

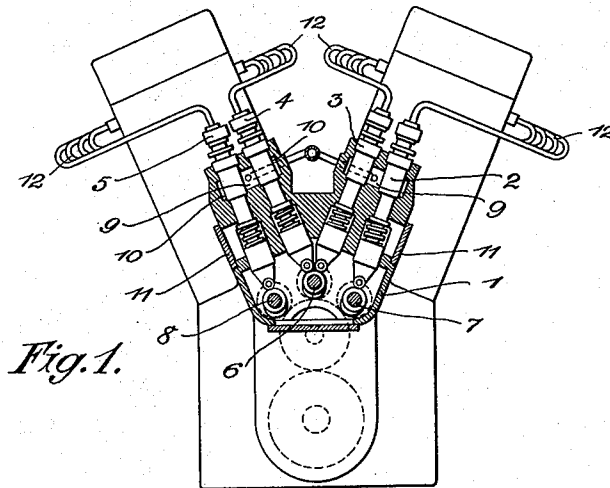
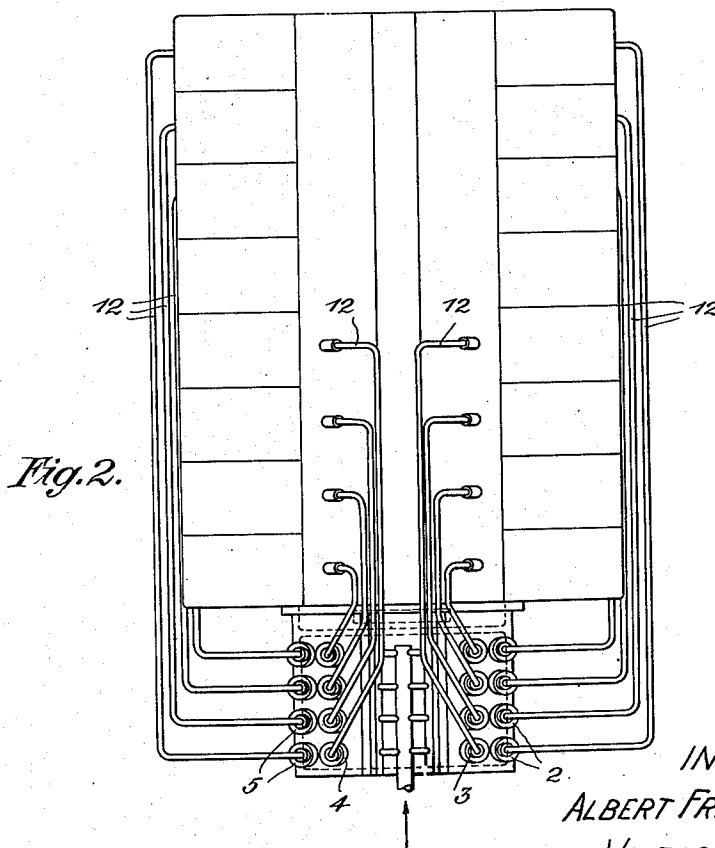
Feb. 11, 1941.

A. FRIEDRICH ET AL

2,231,264

FUEL INJECTION PUMP FOR MULTICYLINDER ENGINES

Filed Dec. 15, 1938



INVENTORS:
ALBERT FRIEDRICH
VICTOR ULRICH
by *A. A. Wische*
Donald W. Ransom
ATTORNEYS

UNITED STATES PATENT OFFICE

2,231,264

FUEL INJECTION PUMP FOR MULTI-CYLINDER ENGINES

Albert Friedrich and Victor Ulrich, Stuttgart-Cannstatt, Germany, assignors to Daimler-Benz Aktiengesellschaft, Stuttgart-Unterturkheim, Germany

Application December 15, 1938, Serial No. 245,810
In Germany December 27, 1937

8 Claims. (Cl. 123-139)

This invention relates to an improved fuel injection pump for multi-cylinder engines and particularly aircraft engines. The type of pump concerned is one having its rams arranged in V-form, at least one fuel pump being allotted to each working cylinder.

Heretofore, such pumps have required considerable space and have been of extremely long construction.

The principal object of the present invention is to provide a pump which has advantages from the point of view of construction and erection, and which is of relatively small structure compared with known pumps. A further object is a pump of the kind referred to which is readily accessible and easy to inspect and maintain.

According to the invention, one or more pumps is added to a V-form group of two pumps or to each of several of such groups, the additional pumps being as far as possible in the same plane as the individual pumps of the group or of the respective group. Advantageously the pumps located on the inside are driven by a common cam shaft.

The invention is diagrammatically illustrated in one embodiment by way of example in the drawing, wherein Fig. 1 is an end elevation of a V-engine with an improved arrangement in sectional elevation. Fig. 2 is a plan of Fig. 1.

