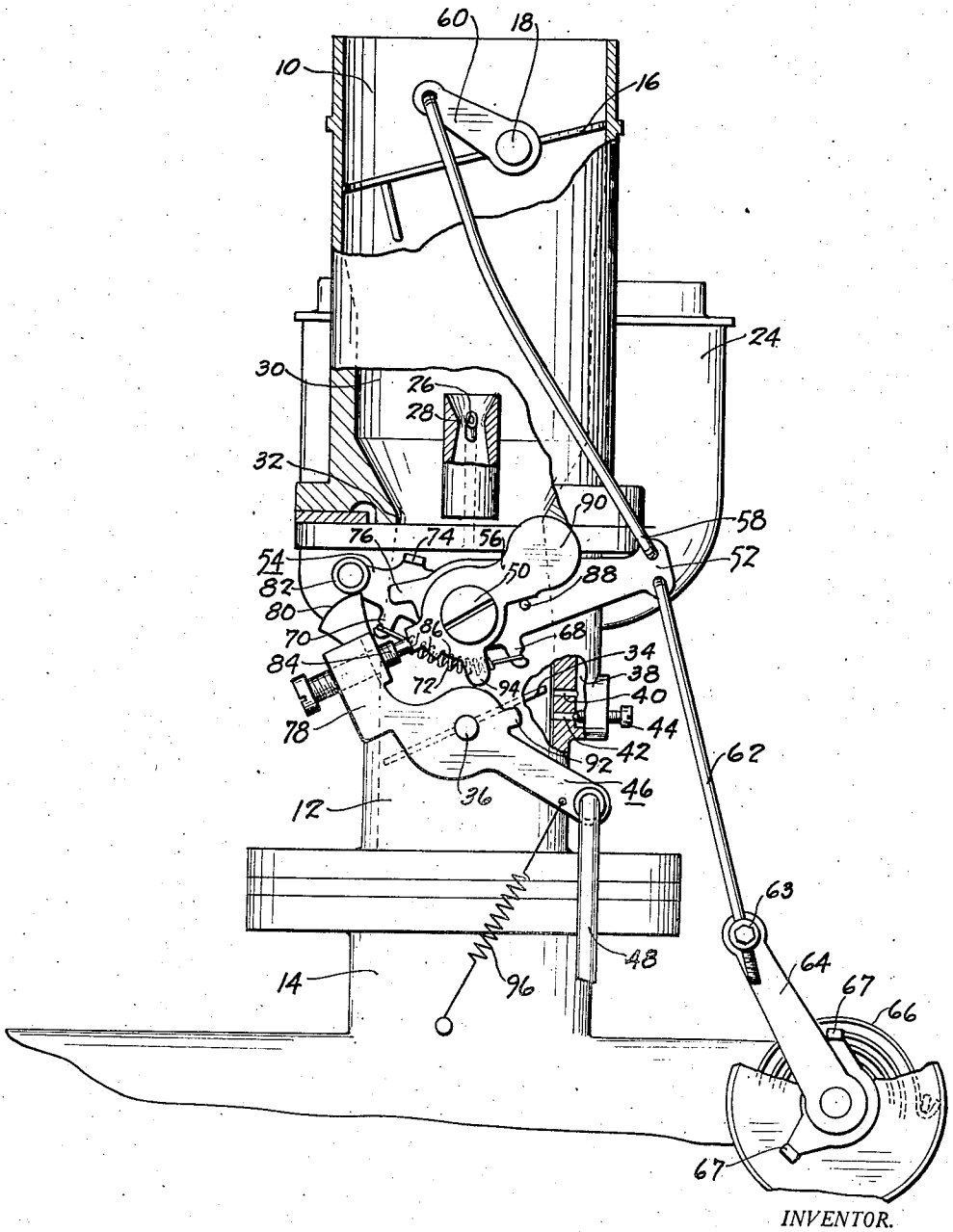
July 26, 1938. S. F. HUNT 2,124,778

CARBURETOR

Filed July 9, 1934



INVENTOR.

Scott F. Hunt

BY P. R. McCrady

ATTORNEY.

