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IN THE UNITED STATES PATENT OFFICE

Patent Application of Louis Chevrolet
R. J. Parrish

Division 28

Serial - 373,209

Room 225

Filed - June 24, 1929

For - Aviation Engine

November 22, 1930.

The Commissioner of Patents,

Washington, D. C.

SIR:

Responsive to Examiner's action dated May 26, 1930,
amend the specification as follows:-

- ✓ Page 2 of the specification, line 1, strike out
- full - . ✓ In lieu of - the - insert - our - . ✓ Line 5, after
- an - insert - inverted type of - . ✓ Line 6, after - and -
insert - in which certain - . ✓ Strike out - illustrates two - .
✓ In lieu of - the - insert - our - . ✓ After - invention - in-
sert - are illustrated - . ✓ Line 7, - Fig. 2 - should begin a
paragraph. ✓ Strike out line 8. ✓ In lieu of line 8 insert
- the gear-chain portion of Fig. 1 - . ✓ Line 9, strike out
- same features - . - Fig. 3 - should begin a new paragraph.
✓ Line 11, in lieu of - the - insert - a - . ✓ Line 12, - Fig. 4 -
should begin a new paragraph. ✓ Line 14, strike out - and is - .
✓ Line 15, strike out - and in the direction of the arrows - .
✓ - Fig. 5 - should begin a paragraph. ✓ Line 14¹⁶, after - 3 -
insert - . - . ✓ Strike out - and - . ✓ Line 16, strike out the
entire line.

✓ Page 3, strike out lines 1 to 30 inclusive, and in
lieu thereof substitute the following paragraphs - (A copy is
attached for your convenience.)

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Authority: E.O. 13526
Date: 10-2-05

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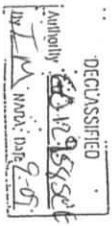
Sub found

Sub A

28

In the drawings 10 indicates a plate or end frame adapted to receive a cover construction 11 and herein said end frame is shown parted as at 12 forming an upper frame member 10-a and a lower frame member 10-b, each being closed by the respective covers 11-a and 11-b, interposed between said frame members is a gasket or compensating sealing construction 13. The two frame members are drawn together by the bolts 14 and associated with each is a lock washer 15. Said bolts have the head portion 16, apertured as at 17. The bolts are turned down tight in order to draw the two frame members together in clamping relation with respect to the sealing member 13, and then are backed off a sufficient amount normally to permit a little play, but such play is prevented by the lock washers 15. The bolts are prevented from loosening through vibration by means of the locking wire 18.

The cylinder has a main body portion or barrel 19 of steel and a head portion 20 of aluminum. As the engine heats up it will be apparent that the distance between the crank shaft 21 and the cam shafts 22, of which there are two, increases. Since the cylinders become very hot in a very short time, and since the end frame is relatively remote from said cylinders, the frame does not acquire the same temperature at the same time as do the cylinders and consequently the amount of expansion in the end frame is not the same as the amount of expansion in the cylinders between the cam shafts and the crank shaft. Unless this expansion is compensated for there will be additional strains exerted in the frame and shafts particularly in the latter.



2 In the drawings, 10^m-11 indicate end plates which are flanged at 10_a - 11_a and are adapted to attachment of covers 10_b - 11_b flanged at 10_c - 11_c. Plate 11 and cover 11_b are fastened together at 12. Flanges 10_a - 11_a and 10_c - 11_c are spaced apart by an interposed resilient gasket 13 and are retained in intimate face to face cooperating relation with one another by bolts 14 with which lock washers 15 are associated. The bolts are sufficiently tensioned to maintain correct relation of the parts which are contiguous at gasket 13; to not materially interfere with the unequal expansion characteristics of the complete assembly; and to relieve the otherwise rigid relation between the upper and lower sections of the gear-chain housing. Bolt heads 16, drilled therethrough at 17, are guarded against excessive loosening by wire 18 successively threaded and secured in a conventional manner.

The composite cylinder has a main body portion comprising a barrel 19 of steel and a head portion 20 of aluminum. The cylinders become very hot after a short period of operation and the consequent expansion increases the distance between the crank shaft 21 and the cam shafts 22_a - 22_b on the engine, to thereby cause a material change in the relative positions of the two part gear-chain housing; the two cam shafts; and the crank shaft. The spaced relation of the gear-chain housing to the cylinders prevents an immediate equalization of temperatures between the two units. Therefore, it becomes necessary to provide means to relieve the stresses which will otherwise produce destructive strains in the associated mechanisms, particularly in the shafts.

a² bolts

2.

