Oct. 1, 1935. S. F. HUNT 2,015,753

CARBURETOR

Original Filed Jan. 25, 1933 3 Sheets-Sheet 1

Fig. 1

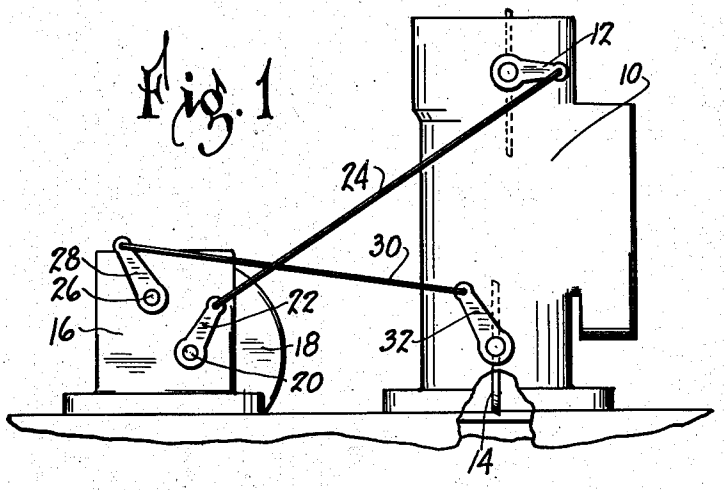
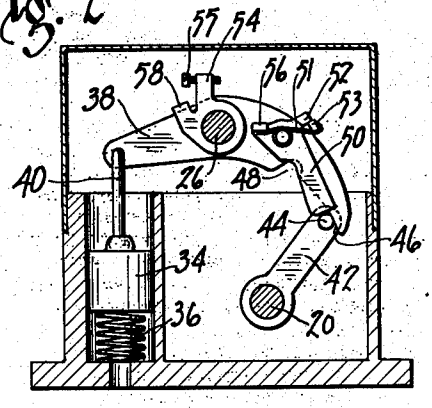


Fig. 2



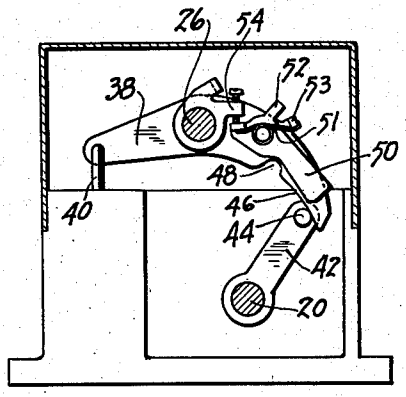


Fig. 3

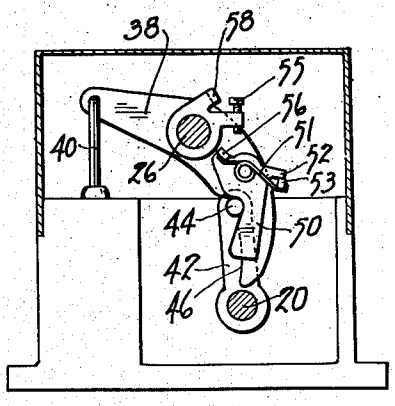


Fig. 4

INVENTOR.
Scott F. Hunt.
BY A. R. McCrady
ATTORNEY.

