June 2, 1931. W. A. CHRYST ET AL 1,807,650

IGNITION TIMER AND FUEL PUMP UNIT

Filed Feb. 20, 1929 3 Sheets-Sheet 1

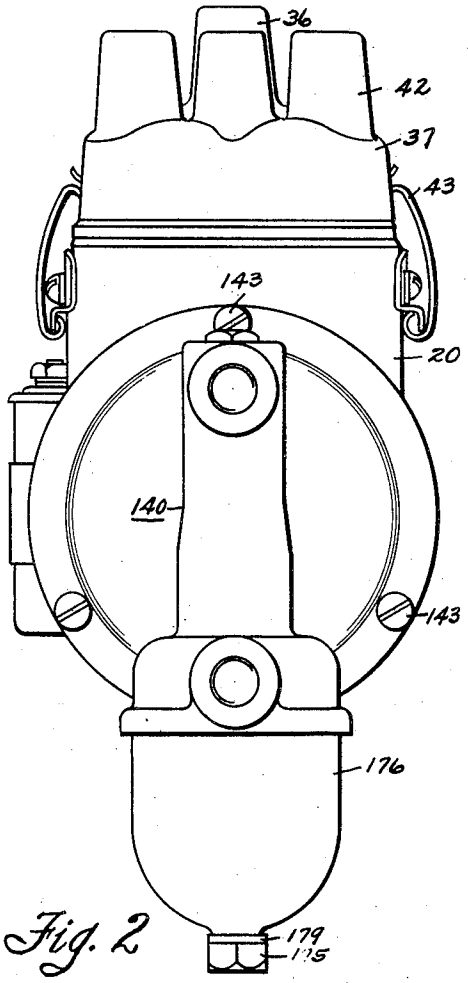


Fig. 2

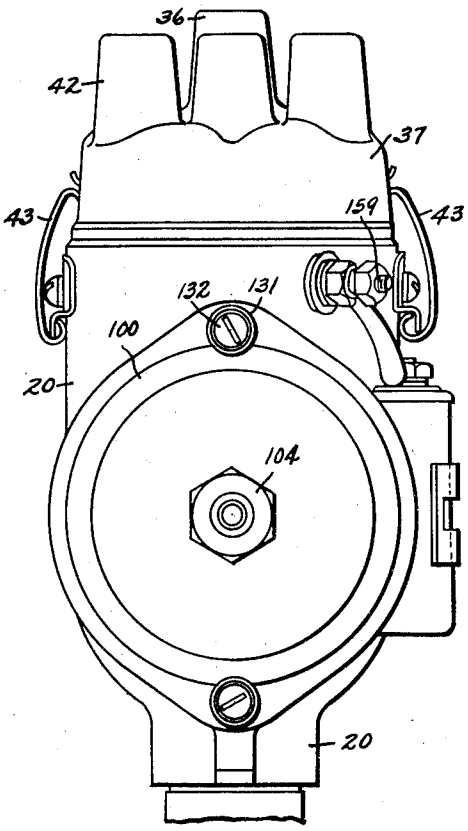


Fig. 3

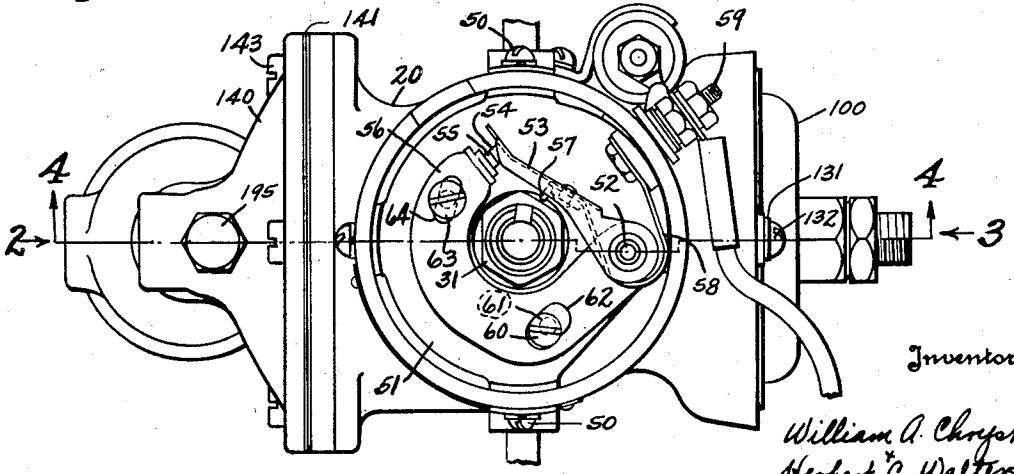


Fig. 1

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IGNITION TIMER AND FUEL PUMP UNIT

