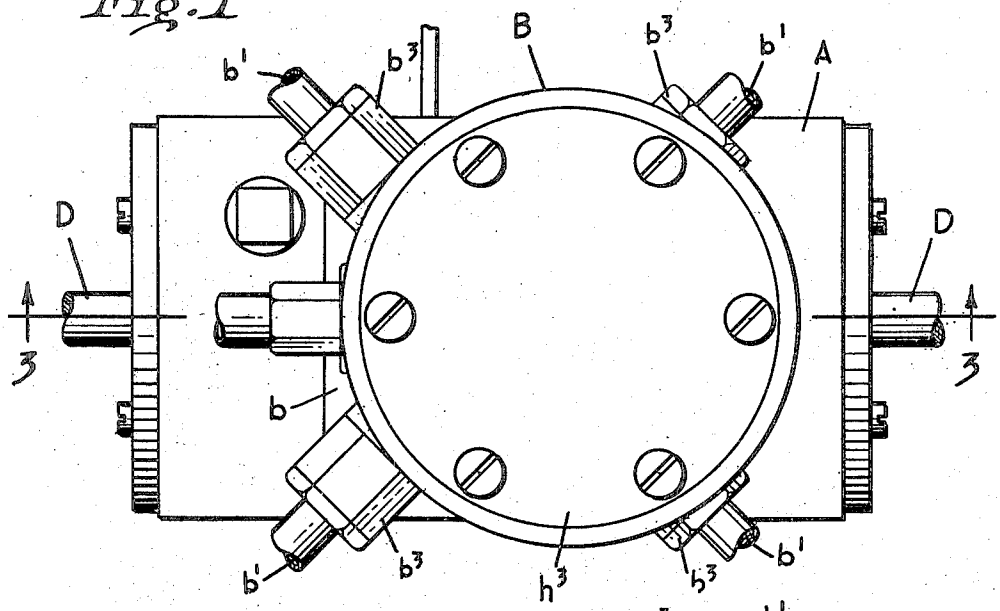
June 14, 1949. W. F. BRYANT 2,473,412

FUEL INJECTION PUMP

Filed May 11, 1945 4 Sheets-Sheet 1

Fig. 1



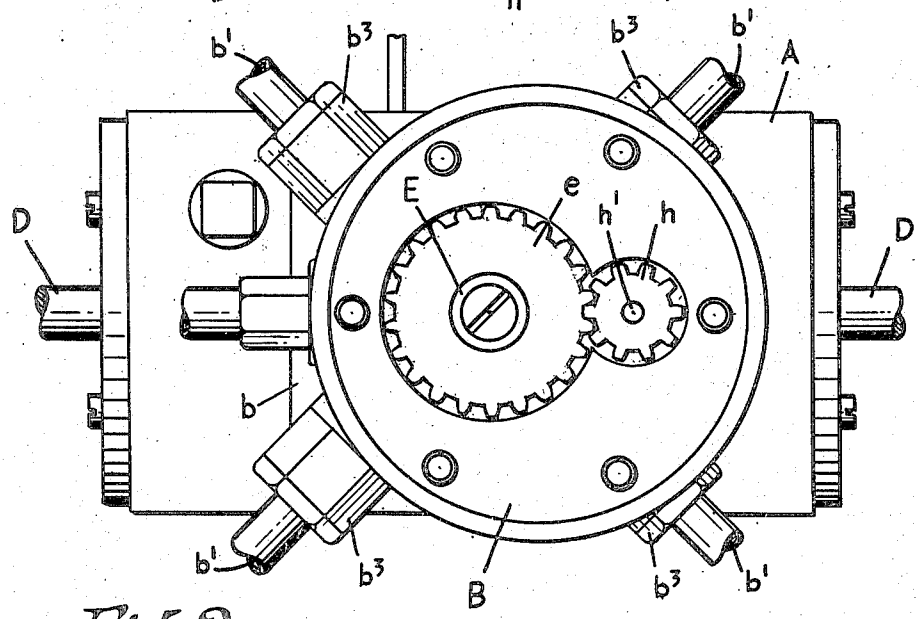


Fig. 2

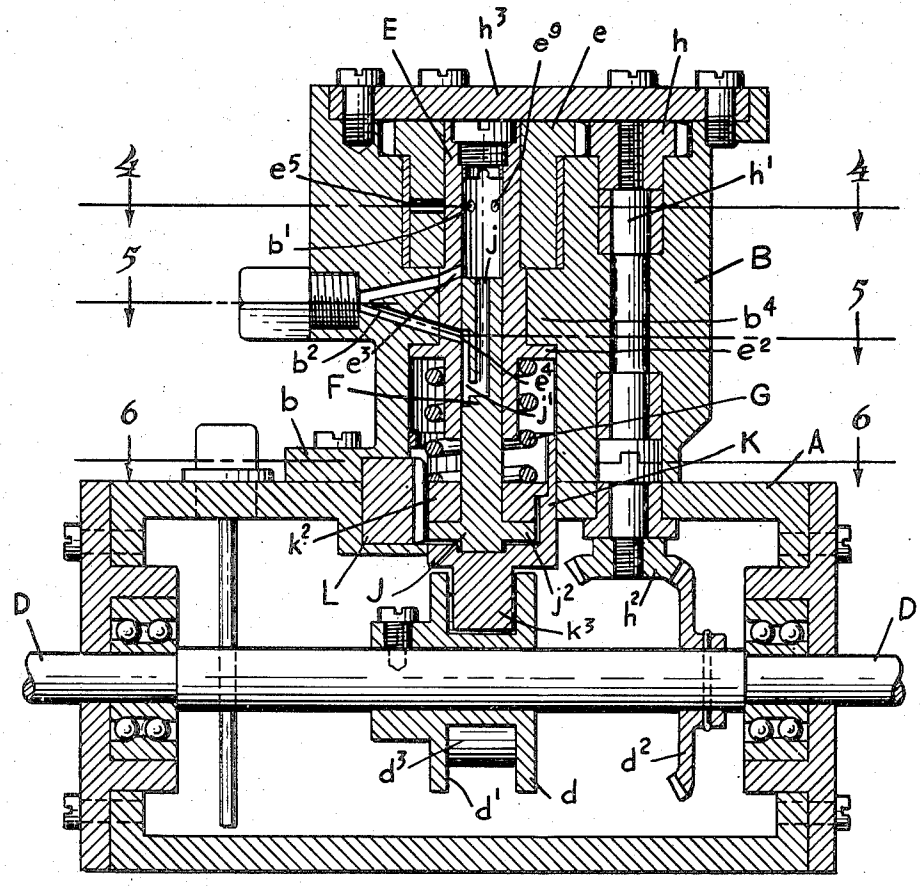
INVENTOR.
William Frederick Bryant
BY

June 14, 1949. W. F. BRYANT 2,473,412

FUEL INJECTION PUMP

Filed May 11, 1945 4 Sheets-Sheet 2

Fig. 3



INVENTOR.

