Oct. 12, 1937. M. E. CHANDLER 2,095,920

CARBURETOR

Filed Jan. 20, 1933 2 Sheets-Sheet 1

Fig. 1

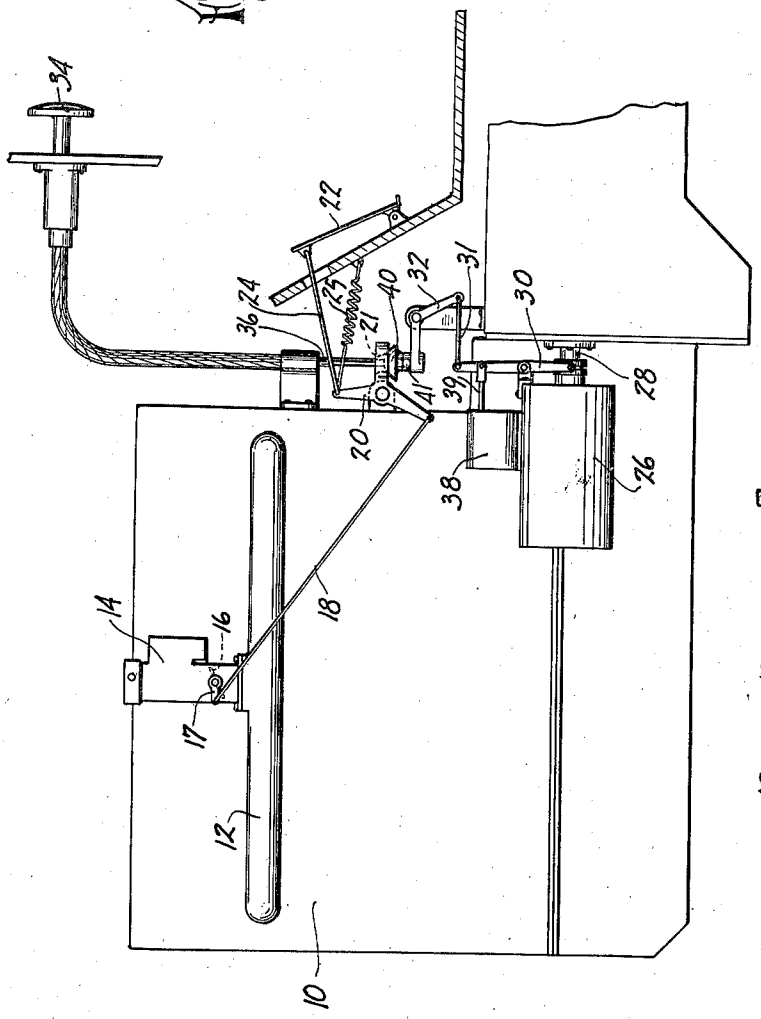
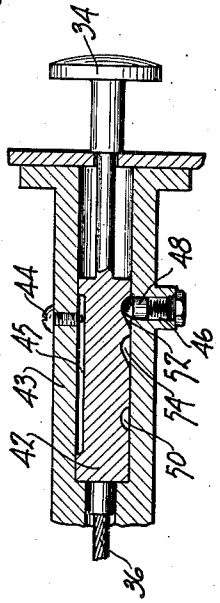