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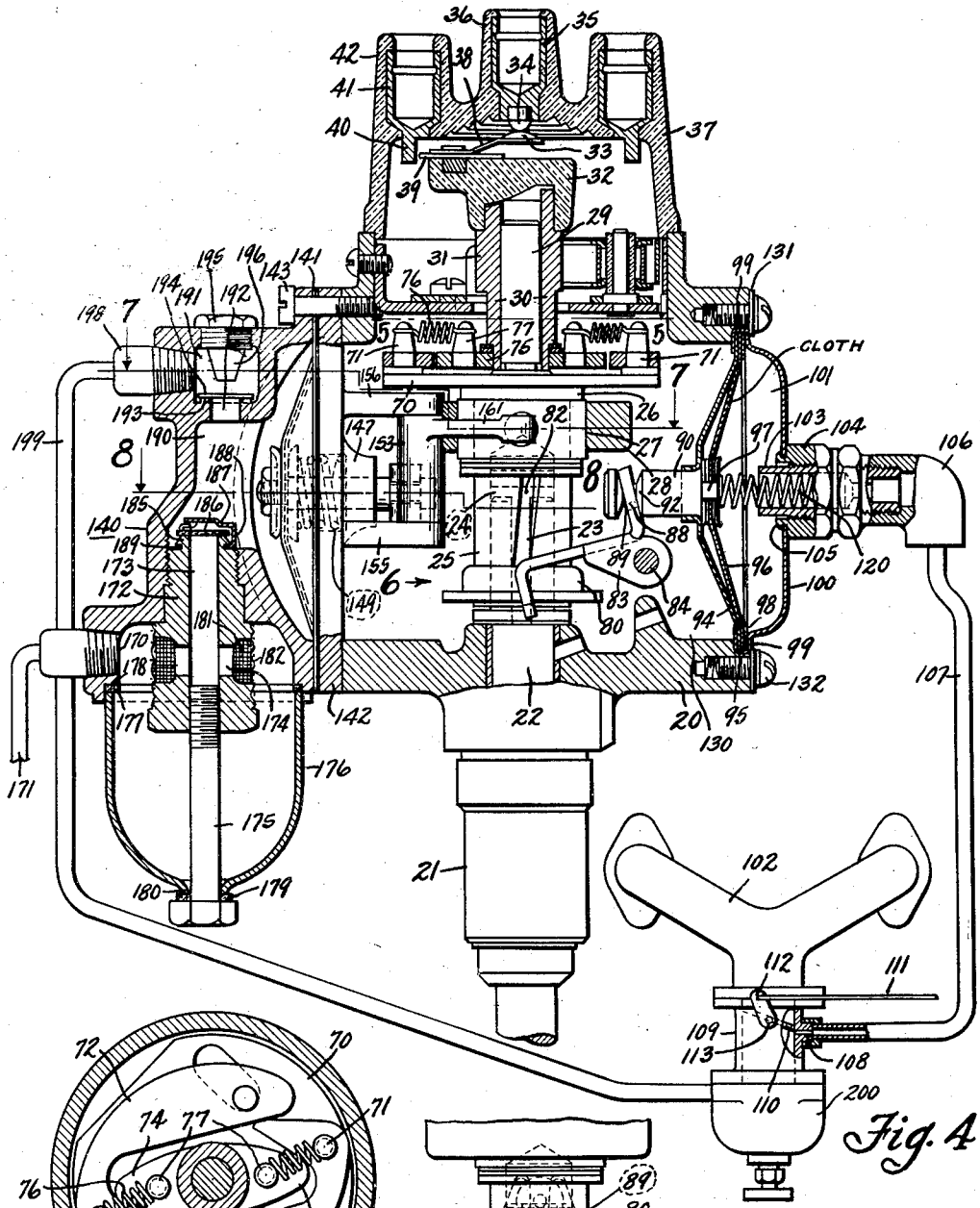