Oct. 1, 1935. S. F. HUNT 2,015,753

CARBURETOR

Original Filed Jan. 25, 1933 3 Sheets-Sheet 2

Fig. 5

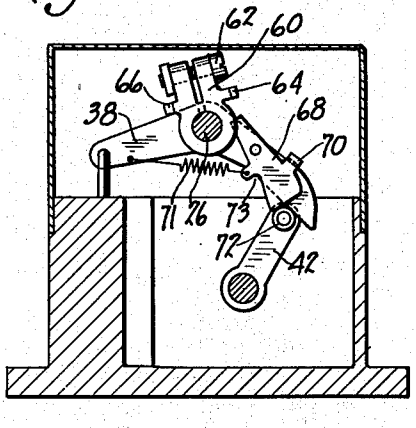
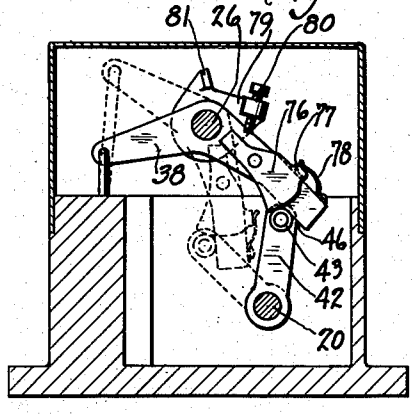