Fig. 2



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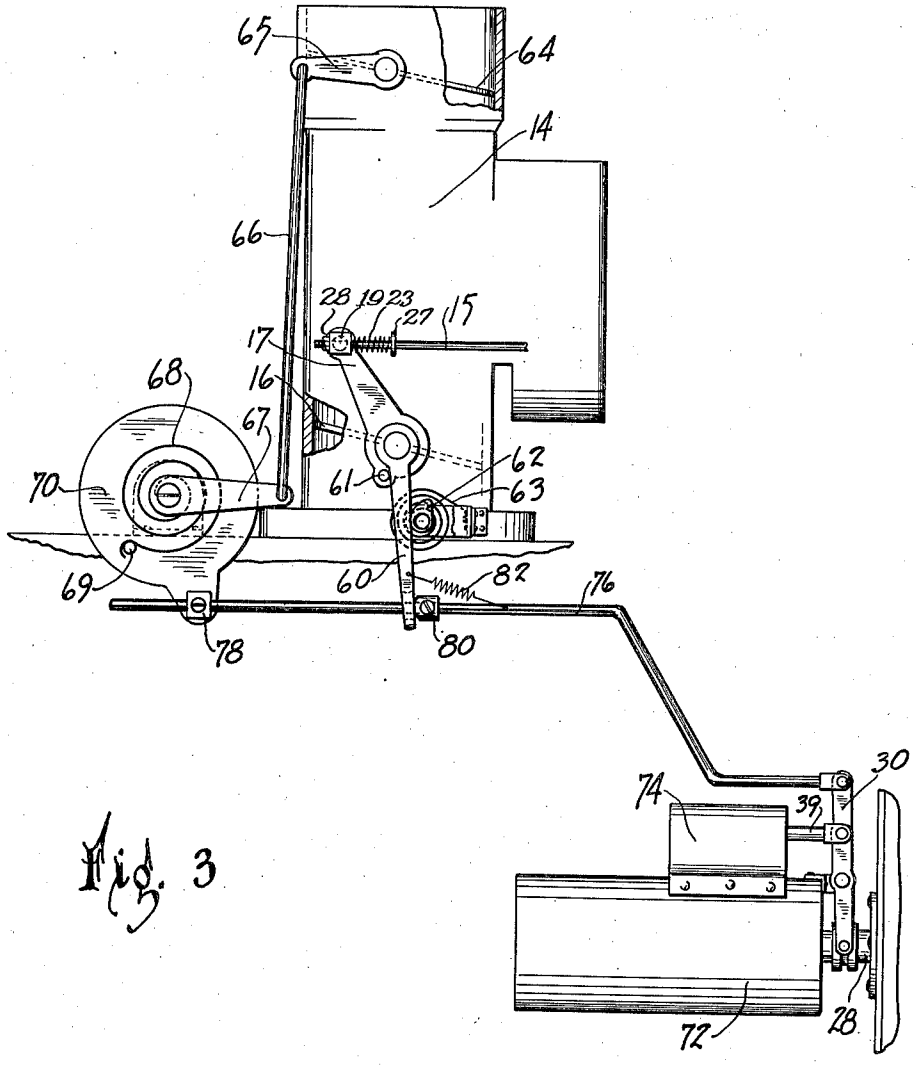


Fig. 3

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CARBURETOR

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Application January 20, 1933, Serial No. 652,721

9 Claims. (Cl. 123—179)

This invention relates to internal combustion engines, more particularly to control mechanism for the carburetor of such an engine, and has for its principal object the provision of a mechanism actuated by the starter control for governing the carburetor during starting.

Internal combustion engines using a mixture of liquid fuel and air require a very rich mixture to start and require that this mixture be graded down in richness to prevent stalling immediately the engine fires. In addition to a choke valve for controlling the richness of the mixture, carburetors employ a throttle by which the admission of mixture to the engine is controlled, and this throttle should be opened to a particular degree for efficient starting and must be closed immediately the engine fires to prevent racing. The numerous manipulations that must be made to start the engine are frequently objectionable particularly when the engine is used in an automobile. In the prior art of which I am aware, the copending application of Hunt and Olson, Serial No. 575,025 filed November 14, 1931, being an example, provision has been made for automatically controlling the choke valve of the carburetor so as to reduce the number of manual operations necessary to start the engine and to provide a better regulation of the engine during its warming up period.

Broadly speaking the present invention improves upon these prior art devices by further reducing the number of manual operations necessary to start the engine and to provide a more positively acting control of the throttle during starting. In its preferred form the apparatus for carrying out the invention provides for setting the controls of the carburetor for starting concurrently with the control of the starter so that but one manual operation is necessary to start the engine.