Fig. 4

Fig. 5

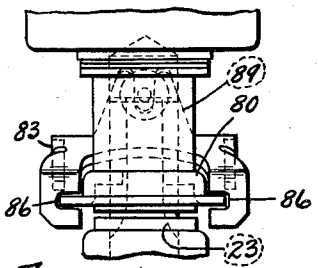


Fig. 6

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IGNITION TIMER AND FUEL PUMP UNIT

Filed Feb. 20, 1929 3 Sheets-Sheet 3

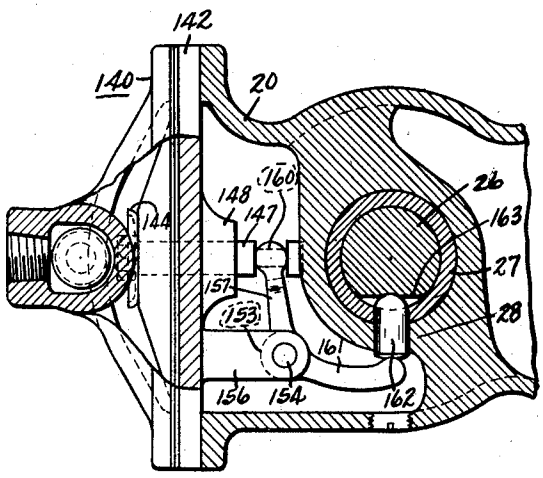


Fig. 7

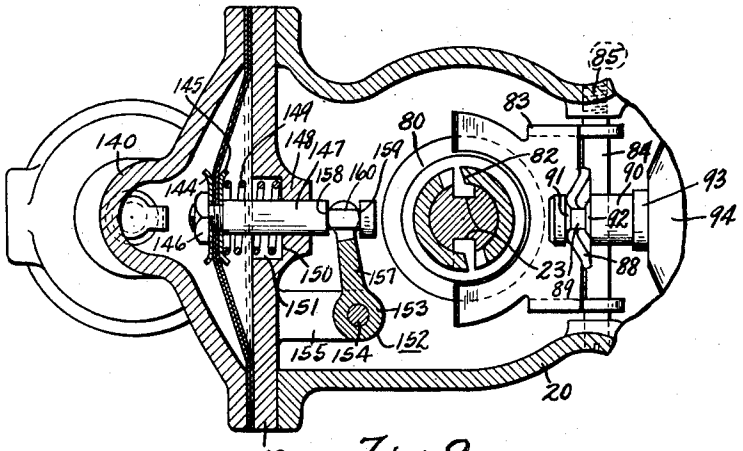


Fig. 8

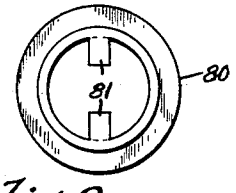


Fig. 9

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UNITED STATES PATENT OFFICE

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IGNITION TIMER AND FUEL PUMP UNIT

Application filed February 20, 1929. Serial No. 341,468.

This invention relates to fuel supply apparatus and ignition apparatus for internal combustion engines. One of the objects of the present invention is to provide simple and compact fuel pump and ignition timer unit for an internal combustion engine, which may be readily mounted upon the engine and have a single drive connection therewith.

Further objects and advantages of the present invention will be apparent from the following description, reference being made to the accompanying drawings wherein a preferred embodiment of one form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a plan view of the pump and timer unit embodying the present invention, the distributor head and rotor being removed.

Fig. 2 is a side elevation looking in the direction of the arrow 2 of Fig. 1.

Fig. 3 is a side elevation looking in the direction of the arrow 3 of Fig. 1.

Fig. 4 is in part a vertical longitudinal sectional view taken on the line 4—4 of Fig. 1, and in part a diagrammatic disclosure of the manner of connecting the unit with an engine carburetor.

Fig. 5 is a sectional view on the line 5—5 of Fig. 4.

Fig. 6 is a fragmentary side view looking in the direction of the arrow 6 of Fig. 4.

Figs. 7 and 8 are fragmentary sectional views taken on the lines 7—7 and 8—8 respectively of Fig. 4.

Fig. 9 is a plan view of a member controlling the connection between the ignition timer and its drive shaft.