Fig. 6



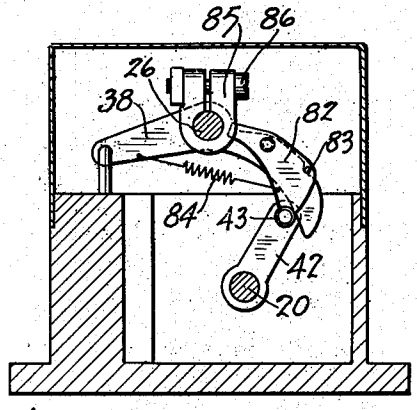


Fig. 7

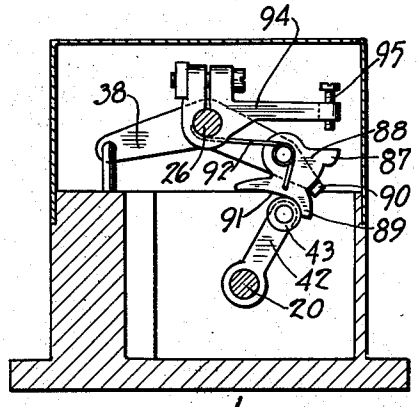


Fig. 8

INVENTOR.
Scott F. Hunt.
BY A. D. McCrady.
ATTORNEY

Oct. 1, 1935. S. F. HUNT 2,015,753

CARBURETOR

Original Filed Jan. 25, 1933 3 Sheets-Sheet 3

Fig. 9

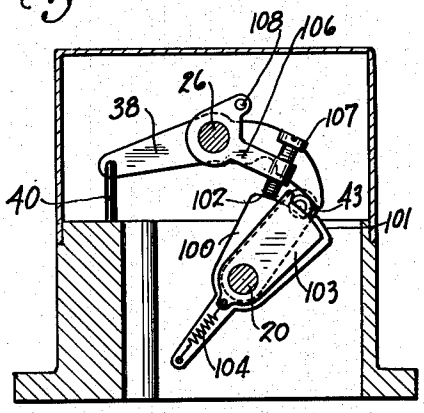


Fig. 10

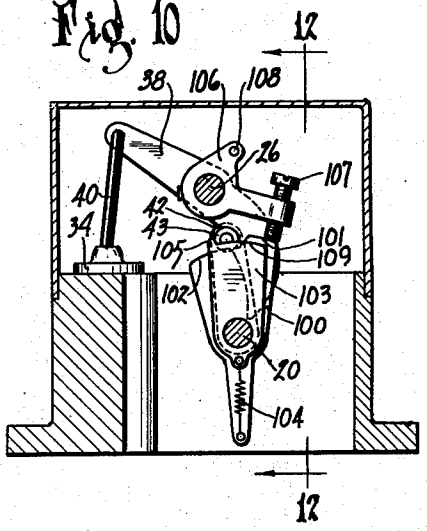


Fig. 11

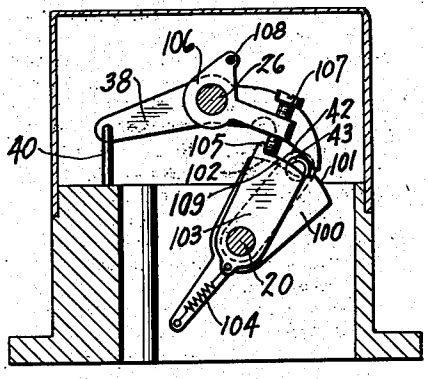


Fig. 13

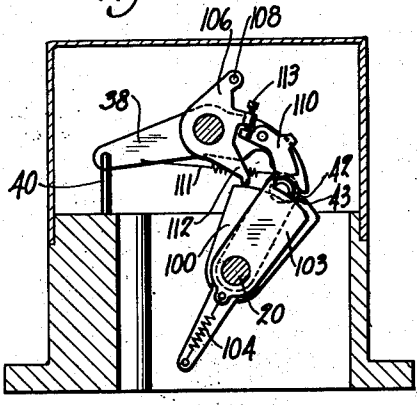
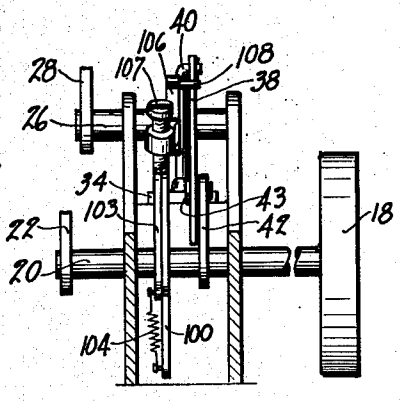


Fig. 12



INVENTOR.
Scott F. Hunt.
BY P. D. McCrady
ATTORNEY.

Patented Oct. 1, 1935 2,015,753

UNITED STATES PATENT OFFICE

2,015,753

CARBURETOR

Scott F. Hunt, South Bend, Ind., assignor to Bendix Aviation Corporation, South Bend, Ind., a corporation of Delaware

Application January 25, 1933, Serial No. 653,519
Renewed October 22, 1934

14 Claims. (Cl. 123—119)

This invention relates to control mechanisms for internal combustion engine carburetors, and has for its principal object the provision of an automatic choke valve control mechanism arranged to govern the degree of opening of the choke valve as a function of temperature when the engine is running and to close the valve when the engine stops.

Internal combustion engines using as fuel a mixture of liquid fuel and air, require a rich mixture when starting and a leaner when the engine is idling during the warming up period. Certain prior art devices, of which the copending application of Hunt and Olson, Serial No. 575,025, filed November 14, 1931, is an example, provide for holding the choke valve of the carburetor closed to form a starting mixture and, when the engine begins firing, further provides for opening the choke valve and grading down the richness of the mixture as a function of engine temperature, until the choke valve is fully opened. Certain internal combustion engines can be started on a normal operating mixture when at or near normal operating temperature and it is not necessary to close the choke valve every time the engine is started. Other engines require a very rich mixture to start regardless of temperature and it is necessary to close the choke valve each time the engine is started.

The present invention improves upon the devices of the prior art by providing for closing the choke valve each time the engine is stopped regardless of temperature.

Internal combustion engines must be idled at a higher speed when they are cold than when they are warm, and the present invention also provides an automatic control of the throttle to set it in starting position when the engine stops, to set it for a fast idle when the engine is cold and to reset it for a slow idle when the engine has reached its normal operating temperature.

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

Figure 1 is an elevational view of a carburetor with the control mechanism of the invention associated therewith;

Figure 2 is a cross sectional view through the control unit showing the same in the position it assumes during the normal running of the engine;

Figure 3 is a view similar to Figure 2 showing the mechanism in position to idle the engine when it is warm;

Figure 4 is a similar view showing the mechanism in position for starting the engine;

Figure 5 is a similar view of a modified form of the invention;

Figure 6 shows another modification, which is arranged to trigger lock the choke valve open and closed;

Figure 7 shows another form of trigger arrangement;

Figure 8 shows a modified form of trigger and throttle controlled unlocking lever therefor;

Figure 9 shows a modified form of control mechanism including a throttle control shown in position for idling the engine at slow speed;

Figure 10 is a view similar to Figure 9 showing the mechanism in position to start the engine when it is cold;

Figure 11 is a view of the mechanism shown in Figure 9 in position for fast idling of the motor;

Figure 12 is a cross sectional view taken along the line 12—12 of Figure 10 looking in the direction of the arrows; and

Figure 13 shows a modified form of the control mechanism shown in Figure 9 including a trigger for controlling the choke valve.