My invention will be best understood from the detailed description and claims which follow, reference being had to the accompanying drawings in which a preferred embodiment of the invention is shown by way of example and in which:

Figure 1 is a diagrammatic view showing the apparatus of the invention applied to an automobile engine;

Figure 2 is a cross sectional view through the starter control lever;

Figure 3 is a diagrammatic view of the invention adapted to an automatic starter.

Referring now to the drawings in more detail, in Figure 1, I have outlined an automobile engine 10 having an intake manifold 12 upon which the carburetor 14 is mounted. A down draft plain tube carburetor is shown by way of example and it is to be understood that it is within the teachings of the invention to provide the carburetor with an automatic choke valve control mechanism such as is shown in the above copending application. The carburetor is provided with a throttle 16 having an operating arm 17 to which a control rod 18 is pivotally attached. A lever 20 pivots upon a suitable bracket on the engine and the other end of rod 18 is pivotally connected to this lever. A foot operated accelerator pedal 22 on the floor board of the car is connected to the lever by a rod 24 to permit moving the throttle to control the engine. A spring 25 connected between the lever and the floor board is tensioned to return the throttle to closed position when the pedal is released.

A starting motor 26, of known construction, is provided with a shaft upon which collar 28 is mounted for sliding. A pivoted lever 30 is connected to the collar and its free end is connected by a suitable link 31 to a pivoted lever 32 mounted upon the flywheel casing of the engine. A starter control button 34, mounted upon the dash of the car, carries a Bowden wire 36 which extends through lever 20 and is connected to the free end of lever 32 to operate the same. A starting switch 38 is mounted on motor 26 and provided with an actuating rod 39 which is connected to lever 30. The opening 21 in lever 20 through which the wire passes is much larger than the wire so that the lever may be turned by the pedal without binding the wire. A large head nut 40 is threaded upon the wire and bears against the lever around the opening 21.

To operate the device button 34 is pulled out when the engine is to be started. This operation rotates lever 32 clockwise and actuates lever 30 to slide the collar and mesh the starter gear with the flywheel gear in the usual manner. Movement of lever 30 moves rod 39 to actuate switch 38 after the gears have been meshed. Switch 38 closes the circuit of the starting motor 26, which operates to turn the engine. As the Bowden wire 36 is moved upwardly nut 40 bears against lever 20 to rotate it and to move rod 18 to set the throttle in starting position. Nut 40 is adjustable on the wire so that the amount that the throttle is opened may be accurately set, and the nut is locked by a suitable locknut 41 so that the setting will remain fixed. As soon as the engine fires, the starting gears are kicked out of mesh in the known manner, and lever 30 is rotated in the clockwise direction. Nut 40 moves

downwardly and spring 25 acts to close the throttle to prevent racing the engine.

As will be seen in Figure 2, starter control button 34 terminates in a plunger 42 which fits in a casing 43 and is prevented from rotating therein by a screw 44 threaded in the casing and projected into a slot 45 in the plunger. The casing is provided with a well 46 in which is fitted a spring pressed round nose detent 48. The plunger is provided with a plurality of recesses with which the detent registers to yieldingly oppose longitudinal movement of the plunger. The innermost one 50 of these recesses has relatively abrupt side walls which engage the detent to hold the apparatus in starting position. When the engine fires and the starting gear is kicked out of mesh with the flywheel gear, tension placed on the Bowden wire by lever 32 pulls the plunger inwardly of the casing despite the detent, this movement backing the detent out of the recess against the tension of its spring. Recess 54 is located intermediately of the plunger and provided with a tapered side wall facing recess 50, and as the plunger is moved inwardly in the above manner the detent slides into recess 54 and stops the movement. In this position lever 20 is rotated sufficiently to set the throttle for a fast idle, but lever 32 is not rotated sufficiently to mesh the gears or to close the starter circuit. As soon as the engine is warmed up to normal operating temperature button 34 is manually restored to its normal position in which detent 48 registers with recess 52 and the engine idles at normal speed. The side wall of the recess adjacent to recess 54 is tapered to guide the detent into the same.

