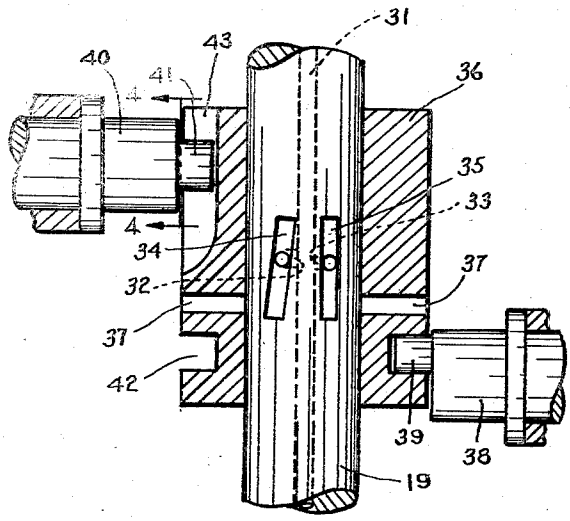
Nov. 19, 1957 W. O. BISCHOFF 2,813,523

FUEL INJECTION PUMP

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Fig. 2.



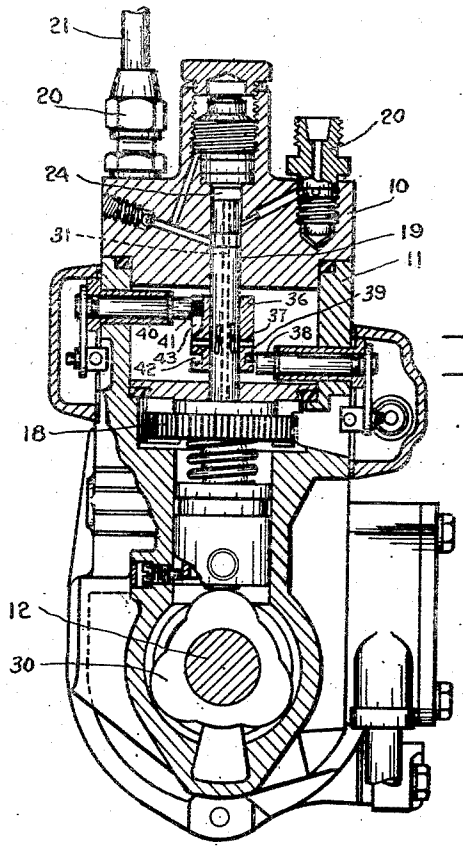


Fig. 1.

INVENTOR.
WALDEMAR O. BISCHOFF
BY
Raymond A. Paquin
ATTORNEY.

Nov. 19, 1957 W. O. BISCHOFF 2,813,523

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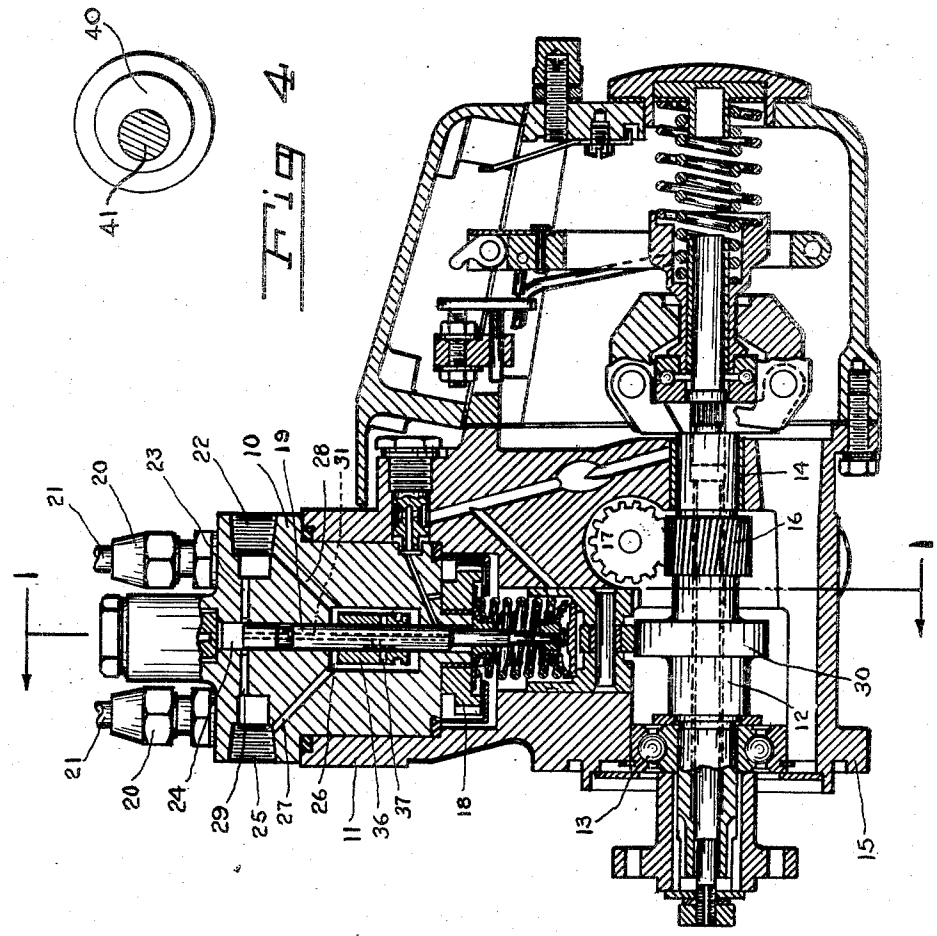