Amendment 11-22-'30

Impulse of 2"

In the drawings, 10-11 indicate end plates which are flanged at 10a - 11a and are adapted to attachment of covers 10b - 11b flanged at 10c - 11c. Plate 11 and cover 11b are fastened together at 12. Flanges 10a - 11a and 10c - 11c are spaced apart by an interposed resilient gasket 13 and are retained in intimate face to face cooperating relation with one another by bolts 14 with which lock washers 15 are associated. The bolts are sufficiently tensioned to maintain correct relation of the parts which are contiguous at gasket 13; to not materially interfere with the unequal expansion characteristics of the complete assembly; and to relieve the otherwise rigid relation between the upper and lower sections of the gear-chain housing. Bolt heads 16, drilled therethrough at 17, are guarded against excessive loosening by wire 18 successively threaded and secured in a conventional manner.

The composite cylinder has a main body portion comprising a barrel 19 of steel and a head portion 20 of aluminum. The cylinders become very hot after a short period of operation and the consequent expansion increases the distance between the crank shaft 21 and the cam shafts 22a - 22b on the engine, to thereby cause a material change in the relative positions of the two part gear-chain housing; the two cam shafts; and the crank shaft. The spaced relation of the gear-chain housing to the cylinders prevents an immediate equalization of temperatures between the two units. Therefore, it becomes necessary to provide means to relieve the stresses which will otherwise produce destructive strains in the associated mechanisms, particularly in the shafts.

c. e. page 2

✓ Page 4, in lieu of lines 1 - 8 inclusive, substitute the following paragraph:

a²
The compensator arrangement permits the ends of the crank shaft and of the cam shafts to move toward and away from each other without bending or distorting them in response to the cylinder expansion; to maintain a full circular bearing for each of the cam shafts and the crank shaft; and prevents breakage of the end frame caused by unequal expansion between the cylinders and the gear-chain housing.

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✓ Page 7, line 17, pluralize - ~~cap~~ - to caps - . ✓ In lieu of - is - insert - ~~are~~ - . ✓ Line 29, after - . - add - At 99 a portion similar to 92 is shown but differs therefrom in that 99 is a broken away portion of 11 in Fig. 2. Part 99, together with 98, serves to tie the lower portion of 11 to the adjacent cylinder. Spacing 100 allows for differences in expansion between 99 and 92 in the same manner as at 97. -

Amend claim 2 as follows:

a³
✓ Line ³2 of the claim, strike out - so-called - . ✓ Line 6, after - cylinders - insert - and at the remote end - . ✓ Line 7 of the claim, after - section - insert - gear-chain housing - . ✓ Strike out - end frame construction - . ✓ Line 8, before - connecting - insert - separably attached to said engine and - . ✓ Line 9, after - and - insert - resilient means - . ✓ Strike out - expansion and contracting compensating means - . ✓ Line 10, in lieu of - the end frame - insert - said - . ✓ After - sections - insert - to compensate for laterally misaligning stresses applied to said sections - .

✓ Cancel claims 3 and 9.

✓ Page 4, line 13, in lieu of - end frame - insert - plate - . ✓ After - 10 - insert - b - . ✓ Line 20, in lieu of - the - insert - a - . ✓ Line 21, in lieu of - any other system of ignition - insert - an auxiliary unit - .

3.

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By: [signature]
Date: 8-14-12

Sub A²
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The foregoing expansion compensator arrangement permits the ends of the crank shaft and the cam shafts to move toward and away from each other as required by the cylinder expansion without bending or distorting the same by reason of the end frame mounting. This permits a full circular bearing to be provided for each of the cam shafts and the crank shaft and breakage of the end frame through expansion is eliminated.

Rotatably mounted in bearing 23 is a tubular member 24 splined as at 25 to a gear or sprocket 26 driven by chain 27 from the crank shaft through sprocket 28.

for a
"Insert"
15
4

Supported by the ~~end frame~~ ^{plate} 10 are a pair of magnetos 30 mounted as at 29, and to the short shaft ^{of the units} 31 projecting from each, ~~see 31~~ ^{to}, is keyed ~~as~~ at 32, a gear 33, retained by the lock washer 34, nut 35 and cotter key 36. ^{Gear 33} The ~~afore~~ ^{is} axially receivable by the enlarged end of the tubular driving member 24, the same being provided with a plurality of semi-circular recesses 37. The sprocket 26, therefore, drives ^a ~~the~~ magneto or ^{an auxiliary unit} ~~any other system of ignition~~ through member 24 and 33 and shaft 31, and any desired timing can be obtained by removing the magneto and repositioning the members 33 in 24. The chain 27 passes over sprocket 38 and the chain is tensioned by an idler sprocket 39, or the like, pivotally supported at 40 in the link 41 and the tension is adjusted by the adjusting mechanism 42.



REMARKS

The amendment to the specification is intended to improve the phraseology, to more definitely indicate certain parts, and to eliminate the inadvertent contradiction between lines 14 and 15. The flanged plates have been numeraled in a manner which indicates the upper and lower portions instead of referring to both parts by one numeral such as 10 for both covers, and 11 for both flanged plates.

