Sept. 11, 1956 A. H. WINKLER 2,762,354

ENGINE STARTING DEVICE

Original Filed Dec. 21, 1946 2 Sheets-Sheet 1

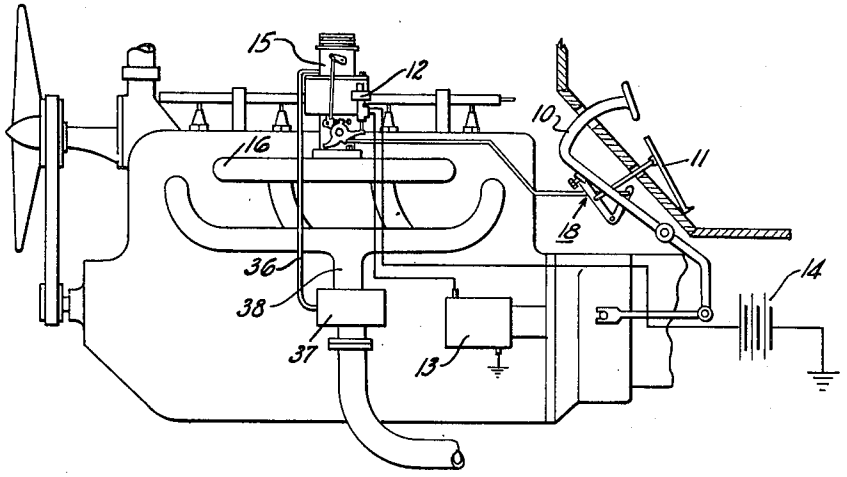


Fig 1

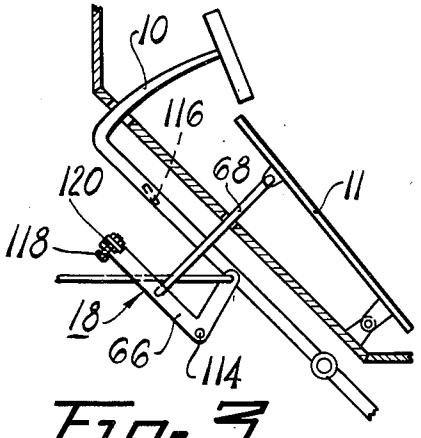


Fig. 3

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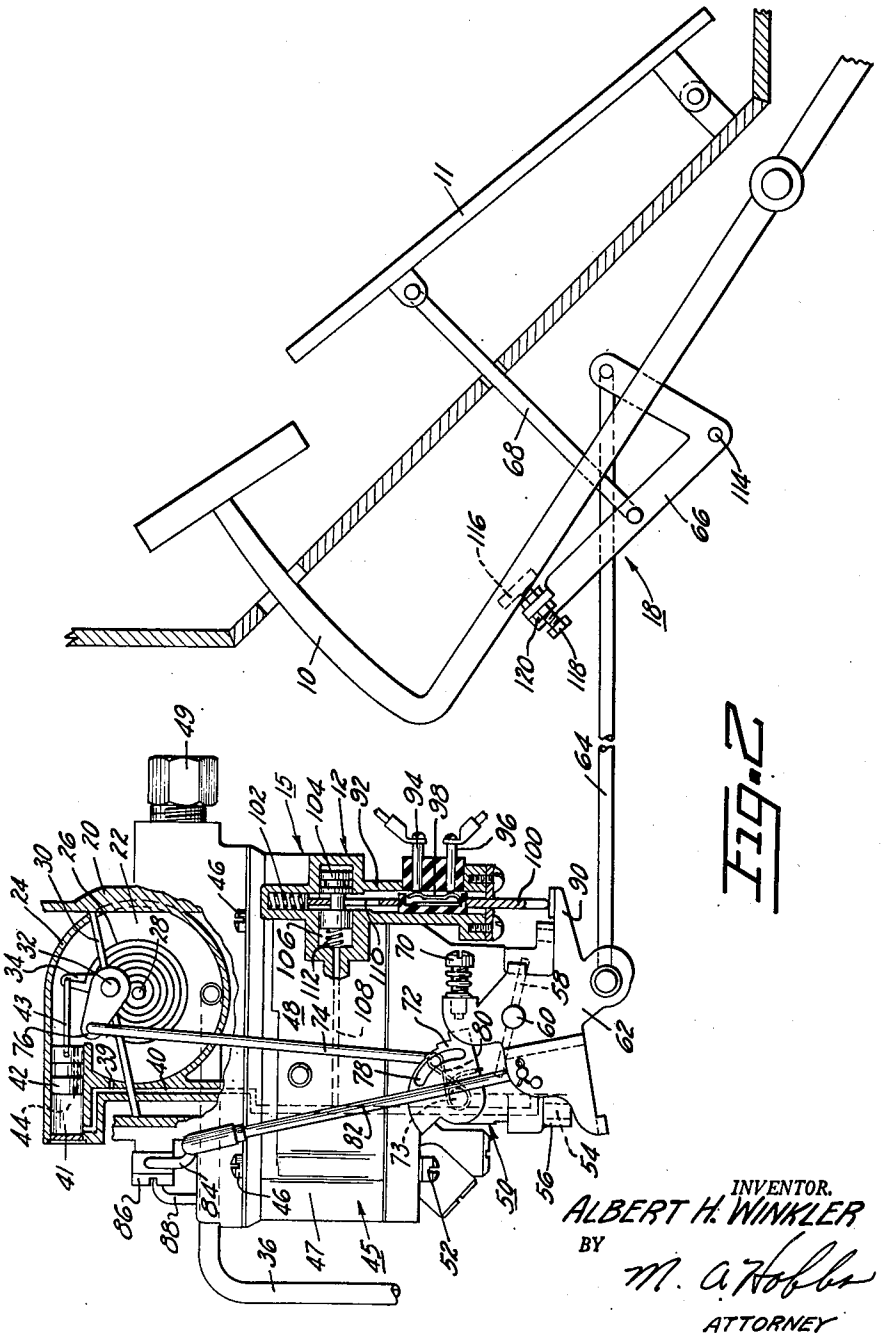


Fig. 2

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2,762,354

ENGINE STARTING DEVICE

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Original application December 21, 1946, Serial No. 717,736, now Patent No. 2,597,606, dated May 20, 1952. Divided and this application April 11, 1951, Serial No. 220,407

6 Claims. (Cl. 123—179)

The present invention relates to a control mechanism for internal combustion engines and more particularly to a control mechanism for starting internal combustion engines used in motor vehicles. This is a division of my copending application Serial No. 717,736, filed December 21, 1946, now Patent No. 2,597,606, issued May 20, 1952.

Modern motor vehicles are generally equipped with a fast idle arrangement and an automatic choke to provide an enriched fuel-air mixture for starting and for operating the engine at subnormal engine temperatures. The fast idle arrangement usually consists of a cam which forms an abutment for an adjustable stop mechanism on the throttle valve lever of the carburetor and which is connected to and controlled by the choke valve so that the throttle valve is held at a partially opened position for fast idling while the engine is cold. As the engine becomes warmer, the thermostat controlling the automatic choke gradually permits the choke valve to open and the fast idle cam to move to a position at which the throttle valve will close to slow idling position. During normal operation of the engine, the choke valve remains completely open and the fast idle cam in the position to permit the throttle valve to close to slow idle position.

For a time after a warm engine has ceased operation, the thermostat does not exert any force in the direction to close the choke valve or to move the fast idle cam to the cold starting position, but as the engine gradually becomes cold, the thermostat begins to apply force to close the choke valve, gradually increasing said force as the engine becomes cooler. The force tending to close the choke valve also urges the cam to fast idle position. The throttle valve stop means abutting against the cam, however, prevents movement thereof against the force of the thermostat so that the fast idle cam is held in a position assumed during normal warm engine operation and the choke valve, being connected to said cam is prevented from completely closing, until said stop means is withdrawn from said cam by the opening movement of the throttle valve. It is thus seen that before the engine can normally be started, it is essential to depress the accelerating pedal or otherwise open the throttle valve to release the fast idle cam and permit the choke valve to close. An arrangement has previously been proposed wherein depression of the starter pedal will crack the throttle valve, but no means has been provided in combination therewith for closing or releasing the choke valve or for setting the fast idle cam for cold starting.

