May 17, 1966 B. WALKER 3,251,352

DELAYED IGNITION SHUT OFF AFTER ENGINE STOPS

Filed March 24, 1964

Fig. 1.

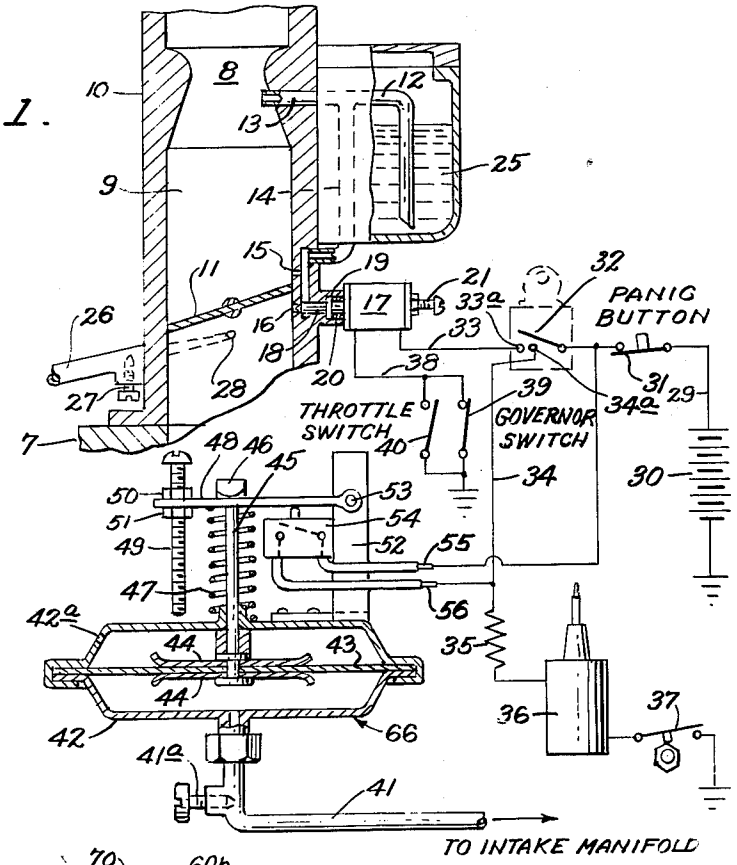


Fig. 2.

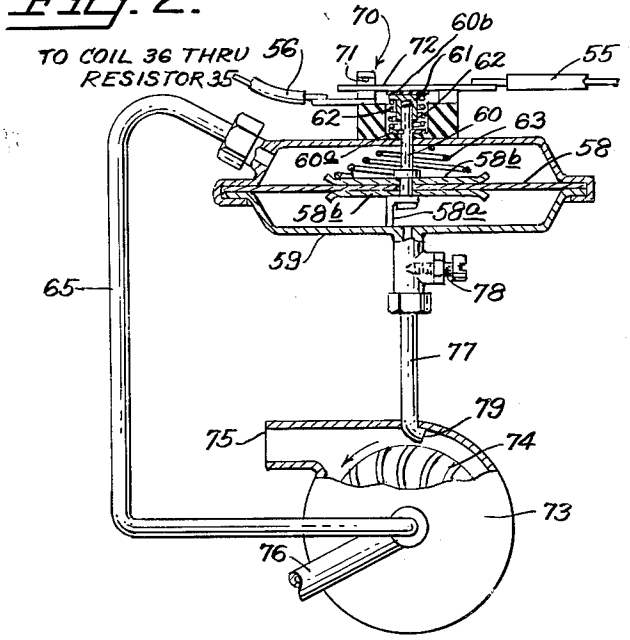
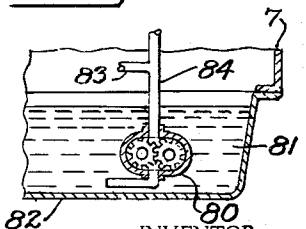


Fig. 3.



INVENTOR.

