better balance of the running parts is obtainable because of the fact that the shaft is journaled to a heavier and more rigid part of the machine.

In assembling this engine the plate 23 with its bearing 24 is first secured to the forward end of the casing after which the crank shaft, naked except for the gear 31, is inserted through the aperture in the rear end of the casing and the forward end of the crank shaft introduced into the aperture in the bearing 24. The plate 18 with its half bearing 20 may now be applied and after that the plate 19 with its half bearing 21, the same being suitably secured to the casing and to each other. The pistons can now be introduced into the upper end of the cylinders (the head part B being still removed) and their pitmen suitably connected to the crank shaft. The inlet and outlet valves may also be introduced through the tops of their respective chambers and arranged in connection with their respective cams. The mode of applying the head part and plate part will be obvious without further description.

By the construction described herein the engine is supported at points where the greatest strain ordinarily exists and the crank case is entirely relieved of the strain due to the suspension. A further and very important advantage in convenient assembling and disassembling as well as in cheapness of construction is secured by mounting the subsidiary mechanism (jack shaft, pump, magneto, etc.) on the removable side plate. This side plate furnishes a base whereon these parts may be truly and accurately assembled in position to coöperate with the driving parts within the crank case. Thereafter, by merely bolting the cover plate in place, the mechanism carried and assembled thereby is brought into operative relation to the coöperating driving mechanism within the case.

While I have described my invention in connection with an automoble engine, it is obvious that many of its features will be of equal advantage in connection with launch engines or other power sources, wherefore I desire it to be understood that I esteem all such uses to fall within the scope of my invention. Likewise while I have necessarily described my invention in detail, I do not propose to be limited to such details, except as the same may be positively included in the claims hereto annexed or may be rendered necessary by the prior state of the art.

Having thus described my invention, what I claim is:

1. In an internal combustion engine, the combination, with a vertically extending cylinder and a crank case therebeneath, said case having one side thereof provided with an opening extending substantially the length of the case and the bottom of said opening being above the bottom of the case, of a crank shaft in said case, a lay shaft journaled in said case adjacent to the said opening, driving connections between said shafts, a gear on the lay shaft, a cover plate for the opening in the crank case and removably attached to the crank case, bearings carried by said cover plate, a jack shaft mounted in said bearings, a gear on said jack shaft meshing with the lay-shaft gear, and subsidiary mechanism also mounted on the cover and driven by said jack shaft, said plate, jack shaft, and subsidiary mechanism forming a unit coöperating with the crank shaft and the lay shaft within the crank case.

2. In an internal combustion engine, the combination, with a vertically extending cylinder and a crank case therebeneath, said crank case having in one side and above the bottom thereof an opening and the side edges of said opening being in a substantially vertical plane, of a crank shaft in said case, a lay shaft journaled in said case and extending across and adjacent to said opening, a cover plate for said opening, bearings carried by the cover plate, a jack shaft journaled in said bearings, a driving connection between the crank shaft and the lay shaft, intermeshing gears on said lay shaft and on said jack shaft, subsidiary mechanism mounted on the cover plate, driving connections between said mechanism and said jack shaft, and means for detachably securing the cover plate and both the attached shaft and mechanism to the crank case.

3. In an internal combustion engine, the combination, with a vertically extending cylinder and a crank case therebeneath having a substantially semi-cylindrical bottom and provided in one of its sides, above such bottom, with an opening extending substantially the length of said side, of a crank shaft in said case, a lay shaft in said case adjacent to said opening, means for driving the lay shaft from the crank shaft, a cover plate removably applied to the opening in the side of the crank case, bearings carried by said cover plate, a jack shaft mounted in said bearings, intermeshing gears on the jack and lay shafts, subsidiary mechanism mounted on the cover plate, and a driving connection between such mechanism and the jack shaft.

4. In an internal combustion engine, the combination, with a vertically extending cylinder and a crank case therebeneath provided in one of its sides, above its bottom, with an opening extending substantially the length of said side, of a crank shaft in said case, a lay shaft in said case adjacent to said opening, means for driving the lay shaft from the crank shaft, a cover plate removably applied to the opening in the side of the crank case, bearings projecting outwardly from said cover plate, a jack shaft mounted in said bearings, intermeshing gears on the jack and lay shafts, subsidiary mechanism mounted on the outer side of the cover plate, and a driving connection between such mechanism and the jack shaft.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

CLAUD H. FOSTER.

Witnesses:
J. B. HULL,
BRENNAN B. WEST.