United States Patent

Dreisin

[15] **3,667,437**

[45] **June 6, 1972**

[54] **MULTIPLE PLUNGER FUEL INJECTION PUMP**

[72] Inventor: **Alexander Dreisin,** Olympia Fields, Ill.

[73] Assignee: **Allis-Chalmers Manufacturing Company,** Milwaukee, Wis.

[22] Filed: **Aug. 19, 1970**

[21] Appl. No.: **65,202**

[52] **U.S. Cl.** ....**123/139 R,** 123/139 AB, 123/139 AE, 123/139 AG, 123/139 AP, 123/140 R

[51] **Int. Cl.** **F02m 59/00**

[58] **Field of Search** ....123/139 R, 139 AB, 139 AD, 123/139 AE, 139 AG, 139 AP, 140 R

[56] **References Cited**

UNITED STATES PATENTS

2,118,578	5/1938	Trapp	123/139
2,147,390	2/1939	Vaudet	123/139
2,813,523	11/1957	Bischoff	123/139
3,421,486	1/1969	Parrish, Jr.	123/139
2,975,776	3/1961	Nicolls	123/139

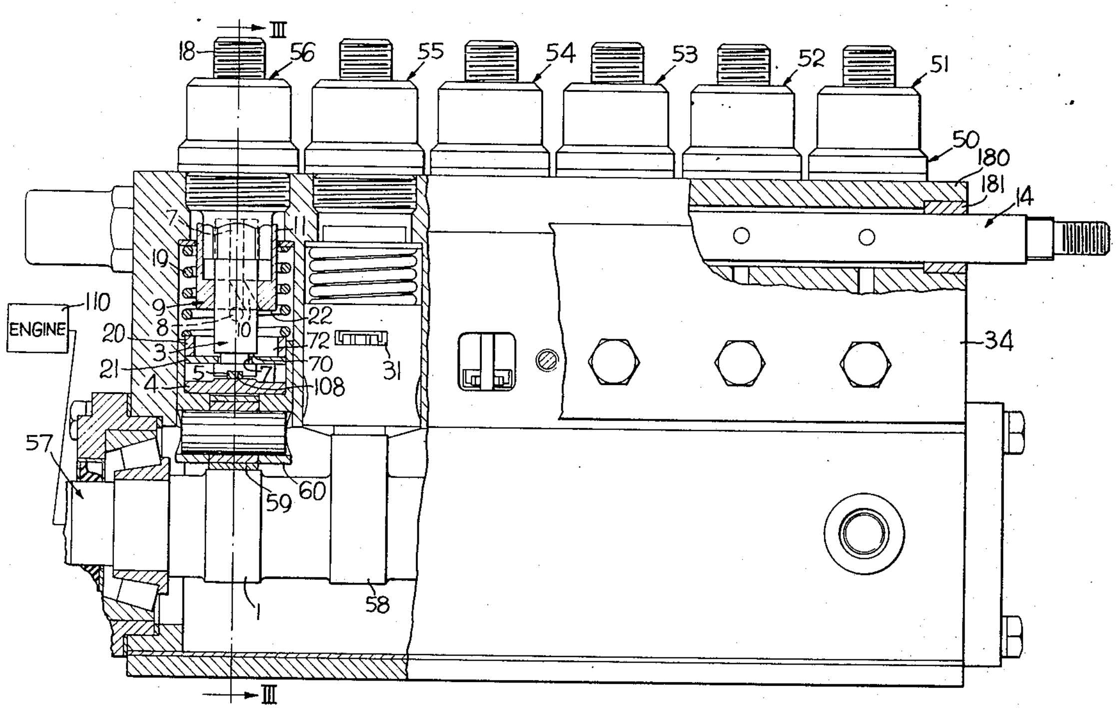
Primary Examiner—Laurence M. Goodridge

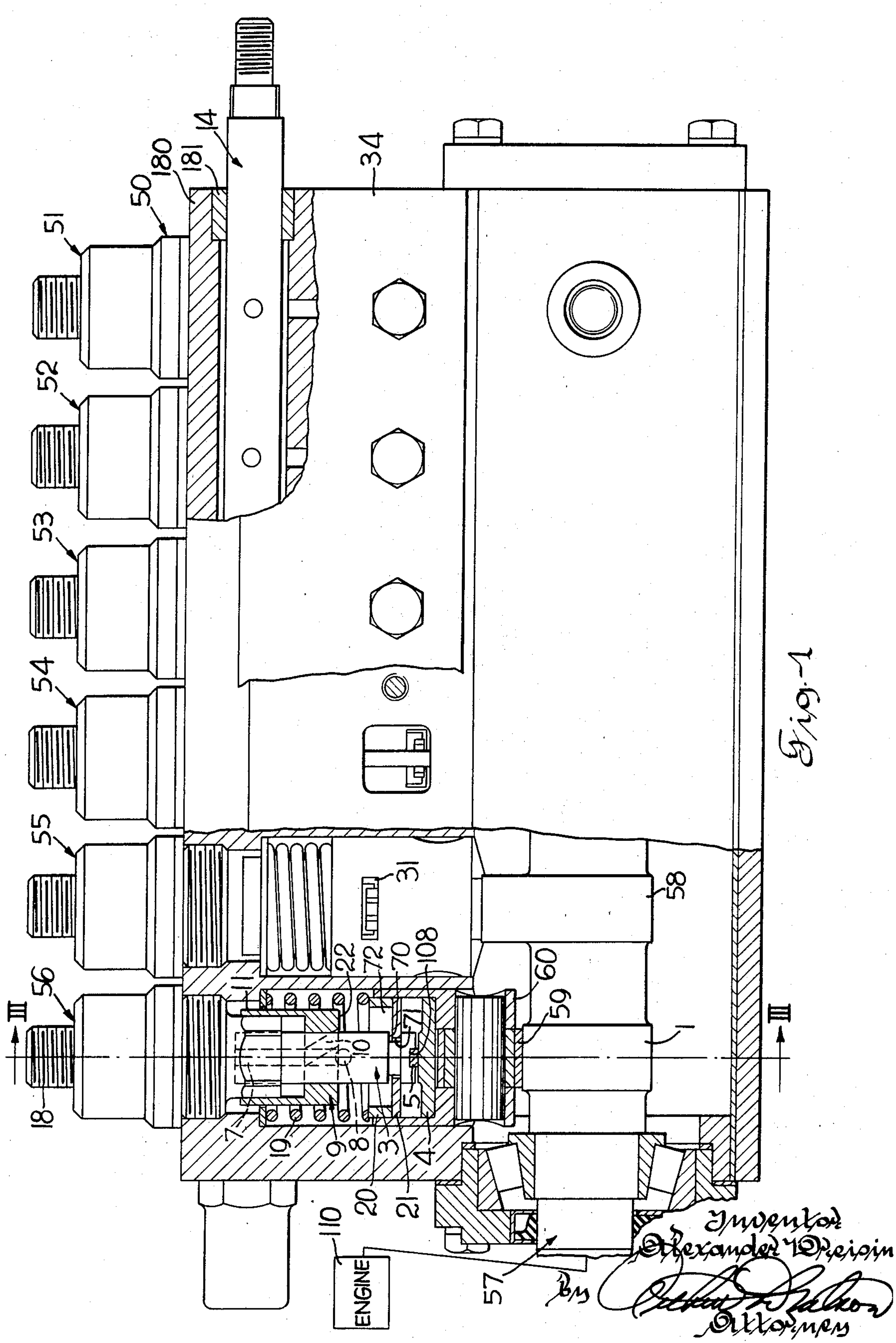
Attorney—Arthur L. Nelson, Robert B. Benson and Charles L. Schwab

[57] **ABSTRACT**

Multiple plunger fuel injection pump having built in fuel injection timing and quantity control.

