Aug. 28, 1962 H. HOGEMAN ET AL 3,050,964

TIMING DEVICE FOR FUEL INJECTION PUMP

Filed Sept. 11, 1961 4 Sheets-Sheet 1

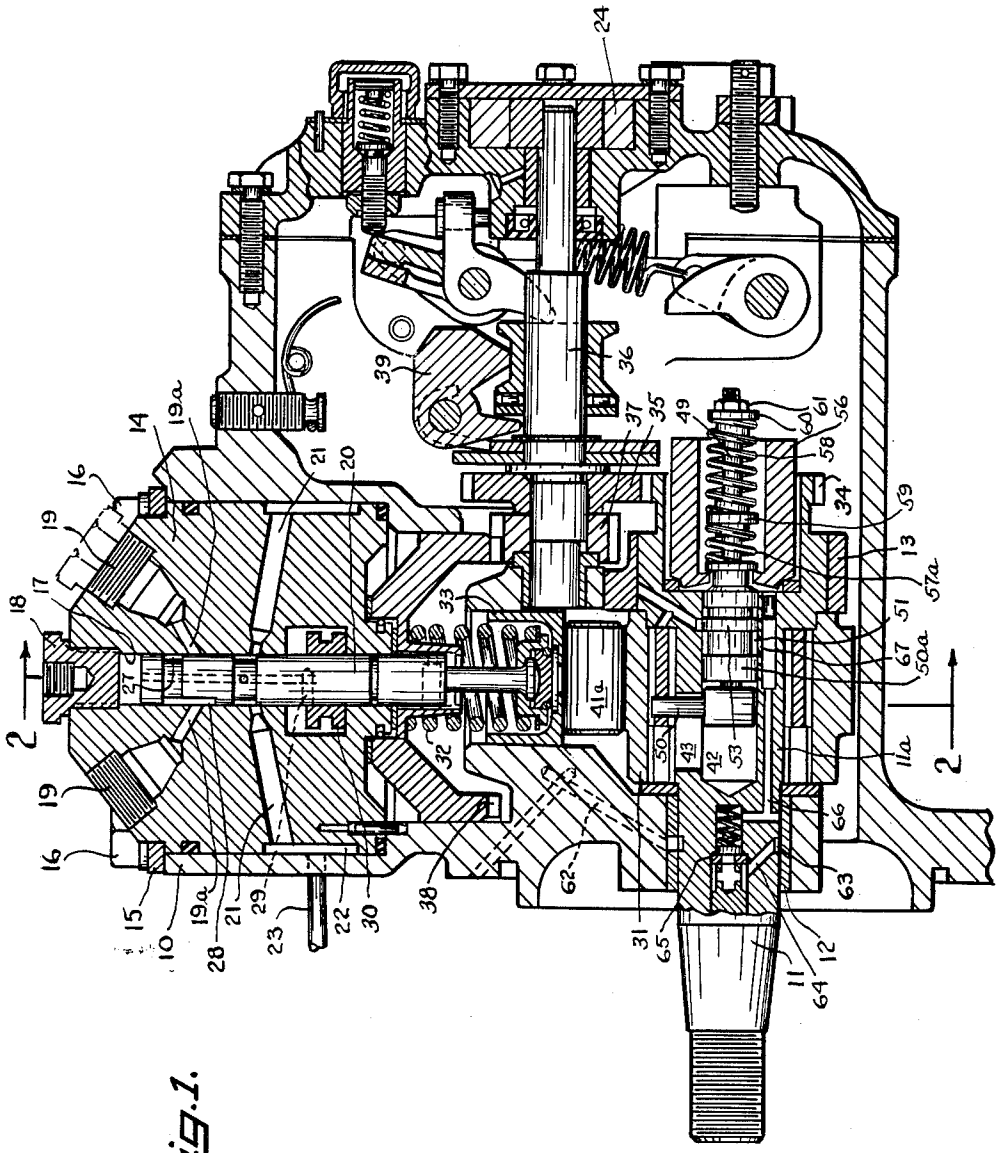

Fig. 1.