Referring to the drawings, the ignition timer and fuel pump unit includes a housing 20, having a tubular shank 21, adapted to fit within a recess or socket in the engine frame, (not shown) and to be secured therein in the desired position of manual adjustment by the usual means well known to those skilled in this art. The shank 21 provides a bearing for the drive shaft 22, which is connected by gearing (not shown) with a rotatable part of the engine, preferably the valve operating shaft. The upper end of the shaft 22 is provided with diametrically opposite longitudinal grooves 23, and fits within a recess 24 provided by the tubular lower end of portion 25 of an intermediate shaft 26, which is journalled in a bearing 27 carried by a bridge member 28 integral with the housing 20. The intermediate shaft 26 is provided with a reduced upper end portion 29 providing a journal for a cam carrying shaft 30 integral with a cam 31. The cam 31 supports and drives a rotor block 32 carrying a rotor center button 33 engaging a center contact 34 electrically connected with a metal cable receiving socket 35 embedded in the non-conducting sleeve 36 integral with a distributor head 37. The center button 33 is urged upwardly against the contact 34 by a leaf spring conductor 38 electrically connected by a segment 39 carried by the rotor 32. The segment 39 rotates past distributor posts 40 arranged in a circular row, each post 40 being integral with a metal cable receiving socket 41 embedded in a non-conducting sleeve 42 integral with the head 37. The head 37 is fastened upon the housing 20 by two resilient hold-down clips 43.

Screws 50 secure to the housing 20 an interrupter supporting plate 51 which carries a stud 52 upon which is pivoted a breaker lever 53 insulated from the stud 52 and plate 51 and carrying a contact 54 which engages a contact 55 carried by a contact bracket 56 which is pivoted around the stud 52. The lever 53 carries a rubbing block 57 which cooperates with the cam 31, so that the contact 54 will be separated from the contact 55 when a lobe of the cam 31 engages the rubbing block 57. A leaf spring conductor 58 having one end attached to the lever 53 and the other to a terminal screw 59 conducts current from the terminal screw 59 to the breaker lever 53 and yieldingly urges said lever toward the cam 31. In order to adjust the rubbing block 57 relative to the cam 31, a screw driver slotted disk 60 having an eccentric shank 61 journalled in the plate 51 and confined within a slot 62 in the bracket 56, is turned in order to rotate the bracket 56 about the stud 52. When the bracket 56 has been adjusted, it is clamped against the plate 51 by a screw 63 passing through a slot 64 in the

bracket 56 and having threaded connection with the plate 51.

The intermediate shaft 26 is connected with the cam carrying shaft 30 by a centrifugal device which comprises a weight plate 70 attached to the shaft 26 and carrying pivot studs 71 pivotally supporting weights 72 each having a lever arm 73 which cooperates with lever arm 74 provided by a plate 75 attached to the lower end of the cam carrying shaft 30. When the weight 72 moves outwardly due to centrifugal force the arm 74 and hence the cam 31 will be rotated clockwise relative to the shaft 26, in order to advance the timing of the ignition. In the disclosed form of the invention the normal form of rotation of the cam 31 is clockwise, as viewed in Fig. 1. Movement of the weights outwardly is resisted by springs 76, each having one end attached to a weight pivot stud 71 and the other to a stud 77 attached to an arm 74 of the plate 75. Therefore, as the speed of the weight plate 70 decreases, the arm 72 will be moved inwardly by the spring 76 and the plate 75 and hence the cam 31 will be rotated counterclockwise in order to retard the ignition.