10 Claims, 11 Drawing Figures




ENGINE
Fig-1
Inventor
Alexander Dreisin
By
Attorneys

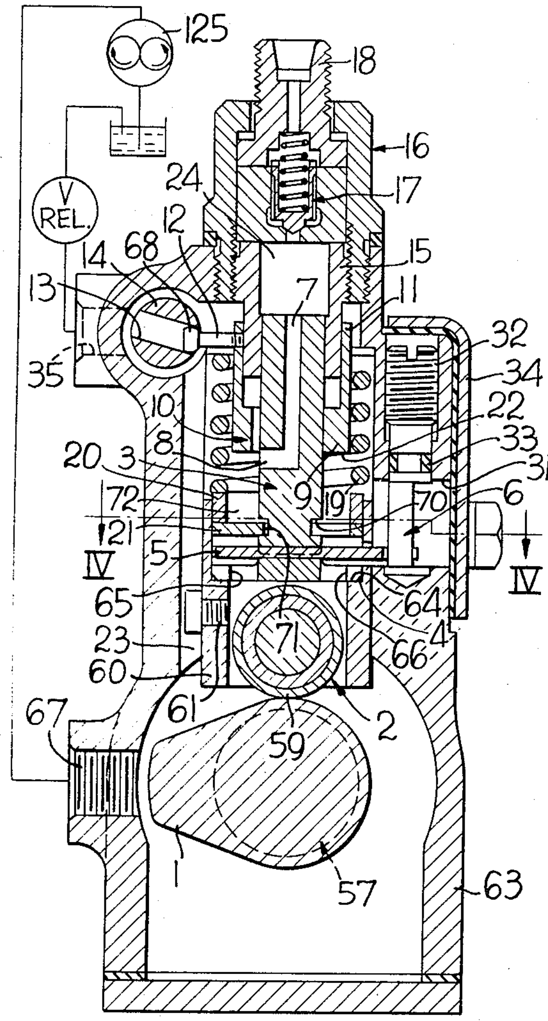


Fig. 3

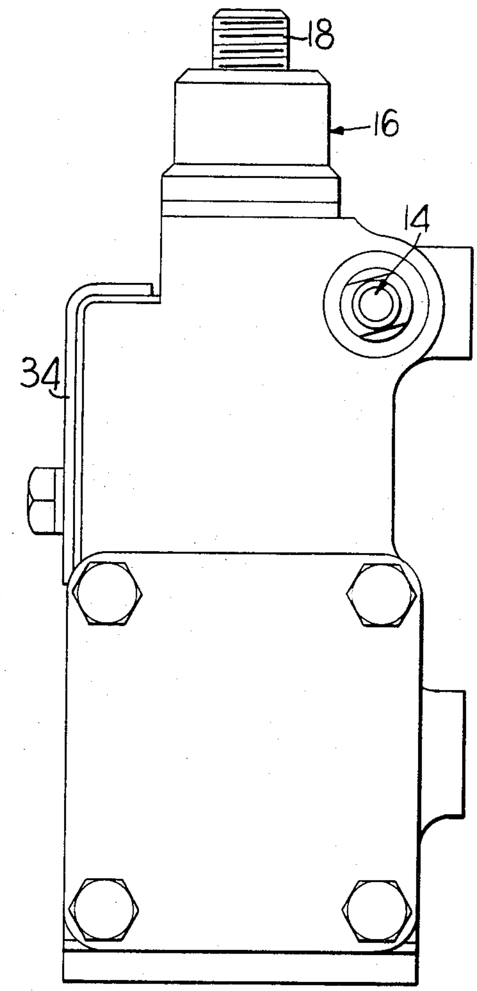


Fig. 2

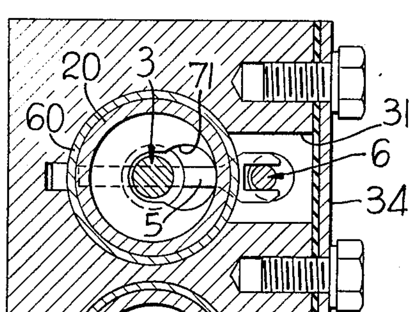


Fig. 4

Inventor
Alexander Dreisin
by
Attorneys

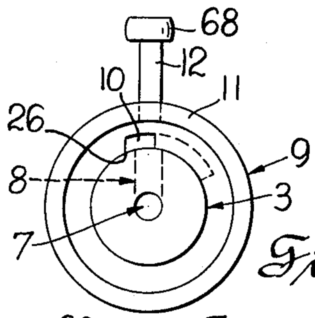


Fig.6

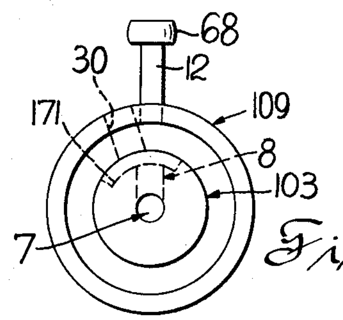


Fig.8

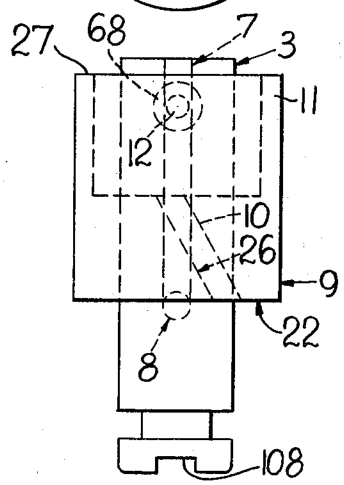


Fig.5

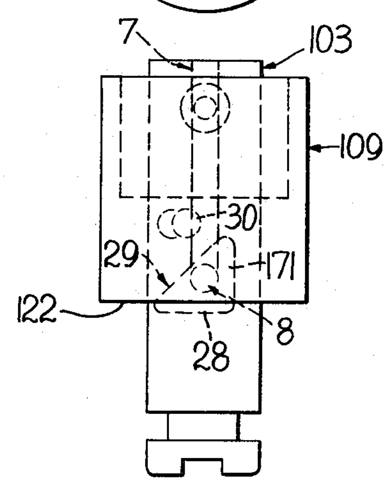


Fig.7

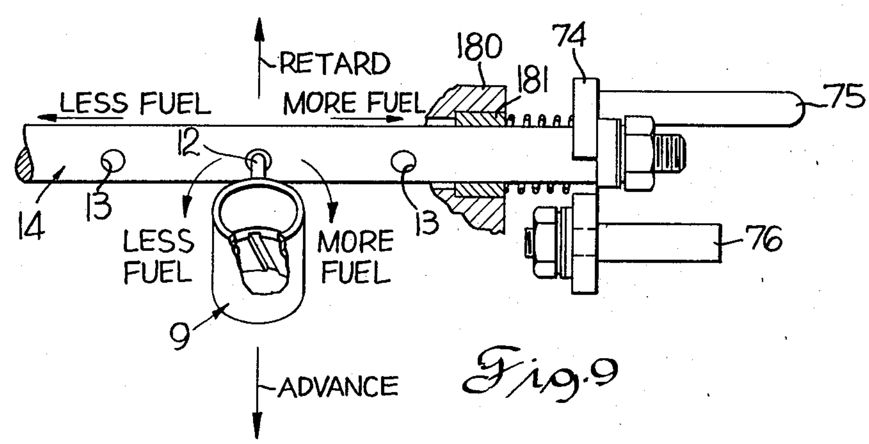


Fig.9

Inventor
Alexander Dreisin
By [signature]
Attorneys

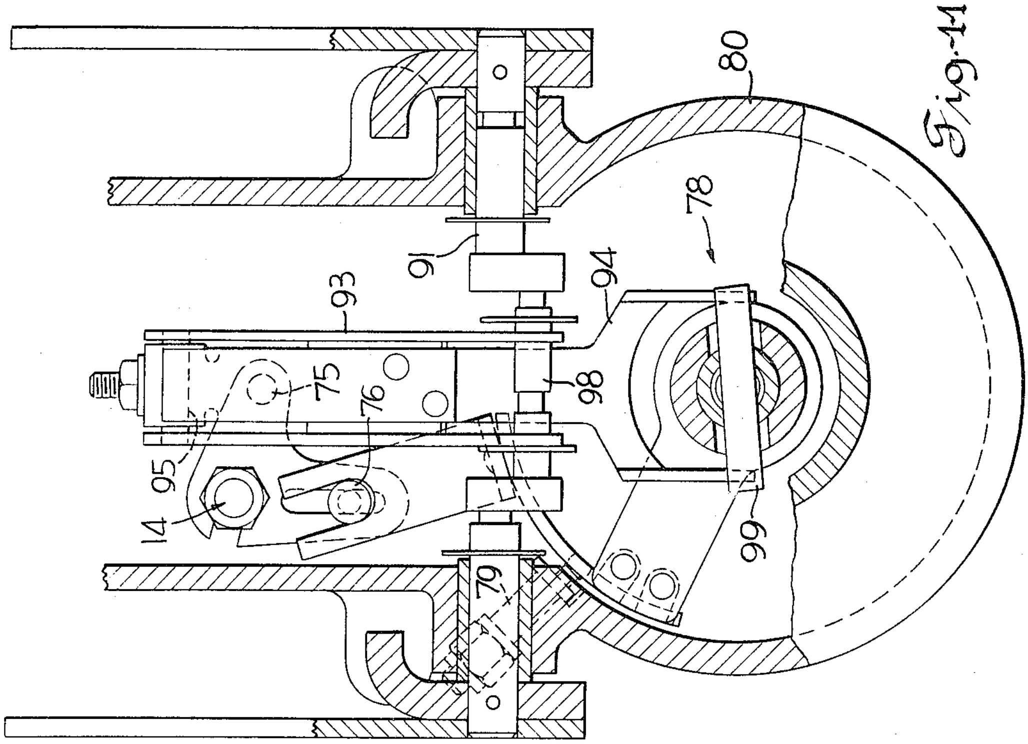


Fig. 11

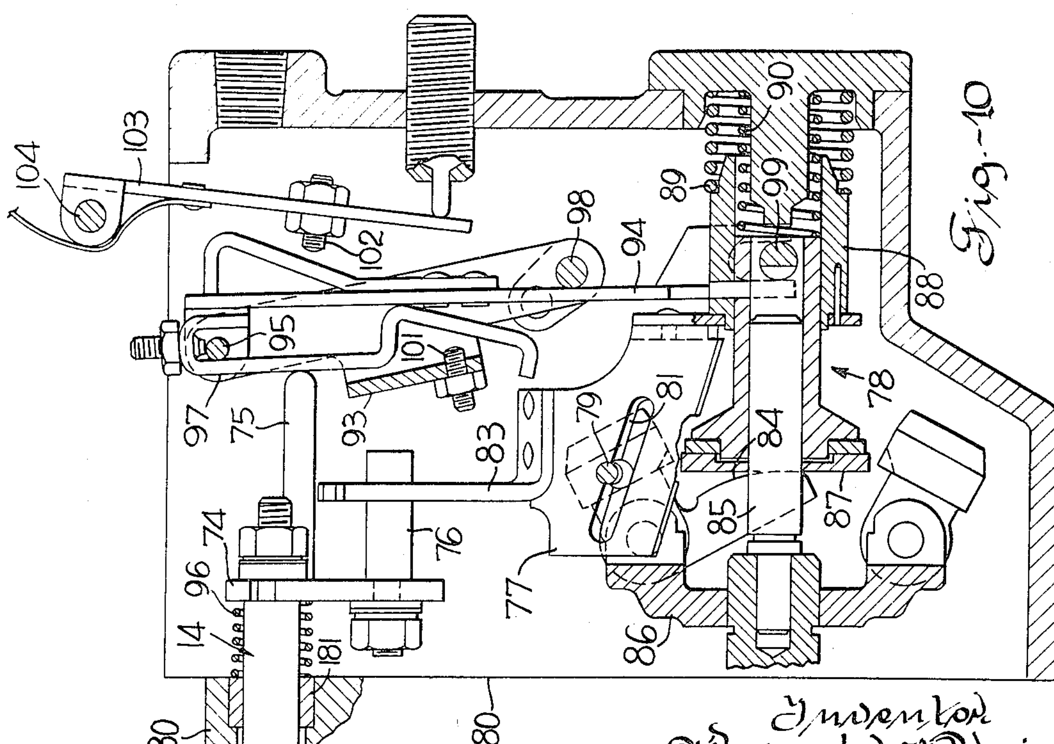


Fig. 10

Inventor
Alexander Dreisin
By
Attorney

MULTIPLE PLUNGER FUEL INJECTION PUMP

This invention relates to a fuel injection pump for an internal combustion engine and more particularly to a multiple plunger fuel injection pump with fuel injection timing and quantity control within the fuel injection pump responsive to engine speed and load conditions.