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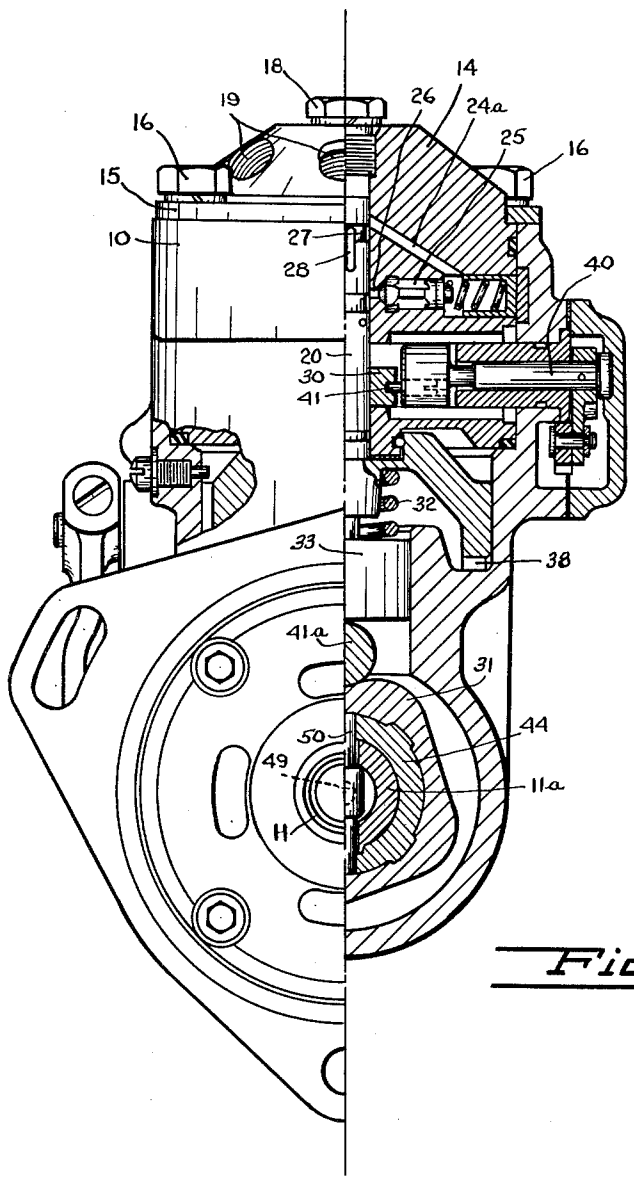

Fig. 2.

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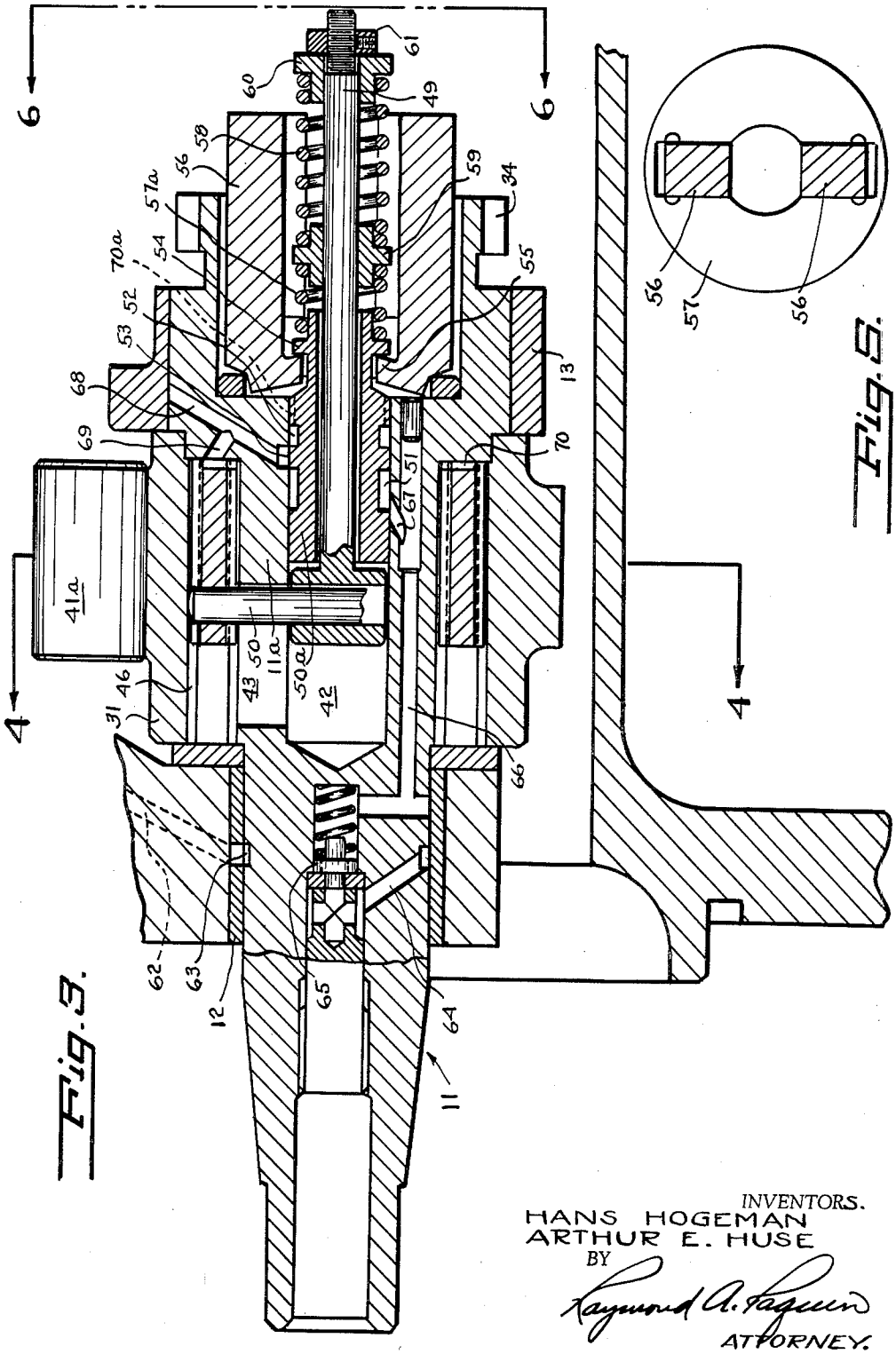