The drawing illustrates the outlines of an internal combustion engine with cylinders disposed in V-form and, preferably, an internal combustion engine with eight cylinders in each row may be considered. At one end of the 16-cylinder V-engine, the pump housing 1 is attached by suitable flanges not shown. Four rows of pumps 2, 3, 4 and 5 are arranged in this housing, there being four pumps one behind another in each case making the sixteen pumps in all, one for each engine cylinder. The rows of pumps 3 and 4 located on the inside are driven by a common cam shaft 6. The rows of pumps 2 and 5 are driven each by a separate cam shaft 7 and 8, these shafts being set back slightly in relation to the cam shaft 6. The rows of pumps 2, 3 and 4, 5 respectively adjacent to each other have common suction passages 9. Moreover, outer relief passages 10 are provided. The setting of the cam shafts and pump rams is effected through openings which are provided in the housing 1 and are closed by covers 11. The manner of operation of such pumps, whose detailed construction may be of any desired kind, is known and is not the subject of the invention. The delivery pipes from the individual pumps to their

respective cylinders are indicated by the reference numeral 12 in Fig. 2.

The number of individual pumps located in a transverse plane depends upon the number of cylinders in the internal combustion engine and upon the ignition order and/or upon the arrangement of the fuel passages. In the case described, a decisive factor is the angle of the rows of pumps located on the inside, which angle amounts to 45° for 16 cylinders. With 24 cylinders, these pumps may make an angle of 30° and there may be 6 pump-rams in a transverse plane. On the other hand, with 12 cylinders and 3 pump-rams in a transverse plane, the V-angle of the pumps amounts to 60°.

It will be seen that we have provided a construction which satisfies the objects enumerated above, and one which constitutes a valuable advance in the art. While we have shown the invention in a certain physical embodiment, it is to be understood that modifications of the structure shown may be made by those skilled in this art without departing from our invention as expressed in the claims which follow.

We claim:

1. In an internal combustion engine having two rows of more than one cylinder each, positioned in the form of a V relatively to one another, the combination of V-shaped pump structure the legs of which are at substantially the same angle as the rows of cylinders, said pump structure including one or more sets of substantially coplanar pumps, at least two pumps in each leg, conduits leading from said pumps to respective individual cylinders so that each cylinder is supplied by a separate pump, and means for mounting said V-shaped pump structure on one end of said engine, the legs of said pump structure lying substantially co-incidentally with the legs of said V-engine.

2. In an internal combustion engine having two rows of more than one cylinder each, positioned in the form of a V relatively to one another, the combination of a V-shaped pump structure, the legs of which are at substantially the same angle as the rows of cylinders, said pump structure including one or more sets of substantially coplanar pumps, at least two pumps in each leg, conduits leading from said pumps to respective individual cylinders so that each cylinder is supplied by a separate pump, means driven by said engine for actuating said pumps, said means including a camshaft common to the pumps of each set on the inside of the V, and means for mounting said V-shaped pump structure on one

end of said engine, in such a manner, as seen from the end of the engine, the legs of said pump structure lie substantially co-incidentally with the legs of said V-engine.

- 5 3. In an internal combustion engine having two rows of more than one cylinder each, positioned in the form of a V relatively to one another, the combination of a V-shaped pump structure the legs of which are at substantially
10 the same angle as the rows of cylinders, said pump structure including one or more sets of substantially coplanar pumps and provided with a common suction chamber for the pumps in one leg of the V, conduits leading from said pumps to re-
15 spective individual cylinders so that each cylinder is supplied by a separate pump, and means for mounting said V-shaped pump structure on one end of said engine in such a manner that, as seen from the end of the engine, the legs on
20 said pump structure lie substantially co-incidentally with the legs of said V-engine.

4. In a multiple pump structure, a pump housing in the form of a V, a plurality of individual coplanar pumps in each leg of said V-shaped
25 housing, said housing having a common suction space for the pumps in each leg, pistons in each pump, and cam means for actuating said pump pistons, said cam means including one cam common to the pump pistons of those pumps in the
30 inner side of each leg.

5. In a multiple pump structure, a V-shaped pump housing including a pair of individual pumps positioned relatively to one another in

the form of a V, a common cam shaft for operating said pair of pumps, a further pair of pumps, one mounted adjacent the outer side of each V-positioned pump, and a pair of cam shafts extending substantially parallel to said common
5 cam shaft, one of said pair operating one of said further pair of pumps and the other of said pair operating the other of said further pair of pumps.

6. The combination according to claim 5, in which each of said further pumps is positioned substantially parallel to its adjacent V-positioned pump.

7. In a multiple pump structure, a V-shaped pump housing including a pair of longitudinally
15 extending sets of pumps, each set being positioned relatively to the other in the form of a V, a common cam shaft for operating the individual pumps of both sets, a further pair of longitudinally extending sets of pumps, one set being
20 mounted adjacent the outer side of each V-positioned set, and a pair of cam shafts extending substantially parallel to said common cam shaft, one of said pair operating the pumps of one set of said further pair and the other of said
25 pair operating the pumps of the other set of said further pair.

8. The combination according to claim 7, in which each set of said further sets of pumps is positioned substantially parallel to its adjacent
30 V-positioned set of pumps.

ALBERT FRIEDRICH.
VICTOR ULRICH.