Multiple plunger fuel injection pumps which are used today on high speed Diesel engines generally have a fixed timing in relationship to the engine. Initiation of injection occurs after the closing of an intake port. In order to change timing of the pump it is required to dephase the pump camshaft in relation to the engine. The camshaft sequentially drives the plungers in the multiple plunger fuel injection pump. The dephasing of the pump is done usually by interposing a mechanical timing advance between the pump drive shaft of the engine and the injection pump camshaft. The mechanical timing advance mechanism consists of centrifugal weights balanced by springs which change their position as a function of engine speed and transform this change into a dephasing between the pump camshaft and the pump drive shaft. This mechanism is bulky and rather complicated because the entire pump driving torque has to be transmitted through the timing advance mechanism. In addition to its bulkiness and complexity which results in low reliability the timing advance mechanism requires an additional installation length between the pump drive shaft and the pump itself. This space is very costly on the engine and sometimes, especially in the smaller models is not available. With Diesel engines, of increasing engine speed which is the modern trend of Diesel engines, it becomes more and more necessary to dephase the fuel injection pump and to control the beginning of injection with relation to the engine in order to obtain the best combustion efficiency and starting properties throughout the engine speed range.

Accordingly, this invention provides a timing advance mechanism in the injection pump per se. By incorporating the timing advance mechanism, within the pump itself, the mechanism can be substantially simplified over the conventional dephasing mechanism in the drive assembly. The control rod connected to a plurality of control sleeves provides a means whereby the timing and quantity control for fuel injection can be conveniently and simply controlled in response to movement of a control member on the governor of the engine.

Accordingly, it is an object of this invention to provide a multiple plunger fuel injection pump with built-in timing and metering control.