Patented July 26, 1938 2,124,778

UNITED STATES PATENT OFFICE

2,124,778

CARBURETOR

Scott F. Hunt, South Bend, Ind., assignor to Bendix Products Corporation, South Bend, Ind., a corporation of Indiana

Application July 9, 1934, Serial No. 734,259

14 Claims. (Cl. 261—39)

This invention relates to temperature control mechanism for carburetors and more especially to means for controlling the richness of the mixture produced by the carburetor, in accordance with temperature and other factors.

Internal combustion engines which burn a mixture of liquid fuel and air require a rich mixture when starting, since the liquid will not vaporize as rapidly when the engine is cold as when it is hot, and therefore a greater percentage of fuel must be supplied in order to obtain the desired combustible charge. After the engine has started, the proportion of liquid fuel to air must be decreased or the mixture will become too rich resulting in irregular operation of the engine and a waste of fuel. The proportion of liquid fuel to air should be further decreased as the engine is progressively warmed up.

Carburetors for internal combustion engines are usually provided with a manually operable throttle valve for regulating the quantity of the combustible mixture admitted to the cylinders of the engine, and a choke valve for regulating the quantity of air admitted to the carburetor. It is known in this art to operate the choke valve by means of a temperature responsive device positioned so that it will be subjected to the heat of the engine, such an arrangement being shown in the copending application of Hunt and Olson Serial No. 575,025 filed November 14, 1931. In said copending application a temperature responsive element is tensioned to move the choke valve toward closed position when the engine is cold, and is arranged to decrease this tension as the engine warms up.

The present invention relates to improving the operation, under certain conditions, by interconnecting the choke valve and the throttle valve in such a manner that each influences the movement of the other. The interconnecting means, in the embodiment illustrated, is so arranged that when the throttle valve is in starting position the choke valve is closed by the thermostat when the engine is cold. When the choke valve is closed the throttle valve is held open slightly to supply a sufficient quantity of combustible mixture to the engine to prevent the engine from stalling. As the engine progressively warms up, the tension on the thermostat is decreased so the choke valve may be more easily moved toward open position, for example, by the suction exerted thereon, the illustrated choke valve being of the unbalanced or pressure-responsive type. A plurality of stepped surfaces may be provided for varying the degree of fast idle as the engine temperature increases. The interconnecting means is so designed that as the throttle valve approaches closed position the force of the thermostat is decreased, and as the throttle is moved to fully open position the choke valve is forced open a small amount.

It is desirable when attempting to start an internal combustion engine to partially open the throttle valve so that a sufficient quantity of combustible mixture may be delivered to the cylinders of the engine to enable it to start. It frequently happens that an operator will inadvertently fail to open the throttle valve when attempting to start the engine and that the time required to start the engine will therefore be increased. To obviate this difficulty applicant provides a device whereby the choke valve cannot close until the throttle valve has been momentarily opened. If the engine is cold, the choke valve will then be moved to closed position by the heat sensitive element, and the throttle valve will be held partially open to assure that a sufficient quantity of combustible mixture will reach the cylinders of the engine to effect prompt starting of the engine.

When the engine has started, it is desirable to decrease the force urging the choke valve toward closed position so that a sufficient quantity of air may be admitted to produce a satisfactory combustible mixture for the engine. To accomplish this result, means are provided for decreasing the force urging the choke valve toward closed position when the operator moves the throttle valve toward the closed position, as he naturally does as soon as the engine starts, in order to prevent racing.

As a further feature of the invention, the percentage of liquid fuel supplied to the engine is increased by partially closing the choke valve when the throttle valve is opened while the engine is cold. The choke valve mechanism therefore at times serves the additional purpose of an acceleration pump.

A further object of this invention is to provide a simple interconnecting mechanism between the choke and throttle valves operable to decrease the force of the thermostat upon the choke valve as the throttle valve approaches the fully closed position, and to provide a plurality of successive fast idle positions of the throttle valve thermostatically regulated by the heat of the engine.

Another object of the invention is to provide means whereby as the throttle valve is moved toward a partially opened position, the choke valve

is urged toward closed position with an increasing force.