Fig. 3.

Fig. 5.

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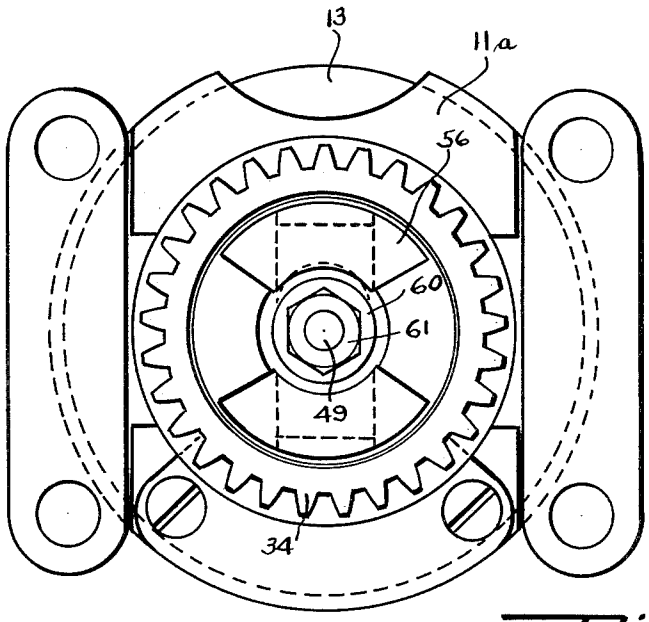
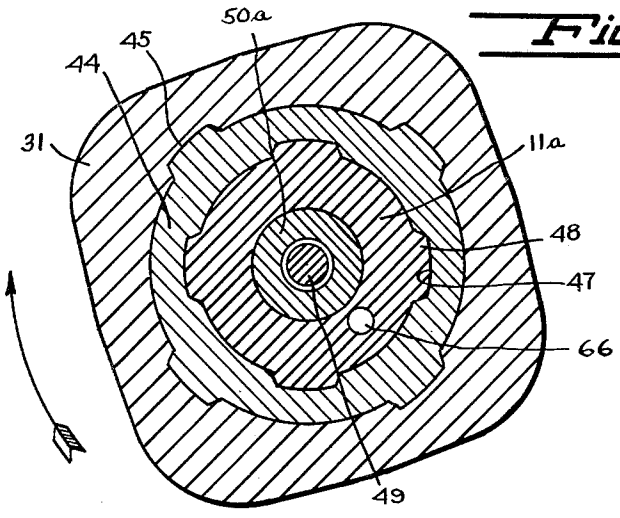


Fig. 6.

Fig. 4.



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TIMING DEVICE FOR FUEL INJECTION PUMP

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3 Claims. (Cl. 64—25)

This invention relates to fuel injection apparatus for internal combustion engines or the like and has particular reference to a new and imporved automatic timing device for fuel injection pumps.