Some later model motor vehicles are provided with a cooperating clutch control and starting mechanism wherein the starting circuit is closed when the clutch pedal is depressed to its most downward limit. By this arrangement, the operator is assured that the vehicle is declutched before the starting circuit is closed, though it is necessary

for the operator to actuate the accelerating pedal to crack the throttle valve and to release the fast idle cam and choke valve.

It can be seen that with vehicles in use at the present time, it is necessary for the operator, in at least two separate and distinct operations, to declutch the vehicle, to crack the throttle valve, to release the fast idle cam and choke valve and to close the starter circuit, a further step being required if the vehicle is not equipped with an automatic choke mechanism. It is one of the principal objects of the present invention to combine the foregoing steps into one single starting operation involving only one mechanical movement by the operator.

Another object of the present invention is to provide a simple and highly reliable mechanism for declutching the vehicle, cracking the throttle valve, releasing the fast idle cam and automatic choke and closing the starter circuit.

A further object of the invention is to provide a control mechanism to perform the aforesaid operations, which may be readily adapted to standard motor vehicles without the necessity of making any substantial modifications in the original construction of said vehicles.

Additional objects and advantages will appear from the following description and accompanying drawings wherein a specific embodiment of the present invention is disclosed, together with a modification thereof. The control mechanism forming the subject matter of the present invention is not limited to the embodiment and the modification thereof disclosed herein nor to any particular type of carburetor or internal combustion engine, but is understood to be adaptable to any engine or vehicle in which are included a carburetor having an automatic choke, a fast idle arrangement, clutch and starting circuit, said combination being hereinafter more fully described.

In the drawings:

Figure 1 is a schematic view of an internal combustion engine showing the present control system mounted thereon;

Figure 2 is a schematic view of the present control system showing generally a carburetor, a starting switch, a clutch pedal and an accelerating pedal of a motor vehicle, the relative size of the carburetor and switch to the clutch and accelerating pedals being larger in the drawing than in standard automotive construction, to show clearly the various parts of the present invention; and

Figure 3 is a view of the clutch pedal showing it in the raised position.

The present control system includes in a motor vehicle an automatic choke, a fast idle arrangement controlled by said choke, a starting switch and a clutch control mechanism in combination with a linkage for actuating the throttle valve, declutching the engine, releasing the choke and fast idle cam and closing the starting switch, all in a single operation requiring only one simple mechanical movement by the operator. The present invention may be readily understood by referring to the drawings in which Figure 1 illustrates an assembly of the several elements comprising the present invention mounted on a conventional internal combustion engine, wherein numeral **10** designates a clutch pedal shown in its depressed position, **11** an accelerating pedal, **12** a starting switch, **13** a starting motor, **14** a battery and **15** a carburetor which for the purpose of illustrating the present invention may be considered conventional, said carburetor being mounted on an intake manifold **16** and connected to said clutch and accelerating pedals by a linkage **18**. Referring to Figure 2, the carburetor which is of

the downdraft double barrel type includes an air horn 20 having mounted thereon an automatic choke 22 consisting of a housing 24, a coiled bimetallic heat responsive element 26 mounted on pin 28, an unbalanced choke valve 30 mounted on shaft 32 and a lever 34 secured to one end of shaft 32, said lever being adapted to be engaged and actuated by the bimetallic element 26. The housing 24 is connected by a conduit 36 to a stove 37 on the exhaust manifold 38 or to some other part representative of engine temperature, and by a port 39 and another conduit 40 to the induction passage on the engine side of the throttle valve. In a cylinder 41 on one side of said housing, a piston 42 is connected to lever 34 by rod 43 and is adapted to be actuated by suction in conduit 40 to partially open choke valve 30 against the opposing force of element 26 when the engine begins to operate under its own power. The suction actuating piston 42 may be modified to some value less than that in the intake manifold by including a bleed into cylinder 41 such as duct 44 through piston 42. In this arrangement, air indicative of engine temperature is drawn through conduit 36 and housing 24 around element 26 through port 39 and also through duct 44 of piston 42 by the engine suction transmitted through conduit 40. Thus, if the engine is cold at starting, the bimetallic element as shown in the drawings is so expanded that it urges lever 34 to the left and choke valve to its closed position. As the air drawn through the housing 24 becomes warmer, bimetallic element 26 coils upon itself, thereby gradually lessening the force urging the choke valve to its closed position until the free end of said element is completely withdrawn from lever 34. Since choke valve 30 is of the unbalanced type, it tends to open of its own accord and also in response to air flow through the induction passage of the carburetor when the throttle valve posterior thereto has been opened.