Referring now to the drawings in more detail, in Figure 1 I have shown a carburetor 10 having an air pressure operated choke valve 12 and a throttle 14. Carburetor 10 is shown as a plain tube down draft carburetor, this type being shown by way of example only as the invention may be applied to any preferred type of carburetor. The control unit, indicated generally at 16, includes the invention, the unit being shown as separate from the carburetor structure for the sake of clarity. In practice the control mechanism may be incorporated in the carburetor proper within the teachings of the invention. As shown the control mechanism includes a thermostat 18 of known construction, preferably a bimetallic element located near the exhaust manifold of the engine, having a shaft 20 which carries an arm 22 that is keyed thereto. A rod 24 connects the free end of the arm to the choke valve thereby to enable the thermostat to control the degree of opening of the valve as a function of temperature. The control unit includes a second shaft 26 to which an arm 28 is fixed. A rod 30 connects the free end of arm 28 with the free end of an arm 32 that is fixed upon the shaft of the throttle so that the shaft 26 is rotated by rotation of the throttle. The control mechanism also includes a piston 34 which is fitted in a cylinder and urged upwardly

therein by a spring 36, the cylinder being connected to the intake manifold of the engine so that the piston is drawn downwardly against the tension of spring 36 when the engine is firing.

A lever 38 is journalled for rotation on shaft 26 and connected by rod 40 to the piston 34 to be operated thereby. An arm 42 is keyed upon thermostat shaft 20 and carries a pin 44 which bears against the arcuate cam surface of lever 38. When the engine ceases firing spring 36 raises piston 34 and moves lever 38 clockwise around shaft 26. Pin 44 moves over surface 46 to rotate shaft 20 counterclockwise and thereby close the choke valve, pin 44 coming to rest in the recess 48 in arm 38 to lock the valve closed. The tension of the thermostat, when the engine is cold, also tends to rotate shaft 20 to close the choke valve. As soon as the engine begins firing again lever 38 is rotated in the opposite direction to unlock lever 42 so that the choke valve may be opened under the control of the thermostat, as will presently appear.

A latching trigger 50 is pivotally mounted upon lever 38 and urged in a clockwise direction around its pivot by a suitable spring 51, this movement being limited by an ear 52 on the trigger and an ear 53 on the lever. An arm 54 is keyed upon throttle shaft 26 and carries an adjustable screw 55 which is arranged to strike an ear 56 and rotate the trigger against the tension of spring 51 as the throttle is closed.

When the motor is not running and is cold, to start it, the throttle is opened part way and the control mechanism is positioned as shown in Figure 4. Pin 44 is registered with recess 48 and the trigger is released and held against the pin by spring 51 which is not strong enough to move the pin out of the recess. The engine is cranked and as soon as it begins to fire the piston rotates lever 38 away from the pin and the choke valve is held closed by the tension in the thermostat and the tension of spring 51 acting through trigger 50. As soon as the throttle is closed to idle the engine, as it should be immediately the engine fires, screw 55 rotates the trigger into the position in which it is shown in Figure 3, and the thermostat alone controls the choke valve. As the engine warms up the tension of the thermostat decreases and allows the choke valve to be opened by the air pressure on it, pin 44 moving over surface 46 into the position in which it is shown in Figure 3. As soon as the throttle is again opened to accelerate the engine, screw 55 moves away from ear 56 and spring 51 moves trigger 50 into its normal position, shown in Figure 2. Pin 44 strikes against the end of the trigger to lock the choke valve open. In this position lever 42, pin 44, trigger 50 and lever 38 together lock piston 34 down in its operated position and it is not vibrated by variations in pressure occurring in the intake manifold during the normal operation of the engine. When the engine is stopped, and the throttle closed, screw 55 unlatches the trigger and spring 36 rotates lever 38. This rotation causes surface 46 to cam pin 44 into recess 48 thereby to close the choke valve even though there is no tension in the thermostat.