Other objects and advantages of the present invention will appear more fully from the following detailed description together with the accompanying drawing which is submitted merely for purposes of illustration and is not intended to define the scope of the invention, reference being had for that purpose to the subjoined claims.

The single figure of the drawing is an elevation, partly in section, of a carburetor embodying a device of the present invention.

The drawing shows a plain tube down-draft carburetor having an upper or air horn section 10 and a throttle body section 12. The throttle body section is designed to connect with a manifold riser 14 communicating with the cylinders of the engine.

The upper or air horn section 10 is fitted with an unbalanced choke valve 16 fixed to a choke shaft 18 journalled in the side walls of the air horn section 10. The air horn section 10 supports a fuel reservoir or float chamber 24 which supplies liquid fuel to a fuel discharge nozzle 26 positioned in the most restricted section of a primary venturi 28 located in the induction passage 30. The primary venturi 28 discharges at the most restricted section of a secondary venturi 32 having its most restricted portion at the intersection of the air horn section 10 and the throttle body section 12.

The throttle body section 12 is provided with a throttle valve 34 fixed to a throttle shaft 36 journalled in the side walls of the throttle body section. An idling fuel passage 30 extends down the side walls of the throttle body section 12 and terminates in two connected discharge orifices 40 and 42 positioned on opposite sides of the throttle valve 34 when in closed position. An idling adjustment screw 44 is provided to regulate the amount of combustible mixture supplied by the orifices 40 and 42 for idling purposes.

The throttle valve 34 is manually operable by means of a lever 46 fixed to the throttle shaft 36 and a rod 48 connected therewith. A stud 50 fixed in the side walls of the throttle body section 12 receives in pivotal relation therewith an arm 52, a follower member 54, and a gravity actuated stop member 56, each independently rotatable on the stud.

The arm 52 extends in a substantially horizontal plane and at its free end receives a rod 58 operably connected with the choke shaft 18 through a crank 60 fixed thereto. Another rod 62 also connects with the free end of the arm 52 and is connected, through a rotatable and adjustable connection 63, with a crank 64 fixed to the inner end of a spirally arranged thermostatic spring 66 positioned adjacent the exhaust manifold or other element subjected to the heat of the engine, adjustable stops 67 being provided to limit the movement of crank 64.

The arm 52 and the follower 54 are provided with depending projections 68 and 70 to which are attached the ends of a tension spring 72 which yieldingly urges the arm 52 in a direction to open the choke valve 16. The follower 54 is provided with an ear 74 designed to contact a projection 76 carried by the arm 52 to limit the relative movement between the arm 52 and the follower 54 in one direction.

The throttle actuating lever 46 carries an extension 78 to which is fixed a cam surface 80 which under certain operating conditions is designed to engage a roller 82 carried at the end of the follower member 54. The cam 80 rotates the follower member 54 in the clockwise direction thereby extending the spring 72 which exerts a force on the arm 52 rotating it in the clockwise direction and tending to open the choke valve 16.

The throttle lever 46 also carries a stop screw 84 designed to selectively engage a plurality of stepped surfaces 86 carried by the stop member 56. A pin 88 projecting from the side of the arm 52 is adapted to contact the lower side of the stop member 56 to limit the movement thereof with respect to the arm 52, for a purpose to be described hereinafter. The stop member 56 is provided with an enlarged section 90 constituting a weight tending to rotate member 56 in the clockwise direction to hold it in contact with the pin 88. It will be seen that as the choke valve 16 progressively opens, the arm 52 rotates in the clockwise direction, thereby through the pin 88 permitting the member 56 to also rotate in the clockwise direction so as to bring one of the lower stepped surfaces 86 in juxtaposition with the stop screw 84 thereby permitting the throttle valve 34 to be more nearly closed, thus decreasing the amount of mixture admitted to the cylinders and causing the engine to idle more slowly.