William Frederick Bryant

BY

June 14, 1949. W. F. BRYANT 2,473,412

FUEL INJECTION PUMP

Filed May 11, 1945 4 Sheets-Sheet 3

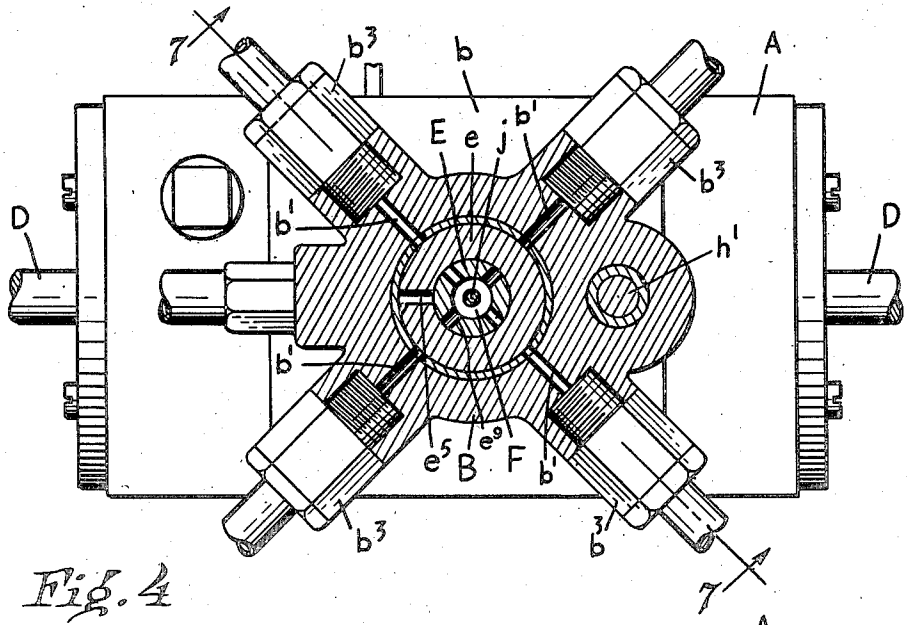


Fig. 4

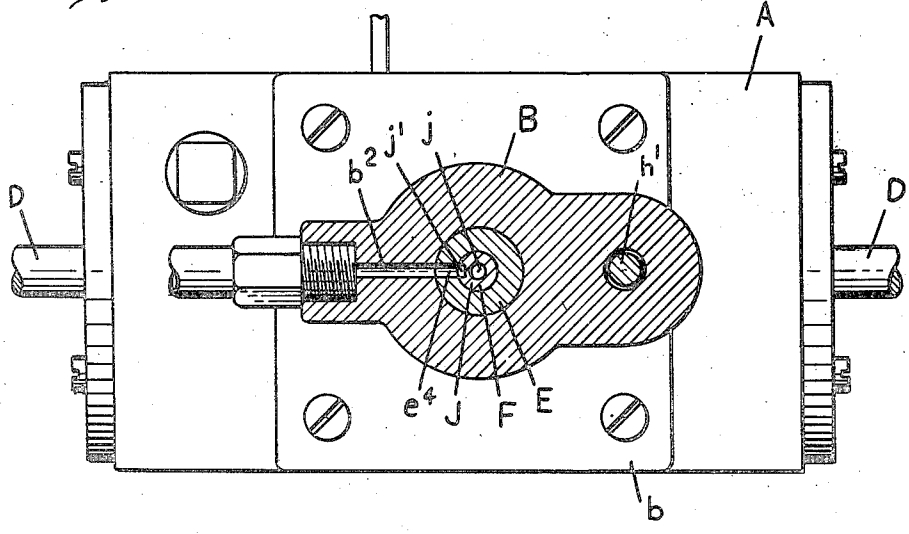


Fig. 5

INVENTOR.