The drive shaft 22 and the intermediate shaft 26 are connected together by a mechanism which is responsive to variations in suction produced by the engine in order to vary the timing of the ignition in response to variations in engine load. This mechanism includes a collar 80, shown in side elevation in Figs. 4 and 6, and in plan view in Figs. 8 and 9. The collar 80 slides along the tubular extension 25 of the intermediate shaft 26 and is provided with diametrically opposite inwardly extending lugs 81 which pass through a diametrically opposite oblique slot 82 in the tubular shaft extension 25 and into the longitudinal grooves 23 in the drive shaft 22. It is, therefore, apparent that axial movement of the collar 80 along the shaft extension 25 will be accompanied by a relative rotary movement between the shaft 26 and the shaft 22. The suction responsive means for operating the collar 80 includes a bell crank lever 83 pivoted upon a rod 84 extending across the interior of the housing 20 and having threaded engagement with the housing at 85, as shown in Fig. 8. The lever 83 includes notched arms 86 which receive the outwardly extending annular flange 87 of the collar 80, and includes a bifurcated lever arm 88 which receives the reduced portion 89 of a rod 90 and which is located between the conical surfaces 91 and 92 of the rod 90. The rod 90 is guided by the tubular extension 93 of a cover plate 94 having its flange 95 clamped against the peripherv of a diaphragm member 96 comprised preferably of one or more layers of substantially airtight cloth such as varnished airplane linen. The rod 90 is attached at 97 to the diaphragm 96. The diaphragm is clamped at its edge between the flange 95 of the cover plate 94 and a gasket 98, which is located against a portion of a substantially U-shaped flange 99 of a cover plate 100. The flange 99 is crimped or otherwise deformed against the flange 95 of the cover plate 94 in order to secure the diaphragm 96 firmly at its edge and provide there a substantially air-tight joint. Thus the cover 100 with its movable wall or diaphragm 96 enclose a suction chamber 101 which is in communication with an engine intake pipe 102 by passages provided by coupling 103, threaded into a bushing 104, attached at 105 to the cover 100, by an elbow 106, a pipe 107, and a passage 108, leading into the side of a carburetor 109 at a point below the carburetor throttle valve 110, when in engine idling position. The valve 110 is operated in the usual manner by an actuating device (not shown) at the driver's seat which is connected by link 111 attached to a lever 112 connected with a thottle carrying shaft 113.

When the engine is idling the suction chamber 101 will be shut off from communication with the engine intake 102, hence the pressure in the chamber 101 will be substantially atmospheric, and the spring 120 confined between the diaphragm 96 and the coupling 103, will be free to urge the rod 90 towards the left and the collar 80 downwardly as viewed in Fig. 4 in order to maintain the ignition in a relatively retarded position. When, at a part-load engine operating condition, the throttle 110 is partly opened, the suction chamber 101 will be under a partial vacuum so that the diaphragm 96 will be moved toward the right against the action of the spring 120 and the lever 83 will be moved clockwise, as viewed in Fig. 4, in order to move the collar upwardly along the tubular extension 25 of the intermediate shaft 26. Due to the connection with the shaft 22 and 26 provided by the lugs 81 of collar 80, the shaft 26 will be rotated clockwise and hence, the cam 31 clockwise as viewed in Fig. 1, in order to advance the timing of the ignition. When the load on the engine increases, requiring the greater throttle opening, the suction in the intake manifold 102 will diminish, assuming the engine speed not to increase. Consequently the vacuum in the suction chamber 101 will diminish, whereupon the spring 120 will move the diaphragm 96 toward normal position, resulting in counter-clockwise rotation of the lever 30, downward movement of the collar 80, and counter-clockwise rotation of the cam 31 relative to the shaft 22. In this way the spark will be retarded as the engine load increases, assuming the engine speed does not increase materially. The cover members 94 and 100 provide a cover for an opening 130 in one side of the housing 20,

and this cover is secured in position by washers 131 attached to the housing 20 by screws 132, said washers overlapping the cover 100, as shown in Fig. 3.

The timer driving mechanism operates also a fuel pump for supplying fuel from a supply tank (not shown) to the carburetor 109. The fuel pump comprises a main casting or frame 140, which, together with a diaphragm member 141 and a spacing and mechanism supporting frame 142, is attached to the housing 20 by screws 143. The diaphragm 141 is composed of one or more layers of fabric material, which is impervious to liquid fuel such as gasoline. For this purpose varnished airplane linen has been found to be satisfactory. At its central portion, the diaphragm 141 is clamped between washers 144 and 145 by means of a nut 146 and a clamping rod 147. The rod 147 slides through a tubular guide 148 provided by the spacer plate 142. A spring 149, which is located between the washer 145 and the end wall 150 of a recess 151, provided in the plate 142, yieldingly urges the diaphragm 141 into the position shown in Figs. 4, 7 and 8. The rod 147 is operated by a bell crank lever 152 having its hub 153 journalled on a pin 154, supported by bracket arms 155 and 156. The bell crank lever 152 has an arm 157 the free end of which is received between surfaces 158 and 159 which define an annular groove 160 in the rod 147. The lever 152 has an arm 161 adapted to bear against a short rod or plunger 162, which is guided by suitable aligned apertures in the bridge member 28 and in the bearing 27. The intermediate drive shaft 26 is notched in the region of the horizontal plane passing through the rod 162 to provide a flat 163, which operates as a cam to move the rod 162 outwardly, when the flat passes beyond the rod 162 during the rotation of the shaft 26. The spring 129 operates to move the rod 162 inwardly towards the shaft 26 due to the action between the rod 147 and the bell crank lever 152.