OK

The solicited corrections to Fig. 1 more definitely indicate a fastening bolt, cam shaft numerals are added and plate numerals are corrected. Fig. 2 is corrected to more clearly indicate the relation of sprocket chain 27 to an attaching bolt, and certain numerals have been used to more clearly indicate the several parts of the flanged plates together with their associated parts in order to agree with Fig. 1 and the specification as herein amended. A separate communication to the Chief Draftsman is attached.

Claim 2 as amended is believed to avoid Masury, Chorlton, Smith, Radloff or Dorris in that these references do not show resilient means clamped between contiguously related portions. Applicant requires means for producing lateral and longitudinal flexibility between the contiguously bolted portions of his gear-chain housing. Mere bolted together housings are not new, they are usually required to meet production or service conditions and the bolted housings in the references appear to be based on such facts. The constructions disclosed in the references do not require universally directional flexibility as does that of applicant. Bramwell shows a gasket 3 which he states is a non-heat conducting ring. His cylinders involve high temperature conditions which are not present in applicant's gear-chain housing. Applicant's member 13 is not

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necessarily non-heat conducting, it acts as a resilient joint between his two portion housing which is subject to stresses produced by a tendency to misalignment between crank shaft 21 and cam shafts 22a and 22b in response to temperature differences between the cylinders and the gear-chain housing. The art of Bramwell is non-analogous to that of applicant in so far as it applies in one instance directly to cylinders and in the other instance it applies to a two part gear-chain housing, the two objectives are materially unrelated although both are in a way, related to engines. The references do not disclose a gear-chain housing spaced apart from the engine crank case and the cylinders. Applicant's gear-chain housing is detachable as a unit from the engine to thus promote servicing and economy in manufacture.

Applicant does not claim fastening bolts and a locking wire per se but he does claim the combination as set forth.

Allowance of claim 2 as amended is solicited.

Applicant has studied the Finley reference in connection with claim 4. Applicant concurs with Examiner in his opinion that the drawings do not adequately indicate the cooperative relations between certain parts. Also, he submits that they do not adequately indicate a member for fastening the lower part of the chainhousing to a cylinder. A portion of the member is shown on the attached marked blue print at 99 in Fig. 4 but section line 2 - 2 of Fig. 1 shown by Fig. 2 is such that 99 does not appear. The portion shown at 99 is attached adjacent the bearing for gear 46 and would be clearly shown by an additional correction of Fig. 2. However, the addition of numerals 22a - 22b to Fig. 1 more clearly brings out the relation of the engine proper to the cam shafts and the chain con-

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necting the crank shaft gear to the cam shaft gears. An additional drawing showing an additional section may also serve to show the connection between the gear-chain housing and the engine as incompletely shown at 99 of Fig. 4 on the marked blue print. Finley does not disclose a cam shaft at the end of the cylinders opposite the crank shaft. Applicants construction avoids the push rods and associated mechanism of Finley. Applicant operates his valves directly from his cams to his valve stems to thereby greatly simplify the construction and to particularly adapt it to aircraft service. Applicant's engine is inverted to thus eliminate obstructions to vision by the pilot.

Finley does not disclose a valve support, a cam shaft bearing and a cylinder which are integral with each other.

Applicant's valves are not supported by a spacing member but to the contrary are supported and guided by a portion 20 of his composite cylinder. Applicant's construction is thereby simplified and materially lightened over that of Dinley.

In view of the above argument claim 4 is believed to avoid Finley and its allowance is solicited.

New claim 15 brings out the fact that applicant's engine is an inverted type in which the crank shaft is attached at the upper ends of the cylinders; that the cam shafts are supported by and at the ends of the cylinders remote from the crank shaft; that the cam shaft operating means is housed in a separate compartment detachably attached to a cylinder and that certain gears are rotatably mounted within and to the gear-chain housing. The cooperating constructional relation of the

several parts materially contributes to light weight and economy in manufacture. Claim 15 is believed to materially differ from the references of record and allowance is solicited.

New claim 16 is intended to cover applicant's internally splined gear for driving an auxiliary unit at a fixed speed relation to the crank and cam shafts and for adjusting the coaxial relation of the auxiliary shaft to the internally splined gear. An auxiliary unit may, for example, comprise an ignition device; a starter; an electric generator; or a combined generator and ignition device as desired. Claim 1 upon which Division was required under date of Jan. 25, 1930, included an ignition unit of a special type whereas new claim 16 is based on a form of drive from within an engine housing and which is adapted to the operating characteristics of a device mounted on the housing. The internally splined gear is adapted to drive, or to be driven by, an auxiliary unit. // Allowance of claim 16 is solicited.

Respectfully,

THE CHEVROLET AIRCRAFT CORPORATION

By Louis Berolay Pres.

W.B. Churcher
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