April 25, 1933. L. CHEVROLET ET AL 1,906,045

AVIATION ENGINE

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FIG. 1

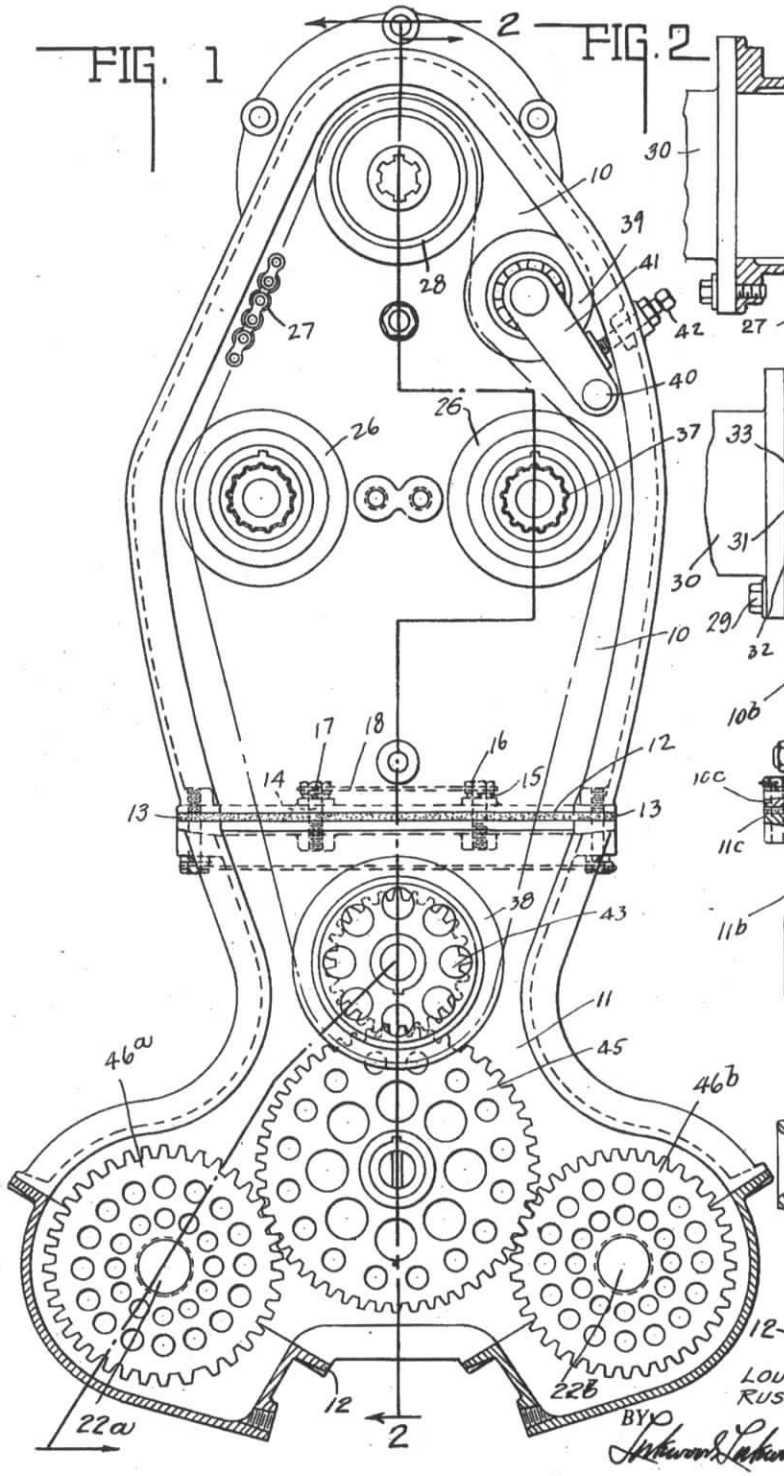

FIG. 2

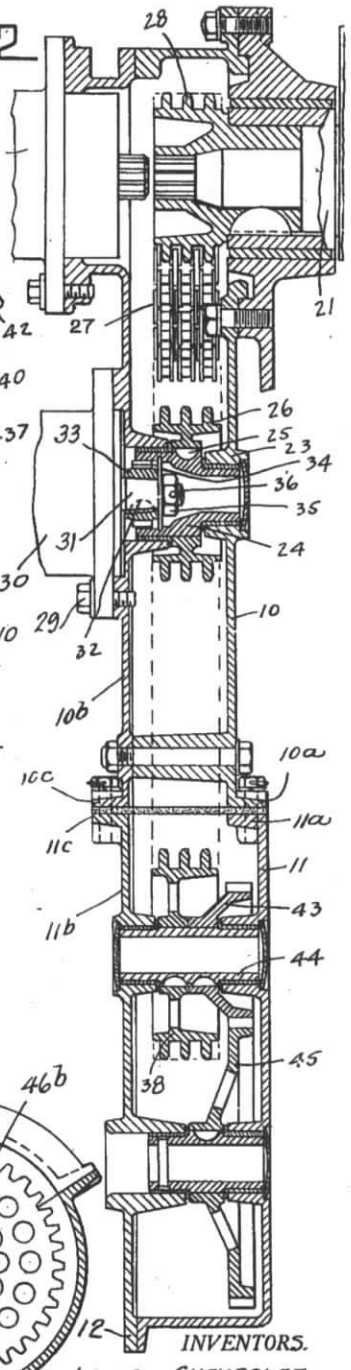

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FIG. 3

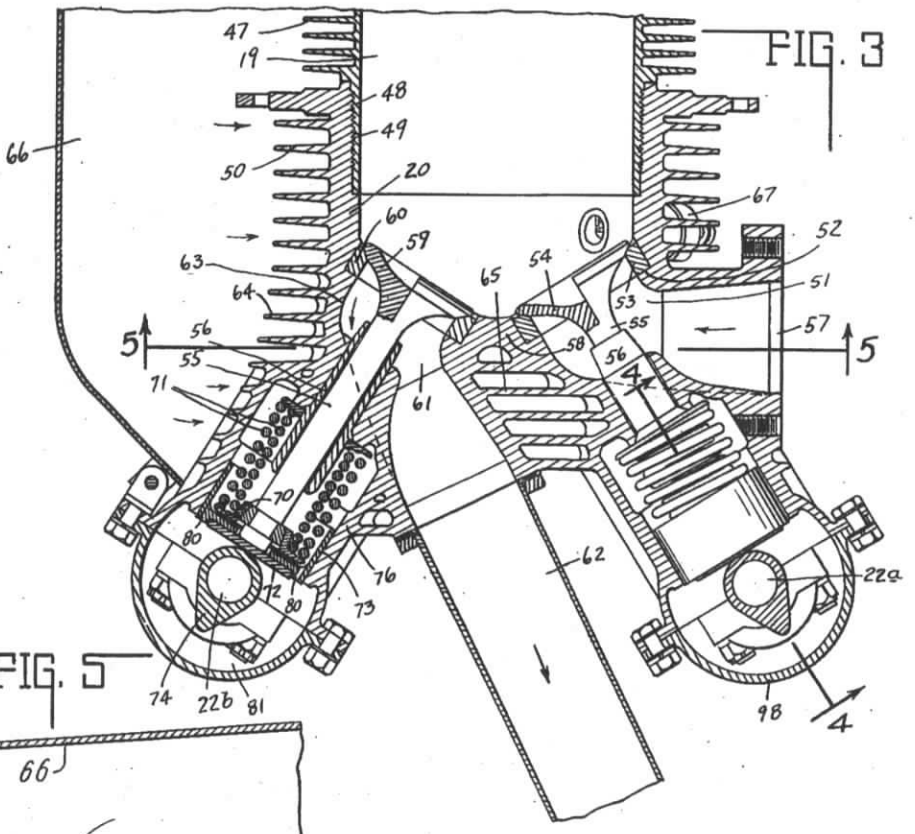

FIG. 5

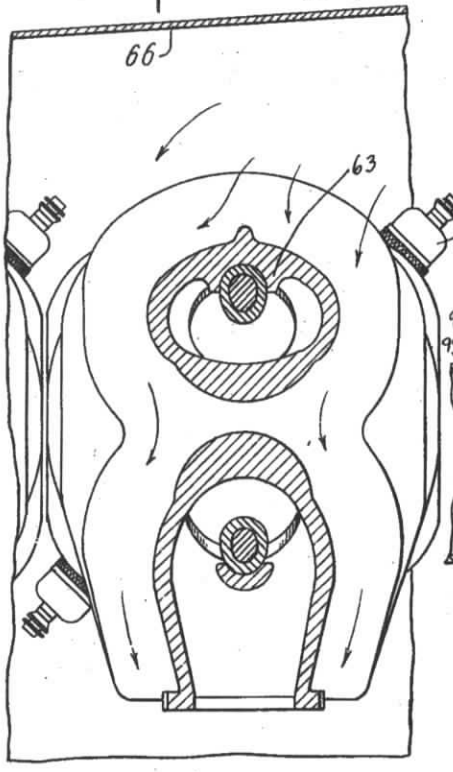

FIG. 4

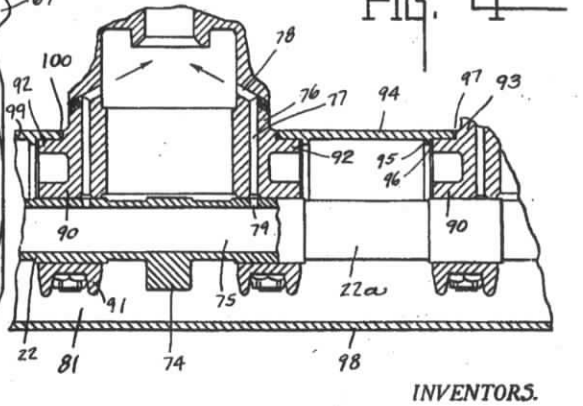

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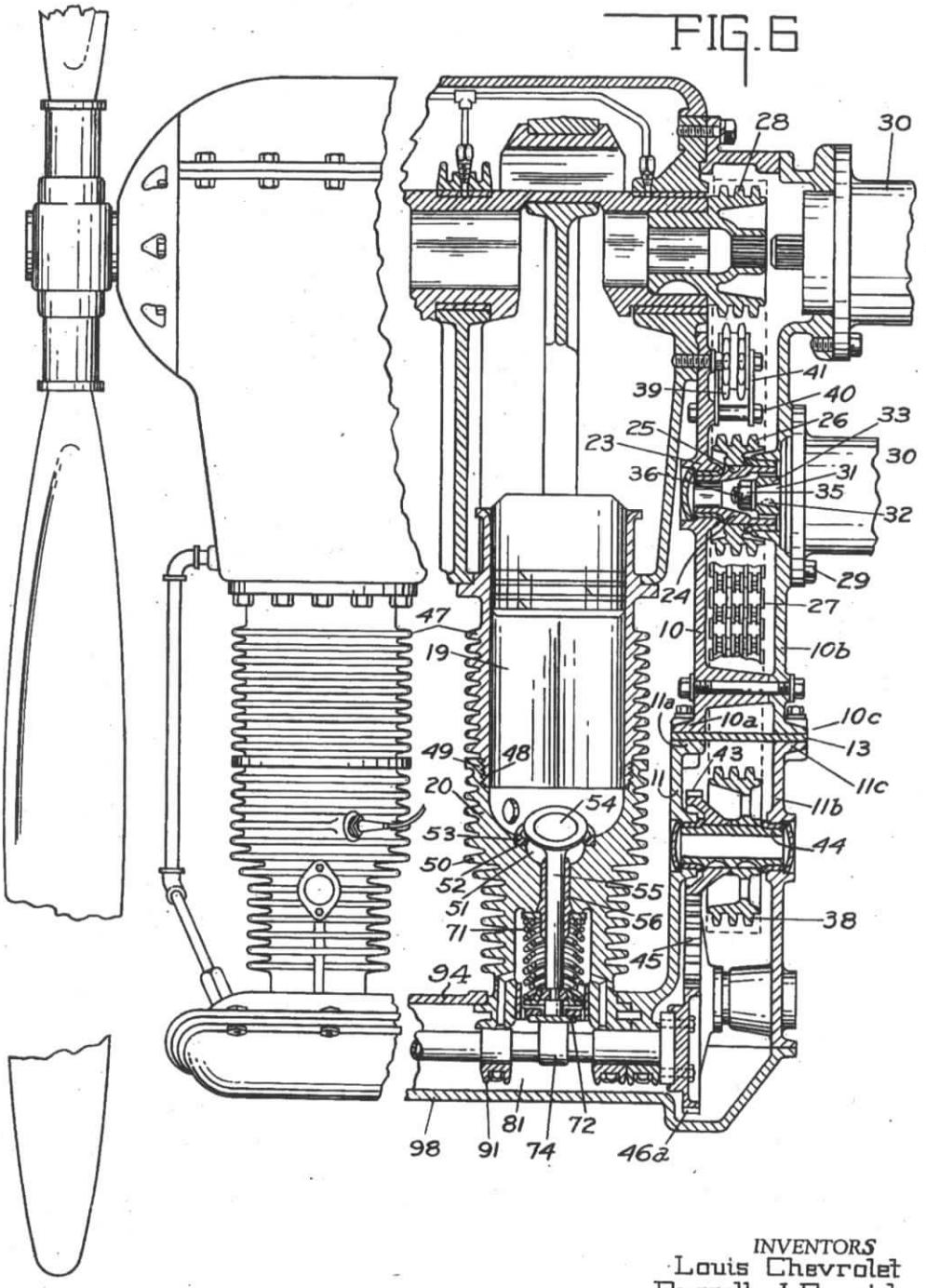
FIG. 6



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UNITED STATES PATENT OFFICE