An object of the invention is to provide a new and improved automatic timing device for fuel injection pumps which is relatively simple and compact and which may be contained within the pump housing if desired.

Another object of the invention is to provide an apparatus of the type set forth which is adapted to automatically control the timing of injection by the pump.

Another object is to provide a new and improved device of the type set forth which combines a centrifugal control means with hydraulic actuating means.

Other objects and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings wherein the preferred form of the invention has been given by way of illustration only.

Referring to the drawings:

FIGURE 1 is a longitudinal sectional view of a fuel injection apparatus embodying the invention;

FIGURE 2 is a sectional view taken on line 2—2 of FIGURE 1 looking in the direction of the arrows:

FIGURE 3 is a fragmentary sectional view generally similar to FIGURE 1 but showing only the timing device;

FIGURE 4 is a sectional view taken on line 4—4 of FIGURE 3 looking in the direction of the arrows;

FIGURE 5 is a plan view of the centrifugal actuating mechanism; and

FIGURE 6 is a view taken on line 6—6 of FIGURE 3 looking in the direction of the arrows.

Referring more particularly to the drawings wherein similar reference characters designate corresponding parts throughout, the apparatus shown embodying the invention comprises a housing or casing 10 in which the drive shaft or cam shaft designated generally at 11 is journalled in the bearings 12 and 13 and said drive shaft 11 is adapted to be operatively connected to the engine and to be driven thereby.

For the purpose of illustration only the invention has been shown applied to a distributor type fuel injection pump. It will be understood that the device may also be applied to in line multiple plunger fuel injection pumps.

The distributor pump shown includes a hydraulic head 14 positioned within casing 10 and held therein by clamps 15 which in turn are retained in operative position by bolts 16.

Hydraulic head 14 is provided with bore 17 having the end thereof closed by threaded plug 18 and said hydraulic head 14 is also provided with the outlets 19 each adapted to be connected to bore 17 by a respective passage 19*a* and each of said outlets 19 is adapted to be connected to a combustion chamber by suitable tubing whereby fuel is delivered to said combustion chambers successively upon reciprocation and rotation of pumping and distributing member 20 in bore 17.

Fuel is adapted to be supplied to bore 17 through inlet passage 21 connecting with peripheral sump 22 in hydraulic head 14 to which fuel is adapted to be supplied through tubing 23 from supply pump 24.

Fuel pumped in bore 17 by pumping and distributing member 20 passes through fuel passage 24*a*, check

valve 25 and port 26 to annular groove 27 on member 20 from which it passes to distributing slot 28 in the periphery of member 20 which slot is adapted to communicate with each of the passages 19*a* successively upon rotation of member 20.

Fuel reaching bore 17 from fill passages 21 passes through port 27 and passage 28 in member 20 to reach bore 17 between plug 18 and the adjacent end of member 20 and on each pumping stroke of member 20 fuel passes through fuel passage 24*a*, delivery valve 25 and port 26 to distributing slot 28 as previously described and spill passage and port 29 is controlled by sleeve 30 for controlling the fuel quantity.

Pumping and distributing member 20 is adapted to be reciprocated in bore 17 by means of cam 31 and return spring 32 which engage the opposite sides of tappet 33 to which the adjacent end of member 20 is connected and member 20 is adapted to be rotated by means of gear 34 on member 11 which gear meshes with gear 35 on governor shaft 36 and on shaft 36 is provided gear 37 which meshes with face gear 38 which is connected to member 20 whereby rotation of face gear 38 effects simultaneous rotation of member 20.

On governor shaft 36 is provided centrifugal weights 39 adapted to be connected to control sleeve 30 through shaft 40 which has an eccentric pin 41 thereon which engages sleeve 30 for adjusting said sleeve relative to spill port 29.

The foregoing mechanism is shown in Patent 2,965,087 to which reference is made for further description and operation of the distributor pump to which the invention has been applied for the purpose of illustrating the invention.

As previously stated, the invention could also be applied to other forms of fuel injection pump.

Between tappet 33 and cam 31 is provided a roller 41*a* which is adapted to engage cam 31 and also tappet 33 for actuating the tappet.

The automatic timing mechanism of this invention and which is carried by cam or drive shaft 11 includes a bore 42 in member 11 and a slot 43 overlying said bore 42 and cam member 31 surrounds portion 11*a* of cam shaft 11.

On the end of portion 11*a* of shaft 11 is provided gear 34.