Arm 54 is provided with an ear 58 which overhangs lever 38 and when the throttle is moved to wide open position, in which it is shown in Figure 2, ear 58 moves lever 38 into its operated position. Pin 44 is thus disengaged from the recess and the choke valve may be opened to permit a flooded condition of the engine to be corrected.

In the modification shown in Figure 5 arm 60 is clamped upon shaft 26 by suitable means 62, and this arm is provided with an ear 64 which corresponds in function to screw 55, and an ear 66 which corresponds in function to ear 58. A trigger 68 is pivotally secured to lever 38 and is provided with a stop 70 which engages the lever to limit the movement of the trigger with respect to the lever. Spring 71 is connected between the lever and the trigger and is tensioned to rotate the trigger to bring stop 70 against the lever. Lever 42 on the thermostat shaft carries a pin or roller 72 which rests against the end of the trigger and the edge of lever 38 when the choke valve is open to lock the valve in that position, and to lock the lever in its operated position. When the choke valve is closed by the cam action of lever 38 pin 72 registers with a recess 73 in trigger 68 to lock the valve closed. Ear 64 unlatches the trigger to restore the choke valve to the control of the thermostat when the throttle is closed to idle the engine.

In the modification shown in Figure 6 lever 38 floats upon shaft 26 as before and is arranged to be rotated thereon by the piston. Thermostat shaft 20 carries a lever 42, keyed thereto, and this lever is provided with a pin or roller 43 which engages the cam surface 46 of the lever. A latch 76 is pivotally mounted upon lever 38 and provided with an ear 77 against which a leaf spring 78 bears to rotate the latch until the ear strikes the lever. When the choke valve is open, pin 43 bears against the end of the latch and against lever 38 to lock the valve. Throttle shaft 26 carries an arm 79 into which is threaded a screw 80 which engages the latch 76 when the throttle is closed, to unlatch the choke valve so that the piston spring can close it. Arm 79 also carries an ear 81 which engages the lever, as the throttle is moved to wide open position, to move the lever and piston to operated position. When lever 38 is in its normal or unoperated position, in which it is shown in dotted lines in the figure, and the choke valve is closed, pin 43 again engages the end of the latch and lever 38 to lock the valve closed.

In the modification shown in Figure 7 trigger 82 is pivotally mounted upon lever 38 and is provided with a stop pin 83 which registers with a recess in the lever. Spring 84 is hooked between the trigger and the lever and is tensioned to seat the pin in the recess. The pin 43 on thermostat arm 42 engages the end of the trigger to lock the choke valve open. An arm 85 is clamped upon shaft 26 by a bolt 86 and when the throttle is closed the head of the bolt engages the trigger and rotates it to release pin 43. The cam end of lever 38 opens the choke valve as the piston spring restores the lever to its unoperated position. When the throttle is moved into wide open position the nut on bolt 86 engages lever 38 to move it into its operated position.

In the modification shown in Figure 8, a trigger 88 is pivotally mounted upon lever 38 and urged in a counterclockwise direction thereon by a spring 92. The trigger is provided with stop ears 87 and 89 which engage an ear 90 on the lever to limit the movement of the trigger. Thermostat arm 42 carries a roller 43 which bears against a short radius cam surface on the trigger. When the choke valve is open roller 43 engages the surface 91 adjacent to stop 89 and the line of thrust on the trigger falls between the pivotal connection of the trigger to lever 38 and the stop, and the tension of the piston spring aids spring 91 in keeping stop 89 against stop 90. The choke valve is locked open. An arm 94 is clamped upon throttle shaft

26 and carries a screw 95 which engages stop 87, when the throttle is closed, to rotate trigger 88 against the tension of spring 92 and bring stop 87 into engagement with ear 90. Stop 89 pushes roller 43 to the left during this rotation of the trigger to bring the line of thrust of lever 42 on the trigger between the pivotal connection of the same and shaft 26, to unlock the choke valve so that the tension of the piston spring can close the valve. With the valve closed, trigger 88 bears against the roller at such an angle that the tension of the piston spring maintains the valve closed. When the throttle is moved to wide open position, the nut on the bolt that clamps arm 94 upon shaft 26 engages lever 38 to move the same to its operated position thereby to bring the center of arcuate surface 91 into substantial alignment with the axis of shaft 20 and the choke valve may be opened by the air pressure upon it under the control of the thermostat. When the engine is firing the piston performs the same function to permit the choke valve to open.