The throttle lever 46 is provided with an ear 92 in the form of a bent-over segment designed to engage a depending segment 94 carried by the member 56 to rotate the latter in the clockwise direction when the throttle lever 46 is rotated in the counterclockwise direction to such an extent that the throttle valve 34 approaches the full open position. The member 56 operates through the pin 88 fixed in the arm 52 to positively open the choke valve 16 a small amount when the throttle valve 34 approaches full open position. This feature makes it possible to draw out an excess charge of fuel from the cylinders if the engine should fail to start and become flooded.

The operation of this device is as follows: When the engine is running and is fully warmed up, the thermostat 66, which is subjected to considerable heat, will exert no force on the choke valve 16. The choke valve will be held in the full open position by the force of the air entering the air horn section 10, and by the force of gravity acting on the unbalanced valve 16 and the actuating mechanism consisting of cranks 60 and 64, rods 58 and 62, and the arm 52.

If now the engine is stopped, the throttle valve 34 will be returned to closed position by the usual throttle return spring, indicated diagrammatically at 96. The stop screw 84 will then engage the lowest of the stepped surfaces 86 of the stop member 56. As the engine cools down, the thermostat 66 will uncoil and will urge the choke valve 16 toward the closed position by means of the connecting linkage. The stop screw 84 will prevent the member 56 and arm 52 from rotating in the counterclockwise direction, so that the choke valve 16 cannot close.

If the operator should attempt to start the engine while it is cold without first opening the throttle valve 34, the choke valve 16 will thus be held in substantially full open position, but if the operator opens the throttle valve to a degree suitable for starting the engine, the thermostat 66 will close the choke valve 16 and will rotate member 56 until the highest of the stepped surfaces 86 comes opposite the stop screw 84. In this position, the cam surface 80 is out of con-

tact with roller 82, and the tension on spring 72 is released.

The engine is then cranked, the choke valve being held fully closed by the force of the thermostat 66. A high suction is therefore exerted upon the fuel nozzle 26 which will draw considerable fuel from the nozzle, giving a rich mixture suitable for starting the engine.

As soon as the engine has started, the operator will release the accelerator pedal to permit spring 96 to close the throttle valve to prevent the engine from racing. The stop screw 84 will thereupon move into contact with the highest of steps 86, and cam surface 80 carried by the throttle actuating lever 46 will engage the roller 82 and rotate the follower member 54 in the clockwise direction, tensioning the spring 72 and exerting a force on the arm 52 tending to rotate it in the clockwise direction to open the choke valve 16. The force of the spring 72 thus opposes the force of the thermostat 66 tending to close the choke valve 16, so that the choke valve 16 may be moved toward the open position by the increased velocity of air flowing through the air horn section 10. A mixture having a greater percentage of air is thus supplied so that the engine will not be flooded with a charge having too high a percentage of liquid fuel.

As the engine continues to run, heat will be transmitted to the thermostat 66 which will exert a decreasing force upon the choke valve and the choke valve will be opened slowly as the engine warms up. As the choke valve opens, the arm 52 and the member 56 are rotated in the clockwise direction, so that the stop screw 84 will contact one of the lower stepped surfaces 86 permitting the throttle valve 34 to more nearly close, and decreasing the idling speed of the engine.

When the engine is warmed up to normal operating temperature, the thermostat 66 will exert no force on the choke valve 16. The choke valve will then be fully open, and the arm 52 and the member 56 will be in their lowermost position, so that the stop screw 84 will engage the lowest step of the stepped surfaces 86, permitting the throttle valve 34 to completely close to permit the engine to idle slowly, drawing fuel and air through the idling nozzles 40 and 42.

If the operator opens the throttle valve before the engine is up to normal operating temperature, the cam 80 moves to the left relative to the roller 82, allowing the follower member 54 to rotate in the counterclockwise direction, decreasing the tension in the spring 72 and allowing the thermostat 66 to move the choke valve 16 toward the closed position and thus enrich the mixture. An acceleration pump effect is thus obtained while the engine is cold so that a richer mixture is supplied to permit the engine to operate smoothly during the transition period from idling speed to high speed operation. When the engine has reached its normal operating temperature, however, the follower 82 is moved, by projection 76 contacting with stop 74, out of the path of cam 80 so that the acceleration pump effect is no longer obtained.