Between cam 31 and portion 11*a* of shaft 11 is provided spline sleeve 44 having external helical splines 45 positioned in helical slots 46 in cam 31 and said spline sleeve 44 has internal helical slots 47 in which are positioned external helical splines 48 on the periphery of portion 11*a* of shaft 11.

Within bore 42 in shaft 11 is provided rod 49 to which is connected drive pin 50 which is connected at its opposite ends to spline sleeve 44 and rod 49.

Within bore 42 and surrounding rod 49 is provided valve member 50*a* having the peripheral grooves 51 and 52 separated by the land 53 as hereinafter described. Valve 50*a* has the flange 54 adapted to be engaged by the ends 55 of centrifugal weight members 56 which are mounted on spider or carrier 57 and are adapted to move said valve in one direction. Opposing the movement of valve 50*a* by centrifugal members 56 are the springs 57*a* and 58 on rod 49 and between which is the seat member 59 whereby the springs 57*a* and 58 may be of different rate. Spring seat 60 may be adjusted on rod 49 to set the tensions of springs 57*a* and 58 by means of nut 61 which is threaded on the end of rod 49 and serves to retain the springs in adjusted position.

The hydraulic system for actuating the timing mechanism is adapted to be actuated by a source of hydraulic pressure which may be the engine lubricating oil or from an external hydraulic pump and said fluid under pressure is adapted to pass through passage 62 to annular groove

63 on shaft 11 and then through duct 64 and past check valve 65 which is preferably provided to prevent back flow and from which said fluid passes through passage 66 and port 67 to bore 42 in member 11.

In the drawings the timing mechanism is shown in full retard position and the valve 50*a* and weights 56 are shown in normal operating position.

The annular groove 51 on valve 50*a* is the high or supply pressure groove. When the weights expand at higher speeds, land 53 is moved to a position where fluid can pass to duct 68 and the fluid then passes through duct 69 into the annular groove 70 on spline sleeve 44 to move the spline sleeve to adjust the position of the cam 31 and thereby adjust the timing of injection by the pump.

As the spline sleeve 44 is moved to the left by hydraulic pressure to change the timing, the rod 49 is simultaneously pulled or moved in the same direction and compresses the springs, thus increasing the spring force and serving to restore the centrifugal weights 56 to their speed stabilized or normally operating position.

When the centrifugal weights 56 collapse at lower speeds, the valve 50*a* is pushed to the left by the spring force and fluid is dumped through groove 52 and passages or slots 70*a* to the sump of the pump and allows the spline sleeve 44 to be moved to the right by spring force and the torque reaction of the pump until the sleeve reaches the extent of its travel or until the weight force is balanced by the springs.

It is pointed out that instead of the splined connection between the sleeve 44 and cam 31 and portion 11*a* of shaft 11 that other means of operatively connecting the sleeve 44 to cam 31 and portion 11*a* may be employed.

The operation of the device is believed apparent from the foregoing description from which it will be seen that the timing apparatus of the present invention serves to automatically adjust the relative position of the tappet and the cam to thereby adjust the timing of injection by the pump.

From the above it will be seen that we have provided new and improved means for obtaining all of the objects and advantages of the invention.

We claim:

1. In a device of the character described, a drive shaft, a cam carried by and operatively connected to said drive shaft and means for adjusting the relative position of said cam and drive shaft, said means comprising a sleeve positioned between said cam and drive shaft, said sleeve being operatively connected to said cam and to said drive shaft and hydraulic means for effecting actuation of said sleeve for adjusting the relative position of said cam and drive shaft and centrifugally actuated means for controlling the operation of said hydraulically actuating means.

2. In a device of the character described, a drive shaft, a cam carried by and operatively connected to said drive shaft and means for adjusting the relative position of said cam and drive shaft, said means comprising a sleeve positioned between said cam and drive shaft, said sleeve being operatively connected to said cam and to said drive shaft and hydraulic means for effecting actuation of said sleeve for adjusting the relative position of said cam and drive shaft, a valve for controlling the operation of said hydraulic actuating means and means for automatically controlling the position of said valve.

3. In a device of the character described, a drive shaft, a cam carried by and adjustable relative to said drive shaft, and means for adjusting said cam relative to said drive shaft, said means for adjusting said cam relative to said drive shaft comprising a splined sleeve positioned between said cam and drive shaft and means for automatically effecting actuation of said splined sleeve for adjusting said cam relative to said drive shaft, said means for effecting automatic actuation of said splined sleeve comprising hydraulic means and valve means for controlling said hydraulic means and means automatically controlling the position of said valve means.

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