In the embodiment of the invention shown in Figures 9, 10, 11, and 12, I have shown a control for automatically setting the throttle in starting position, when the engine is not running and is cold, for setting the throttle to give a fast idle during the warming up period, and to reset the throttle for a slow idle after the engine is warm and the choke valve is fully opened. This feature, broadly speaking, is an improvement upon the disclosure of the co-pending application of Hunt, Serial No. 630,274, filed August 24, 1932. In this arrangement lever 38 floats upon shaft 26 and lever 42 is keyed to shaft 20 and is provided with a roller which engages a cam surface on lever 38 as before. A plate 100 is keyed to shaft 20 and provided with a cam boss 101 and with an arcuate surface 102 whose center coincides with the axis of shaft 20. A second plate 103 floats upon shaft 20 and is adjacent to plate 100. A spring 104 is connected between plates 100 and 103 and is tensioned to keep plate 103 normally centered on plate 100. Plate 103 is provided with an arcuate cam surface 109 which centers on the axis of shaft 20 and out of one end of which rises a stop boss 105. An arm 106 is fixed upon shaft 26 and carries a screw 107 which is adapted to engage cam surfaces 101, 102, 109, and the stop 105. In the operation of the device, when the engine is not running and the choke valve is closed by the combined action of the thermostat, when cold, and the piston spring, screw 107 rides over the cam boss and the parts are positioned as shown in Figure 10. The choke valve is locked closed by the engagement of the roller 43 with a recess in lever 38 and the throttle is opened to starting position, that is to say about one fourth open. Plate 103 is centered upon plate 100.

When the engine is started, vacuum in the intake manifold operates lever 38 counterclockwise on shaft 26 to release the choke valve by disengaging the roller from the recess in lever 38. The choke valve opens under the control of the thermostat to grade down the richness of the fuel mixture as a function of temperature. Immediately the engine fires, the choke valve will open sufficiently to move the screw 107 out of engagement with the cam boss 101 and into engagement with the cam surface 109, of plate 103, which is positioned to prevent the throttle from fully closing. A fast idle of the engine during the warming up period results. If the engine is idled until normal operating temperature is reached, the parts reach the position in which they are shown in Figure 11. Screw 107 engages stop boss 105 and plate 103 is pulled off center as plate 100 is moved by the choke valve moving to wide open position. Spring 104 is tensioned. As soon as the throttle is opened to accelerate the engine, screw 107 is disengaged from boss 105 and spring 104 recenters plate 103 upon plate 100. When the throttle is subsequently closed screw 107 registers with cam surface 102, which is positioned to permit the throttle to close fully and a slow idle of the engine results. The edge of lever 38 engaged by roller 43 is shaped to bear upon roller 43 at a point aligned with the axes of the roller and shaft 20, when the choke valve is fully opened, and because of this dead center position the choke valve is locked open by the piston spring. Lever 42 also serves to lock the piston in its operated position so that it will not be vibrated by the variations in pressure occurring in the intake manifold during the operation of the engine. Arm 106 is provided with a pin 108 which engages lever 38, when the throttle is in wide open position, to move the lever to its operated position.

In the modification shown in Figure 13 the automatic throttle control is combined with the trigger type automatic choke shown in the prior figures. In this modification lever 38 carries a trigger 110, pivotally connected thereto and rotated into latching position by spring 111. Arm 106 carries a subarm 112 which engages the cams of the throttle control in lieu of a screw. Arm 106 also carries a screw 113 which engages the trigger to unlatch the same when the throttle is fully closed. The operation of the device will be apparent from the foregoing and need not be described in detail herein.