The main carburetor body 45, on which air horn 20 is mounted and secured by machine screws 46, contains an induction passage with a main and a boost venturi and a discharge nozzle disposed therein. The main body also contains a conventional accelerating pump in housing 47, a power enrichment means (not shown) and a fuel bowl or float chamber 48 adapted to receive fuel from inlet 49, said main body being mounted on throttle body 50 and secured thereto by machine screws 52. The throttle body is mounted on an intake manifold of an internal combustion engine and secured thereto by bolts inserted in holes 54 of external flange 56 at the lower edge of said throttle body.

A throttle valve 58 is mounted on shaft 60 and actuated by a throttle valve lever 62 on the end of said shaft, said lever being connected to the accelerating pedal 11 by rod 64, bell crank 66 and rod 68. The closing of the throttle valve is limited when the engine is cold by screw 70 on lever 62 abutting against the periphery of a fast idle cam 72 mounted on stud 73, said periphery being so arranged in stepwise profile that the throttle can be held at various partly closed positions while the engine is running at subnormal temperatures. Cam 72 is connected with the automatic choke by rod 74 and lever 76, the lower end of said rod being inserted in a crescent shaped slot 78 of cam 72 and yieldably held in the central portion of said slot during normal operation of the engine by spring 80. The accelerating pump is actuated by the opening movement of the throttle valve lever through rod 82, lever 84 pivoted on screw 86 and rod 88 which connects lever 84 with the piston of the accelerating pump.

The starting switch 12 shown in Figure 2 is mounted on the side of carburetor 15 and is actuated by arm 90 of throttle valve lever 62. The switch which is enclosed in housing 92 is provided with two fixed electrical contacts 94 and 96 and a sliding contact 98 mounted on a reciprocable member 100 for completing the circuit between the fixed contacts, said fixed contacts being connected by lead wires to motor 13 and battery 14. Member 100 is urged toward closed circuit position by spring 102 mounted in the upper end of housing 92 and is held in open circuit position by arm 90 when the throttle valve is closed. A piston 104 which is actuated by intake manifold suction transmitted through conduits 40 and 108 to the left end of cylinder 106 is provided to lock member 100 in open position by sliding to the left through slot 110 in member 100 when said member is lifted by arm 90 after the engine begins to operate on its own power. After the engine stops, the piston 104 is returned by spring 112 to the position shown in Figure 2 when the throttle valve is closed.

While any suitable type of starting switch and circuit may be used, a starting circuit is preferred which will automatically open when the engine begins to run of its own power and remain open until the engine stops. The carburetor starting switch disclosed in my copending application Serial No. 552,609 filed September 4, 1944, now Patent No. 2,492,340, is similar to the one shown in Figure 2 and is particularly suitable for the present invention. A solenoid switch is preferably used in conjunction with the carburetor starting switch.

The linkage 18 consists of a bell crank 66 pivoted on a pin 114, rod 64 connecting one arm of said bell crank with the throttle valve lever 62, and another rod 68 connecting the other arm of said bell crank with the accelerating pedal 11, one end of said bell crank being adapted to be engaged by a lug 116 on clutch pedal 10. The end of the bell crank engaged by lug 116 is provided with a screw 118 so that the time for actuating the linkage in the starting operation can be accurately predetermined. After the adjustment has been made, said screw is held in the desired position by lock nut 120.