Fig. 4

Fig. 3

INVENTOR.
WALDEMAR O. BISCHOFF
BY
Raymond A. Paquin
ATTORNEY.

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2,813,523

FUEL INJECTION PUMP

Waldemar O. Bischoff, Holyoke, Mass., assignor to American Bosch Arma Corporation, a corporation of New York

Application October 29, 1953, Serial No. 388,974

4 Claims. (Cl. 123—139)

This invention relates to fuel injection apparatus and has particular reference to a new and improved injection timing arrangement for distributor type fuel injection pumps which employs a combined pumping and distributing member.

An object of the invention is to provide a new and improved apparatus of the type set forth which is relatively simple and less expensive to manufacture and assemble and trouble free in operation.

Another object is to provide an apparatus of the type set forth which is of the high pressure metering type and which has relatively simple and inexpensive timing means.

Another object is to provide an apparatus of the type set forth wherein the metering means may be adjusted for controlling the timing of injection.

Other objects and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings. It will be understood that changes may be made in the details of construction and arrangement of parts without departing from the spirit of the invention, as set forth in the accompanying claims.

Referring to the drawings:

Fig. 1 is a sectional view taken on line 1—1 of Fig. 3, looking in the direction of the arrows;

Fig. 2 is a fragmentary sectional view of the device shown in Fig. 1, but on an enlarged scale;

Fig. 3 is a longitudinal sectional view of the apparatus embodying the invention; and

Fig. 4 is a sectional view taken on line 4—4 of Fig. 2, looking in the direction of the arrows.

Referring more particularly to the drawings wherein similar reference characters designate corresponding parts throughout, the device shown embodying the invention comprises the pump head **10** which fits into a recess in the main pump housing **11** and is secured thereto by bolts or the like, not shown.

The cam shaft **12** is mounted for rotation in said housing **11** on the ball bearing **13** and bearing **14** respectively, and mounting flange **15** is provided for securing the pump assembly in position on the engine. On the cam shaft **12** is provided the helical gear **16** which is rotated upon rotation of the cam shaft **12** and which meshes with a gear shaft, not shown, driving gear **18** on plunger **19** and thereby rotating plunger **19** as described in Patent 2,518,473 to which reference is made for further description and operation.

The hydraulic head **10** has outlets **20**, one of which is provided for each combustion chamber adapted to receive fuel from the device, and which outlets are connected to their respective combustion chambers by pipe lines **21**.

The hydraulic head **10** has an inlet port **22** adapted to be connected by a hydraulic line, not shown, to the fuel supply pump or other source of fuel and is connected through the port **23** to the pumping chamber **24**. The hydraulic head **10** also has the outlet or return port **25** adapted to be connected by a hydraulic line to the fuel

tank and in said line may be positioned a check valve for controlling or maintaining the desired fuel supply pressure in the pump.

The spill chamber **26** is connected by the passage **27** and **28** to the ports **25** and **22** respectively. Port **25** is connected by port **29** with pumping chamber **24**.

Plunger **19** is adapted to be reciprocated by cam **30** on cam shaft **12** upon the rotation of the cam shaft.