Brooks Walker

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DELAYED IGNITION SHUT OFF AFTER ENGINE STOPS

Brooks Walker, 1280 Columbus Ave., San Francisco 11, Calif.

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5 Claims. (Cl. 123—148)

This invention pertains to improved methods of shutting off an engine in such a way that less unburned hydrocarbons are emitted from the exhaust during shut off than with a conventional engine shut off by ignition alone. Likewise, since the exhaust pipe, muffler, etc. are not left charged with a normal amount of unburned hydrocarbons resulting from an ignition shut off, there will be much less unburned hydrocarbons emitted from the exhaust when the engine is started up. Because the manifold is left dry on shut down, it may be necessary to crank the engine just a little longer in starting to get the manifold wet or it may be necessary to give the accelerator pump a kick by the foot throttle or an auxiliary device just before starting to reduce cranking time.

Another advantage of this invention is the reduction in raw gasoline drawn into the engine at shut down that dilutes the lubrication on the cylinder walls, etc.

My co-pending application, U.S. Patent No. 3,158,144 entitled "Engine Shut Off," provides a single key engine shut off by a key energized or moved dash pot in the ignition key mechanism. This puts more work on the key in operating the dash pot. This invention allows the use of a conventional ignition key and switch that operates accessories, starter, ignition, etc. and still provides a delay in ignition shut off until after the engine has been stopped by simply turning the "ignition" key to off.

Another advantage is the provision of a "panic button" to stop the engine if the throttle sticks open, the throttle closing spring breaks, the butterfly plate drops off, etc. when turning off the key might not stop the engine in this construction (the main fuel jets would be on and the intake vacuum would hold the auxiliary ignition switch closed).

Another feature of the invention is the use of pressure from the water pump from water velocity and pumping developed in the water to actuate a diaphragm dash pot to provide the delay in closing of the auxiliary ignition switch.

Another feature is the use of the lubricating oil pressure from the engine oil pump to charge the diaphragm or dash pot to provide the delay in ignition cut off after the engine stops.

Another feature of this invention is to leave the circuit from the battery through the key switch to the ignition coil substantially unchanged and provide a parallel circuit operated with a delay to keep the ignition on after the key switch is turned off until after the engine is stopped.

Another feature is to have the voltage drop resistance in the key circuit to the spark coil as well as in the delay circuit. The voltage step up when the starter is connected can still be used in the conventional manner for better starting if desired.

Other features of the invention will be more particularly pointed out in the accompanying specifications and claims.

I have illustrated my invention by way of example in the accompanying drawings, in which:

FIG. 1 shows a side elevation of a portion of an engine, a carburetor partly in section and an engine vacuum operated switch with a schematic diagram of the wiring to accomplish one form of the invention.

FIG. 2 is a side elevation view partly in section of a water pump and water pressure actuated switch forming another form of the invention.

FIG. 3 is a side elevation of an engine lubricating oil pump and a portion of an engine oil sump as another form of engine liquid pressure source to operate a switch and delay forming still another form of the invention.

In all figures like numerals refer to corresponding parts.

In FIG. 1 I have shown an engine **7** on which is mounted a carburetor body **10**, a throttle butterfly **11**, a fuel pick up tube **12** in the fuel **25** of the float bowl. Main jet **13** supplies fuel into the venturi area **8** of the carburetor barrel **9**. Tube **14** conveys a rich mixture of fuel and air from the bowl through pipe **12** and air from the main jet **13** to the area of the closed throttle **11** when more air is admitted at transfer port **15**. The rich mixture is controlled by the solenoid valve **18**. This valve **18** is urged to closed position to close off idle fuel to port **16** by spring **20** acting on shoulder **19**. The solenoid **17** retracts valve **18** when the solenoid is energized. Adjustment screw and nut **21** adjust the amount that valve **18** opens as an adjustment for the rich idle fuel and air entering below throttle **11** as an idle adjustment. Additional air for idling can enter through pipe **26** past volume adjusting valve **27** and through orifice **28** to give this idle air a centrifugal velocity around barrel **9** below throttle **11** to mix better with the rich idle fuel and air entering through port **16**.