It is another object of this invention to provide a multiple plunger fuel injection pump incorporating a timing and metering control responsive to speed and load conditions of the engine.

It is a further object of this invention to provide a cam operated multiple plunger fuel injection pump having a speed responsive control element operating a control sleeve on each of the plurality of plungers to thereby control fuel injection timing and quantity.

It is a further object of this invention to provide a cam operated multiple plunger fuel injection pump having a control sleeve on each of the plungers controlled in response to a governor operated control mechanism to thereby control timing and quantity of fuel injection for each of the plurality of plungers.

The objects of this invention are accomplished by incorporating in a multiple plunger fuel injection pump a control sleeve operating with each plunger. A control rod is connected to each of the control sleeves and is adapted for reciprocal and rotational movement to in turn provide reciprocal and rotating movement *o* the control sleeves. The control member on a governor operates in response to the speed and a manual setting on the throttle shaft which in turn transmits a rotational and reciprocal movement to the control rod. The control rod being connected to each control sleeve on the plurality of plungers operates to control the initiation and termination of fuel injection and also the duration of fuel injection to thereby control timing and quantity of fuel injection of the engine in response to the speed and load conditions.

The preferred embodiments of this invention are illustrated in the attached drawings.

FIG. 1 is a side elevation view with portions of a fuel pump cutaway to show related parts of the pump.

FIG. 2 is an end view of FIG. 1.

FIG. 3 is a cross section view taken on line III—III of FIG. 1.

FIG. 4 is a cross section view taken on line IV—IV of the FIG. 3.

FIG. 5 is a view of the plunger and control sleeve.

FIG. 6 is a plan view of FIG. 5 showing the plunger and control sleeve.

FIG. 7 is a modification of the plunger and control sleeve.

FIG. 8 is a plan view of the modification shown in FIG. 7.

FIG. 9 is a fragmentary view of the control rod and one of the control sleeves illustrating their operation in the fuel pump.

FIG. 10 is a cross section view of the governor connected to the control rod.

FIG. 11 is a cross section view of the governor as viewed from the end of the control rod.

Referring to the drawings, FIG. 1 illustrates a multiple plunger fuel injection pump **50** having a plurality of cam operated pump assemblies **51**, **52**, **53**, **54**, **55** and **56**. The camshaft **57** includes a plurality of cams, of which cams **1** and **58** are shown, which operate the pump assemblies **56** and **55** respectively. The camshaft **57** is engine driven and directly connected to the engine **110**. FIG. **3** illustrates the cam follower **2** which is driven by the cam **1** on the camshaft **57**. The cam follower **2** includes a roller **59** supported in the follower sleeve **60**. The follower sleeve **60** receives the follower plate **4** which carries the plunger **3**. The follower sleeve **60** also carries the pin **61** which rides up and down in the slot **23** of the housing **63**. Pin **61** maintains the alignment of the roller **59** on the cam **1**.

The shoulder **64** on follower sleeve **60** supports the follower plate **4**. The follower plate **4** is formed with openings **65** and **66** to permit the flow of fuel through the plate when the follower reciprocates.

As shown on the left side of FIG. **1**, the plunger **3** is spaced from the cam follower plate **4** by a rectangular strip or timing shim **5** visible also in FIG. **3** and the partial section view FIG. **4**. Timing pin **6** locates the timing shim angularly in relation to the pump body as will be explained more fully later in the description.

The plunger **3** has a milled slot **108** in the bottom which straddles the timing shim **5** and it is therefore retained in an angularly controlled position in relation to pump housing.

The plunger **3** has an axial drilled passage **7** communicating with a radial port **8**. The intermediate portion of the plunger is fitted within the control sleeve **9** which has a helical slot **10** on its inner periphery on the same side of the plunger as the radial port **8**. The control sleeve **9** has the cylindrical wall **11** extending upwardly. A control finger **12** is rigidly connected with this cylindrical wall and is equippedwith a spherical end **68** which has a sliding fit in the cross drilled passage **13** located in the control rod **14**.

The upper portion of the plunger **3** is fitted into the barrel **15**. The barrel **15** is threaded on the outer periphery and is held in delivery union **16** which also carries a delivery valve **17** and an outlet fitting **18**.

The plunger spring **19** transmits a downward force through the lower spring seat **20** to the plunger retaining plate **21** which engages a peripheral recess **70** on the plunger **3**. The retaining plate **21** is formed with an opening **71** to facilitate assembly and to permit fuel to flow into the fuel supply chamber **72** surrounding the control sleeve **9**.

Fuel from a supply pump **125** passes through the opening **67** through slot **23** vertically upward into the supply chamber **72**. The camshaft compartment is also filled through the opening **67** which flows upwardly through the cam follower plate **4** and retainer plate **21**. Excess fuel continues to flow upwardly through the chamber **72** and outlet opening **35** and returns through a pressure relief valve to the fuel tank.

Barrel **15** and plunger **3** form the fuel injection chamber **24** which discharges pressurized fuel through the delivery valve **17**. The delivery valve **17** is in communication with the fitting **18** which is adapted for connection to a combustion chamber of an internal combustion engine.

A calibration means to accommodate vertical tolerances is provided as shown in FIGS. **1**, **3** and **4**. The calibration screw **32** has an eccentric timing pin **6** received in the fork timing strip **5**. Timing strip **5** is received within a slot **108** in the lower end of the plunger **3**. The timing strip **5** will be manufactured in varying thicknesses and can be inserted through the window **31** to make the proper calibration setting for each individual pump assembly. The O-ring **33** seals the calibration screw. The pump cover **34** covers the timing window **31** and at the same time will prevent unauthorized interference with the adjustment screw **32**.