William Frederick Bryant

BY

June 14, 1949. W. F. BRYANT 2,473,412

FUEL INJECTION PUMP

Filed May 11, 1945 4 Sheets-Sheet 4

Fig. 6

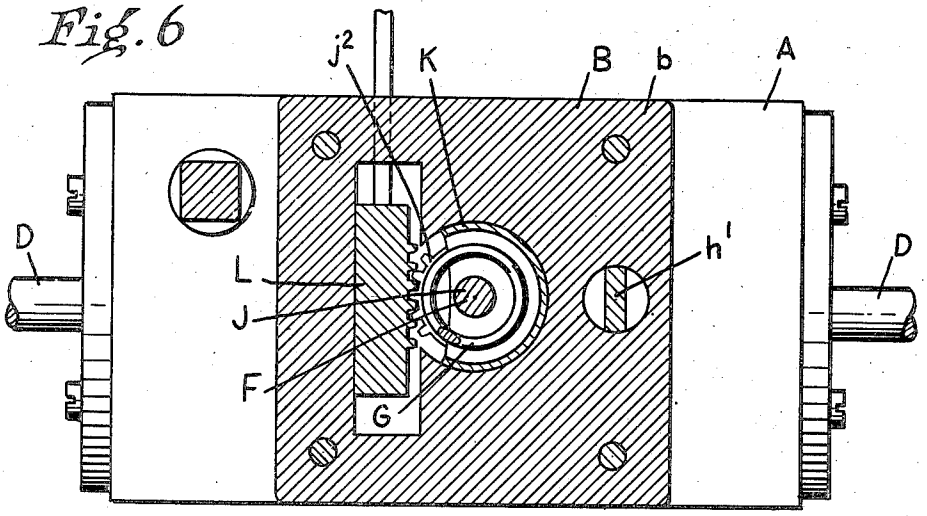


Fig. 7

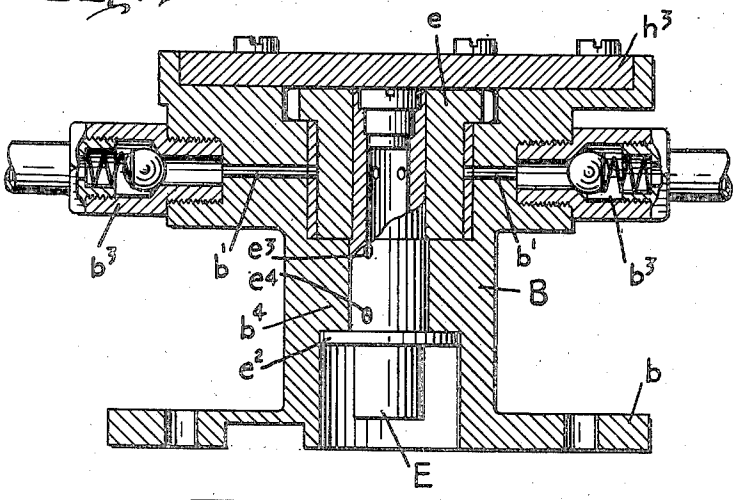


Fig. 9

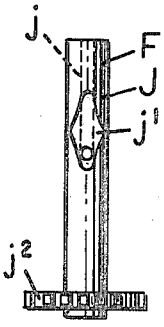


Fig. 8

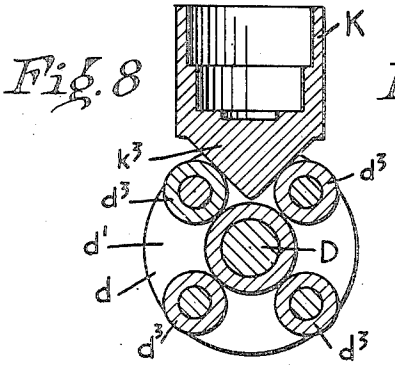


Fig. 11

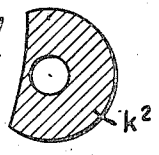


Fig. 10



INVENTOR.

William Frederick Bryant

BY

Thomas Attorney

Patented June 14, 1949

2,473,412

UNITED STATES PATENT OFFICE

2,473,412

FUEL INJECTION PUMP

William Frederick Bryant, Chamblee, Ga.

Application May 11, 1945, Serial No. 593,308

5 Claims. (Cl. 103—2)

1

This invention relates to an injector system for liquid fuel engines and is characterized by a single fuel injecting pump for a multiplicity of cylinders, the piston of the pump having a constant stroke irrespective of the speed of and load on the engine, such variable being provided for by variation in the period of the piston stroke during which fuel is injected into the engine cylinders.

To this end it involves a much simplified form of fuel injector, which is compact and easy to manufacture and it consists in the construction arrangement and combination of the several parts as will be hereinafter described and claimed.

Referring to the accompanying drawings in which corresponding parts are designated by corresponding marks of reference,

Figure 1 is a plain view of an injector unit embodying my invention;

Figure 2 is a similar view thereof with the cover plate removed;

Figure 3 is a vertical section on line 3—3 of Figure 1;

Figures 4, 5 and 6 are horizontal sections on lines 4—4, 5—5 and 6—6 respectively, of Figure 3;

Figure 7 is a detailed vertical section on line 7—7 of Figure 2 of the pump cylinder;

Figure 8 is a detailed view of the drive for the pump plunger;

Figure 9 is an elevation of the pump plunger;

Figures 10 and 11 are a section and a plan respectively, of the plunger spring abutment ring.

The injector case consists of a box base A having an opening in its top closed by the flange b on the lower end of the pump cylinder casting B.