The pump frame 140 provides an intake passage 170, which may be connected by a pipe 171 with a fuel tank (not shown). The frame 140 is threadedly engaged by a plug 172 providing a vertical fluid passage 173 and horizontal fluid passages 174. Adjacent its lower end the plug 172 is threadedly engaged by a screw 175, which clamps a fuel bowl 176 and a gasket 177 against an annular shoulder 178, provided by the frame 140. The shank of the bolt 175 passes through the bottom of the fuel bowl 176 and the head of the bolt clamps a sealing gasket 179 against a small annular flange 180 provided by the bowl 176. The plug 172 provides an annular groove 181 surrounded by a fuel screen 182 through which fuel must pass from the interior of the bowl 176 into the passage 173. The upper end of the plug 172 provides a pump intake valve seat 185 adapted to be engaged by a disk valve 186 retained by a valve cage 187 having legs 188 bent inwardly into an annular groove 189, provided by the plug 172. The space within the frame 140 and located above the valve 186 and to the left of the diaphragm 141 constitutes a displacement chamber indicated by numeral 190. The frame 140 provides an outlet valve chamber 191 in communication with the displacement chamber 190 through a passage 192. Around the passage 192, the frame 140 provides an annular ledge 193 constituting a seat for an outlet valve 194, which is confined by a plug 195 having an extension 196. The pump outlet valve chamber 191 is connected with the carburetor fuel bowl 200 by a coupling 198 and a pipe 199.

When the shaft 22 is rotated to operate the ignition timer, the pump diaphragm 141 will be flexed toward the right and back again alternately due to the cooperation of the intermediate drive shaft 26 of the timer, rod 162, bell crank lever 152, and rod 147. The mechanism is so arranged that there is a positive mechanical pull exerted upon the diaphragm 141 toward the right in order to draw fuel into the displacement chamber 190. Fuel is forced out of the displacement chamber 190 into the carburetor bowl 200 by the spring 149. In case the fuel bowl is full, at the time the spring 149 is released to force more fuel out from the pump, the closing of the float valve in the fuel bowl will cause a pressure to be built up in the body of fuel which is located between the float valve of the fuel bowl and the pump inlet check valve 186 and this pressure will be sufficient to overcome the action of the spring 149. The spring 149 is strong enough to force fuel from the displacement chamber into the carburetor bowl when the latter needs replenishing, but is sufficiently weak to prevent forcing more fuel than is required into the carburetor bowl. In this way the delivery stroke of the pump is controlled automatically in response to the level of fuel in the float bowl 200 of the carburetor.

The timer and pump unit may be readily assembled and disassembled. The pump and its operating mechanism may be removed from the housing without interfering with the operation of the remaining mechanism which operates the circuit interrupter. Also the suction chamber device can be removed without interfering with the operation of the pump or with the drive mechanism for the timer. Generally the apparatus will be assembled by first assembling the shaft 22 and collar 80 with the housing 20. Then a separate sub-assembly comprising the cam carrying shaft 30, intermediate shaft 26, and centrifugal mechanism connecting these shafts, and the bearing 27, is assembled as shown within the housing. Next the circuit breaker

sub-assembly mounted upon the breaker plate 51 may be assembled within the housing. Then there may follow the assembling of the bell crank lever 83, rod 84, and the suction chamber unit including the cover members 94 and 100, and parts supported thereby. The pump and pump operating mechanism are assembled together, the edges of the diaphragm being cemented together and to the pump frame 140 and the spacing frame 142. This sub-assembly of pump and operating mechanism is then attached to the housing 20 by the screws 143. After the interrupter has been properly timed the rotor and distributor heads are attached.

While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. An ignition timer and pump unit comprising, in combination, a housing having openings in the walls thereof, an ignition interrupter closing one of the openings, a pump and operating mechanism closing another opening, a suction chamber closing still another opening and having a movable wall and communicating with an engine intake, pump and timer operating mechanism within the housing and including a common operating shaft extending outside the housing, and means associated with the shaft and suction chamber for controlling the timing of the ignition.

2. An ignition timer and pump unit comprising, in combination, an interrupter, a cam for operating the same, a driven shaft operatively connected with the cam, a drive shaft, means for connecting the shafts and for controlling the angular rotation between them, and a pump and pump operating mechanism actuated by said driven shaft.