FIG. **5** illustrates the control sleeve **9** on the plunger **3**. FIG. **6** also illustrates a plan view of the control sleeve **9**. The passage **7** extends upwardly through a portion of the plunger **3** and is connected to the radial port **8** which extends to the outer periphery of the plunger **3**. The sleeve **9** is shown with a helical slot **10** cut on its inner periphery forming an edge **26** which passes over the radial port **8** as the plunger is moved upwardly.

FIGS. **7** and **8** show a modified control sleeve **109** on the modified plunger **103**. The axial passage **7** is connected to the radial port **8** as shown. A recess **171** is formed in the plunger **103** having a triangular configuration as shown in FIG. **7**. The edge **28** of the recess **171** comes in to register with the lower edge **122** of the control sleeve **109** to initiate fuel injection. The triangular recess forms a helical edge **29** which subsequently comes in communication with the radial opening **30** in a control sleeve **109** as the plunger is moved upwardly to terminate injection.

It is understood that the metering edges **28** and **29** and recess **171** could be inverted from that shown in FIGS. **7** and **8** whereby the registry of helical edge **29** and passage **8** control initiation of injection. The beginning of the effective stroke with a constant port closing is shown.

A control rod **14** controls a plurality of control sleeves such as control sleeve **9** on mating plungers such as plunger **3**. Each control sleeve is connected to the control rod **14** by a stem **12** received in an opening **13** and forms a spherical head **68** as shown in FIG. **3**. The control rod reciprocates to rotate the control sleeve and thereby increase or decrease the fuel quantity of injection per stroke. The control rod **14** also rotates in response to engine speed causing a lifting and lowering of the control sleeve which in turn produces a change in the timing of fuel injection. This movement of the control rod **14** is accomplished with a conventional speed responsive mechanism such as an engine governor. For the purpose of illustration the function of the governor and its control of the control rod **14** is shown in FIGS. **9**, **10** and **11**. The control rod **14** is connected to the control sleeve **9** as shown in FIG. **9**. The control rod **14** is connected to the governor plate **74** which carries the control finger **75** extending axially in parallel with the control rod **14** to control fuel quantity. The timing finger **76** extends from the governor plate **74** and is adapted for rotating of the control rod **14** about its axis to control timing of injection.

Referring to FIGS. **10** and **11** a governor is shown connected to the governor plate **74** through the control finger **75** and the timing pin **76**. The governor plate **74**, timing pin **76** and control finger **75** are rigidly fastened to the control rod **14** to transmit rotary motion produced by a slotted plate **77** and transmit axial motion produced by motion of the governor yoke assembly to the control finger **75** and the control rod **14**.

The timing of fuel injection is contolled by a rotary motion generated by the centrifugal governor **78**. The screw **79** is rigidly fixed to the governor housing **80** and engages an angled slot **81** in the slotted plate **77**. A rotary motion is imposed on a slotted plate **77** as it moves axially responsive to speed changes. The timing fork **83** is rigidly fixed to the slotted plate **77**. The timing fork **83** transmits a rotating force to the timing pin **76** which inturn is transmitted through the governor plate **74** to the control rod **14** producing a vertical displacement of the control sleeve **9**.

An angular displacement of the slotted plate **77** is a function of the axial displacement of the slotted plate **77** and the angle of the slot **81**.

Referring to the governor **78**, the fly weights **84** are driven by shaft **85** which is connected to the engine. The shaft **85** carries the bracket **86** for pivoting the weights **84**. As the fly weights **84** rotate, a centrifugal force is generated tending to accelerate them radially. This force is transmitted through the fly weight fingers and thrust bearing **87** to the shifter sleeve **88** and the slotted plate **77**. The impending motion of the shifter sleeve **88** and slotted plate **77** is opposed by the spring force of the springs **89** and **90** which creates an equilibrium position of the shifter sleeve **88** solely a function of governor speed or engine speed. By utilizing the shifter sleeve **88** as a speed sensing member, the timing fork **83** transmits a signal of the axial position of the shifter **88** to the slotted plate **77** to the timing pin **76**, causing the control rod **14** to rotate and to move the control sleeve **9** vertically.

The slotted plate **77** and the shifter **88** are rigidly fastened together and moves the unit axially and angularly. As the speed increases the shifter sleeve **88** moves axially toward the spring **89** and **90** until a new position of equilibrium is reached. This axial movement of the shifter **88** and the slotted plate **77** in cooperation with the screw **79** and the angled slot will cause further rotation of the slotted plate **77** and the timing fork **83**. This rotation is transmitted by the timing pin **76** through the governor plate **74** and control rod **14**. The control rod **14** moves the control sleeve **20** thus lowering the control sleeve. Port closing or beginning of the injection will occur earlier in the cycle as the speed increases.

The speed setting of the internal combustion engine is controlled through a throttle shaft **91** which is manually controlled. Once the throttle shaft **91** is set the centrifical governor will substantially maintain the speed setting of the throttle control. The throttle shaft **91** is mounted on the governor housing **80**.

The governor yoke assembly comprises a torque link **93** and a yoke **94** rotatably hinged on a pin **95**. A spring **96** is compressibly positioned etween the sleeve **181** carried on housing **180** and the governor plate **74**. This spring biases the control finger **75** to an engagement position n the torque plate **97** to maintain the torque plate in contacting position with the shaft **95** and yoke **94**. The force of the spring will bias the governor yoke **94** to engage the shaft **95** and cause the torque plate **97** and yoke **94** and torque link **93** to initially rotate as a unit about the pin **98**.