If the engine should for any reason be overchoked so that it is impossible to start it, due to the presence of too rich a mixture in the cylinders, the choke valve 16 may be partially opened by moving the throttle valve 34 to full open position. As the throttle valve 34 approaches the full open position the stop member 92 engages the depending segment 94 on cam member 56 and rotates the cam member 56 together with the arm 52 in the clockwise direction thereby partially opening the choke valve 16. Upon cranking the engine, an excess of air will then be drawn into the cylinders which will draw out the surplus fuel so that another attempt may be made to start the engine.

While the invention has been described with reference to a specific embodiment, it is not my intention to limit the scope of the invention to the details disclosed nor otherwise than by the terms of the appended claims.

I claim:

1. In a carburetor having a throttle, a pressure responsive choke valve, a thermostat yieldingly urging the choke valve closed when cold, and cam mechanism energized when the throttle is in or near its closed position, and inoperative when the throttle is in or near its wide open position, for yieldingly opposing the action of the thermostat.

2. In a carburetor having a throttle, an unbalanced choke valve, a thermostat yieldingly urging the choke valve closed when cold, and cam means energized when the throttle is closed for yieldingly opposing the action of the thermostat, said means being denergized when the throttle is opened to permit the thermostat to yieldingly urge the choke valve toward closed position.

3. A carburetor comprising a throttle, an unbalanced choke valve, a thermostat yieldingly urging the choke valve closed when cold, and cam actuated yielding means becoming operable to oppose the closing movement of the choke valve as the throttle valve approaches the closed position, said yielding means reaching maximum effectiveness when the throttle is approximately at its fast idle position.

4. In a carburetor having a throttle, an unbalanced choke valve, a thermostat yieldingly urging the choke valve closed when cold, cam actuated resilient means operable to yieldingly oppose the closing movement of the choke valve as the throttle valve approaches the closed position, and means operable to positively open the choke valve as the throttle valve approaches full open position.

5. A carburetor comprising a throttle, an unbalanced choke valve, a thermostat yieldingly urging the choke valve closed when cold, resilient means operable to yieldingly oppose the closing movement of the choke valve as the throttle valve approaches the closed position, means operable to positively open the choke valve as the throttle valve approaches full open position, and means operable by the thermostat when cold to prevent the throttle valve from completely closing.

6. In a carburetor having a body section, a throttle valve, means to actuate the throttle valve, an unbalanced choke valve, connecting means between the throttle valve and the choke valve comprising a plurality of members pivotally mounted on the body section, a thermostat operably connected to one of said members to yieldingly urge the choke valve closed when cold, yielding means connecting two of said members, and means carried by the throttle actuating means to energize the yielding means as the throttle valve is moved toward closed position, said yielding means being operable to oppose the action of the thermostat with a force which reaches maximum when the throttle valve is approximately at its fast idle position.

7. A carburetor comprising a body section, a throttle valve, means to actuate the throttle valve, an unbalanced choke valve, connecting means be-

tween the throttle valve and the choke valve comprising a plurality of members pivotally mounted on the body section, a thermostat operably connected to one of said members to yieldingly urge the choke valve closed when cold, yielding means connecting two of said members, means carried by the throttle actuating means to energize the yielding means as the throttle valve is moved toward closed position, said yielding means being operable to oppose the action of the thermostat, a plurality of stepped surfaces carried by one of said pivotally mounted members, and stop means carried by the throttle actuating means whereby the throttle valve is prevented from completely closing when the choke valve is closed.

8. In a carburetor having a body section, a throttle valve, means to actuate the throttle valve, an unbalanced choke valve, connecting means between the throttle valve and the choke valve comprising a plurality of members pivotally mounted on the body section, a thermostat operably connected to one of said members to yieldingly urge the choke valve closed when cold, yielding means connecting two of said members, means carried by the throttle actuating means to energize the yielding means as the throttle valve is moved toward closed position, said yielding means being operable to oppose the action of the thermostat, and interengaging stop means carried by the throttle actuating means and one of the pivotally mounted members whereby the choke valve is partially opened as the throttle valve approaches the full open position.