While I have chosen to show my invention by illustrating and describing a preferred embodiment of it, I have done so by way of example only as there are many modifications and adaptations that an be made by one skilled in the art within the teachings of the invention.

What is claimed is:

1. In a control mechanism for an internal combustion engine carburetor having a choke valve and a throttle, a thermostat for controlling the degree of opening of the choke valve as a function of temperature, means for locking said choke valve open, and means for unlocking said locking means each time the throttle is closed.

2. In a control mechanism for an internal combustion engine carburetor having a choke valve and a throttle, a thermostat for controlling the degree of opening of the choke valve as a function of temperature, means for locking said choke valve open, means for unlocking said locking means each time the throttle is closed, and means for closing the choke valve when the engine stops.

3. In a control mechanism for an internal combustion engine carburetor having a choke valve and a throttle, a thermostat for controlling the degree of opening of the choke valve as a function of temperature, means including a trigger for locking said choke valve open, means for moving said trigger to unlock the choke valve each time the throttle is closed, and means for closing the choke valve when the engine stops.

4. In a control mechanism for an internal combustion engine carburetor having a choke valve and a throttle, a thermostat for controlling the degree of opening of the choke valve as a function of temperature, means including a trigger for locking said choke valve open, a lever

fixed to and moved with the throttle for moving said trigger to unlock the choke valve each time the throttle is closed, and means for closing the choke valve when the engine stops.

5. In a control mechanism for an internal combustion engine carburetor having a choke valve and a throttle, a thermostat for controlling the degree of opening of the choke valve as a function of temperature, an arm on said thermostat moved with the choke valve, a lever engaging said arm when the choke valve is closed to lock the same closed, means for disengaging said lever from the arm when the engine fires to permit the choke valve to open under the control of the thermostat, a trigger on said lever engaging said arm when the choke valve is open to lock the same open, means for moving said trigger to unlock the choke valve when the throttle is closed, and means for moving said lever to engage the arm and close the choke valve when the engine stops.

6. In a control mechanism for an internal combustion engine carburetor having a choke valve and a throttle, a shaft, means connecting the shaft to the choke valve, an arm on the shaft, a second shaft, a lever floating on said second shaft, means on said lever registered with said arm to lock the choke valve closed, means actuated by vacuum in the engine for moving said lever to unlock said arm, a thermostat connected to said first shaft for regulating the degree of opening of the choke valve as a function of temperature, a trigger on said lever engaging said arm to lock the choke valve open, means on said second shaft engaging said trigger when the throttle is closed to unlock the choke valve, and means effective when the engine stops for moving said lever to close the choke valve.

7. In a control mechanism for an internal combustion engine carburetor having an air pressure actuated choke valve and a throttle, a pivoted arm connected to the choke valve, a pivoted lever, a spring for moving the lever in one direction to engage the arm and close the choke valve for starting the engine, a piston for moving the lever out of engagement with the arm to permit the choke valve to open, a thermostat connected to control the degree of opening of the choke valve as a function of temperature, a latch pivoted on said lever and engaging said arm to lock the choke valve open, and means for disengaging the latch from the arm when the throttle is closed to permit said spring to close the choke valve when the engine stops.

8. In a control mechanism for an internal combustion engine carburetor having an air pressure actuated choke valve and a throttle, a pivoted arm connected to the choke valve, a pivoted lever, a spring for moving the lever in one direction to engage the arm and close the choke valve for starting the engine, a piston actuated by vacuum in the engine for moving the lever out of engagement with the arm to permit the choke valve to open, a thermostat connected to control the degree of opening of the choke valve as a function of temperature, a trigger pivoted to said lever, a spring for rotating the trigger, stop means for limiting said rotation to position the trigger to engage the arm and lock the choke valve open, and means for disengaging the trigger from the arm when the throttle is closed to permit said first spring to close the choke valve when the engine stops.