LOUIS CHEVROLET, OF BALTIMORE, MARYLAND, AND RUSSELL J. PARRISH, OF INDIANAPOLIS, INDIANA, ASSIGNORS, BY MESNE ASSIGNMENTS, TO THE GLENN L. MARTIN CO., OF BALTIMORE, MARYLAND, A CORPORATION OF MARYLAND

AVIATION ENGINE

Application filed June 24, 1929. Serial No. 373,209.

This invention relates to an internal combustion engine suitable for aviation purposes and of the cylinder-in-line type.

The chief object of this invention is to provide an internal combustion engine which incorporates certain desirable features that facilitate in the assembly and construction, as well as increase the efficiency of operation of the engine.

One of these features consists in the resilient compensating connection between parts which normally have different amounts of expansion.

A second feature of the invention consists in a readily adjustable internal-external drive.

A third feature of the invention consists in the predetermined directional discharge of the exhaust gases and the directional cooling associated with the hottest part of the engine other than the explosion chamber.

Another feature of the invention consists in the simultaneous lubrication and cooling of the valve mechanism.

Still a further feature of the invention consists in the telescopic adjustable cam shaft housing arrangement.

Other features of the invention will be set forth more in detail hereinafter.

The nature of our invention will be understood from the accompanying drawings and the following description and claims:

In the drawings Fig. 1 is an end elevation of an inverted type of internal combustion engine suitable for aviation purposes and in which certain features of our invention are illustrated.

Fig. 2 is a longitudinal section taken on line 2—2 of the gear-chain portion of Fig. 1.

Fig. 3 is a longitudinal sectional view through the valve end of a cylinder illustrating the so-called overhead valve type engine and a directional exhaust and cooling system.