The plunger **19** is provided with the axial hole or passage **31** which communicates with pumping chamber **24** through ports **32** and **33** with slots **34** and **35** respectively on the periphery of plunger **19**. It will be noted that slot **35** extends in a straight direction whereas slot **34** is helically positioned, that is, it extends in a helical direction relative to slot **35**. Sleeve **36** surrounds plunger **19** and overlies both slots **34** and **35** and is provided with the bypass or spill ports **37**, one of which is provided for each outlet **20**.

It will be noted that sleeve **36** may be adjusted axially, relative to plunger **19**, by means of shaft **38** and eccentric connection **39** in peripheral slot **42** in sleeve **36** whereby the quantity of fuel bypassed may be controlled, thereby controlling the quantity of fuel injected. The timing of injection is controlled through shaft **40** with eccentric connection **41** in slot **43** and adapted to rotate sleeve **36** relative to plunger **19**.

Peripheral slot **42** allows rotary motion of the sleeve without disturbing the axial position and axial slot **43** allows vertical adjustment of the sleeve without disturbing the rotary adjustment thereof.

It will be noted that the timing of beginning and ending of injection can be controlled depending upon the direction of rotation of sleeve **36** whereby the injection may be advanced or retarded in relation to the drive.

It will be noted that the injection stroke may have various characteristics through the selection of the shape and relative positions of the grooves in the plunger. By having one slot parallel to the axis of the plunger and the other angled it is possible to have a constant beginning and variable ending to the injection stroke, or a variable beginning and constant ending, dependent upon the direction of rotation. Both variable beginning and variable ending in one stroke can be achieved by angling both slots in relation to the axis of the plunger. From the foregoing it will be seen that one of the ports controls the beginning of injection and the other controls the end of injection.

In Patent 2,518,473 there is disclosed an arrangement for varying the timing of injection of apparatus of the type set forth and which requires separate sleeves and axially displaced ports in the plunger, whereas in the present invention, only one sleeve is employed with a pair of grooves and ports in the plunger with means for rotating the sleeve and the present arrangement provides a simple, economical and fool proof arrangement whereby the timing of injection may be easily and quickly varied at will.

From the foregoing it will be seen that I have provided simple, efficient and economical means for obtaining all of the objects and advantages of the invention.

I claim:

1. In a device of the character described, a combined pumping and distributing plunger member, means for reciprocating said plunger member for pumping fuel and for rotating said plunger member for distributing fuel, said plunger member having longitudinal bore means and a pair of circumferentially spaced ports communicating with said bore means, one of said ports controlling the beginning of injection and the other controlling the end of injection, a pair of slots in said plunger, each of said slots communicating with one of said spaced ports, and

a sleeve surrounding said plunger member and overlying said ports, said sleeve having port means adapted to communicate with said port means in said plunger member and means for pivoting said sleeve about said plunger member.

2. In a device of the character described, a combined pumping and distributing plunger member, means for reciprocating said plunger member for pumping fuel and for rotating said plunger member for distributing fuel, said plunger member having longitudinal bore means and a pair of circumferentially spaced ports communicating with said bore means, one of said ports controlling the beginning of injection and the other controlling the end of injection, a pair of slots in said plunger, each of said slots communicating with one of said spaced ports, and a sleeve surrounding said plunger member and overlying said ports, said sleeve having port means adapted to communicate with said port means in said plunger member and means for pivoting said sleeve about said plunger member, and means for moving said sleeve axial of said plunger member.

3. In a device of the character described, a bore, a plunger mounted for reciprocating and rotating in said bore for pumping and distributing fuel to a plurality of outlets successively, said plunger having an axial bore and a pair of spaced ports communicating with said bore, one of said ports controlling the beginning of injection and the other controlling the end of injection, a pair of slots in said plunger, each of said slots communicating with one of said spaced ports, said slots being in angled relation, a sleeve overlying said ports, said sleeve having port means, means for moving said sleeve axial of said plunger and means for pivoting said sleeve relative to said plunger.

4. In a device of the character described, a bore, a plunger mounted for reciprocating and rotating in said bore for pumping and distributing fuel to a plurality of outlets successively, said plunger having an axial bore and a pair of circumferentially spaced ports communicating with said bore, one of said ports controlling the beginning of injection and the other controlling the end of injection, a pair of slots in said plunger, each of said slots communicating with one of said spaced ports, said slots being in angled relation, a sleeve overlying said ports, said sleeve having port means, means for moving said sleeve axial of said plunger and means for pivoting said sleeve relative to said plunger.

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