D is the motor shaft of the engine (or some shaft driven thereby) which projects into the base A and has keyed thereon the channelled cam wheel D–i (to be described in detail later) and the bevelled gear wheel d^2.

The pump cylinder casting has a vertical bore in which is contained a sleeve E and the plunger F, the latter within the former.

The cylinder has equally horizontally spaced near its upper end fuel ejection ports b^1 corresponding in number to the number of the engine cylinders to be served (see Figures 2 and 4) and below the ejection ports a single induction port b^2, displaced angularly in respect to two of the ejection ports and having its inner end bifurcated so that such induction port communicates with the bore at two points, one above the other (see Figure 3). Check valves b^3 are provided at each ejection portion in the feed line to the corresponding engine cylinder. The induction port is of

2

course connected to a proper source of liquid fuel supplied.

The central bore of the cylinder is restricted midway of its length by the annular shoulder b^4.

Contained within the bore is the sleeve E having mounted on its upper end the pinion e and intermediate of its length an external annular flange e^2 which is spring-pressed upwardly against the lower surface of the shoulder b^4 by the spring G. The pinion e is driven with the same angular velocity as the shaft D through the pinion h (see Figure 2), shaft h^1 and bevelled gear h^2 from the bevelled gear d^2. The pinions e and h are contained in recesses formed in the head of the pump cylinder, which are provided with the cover plate h^3. The shaft h^2 has its bearings in the casting B.

The sleeve has two ports e^3, e^4 through the wall thereof (see Figure 3), the ports e^3 and e^4 being in pairs, the one above the other. These ports register with the corresponding branches of the fuel inlet port b^2. The sleeve is also provided with a series of ports e^9 while the hub of the pinion e is provided with a single fuel outlet port e^5 (see Figures 3 and 4) adapted on rotation of the hub to register in succession with the fuel ejection ports b^1 in the casting and e^9 in the sleeve.