Fig. 4 is a longitudinal sectional view taken through one of the valve pockets, cam shaft and housing, taken on line 4—4 of Fig. 5 is a sectional view taken on line 5—5 of Fig. 3.

Fig. 6 is a side elevation of the engine partially in section showing the features of Figs. 1 to 5 inclusive in their operative relation to one another.

In the drawings, 10—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.

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

tain 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.

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.

Auxiliary units that are adapted to be operatively connected to crankshaft 21 through either a gear or a chain are supported by plate 10*b* at 29. Each unit 30 has a shaft 31 that is keyed at 32 to a gear 33. The gear may be retained by lock washer 34, nut and cotter pin 36. Gear 33 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 magneto or an auxiliary unit 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.

An off-set gear 43 is coaxially mounted upon the shaft 44 supporting sprocket 38 and both are keyed thereto. Offset gear 43 meshes with gear 45 which in turn meshes with the gears 46*a* and 46*b* carried by the ends of the cam shafts. Since the two cam shafts are driven by a single intermediate gear, they rotate in the same direction.

Each cylinder 19 has formed integral thereon a plurality of heat radiating fins 47 and a threaded portion 48 having threaded engagement with the correspondingly threaded portion 49 of the head 20. The steel portion of the cylinder constitutes substantially the entire cylinder body and the aluminum portion constitutes the head portion as shown. The aluminum portion also has peripherally enveloping fins 50 thereon and formed in the head is an intake passage 51 enlarged at 52 to receive a valve seat 53 closed by a valve 54 having its stem 55 slidably mounted in the valve guide 56.

The exhaust gases are discharged when the exhaust valve 59 is lifted from its seat 60. The exhaust passage is not directed the same as the intake passage, but said passage 61, which is of uniform cross section, extends between the two cam shafts as at 62. The hottest portion of the exhaust passage, on account of the deflection of the exhaust gases, is indicated at 63 and the wall thereof is integral with the fins 64 that extend around said passage, said fins merging with the fins around the intake passage as at 65.

The air which passes along the engine is trapped by a scoop 66 and is caused to pass along the same and exhaust side of each cylinder and between each cylinder as indicated by the arrows in Fig. 5 around the exhaust valve construction for cooling the same. This predetermined directional discharge of the exhaust is such that the air for cooling supplied thereto by the scoop first impinges upon the hottest part of the exhaust passage to cool the same and then passes on to the cooler portions before completing its discharge.

The direction of discharge about the cylinders is illustrated in Fig. 5 and said figure also illustrates the dual ignition in the form of dual spark plugs 67.

The valve construction for intake and exhaust valves is substantially identical and therefore a description of one will suffice for both. The valve guide 56 slidably supports the stem 55 which at the end opposite from the valve terminates in a spring retainer 70 that engages the ends of a multiple concentric spring construction 71. A follower in the form of a plate 72 is mounted by a cup 73 having a tubular portion and a plate portion. The plate 72 is engaged by the cam 74 and is caused to reciprocate with the stem in opposition to the springs when the cam is rotated.

The cam shaft 22 is hollow as at 75 and in the housing portion 76 that encloses the valves there are provided passages 77 that discharge angularly as at 78 toward the stem and guide. A plurality of passages 77 is provided and the cam shaft has a port 79 that is adapted to connect each of the longitudinal passages 77 with the interior 75 of the cam shaft. Lubricant under pressure is carried by the cam shafts and the lubricant is discharged whenever the port 79 registers with the passage 77 and discharges from the angular passage 78 inwardly toward the valve construction.

The registration of port 79 with the passage 77 is such that the discharge through the passages 78 occurs while the valve spring is extended and the valve closed. This is to permit the lubricant to pass through the springs as well as engage the same, and the passage is so directed that the lubricant impinges upon the guide, runs down the same and not only lubricates but cools all these parts. The surplus lubricant drains through the construction and discharges through ports 80 in cup 73 into the cam shaft housing chamber 81. The registration of the ports 79 with the passages 77 is such that for each cam shaft no more than one port is in registration with its cooperating passage at any one time. This arrangement permits the lubricant to be forced through the ports 79 and passages 77 and 78 under full pressure.