In Figure 1, I have shown levers 20 and 32 as single piece levers having a plurality of arms. In an actual installation each of these levers may comprise two or more separate members fixed upon a suitable cross shaft on the motor. This will be necessary in many instances because the starter and carburetor are located upon opposite sides of the engine, and the example shown may be modified to meet these and other requirements within the teachings of the invention.

In the full automatic embodiment of the invention shown in Figure 3 carburetor 14 is provided with a throttle 16 which has an operating lever 17 that is connected to the accelerator pedal by a rod 15. Rod 15 has sliding engagement in a block 19 which is pivotally mounted at the outer end of lever 17. A compression spring 23 is interposed between the block and a collar 27 on rod 15 to yieldingly urge the lever 17 into contact with a nut 28 on the outer end of the rod. A lever 60 floats upon the throttle shaft and is limited in its movement thereon by a pin 61 on lever 17. Lever 60 engages a cam 62 which is rotated by a thermostat 63 to adjust the throttle for idling the engine in a manner more fully explained in the copending application of Elmer Olson, Serial No. 651,589, filed January 13, 1933. The choke valve 64 is an unbalanced valve having an actuating lever 65 to which a rod 66 is connected. The lower end of rod 66 is connected to an arm 67 which is fixed upon the shaft of the thermostat 68. The element of the thermostat is connected between this shaft and the casing 70 in which the unit is housed and the shaft journalled, in the manner more fully set out in the copending application of S. F. Hunt, Serial No. 647,641, filed December 16, 1932. The thermostat functions to control the degree of opening of the choke valve as a function of engine temperature in the manner set out in the above application of Hunt and Olson.

The automatic starting motor 72, which may be of the type shown in the Patent 1,773,913, issued to Loehr et al., August 26, 1930, is provided with a solenoid 74 which is energized over a circuit, not shown, that is closed by the ignition switch. Energization of the solenoid draws plunger 39 to the left to rotate lever 30 and slide collar 28 on the starter shaft to mesh the gears, and also closes the starter switch (not shown) in the manner disclosed in said Loehr et al. patent. A rod 76 is pivoted to lever 30 and connected to the thermostat casing 70 by a pivotal connection 78. Rod 76 passes through the lower end of lever 60 and carries a collar 80 adapted to bear thereagainst. A spring 82 is connected between the rod and lever 60 and is tensioned to keep the lever against collar 80. Movement of lever 30, as above explained, moves rod 76 and rotates the thermostat casing to increase the tension of the thermostat to insure that the choke valve will be held closed during the operation of the starter. This movement of the rod causes collar 80 to move lever 60 which bears against pin 61 to open the throttle to starting position. This slight movement of the throttle may take place without movement of rod 15, due to the sliding relation between block 19 and rod 15. As soon as the engine fires, the starting gears are kicked out of mesh and lever 30 is thereby rotated in the opposite direction to move rod 76 and restore the thermostat casing and throttle to their normal positions. The circuit of the starting motor is opened by the automatic control outlined in the above patent. Firing of the engine creates a high vacuum in the carburetor and the choke valve is drawn open against the tension of the thermostat to grade down the richness of the mixture, the tension of the thermostat decreasing as the temperature of the engine rises, to permit the valve to open more fully. Thermostat 63, acting through cam 62, sets the throttle so that the engine is idled rapidly when the engine is cold and the idling speed is reduced as the engine warms up. Should the engine stall, the automatic starter will repeat the above operations to restart the engine without further manual manipulation.

I have shown and described the preferred embodiment of my invention by way of example only and am not to be limited by the specific disclosure as the apparatus shown may be modified, by one skilled in the art, within the teachings of the invention.

What is claimed is:

1. The combination with an internal combustion engine having an automatic starter and a carburetor, a throttle for governing the admission of mixture to the engine, and a choke valve for governing the richness of the mixture, of a thermostat for controlling the degree of opening of the choke valve as a function of temperature, and means operated by the starter for tensioning the thermostat to set the valve to produce a rich mixture and for setting the throttle for starting.