3. An ignition timer and pump unit comprising, in combination, an interrupter, a cam for operating the same, a cam operating shaft, a bearing for said shaft, a pump operating cam provided by the shaft at its journal in said bearing, pump operating mechanism including a part extending through said bearing and coacting with the pump operating cam, and a fuel pump operated by said mechanism.

4. An ignition timer and pump unit comprising, in combination, an interrupter, a cam for operating the same, a cam operating shaft supporting the cam, a centrifugal device connecting the shaft and cam, a bearing for said shaft, supporting endwise the centrifugal device, a pump operating cam provided by the shaft at its journal in said bearing, pump operating mechanism including a part extending through said bearing and coacting with the pump operating cam, and a fuel pump operated by said mechanism.

5. An ignition timer and pump unit comprising, in combination, an interrupter, a cam for operating the same, a drive shaft, an intermediate shaft, means responsive to engine suction for connecting the drive shaft and intermediate shaft and for varying the angular relation between them, means responsive to engine speed for connecting the interrupter cam with the intermedite shaft and for varying the angular relation between them, a bearing for the intermediate shaft, a pump operating cam provided by the shaft at its journal in said bearing, pump operating mechanism including a part extending through said bearing and coacting with the pump operating cam, and a fuel pump operated by said mechanism.

6. An ignition timer and pump unit comprising, in combination, an interrupter, a cam for operating the same, a drive shaft, an intermediate shaft, means responsive to engine suction for connecting the drive shaft and intermediate shaft and for varying the angular relation between them, means responsive to engine speed for connecting the interrupter cam with the intermediate shaft and for varying the angular relation between them, and a pump having operating mechanism including a cam provided by said intermediate shaft.

7. An ignition timer and pump unit comprising, in combination, a housing, a circuit interrupter and a cam for operating the same located within the housing, an operating mechanism providing a shaft for operating the interrupter cam and providing a pump operating cam, and a sub-assembly comprising a pump and pump operating mechanism actuated by the pump operating cam and removable as a unit from the housing while the interrupter cam operating mechanism remains assembled.

8. Apparatus according to claim 7 in which the interrupter and a portion of its operating mechanism may be removed from the housing while the pump and pump operating mechanism remain assembled with the housing.

9. Apparatus according to claim 7 in which the interrupter is removable as a unit from the housing, and in which the interrupter cam and the cam operating shaft are removable as a unitary sub-assembly from the housing while the pump and pump operating mechanism remain assembled with the housing.

10. An ignition timer and pump unit comprising, in combination, a circuit interrupter constituting a separable sub-assembly unit; a separable sub-assembly unit comprising interrupter drive including a cam; an intermediate shaft having a pump operating cam, and a centrifugal device connecting the intermediate cam and intermediate shaft; a separable subassembly unit comprising a fuel

pump and pump operating mechanism; and a subassembly unit comprising a housing and a main drive shaft; said pump subassembly unit being removable from the housing while the other subassemblies remain assembled with the housing subassembly, and the two subassemblies first mentioned being removable as units from the housing while the pump subassembly remains assembled with the housing.

11. Apparatus according to claim 10, in which the intermediate drive shaft and the main drive shaft are connected by mechanism responsive to engine intake suction for varying the angular relation between said shafts, said suction responsive mechanism being removable from the housing while the other subassembly units remain assembled therewith.

12. An ignition timer and pump unit comprising, in combination, a circuit interrupter; a driven member for operating said interrupter; a driving member; mechanism connecting the driving and driven members, said mechanism being adapted to vary the angular relation between them; and a pump having operating mechanism actuated by one of said members.

13. An ignition timer and pump unit comprising, in combination, a circuit interrupter; a driven member for operating said interrupter; a driving member; mechanism connecting the driving and driven members, said mechanism being adapted, in response to variations in the speed of the driving member, to vary the angular relation between said members; and a pump having operating mechanism actuated by the driving member.

14. An ignition timer and pump unit for an internal combustion engine comprising, in combination, a circuit interrupter; a driven member for operating said interrupter; a driving member; mechanism connecting the driving and driven members, said mechanism being adapted, in response to variations in engine suction conditions to vary the angular relation between said two members; and a pump having operating mechanism actuated by the driven member.

In testimony whereof we hereto affix our signatures.

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