Operation

When an internal combustion engine equipped with the present control mechanism has been stopped after operating under normal engine temperatures, the throttle valve closes and the adjustable screw 70 engages the periphery of cam 72 on one of its lower steps, the choke valve remaining wide open completely independent of the bimetallic element 26. As the bimetallic element cools, it eventually engages lever 34 and gradually urges choke valve 30 toward its closed position. The closing movement of the choke valve, however, is resisted by cam 72 being held in a fixed position by stop screw 70 engaging one of the lower steps of the cam periphery, though partial closure of said choke valve may be permitted by the yieldable connection between said cam and rod 74 provided by spring 80. Thus, while the engine is cold and the throttle valve closed, the fast idle cam is in slow idle position, the choke valve is wide open or only partly closed and the starting switch is held open by arm 90 lifting member 100.

In starting the cold engine, the operator depresses clutch pedal 10 until lug 116 engages screw 118 of lever 66 and, through said lever, rod 64 and throttle valve lever 62, the operator cracks or slightly opens the throttle valve and withdraws stop screw 70 from the lower steps of the periphery of cam 72, thus permitting said cam to move to fast idle position under the force of the thermostat urging lever 76 and rod 74 upwardly and choke valve 30 to its closed position. Almost simultaneously with withdrawal of screw 70 from cam 72, contact 98 of switch 12 engages contacts 94 and 96, thus closing the starting circuit and cranking the engine.

When the engine begins to operate under its own power before the throttle has been opened by the accelerating pedal, suction in the induction passage posterior to the throttle valve draws piston 42 to the left, as shown in Figure 2, thus urging choke valve 30 to a partly open position so that the engine may receive the proper fuel-to-air mixture for fast idling, the throttle valve being held in fast idle position by the higher steps on the pe-

riphery of cam 72. The suction in the induction passage also draws the air from stove 37 around the exhaust manifold through conduit 36, housing 24, port 39 and conduit 40. A portion of the air entering housing 24 also passes through calibrated hole 44 of piston 42 and thence into conduit 40, the purpose of said hole being primarily for controlling the amount of suction exerted on piston 42. The air from stove 37 passing through housing 24 gradually heats thermostat 26, causing it to lessen its force urging the choke valve to the closed position until said thermostat completely withdraws from lever 34. Choke valve 30 is then permitted to open wide of its own accord or under the influence of air flow in the induction passage. The opening movement of the choke valve moves fast idle cam 72 to its slow idle position.

If the throttle valve is opened while the engine is operating at subnormal temperatures, the choke valve is urged in the opening direction in opposition to the closing force of thermostat 26 by the air flow in the induction passage, and the cam is simultaneously urged to its slow idle position by the linkage between said cam and choke valve. When the throttle valve is again closed, stop screw 70 contacts the periphery of said cam before the thermostat has had sufficient time to return the choke valve to closed or partially closed position and the cam to its fast idle position. The cam is thus held in its slow idle position by screw 70 contacting the periphery of said cam. The choke valve, however, is permitted to readjust itself to approximately the proper position for the particular engine temperature by the yieldable connection between cam 72 and rod 74 as provided by slot 78 and spring 80. This slot and spring also permit the choke valve to open even though the cam is continually held in fast idle position by screw 70 during the time the engine is warming up to normal operating temperatures.

As long as the clutch pedal is held in its depressed position on starting, contacts 94, 96 and 98 remain closed, but as the throttle valve is returned to idling position after the engine starts, arm 90 lifts member 100 to the position at which piston 104 is permitted to move to the left through slot 110 under the influence of engine suction transmitted to cylinder 106 through conduits 40 and 108, thus locking said contacts in open position. Piston 104 remains in locking position so long as the engine is operating under its own power and is only returned to the unlocking position, shown in Figure 2, when the throttle valve is closed after the engine has stopped running.

From the foregoing description of the operation of the present invention, it can be seen that depression of the clutch pedal to its lowermost position executes every mechanical manipulation required to start the engine and even to provide the necessary conditions thereafter for normal engine operation during the warming-up period.