As stated, the inlet ports b^2 in the cylinder are so angularly displaced in respect to the ejection ports b^1 therein as to be between two of the latter ports, while the outlet ports e^9 in the sleeve have the same angular displacement in respect to the inlet ports e^3 and e^4 therein.

The ends of the several ports in the cylinder may be widened where they communicate with the bore or such widening may be given to the ports in the sleeve to increase the period during the rotation of the hub that such ports are in communication. Such a widening is indicated at e^5 in Figure 4.

The piston or plunger J has an axial bore j opening on the upper end of the plunger and communicating with a cut away portion j^1 on one side of the plunger. This cutaway portion is diamond shaped in contour with its major axis lengthwise of the plunger (see Figure 9).

The plunger has a collar j^2 (which is a quadrant or quarter gear) surrounding its lower end contained within the cup K located within the lower portion of the bore of the cylinder casting. The cup has a rack segment on its periphery which meshes with teeth on the rack bar L properly guided in the base and actuated in any proper manner (manually or automatically) to rotate the plunger in the sleeve in accordance with the engine speed desired. To permit this meshing

the walls of the cup are cut away on one side.

Within the cup and resting on the collar of the piston is an abutment ring k^2 on which the lower end of the spring g abuts.

A triangular lug k^3 or cam follower projects downwardly from the lower surface of the cup into the channel d^1 of the cam wheel d. In this channel are mounted rollers d^3 corresponding in numbers to the cylinders to be served.

Compression within the cylinder is controlled by adjusting a screw end in the head of the sleeve.

It will be noted that:

1. The distribution of fuel to the several engine cylinders is accomplished by the rotation of the distributing hub of the pinion e.

2. The amount of fuel delivered on each stroke of the plunger to an engine cylinder is determined by the angular position of the plunger within the sleeve, this being due to the shape of the cutaway portion j^1, such position being controlled through the rack L.

3. The fuel charge is trapped in the cylinder only after the plunger has gained speed after passing its lower center.

Operation

With the parts in the position as above described and shown in Figure 3, after the descent of the plunger under the influence of the spring G, communication is established between both branches of the fuel inlet port b^2 and the head of the cylinder. When the plunger is raised by the cam wheel the upper inlet port in the sleeve will be closed by the plunger, but communication will continue between the inlet port and the head of the sleeve through the lower inlet port e^4 and the lateral opening in the plunger until the latter has been moved sufficiently to break the connection, the exact time this is broken and hence the amount of charge that will be delivered depending on the angular position of the plunger as determined by the rack L. Thereafter the continued up stroke of the plunger compresses the trapped charge which, when the single outlet port e^5 in the distributing hub of the pinion e registers with one of the eduction ports b^1 in the cylinder casting is delivered suddenly and with full pressure to the connected cylinder.

Having thus described my invention what I claim as new and desire to secure by United States Letters Patent is:

1. In a liquid fuel injector, the combination with a housing having an induction port and a series of eduction ports, of a tubular cylinder within the housing having an induction port registering with the induction port in the housing, and a plurality of eduction ports, a reciprocating piston in the cylinder opening and closing on its movement the induction port therein, a rotary member surrounding the head of the cylinder and having an eduction port, and means for reciprocating the piston and rotating the rotary member in synchronism with each other.

2. In a liquid fuel injector, the combination with a housing having a bore therein and having an induction port and a series of eduction ports of a tubular cylinder within the bore of the housing, having a plurality of induction ports therein, the one above the other, and each connecting with the induction port in the housing, and a plurality of eduction ports, a reciprocating piston in the cylinder successively covering and uncovering in its reciprocation the two induction ports in the cylinder and having a lateral port in communication with its head, brought into registration with the lower induction port on the compressive stroke of the piston, a rotary member surrounding the head of the cylinder and having an eduction port, and means for reciprocating the piston and rotating the rotary member in synchronism with each other.

3. A liquid fuel injector, such as defined in claim 2, in which the wall of the piston has a diamond-shaped depression surrounding its lateral opening, in combination with means for adjusting the piston around its longitudinal axis.

4. A liquid fuel injector, such as is defined in claim 1, in combination with a threaded head for the pump cylinder.

5. A liquid fuel injector, such as defined in claim 1, embodying a cam for actuating the plunger on the pressure stroke, and a spring opposing such stroke interposed between the tubular cylinder and the piston and a common drive for the cam and rotary member in synchronism with each other.

WILLIAM FREDERICK BRYANT.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,791,600	Onions	Feb. 10, 1931
2,084,057	French	June 15, 1937
2,353,188	Roosa	July 11, 1944