The operation of this solenoid is by battery **30**, line **29**, through panic switch **31**, key switch **32** (closes when in "on" position), wire **33** to the coil in solenoid **17**. The other end of the coil in solenoid **17** is connected through line **38** to two parallel switches, one throttle switch **40** which is open when the throttle is closed and closed when the throttle is in all positions except idle. The second switch is governor switch **39** which is open above a predetermined speed such as 1100 r.p.m. so that the idle fuel is on at all times except when decelerating with a closed throttle above the governor set speed such as 1100 r.p.m.

An intake vacuum operated switch mechanism **66** includes a tube **41** connected to the engine intake manifold (not shown) and to housing **42**. Diaphragm **43** is secured to washers **44** and stem **45**. Stem **45** has head **46** which is located above arm **48**. Spring **47** urges arm **48**, head **46**, stem **45**, and diaphragm **43** to the position shown in FIG. 1.

Bracket **52** carries pivot pin **53** that supports one end of arm **48**. Adjustable stop screw **49** and lock nuts **50** and **51** limit the downward travel of arm **48** so as not to damage switch **54**. Switch **54** is open when there is no intake manifold suction such as after the engine is fully stopped as shown. Spring **47** is light so that a light intake suction (in the neighborhood of 3" of water will operate switch **54** by suction) such as exists when the engine is operating at full open throttle at low speeds or when cranking, the switch **54** will be closed, connecting line **55** which is connected on the key switch **42** side of panic switch **31** to line **56** which leads to line **34** to connect the battery **30** to spark coil **36** through resistor **35**. Breaker switch **37** breaks the primary circuit in coil **36** in the conventional manner and the usual distributor and leads to the spark plugs are used though not shown herein.

In action when the engine is to be started the key switch **32** is turned on, the solenoid **17** is energized turning on the idle fuel and the ignition is turned on by switch **32** contacting terminal **34***a*, line **34**, resistor **35** through coil **36** to breaker **37**. This circuit keeps the ignition on during all operations of the engine while the key switch is in the "on" position.

Intake vacuum actuated switch **54** is closed as the engine is cranked or after starting and is kept closed while

the engine is operated. However, if the suction at some slow speed wide open operation provides insufficient suction on diaphragm 43 to keep switch 54 closed, ignition would be still provided by key switch 32, line 34, resistance 35, etc. When it is desired to stop the engine, key switch 32 is turned off by opening key switch 32. This cuts off power to contact 33*a*, line 33 and solenoid 17 so that the idle fuel is shut off which shuts off the engine, as there is still suction in the intake manifold during the time the engine is changing to no speed, switch 54 remains closed by diaphragm 43 and associated parts during the time the engine is slowing down and until after it stops so that the current flows from the battery through panic switch 31, line 55, switch 54 which is closed, line 56, to resistor 35 to spark coil 36, and the ignition system.

Switch 54 stays closed until after the engine stops due to lack of fuel, but the fuel is burned in the cylinder by the continuing spark at correct cycles as long as there is combustible mixture drawn into the cylinders at the start of shut down before lack of fuel kills the motor, thereby greatly reducing the unburned hydrocarbons emitted to the atmosphere during shut down. After the engine stops and the intake manifold suction drops to substantially no suction and the pressure below the diaphragm 43 returns to nearly atmospheric, diaphragm 43 will return to the position shown in FIG. 1. It may be desirable to use an adjustment screw 41*a* in line 41 to slow down this action. A bleed 42*a* admits atmospheric pressure to the upper side of diaphragm 43 if desirable. Switch 54 will open and cut off the current to coil 36 when diaphragm 43 moves to the position shown in FIG. 1 after the engine is stopped, thus turning off switch 54 and the ignition only after the engine is stopped.