It is contemplated that other arrangements of elements comprising the present invention than those shown in the accompanying drawings may be provided without departing from the scope of the present invention; for example, the mechanism for cracking the throttle valve may be actuated by a linkage in series with the starting switch or by a solenoid controlled by the starting circuit; further, a means may be included for rendering the throttle cracking means inoperative when the clutch pedal is depressed after the engine begins to operate under its own power.

I claim:

1. In an internal combustion engine propelled vehicle having a clutch, a clutch pedal, a starting circuit and a carburetor including a throttle valve, a choke and a thermostat for controlling said choke in accordance with engine temperature: a control mechanism comprising a fast idle cam; a linkage connecting said cam and thermostat for controlling the position of said cam in accordance with engine temperature; a throttle valve lever having a stop thereon for engaging said cam, said stop in cooperation with said cam being adapted to hold said choke in a partially opened position in opposition to the closing force of said thermostat; a starting switch in said circuit; a member operated with said throttle valve for preventing said switch from closing when the throttle valve is closed and a linkage including a one-way connection adapted to be actuated by said clutch pedal to open said throttle valve, release said fast idle cam and choke and move said member to permit said switch to close.

2. In an internal combustion engine propelled vehicle having a clutch, a starting circuit, a switch for said circuit and a carburetor including a choke valve, a throttle valve and a fast idle cam: a control mechanism comprising a linkage connecting said choke valve with said cam for intercontrolling said cam and valve; a throttle valve lever having a stop thereon for engaging said cam; a clutch pedal; a linkage between said clutch pedal and said throttle valve lever; a member operated with said throttle valve for holding said switch open when the throttle valve is closed and a linkage between said clutch pedal and said starting switch, whereby the operations for declutching the vehicle, opening said throttle valve, releasing said fast idle cam and choke, and closing the starting switch are completed in a single movement by the operator.

3. In an internal combustion engine propelled vehicle having a clutch, a starting circuit, a switch for said circuit and a carburetor including a choke valve, a throttle valve and a fast idle cam: a control mechanism comprising a linkage connecting said choke valve with said cam for interconnecting said cam and valve; a throttle valve lever having a stop thereon for engaging said cam; a clutch pedal; a linkage between said clutch pedal and said throttle valve lever; and a linkage between said throttle valve and said starting switch for preventing said switch from closing when the throttle valve is closed; whereby the operations for declutching the vehicle, opening said throttle valve, releasing said fast idle cam and choke, and closing the starting switch may be completed in a single movement by the operator.

4. For use on an internal combustion engine propelled vehicle having a clutch, a clutch pedal, a carburetor, an accelerating pedal, and a starting circuit: a choke; a throttle valve; a fast idle cam; a linkage connecting said choke and said cam; a throttle lever having a stop thereon for engaging said cam, said stop in cooperation with said cam being adapted to hold said choke in a partially opened position; a switch for said circuit mounted adjacent said throttle valve; a member for preventing said switch from closing when the throttle valve is closed; a linkage adapted to connect said accelerating pedal and said throttle lever; and a means including a one-way connection adapted to be actuated by said clutch pedal for actuating said throttle valve, releasing said choke and moving said member to permit said switch to close.

5. For use on an internal combustion engine propelled vehicle having a clutch, a clutch pedal, a carburetor, and a starting circuit: a choke; a throttle valve; a fast idle cam; a linkage connecting said choke and said cam; a throttle lever having a stop thereon for engaging said cam, said stop in cooperation with said cam being adapted to hold said choke in a partially opened position; a switch for said circuit mounted adjacent said throttle valve; a lever operatively connecting said throttle valve and said switch for preventing said switch from closing when the throttle valve is closed; and a linkage including a one-way connection adapted to be operated by said clutch pedal to open said throttle valve, release said choke and move said last mentioned lever to permit said switch to close.

6. For use on an internal combustion engine propelled vehicle having a clutch, a clutch pedal and a starting circuit: a carburetor having a choke and a throttle valve; a switch for said circuit having a yieldable means for urging the switch to its closed position; and a throttle lever having a member for preventing said switch from closing when the throttle valve is closed; a linkage and

means responsive to movement of the clutch pedal for actuating said linkage to operate said lever to open said throttle valve and move said member to permit said yieldable means to close said switch.

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