9. A carburetor comprising a body section, a throttle valve, means to actuate the throttle valve, an unbalanced choke valve, connecting means between the throttle valve and the choke valve comprising a plurality of members pivotally mounted on the body section, a thermostat operably connected to one of said members to yieldingly urge the choke valve closed when cold, yielding means connecting two of said members, means carried by the throttle actuating means to energize the yielding means as the throttle valve is moved toward closed position, said yielding means being operable to oppose the action of the thermostat, a plurality of stepped surfaces carried by one of said pivotally mounted members, stop means carried by the throttle actuating means whereby the throttle valve is prevented from completely closing when the choke valve is closed, and interengaging stop means carried by the throttle actuating means and one of the pivotally mounted members whereby the choke valve is partially opened as the throttle valve approaches the full open position.

10. In a carburetor having a body section, a throttle valve, means to actuate the throttle valve, an unbalanced choke valve, a thermostat yieldingly urging the choke valve closed when cold, connecting means between the choke valve and the throttle valve including stop means coacting with the throttle actuating means whereby the thermostat is prevented from closing the choke valve until the throttle valve is moved to partially open position, said stop means functioning to prevent the throttle valve from completely closing while the choke valve is closed.

11. In a carburetor having a body section, a throttle valve, means to actuate the throttle valve, a pressure responsive choke valve, a thermostat yieldingly urging the choke valve closed when cold, connecting means between the choke and throttle comprising a plurality of members pivotally mounted upon the body section, one of said members being interposed between the thermostat and the choke valve, a cam carried by the throttle actuating means, another of said members having a follower designed to engage the cam, yielding means between said members urging the choke valve toward open position and urging the follower toward engaging position with the cam, and stop means between said members to restrict the relative rotation of the two members in one direction.

12. In a carburetor having a body section, a throttle valve, means to actuate the throttle valve, a pressure responsive choke valve, a thermostat yieldingly urging the choke valve closed when cold, connecting means between the choke and throttle comprising a plurality of members pivotally mounted upon the body section, one of said members being interposed between the thermostat and the choke valve, a cam carried by the throttle actuating means, another of said members having a follower designed to engage the cam, yielding means between said members urging the choke valve toward open position and urging the follower toward engaging position with the cam, stop means between said members to restrict the relative rotation of the two members in one direction, a plurality of stepped surfaces carried by another of said pivotally mounted members, and adjustable stop means carried by the throttle actuating means to engage said stepped surfaces to hold the throttle valve partially open when the choke valve is closed.

13. In a carburetor having a body section, a throttle valve, means to actuate the throttle valve, a pressure responsive choke valve, a thermostat yieldingly urging the choke valve closed when cold, connecting means between the choke and throttle comprising a plurality of members pivotally mounted upon the body section, one of said members being interposed between the thermostat and the choke valve, a cam carried by the throttle actuating means, another of said members having a follower designed to engage the cam, yielding means between said members urging the choke valve toward open position and urging the follower toward engaging position with the cam, stop means between said members to restrict the relative rotation of the two members in one direction, a plurality of stepped surfaces carried by another of said pivotally mounted members, and adjustable stop means carried by the throttle actuating means to engage said stepped surfaces to hold the throttle valve partially open when the choke valve is closed, and to prevent the thermostat from closing the choke valve until the throttle valve has been first partially opened.

14. In a carburetor having a throttle a pressure responsive air inlet valve, a thermostat yieldingly urging said valve closed when cold, yielding means operable to oppose the closing movement of said valve as the throttle approaches closed position, and means operable when the engine is cold to prevent said valve from closing until the throttle has been opened.

SCOTT F. HUNT.

DISCLAIMER

2,124,778.—*Scott F. Hunt*, South Bend, Indiana. CARBURETOR. Patent dated July 26, 1938. Disclaimer filed August 1, 1940, by the assignee, *Bendix Products Corporation*.

Hereby enters this disclaimer to claim 10 of said patent.

[*Official Gazette August 27, 1940.*]