The shifter pin **99** engages the lower end of the governor yoke **94** and transmits an axial motion of the shifter sleeve **88** and slotted plate **77** to the governor assembly. When an equilibrium position exists between the fly weights **84** and the governor springs **89** and **90**, rotation of the throttle shaft **91** will displace the pin **98**. This will force the governor yoke assembly to rotate about the shifter pin **99**. The torque plate **97** on the upper end of the governor yoke **93** transmits the rotational movement to cause in the control finger **75** an axial movement which will rotate the control sleeve **9** so the required amount of fuel may be delivered to the engine.

With the throttle shaft held in this position, the position of the pin **98** remains the same. A decrease in engine speed in other words, a load increase will make shifter sleeve **77** move to a new equilibrium position away from the governor springs **89** and **90**. This movement will be transmitted by the shifter pin **99** to slots in the lower end of the governor yoke **94**. The control finger **75** is contact with the torque plate **97** at the end of the governor yoke **93** will be moved toward an increased fuel position which will tend to reestablish the original speed.

The torque plate **97** is retained on the governor yoke **94** by the pin **95**. The spring **96** biases the torque plate **97** to an engagement position with the pin **95** and yoke **94**. This arrangement provides for a degree of governor yoke rotation relative to the link **93** which is limited by the clearance between the torque adjusting screw **101** on the torque link **93**. This rotation occurs when the yoke rotates about the fuel stop adjusting screw **102** on the fuel stop lever **103** which is pivotally supported on the shaft **104** and mounted in housing **80**. Although the complete description of the governor is quite extensive, it is understood that a conventional governor which provides a speed control for timing of fuel injection and a torque control or load control which is responsive to a manual and speed control to provide a control of the quantity of fuel injected would be satisfactory. The multiple plunger fuel injection pump as described operates in response to such a speed and manual control such as set forth in this description above. A more detailed description of the governor assembly can be had by reference to the U.S. Pat. No. 3,421,486, entitled Fuel Injection Control, if a more detailed description is desired.

The relative position of the various parts of the governor mechanism are shown in the high idle position in FIGS. **10** and **11**.

The injection pump operates as follows. Fuel under pressure from supply pump **125** enters the injection pump housing **63** through the opening **67**. As fuel is supplied to the fuel injection pump assembly, it is permitted to flow upwardly through the cam follower **2** and slot **23** as well as the radial port **8** and the axial passage **7** to the fuel injection pump chamber **24**, when the plunger is at the bottom of the stroke. As the cam **1** rotates the plunger begins to lift until the port **8** is closed by the lower edge **22** of the control sleeve **9**. As the plunger continues to rise, it compresses the fuel into the pumping chamber **24**. Fuel pressure opens delivery valve **17** and the fuel then passes into the outlet connector **18** and from there through a high pressure line, and a fuel injection nozzle to the combustion chamber.

On its further upward movement radial passage **8** registers with the lower edge **26** of the helical slot **10** in the control sleeve **9**. As shown in FIG. **3** this slot communicates with the fuel filled cavity **72** in the pump housing through the intersection of the helical slot **10** with the lower edge **22** and the upper edge **27** of the control sleeve **9**. When the upper edge of the radial port **8** registers with the edge **26**, communication is reestablished between the pumping chamber **24** and the fuel supply chamber **72**. The injection pressure is spilled and the delivery valve **18** closes and injection is terminated in a conventional manner.

Two control motions are available to the control sleeve **9**. The first motion is up and down. This motion can be induced by rotation of the control rod in a clockwise or counterclockwise direction. This motion will move the outside edge of the passage **13** up and down and this movement is transmitted to the control sleeve **9** by the finger **12**. When the control sleeve **9** is lifted closing of port **8** will occur later. Injection will be retarded without affecting the output quantity. Lowering of the control sleeve will effect closing of the radial port **8** and will advance injection.

The second mode of control occurs when the rod is moved axially back and forth. This does not affect the port closing or the injection timing, however, it changes the effective stroke by moving the helical slot **10** away or toward the port **8**. Moving it toward port **8** will decrease the effective stroke because the upper edge of the port **8** will meet edge **26** sooner decreasing the delivery quantity of the pump.

An alternative arrangement is shown in FIGS. **7** and **8**. In these figures the helical recess of essentially a triangular shape is produced on the circumference of the plunger **103**. As shown in FIG. **8** the recess has a predetermined depth. The recess communicates with the axial passage **7** through the radial port **8** but the metering and timing are now controlled by the edges of the triangular cutout on the plunger as follows. When the plunger starts its rise, edge **28** of the recess on the plunger registers with the lower edge **122** of the control sleeve **109** effecting the port closing. In its further upward stroke the helical edge **29** of the plunger recess will register with the radial passage **30** on the inside diameter of the control sleeve **109** and this will effect the spill of pressure from the pumping chamber **24**. Both metering arrangements shown in FIGS. **5**, **6** and FIGS. **7** and **8** are functionally alike and differ only in manufacturing details.

The metering edge can also be reversed and positioned upside down in both arrangements so that instead of having a constant port closing for begining of injection with the variable port opening for ending of the injection the metering element could be so arranged as to result in a variable beginning of fuel injection and a constant time of ending or termination of fuel injection.

When a multiple plunger fuel injection pump is assembled in the process of manufacturing certain service adjustments have to be made to obtain equal timing and equal delivery quantity of fuel form all outlets. This process is known as calibration and is accomplished as described below. Due to the accumulation of vertical tolerances the port **8** will reach the edge **22** at camlifts which will vary from one element to the next. In order to make sure that the port closing occurs always at the same camlift timing, strips **5** will be manufactured in varied thicknesses and will be introduced into the individual pumping element assemblies through the windows **31**.