Each cylinder head 20 has formed therein the lateral bearing extensions 90 and the

caps 91 are associated therewith for rotatably mounting the cam shaft 22. Concentric with the bearing 90 is a semi-circular flange 92 that is shouldered as at 93 and interposed between a pair of said flanges is a semi-cylindrical spacing closure 94 that has the inwardly directed flanges 95 thereon. As shown clearly in Fig. 4, the spacings 96 and 97 are such that as the engine heats up and expands the cylinders maintain their usual longitudinal spacing and they are not distorted therefrom by reason of a solid connection between the cylinders or the head construction. A cam shaft cover 98 is suitably secured to the flanges associated with each of the cam shaft housing constructions, and all of the parts are thus secured together for enclosing the cam shaft. 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.

The invention claimed is:

1. In an internal combustion engine the combination of a plurality of individual cylinders arranged in straight line formation, a crank shaft associated with each cylinder and coincident with said alignment, a cam shaft likewise in alignment therewith and positioned oppositely with respect to the cylinders and at the remote end from said crank shaft, a multiple section gear-chain housing separably attached to said engine and connecting one end of the cam shaft and crank shaft, and resilient means interposed between said sections to compensate for laterally misaligning stresses applied to said sections.

2. In an internal combustion engine the combination of a plurality of cylinders in line; a cam shaft for valve operation; a head for each of said cylinders; a valve support and cam shaft bearing integral with each of said heads; a cam shaft embracing spacer between adjacent cylinders, said spacer being shouldered to the support and bearing; and a cover for the cam shaft and the supports, said spacers being detachably attached to said cover.

3. In an internal combustion engine, the combination of a plurality of cylinders arranged in line, a plurality of cam shafts arranged side by side but in spaced relation, valve means in each cylinder controlled by each of the cam shafts, an intake passage in the head of the cylinder, and an exhaust passage likewise therein and having directional discharge between said cam shafts.

4. In an internal combustion engine, the combination of a plurality of cylinders arranged in line, a plurality of cam shafts arranged side by side but in spaced relation, valve means in each cylinder controlled by each of the cam shafts, an intake passage in the head of the cylinder, an exhaust passage likewise therein and having directional discharge between said cam shafts, and means for presenting a cooling medium initially to the exhaust portion of the cylinder.

5. In an internal combustion engine, the combination of a plurality of cylinders arranged in line, a plurality of cam shafts arranged side by side in spaced relation, valve means in each cylinder controlled by each of the cam shafts, means for supplying cooling air to one side of the engine, an intake passage communicating with each cylinder and upon the side opposite therefrom, and an exhaust for each cylinder and directed between the cam shafts for presenting uninterrupted cylinder contact to the cooling medium upon the side opposite the intakes.

6. In an internal combustion engine, the combination of a plurality of vertical cylinders arranged in tandem relation; an inlet and an outlet valve in each of said cylinders; a crank shaft collectively associated with said cylinders; two cam shafts aligned with said crank shaft and rotatively mounted on extended portions of said cylinders at their ends opposite said crank shaft, the cams of said shafts being in direct operative relation to the stems of said valves; a gear-chain housing detachably attached to one of said cylinders; meshed gears mounted within said housing for rotating said cam shafts; a chain adapted to rotate said gears; and a gear attached to said crank shaft to operate said chain.

7. In an internal combustion engine, a crank shaft; a cam shaft; a chain adapted to rotation of said cam shaft by said crank shaft; a housing for said chain, said housing being detachably attached to said engine; an internally splined gear rotatably mounted within said housing in fixed relation and adapted to rotation by said chain; and provision on said housing for mounting an auxiliary unit adapted to spline into said gear.

In witness whereof, we have hereunto affixed our signatures.

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