2. The combination with an internal combustion engine having a carburetor and a starting motor, of a choke valve in the carburetor, means for automatically controlling the degree of opening of the valve to regulate the richness of the fuel mixture produced by the carburetor, a

throttle for controlling the admission of mixture to the engine, and means controlled by the starting motor for setting said automatic means to produce a rich mixture for starting and to set said throttle in starting position while the starting motor is operating to start the engine.

3. The combination with an internal combustion engine, of a starting motor, a starting gear, a control member associated with the gear, means including a member becoming operative when the engine is conditioned for starting connected to the control member for actuating the latter to engage the gear with the engine, a carburetor comprising a throttle, means actuated by movement of the control member to open the throttle to a degree suitable for starting the engine, and throttle actuating means operable independently of the means actuated by movement of the control member.

4. The combination with an internal combustion engine, of a starting motor, a starting gear, a pivoted lever associated with the gear, means connected to the lever for rotating the same to engage the gear with the engine, a carburetor comprising a throttle, manually operable control means for said throttle means engaging the lever and moved thereby independently of the manually operable means to set said throttle in partially open position for starting the engine, said gear being kicked out of engagement with the engine when the engine fires to move said lever in the opposite direction, and means for restoring said throttle to closed position.

5. The combination of an internal combustion engine, a starting motor, a starting gear, a pivoted lever connected to the gear, a solenoid having a plunger connected to the lever and actuated by the solenoid to move the lever and mesh the starting gear with the engine, a carburetor, control means for the carburetor, and means including a rod pivoted to the lever and moved thereby for setting said control means for starting the engine.

6. A starter for internal combustion engines embodying therein the combination with an electric starting motor, means controlling the application of energy to said motor, a carburetor having a choke valve and a throttle valve, and manually operative means for actuating said throttle valve, of a thermostatic element adjacent the engine, connections between said element and said choke valve, said element and said connections being so set that the choke valve will be partially closed at normal temperatures, and will be opened at elevated temperatures, means simultaneously operative upon the means controlling the application of energy to the starting motor, upon said choke valve and upon said throttle valve, whereby with the energizing of said motor said choke valve will be fully closed, and the thermostatic element operative thereon will be tensioned, and said throttle valve will be opened, and with the de-energizing of said starting motor said choke valve will be partially opened, and said throttle valve will be closed, and means operative upon said manually operative means to close said throttle valve independently of the means operative upon said choke valve.

7. The combination with an internal combustion engine having a carburetor and a starting motor, of a choke valve in the carburetor, means for automatically controlling the degree of opening of the valve to regulate the richness of the fuel mixture produced by the carburetor, a throttle for controlling the admission of mixture to the engine, means controlled in accordance with the actuation of the starting motor for setting said automatic means to produce a rich mixture for starting and to set said throttle in starting position while the starting motor is operating to start the engine, and means operative at relatively low temperatures to prevent the throttle returning to its normal position.

8. In combination with an internal combustion engine having a carburetor and an electric starter-motor, a butterfly choke-valve for said carburetor, said choke-valve being eccentrically mounted so as to tend to swing toward open position under the influence of air flowing past it, resilient temperature-responsive means opposing opening movement of said choke-valve, said means being responsive to engine-temperature to decrease the opposition it offers to opening movement of said choke-valve as engine-temperature increases and electro-magnetic means jointly energizable with said starter-motor for holding said choke-valve in fixed position against the effective force exerted on it by air flowing past it.

9. In combination with an internal combustion engine having a carburetor and an engine-cranking device, a butterfly choke-valve for said carburetor, said choke-valve being eccentrically mounted so as to tend to swing toward open position under the influence of air flowing past it, resilient temperature-responsive means opposing opening movement of said choke-valve, said means being responsive to engine-temperature to decrease the opposition it offers to opening movement of said choke-valve as engine-temperature increases and means jointly operable with said cranking device for holding said choke-valve in fixed position against the effective force exerted on it by air flowing past it.

MILTON E. CHANDLER.