Subsequently the quantity delivered by each element will be adjusted by means of the calibration screw **32** which is equipped on its lower end with the timing pin **6** arranged eccentrically to its threaded portion. An O-ring **33** located below the thread of the adjusting screw seals the interior of the pump against fuel leakage past the adjusting screw **32**.

The lower end of the timing pin **6** registers with the forked end of the timing strip **5**. Rotating of the adjusting screw in the clockwise or counterclockwise direction will rotate the plunger slightly in relation to the pump housing and in relation to the control sleeve which will alter the delivery of this particular element. This adjustment is used to equalize the delivery of all pump elements.

Accordingly it can be seen that the metering and timing arrangement built into the control sleeve allows fuel injection to advance and retard with a very small force by rotating of the control lever. Both the timing and metering movements of the control rod can be introduced by a single centrifugal governor in a manner similar to the one which has been described in the above description. In addition the manner in which the fuel quantity can be equalized and the timing can be made uniform is also incorporated in this invention. Accordingly the automatic timing advance is built into the pump assembly which provides a compact fuel pump mechanism which can be contained with the normal in line pump and governor assembly package of a Diesel engine.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A multiple plunger fuel injection pump for an internal combustion engine comprising, a pump housing means defining a plurality of bores, a plunger received in each of the bores and defining a fuel injection pumping chamber and a fuel supply chamber in each of said bores, a delivery valve in communication with each of said fuel injection pumping chambers, each of said plungers defining passage means selectively communicating between said injection pumping chamber and said supply chamber for supplying fuel to said injection pumping chamber, means sequentially reciprocating each of said plungers for discharge of fuel from said fuel injection pumping chamber through said delivery valve, a control sleeve mounted for reciprocal and rotational movement about each of said plungers and defining port means with said plunger for controlling the closing and opening of said passage means in said plunger between the supply chamber and the fuel injection pumping chamber, lever means connected to said plunger for rotating said plunger in said housing means to calibrate one of said plungers relative to remaining plungers, a speed responsive device adapted for connection to an engine including a control member moving in response to engine speed and

load, means connecting said control member to each of said control sleeves for transmitting rotational and axial movement of said sleeves thereby controlling the quantity and timing of fuel injection delivered from said injection pumping chambers through said delivery valves.

2. A multiple plunger fuel injection pump for an internal combustion engine as set forth in claim 1 wherein said means sequentially reciprocating said plungers comprises a cam, a cam follower connected to each of said plungers to operate said plungers in response to operation of said cam, said lever means defines a shim removably positioned between said plunger and said follower, a window for selectively positioning said shim of predetermined thickness between said plunger and said follower when said window is open.

3. A multiple plunger fuel injection pump for an internal combustion engine as set forth in claim 1 wherein said means sequentially reciprocating each of said plungers includes, a cam, a cam follower operated by said cam, said lever means defining calibration shim removably positioned between said plunger and said cam follower to thereby provide a means of selectively controlling the high and low position of each of said plungers in response to rise and fall of said cam follower.

4. A multiple plunger fuel injection pump for an internal combustion engine as set forth in claim 1 wherein said plunger and control sleeve define a spill slot means having a diagonal edge, said lever means connected to said plunger for rotating said plunger on its axis relative to said sleeve for selectively and alternatively increasing and decreasing quantity of fuel injection, an adjusting screw means mounted in said housing connected to said lever means to thereby adjustably rotate said plunger relative to said control sleeve to vary fuel quantity injection.

5. A multiple plunger fuel injection pump for an internal combustion engine as set forth in claim 1 wherein said speed responsive device includes said member rotatably and axially movable relative to said housing means, a timing mechanism including a control rod in said means connecting said control member with each of said control sleeves providing axial movement of said control sleeves for timing control, means for transmitting axial movement from said control member to said control rod to rotatably move said control sleeves for fuel quantity control, said lever means connected to said plunger providing timing calibration by its selective thickness and quantity calibration through plunger rotation by said lever means.

6. A multiple plunger fuel injection pump for an internal combustion engine as set forth in claim 1 wherein each of said plungers and control sleeves define a diagonal spill slot and port means whereby rotational movement of said control sleeve varies fuel injection quantity, said means reciprocating said plungers including a cam and a cam follower, said lever means defining a shim removably positioned between said plunger and said cam follower to control the extreme reciprocal positions of said plungers in response to rise and fall of said cam follower, said lever means operating to selectively rotate said plunger relative to said control sleeve to thereby increase or decrease quantity of fuel injection of the adjusted plunger with relation to remaining multiplungers at said pump.

7. A multiple plunger fuel injection pump for an internal combustion engine as set forth in claim 1 wherein each of said plungers define a spill port in said passage means, each of said control sleeves define a diagonal slot on their internal periphery for spilling high pressure fluid from said fuel injection pumping chamber through said spill port for termination of fuel injection, said means reciprocating said plunger including means selectively receiving said lever means of desired thickness for calibration of timing.

8. A multiple fuel injection pump for an internal combustion engine as set forth in claim 1 wherein the end of said plunger includes slot means for receiving said lever means to thereby selectively control the plunger position axially and angularly relative to its mating control sleeve for calibration of said plunger.

9. A multiple plunger fuel injection pump for an internal combustion engine as set forth in claim 7 including means defining a window for removably positioning said lever means for rotating said plunger in said housing means, an adjusting screw pivoting said lever means to calibrate said plungers relative to the remaining plungers, a cover removably positioned over said adjusting screw and said window.

10. A multiple plunger fuel injection pump for an internal combustion engine as set forth in claim 1 including an adjusting screw for pivoting said lever means and rotating said plunger, a cover removably positioned over said adjusting screw.

* * * * *