9. In a control mechanism for an internal combustion engine carburetor having a choke valve and a throttle, a pivoted arm connected to the choke valve, means engaging the arm for locking the choke valve closed and for locking it open, means for releasing the arm from closed position when the engine fires, a thermostat for controlling the degree of opening of the choke valve as a function of temperature, a pivoted arm connected to the throttle, and cam means engaging said throttle arm to set the throttle in starting position when the choke valve is locked closed, in fast idle position when the choke valve is opening under the control of the thermostat and in slow idle position when the choke valve is locked open.

10. In a control mechanism for an internal combustion engine carburetor having a choke valve and a throttle, a shaft, an arm fixed on said shaft and connected to the choke valve, means engaging the arm for locking the choke valve closed and for locking it open, means for releasing the arm from closed position when the engine fires, a thermostat for controlling the degree of opening of the choke valve as a function of temperature, cam means on said shaft fixed with respect to said lever, and a pivoted lever connected to the throttle and engaging said cam means to set the throttle in starting, fast idle and slow idle positions respectively as the choke valve is closed, partly open, and fully open.

11. In a control mechanism for an internal combustion engine carburetor having a choke valve and a throttle, a shaft, means connecting the shaft to the choke valve, an arm fixed upon the shaft, means engaging the arm for locking the choke valve closed and for locking it open, means for releasing the arm from closed position when the engine fires, a thermostat for controlling the degree of opening of the choke valve as a function of temperature, a plate fixed on said shaft, two cam surfaces on said plate located at different radial distances from the axis of said shaft, a second plate journalled on said shaft and disposed adjacent to the first plate, a cam surface on said second plate located intermediate the cam surfaces on said first plate, and means connected to the throttle and engaging the cam surface most distant from the axis of the shaft when the choke valve is locked closed, engaging the intermediate cam when the choke valve is opening under the control of the thermostat and engaging the near cam when the choke valve is locked open to set the throttle respectively for starting, fast idling and slow idling the engine.

12. In a control mechanism for an internal combustion engine carburetor having a choke valve and a throttle, a shaft, means connecting the shaft to the choke valve, an arm fixed upon the shaft, means engaging the arm to lock the choke valve closed and to lock it open, vacuum actuated means for releasing the arm from closed position when the engine fires, a thermostat for controlling the degree of opening of the choke valve as a function of temperature, cam means on the shaft fixed with respect to the arm, a pivoted lever engaging said cam means and connected to the throttle to set it to starting position, fast idle position and slow idle position respectively as the choke valve is closed, partially open and fully open, and means for restoring the choke valve and throttle to starting position when the engine stops.

13. In a control mechanism for an internal combustion engine carburetor having a choke valve and a throttle, a shaft, means connecting the shaft to the choke valve, an arm fixed upon

the shaft, a pivoted lever engaging the arm to lock the choke valve closed, vacuum actuated means for releasing the arm from closed position when the engine fires, a thermostat for controlling the degree of opening of the choke valve as a function of temperature, means on said lever for locking the choke valve open, cam means fixed on said shaft, a throttle lever engaging said cam means to set the throttle in starting position, fast idle position, and slow idle position, respectively, as the choke valve is closed, partially open and fully open, means on said throttle lever for releasing said locking means when the throttle is closed, and means for restoring the choke valve and throttle to starting position when the engine stops.

14. In a control mechanism for an internal combustion engine carburetor having an air pressure actuated choke valve and a throttle, a shaft, means connecting the shaft to the choke valve, an arm fixed upon the shaft, a pivoted lever engaging the arm to lock the choke valve closed, vacuum actuated means for moving said lever to release the arm when the engine fires, a thermostat connected to said shaft for governing the degree of opening of the choke valve as a function of temperature, means on said lever for locking the choke valve open, a start and slow idle cam fixed upon said shaft, a fast idle cam loosely mounted on the shaft adjacent to said first cam, spring means for keeping said second cam centered on the first, and an arm connected to the throttle and engaging said cams to set the throttle for starting, fast idling, and slow idling respectively as the choke valve is closed, partly open and fully open.

SCOTT F. HUNT.