The dual contacts 33*a* and 34*a* that are contacted by the switch arm of key switch 32 when in the "on" position might be the ignition contact and one auxiliary device contact as are used in many ignition switches. These two contacts are necessary so that switch 54 when closed will not energize solenoid 17 to admit idle fuel when key switch 32 is in the "off" position.

In FIG. 2 I have shown a water pump 73 with a rotor 74 rotating in a counter clockwise direction, and an intake pipe 76 and an outlet pipe 75. A Pitot tube 79 picks up the pressure from the velocity of water following the rotor 74 plus any pressure due to a pressure cap in the radiator not shown. Pipe 77 and flow valve 78 admit the pressure from Pitot tube 79 to the lower side of diaphragm 58 in housing 59. Washers 58*b* connect diaphragm 58 to sealed stem 60. Telescoping cap 61 is urged against switch blade 72, by spring 62, which spring rides on washer 60*b*, shoulder 60*a* of stem 60. Cone spring 63 urges diaphragm 58 down so that nut 58*a* strikes the housing 59 to limit the downward travel after switch 70 has opened by pulling away from point 71. Cone spring 63 may not be necessary to return diaphragm 58 to the position shown in FIG. 2, as spring 62 may serve this purpose, plus the stiffness of switch blade 72. Switch blade 72 of switch 70 is connected to line 56 through point 71 when actuated by water pressure when the engine is running to connect line 56 to line 55 to act similar to the action of switch 54 in FIG. 1. The reason for the telescoping cap 61 on stem 60 is so that diaphragm 58 can act through an appreciable distance after closing arm 72 against point 71 and providing a time factor when the engine is stopped for the fluid to flow back through

metering valve 76 to the pump while still holding arm 72 against point 71 until shortly after the engine has stopped. Metering valve 78 can control the rate of back flow to determine the time delay in opening of switch arm 70 to hold the ignition on after the key switch has been turned off. Line 65 carries the pressure from the intake side of pump 73 to the upper side of diaphragm 58 to neutralize the pressure in a pressure cooling system such as may be caused by pressure radiator cap.

In FIG. 3 I have shown lubricating oil pump 80 located in the oil pan 82 below the oil 81 of the engine 7. Discharge pipe 84 leads to the relief valve and bearings not shown and could have a branch 83 which could connect to or replace line 77 if oil pressure rather than water pressure were to be used to operate the ignition delay cut off switch 72 of FIG. 2.

I have illustrated my inventions in these various forms; however, many other variations may be possible within the scope of this invention.

To those skilled in the art to which this invention relates many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. The disclosures and description herein are purely illustrative and are not intended to be in any sense limiting.

I claim as my invention:

1. In an engine having an ignition system, an electrically controlled idle fuel supply system and a key operated ignition switch that also controls the electrical circuit for said idle fuel supply system the combination therewith of engine-driven fluid pressure generating means, and a pressure-controlled second switch in said ignition system only and in parallel therewith said key operated switch and closed so long as a predetermined pressure is achieved by said generating means for keeping the ignition system on for a period after the ignition switch is turned off until the engine stops due to the turning off of said idle fuel.

2. The combination as defined in claim 1 in which said generating means for keeping said second switch closed comprises the engine manifold which generates intake suction pressures.

3. The combination as defined in claim 1 in which said engine driven generating means includes a cooling water pump, said second switch being actuated by water pressures from said cooling water pump.

4. The combination defined in claim 1 in which said engine driven generating means includes a lubricating oil pump, the oil pressure from said engine oil pump operating said second switch.

5. In an engine having an ignition system, a carburetor, an idle fuel supply system in said carburetor, filled pressures generated in said engine when operating which are different than when said engine is stationary, a key operated device including an idle fuel flow control, a second switch operated by said fluid pressures generated when the engine is operating to keep the ignition on while the engine is stopping after said key operated fuel device has been turned off and has turned off said idle fuel flow to said engine.

No references cited.

MARK NEWMAN, *Primary Examiner.*

RICHARD B. WILKINSON, *Examiner.*