Oct. 25, 1960 C. L. WAGNER 2,957,465

FAST OPENING CHOKE MECHANISM

Filed May 23, 1958 2 Sheets-Sheet 1

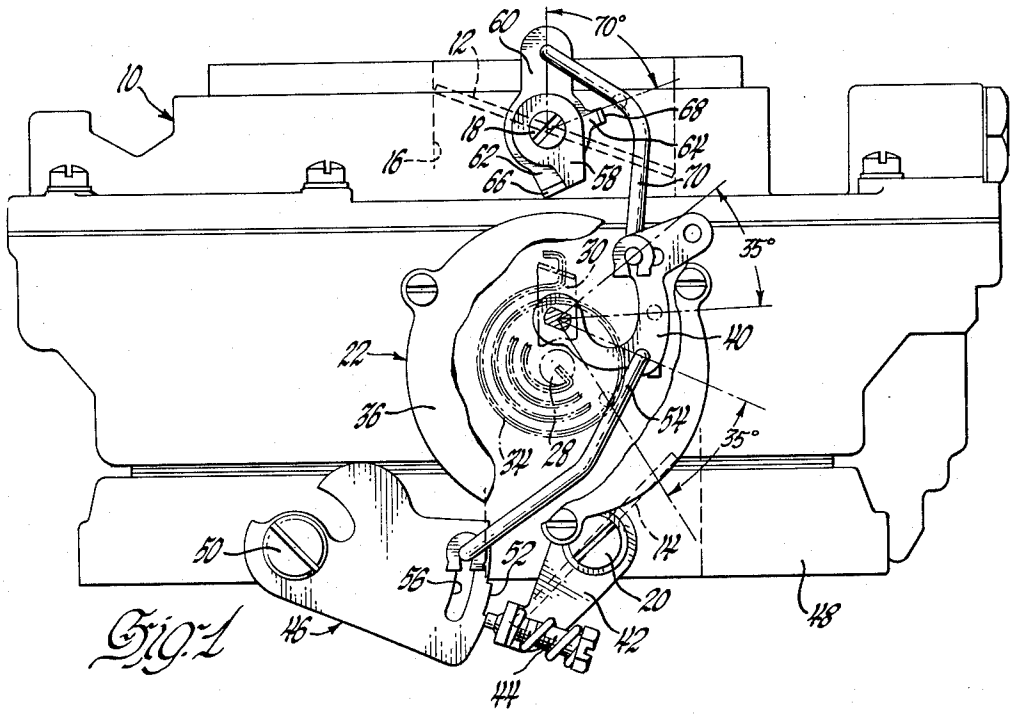


Fig. 1

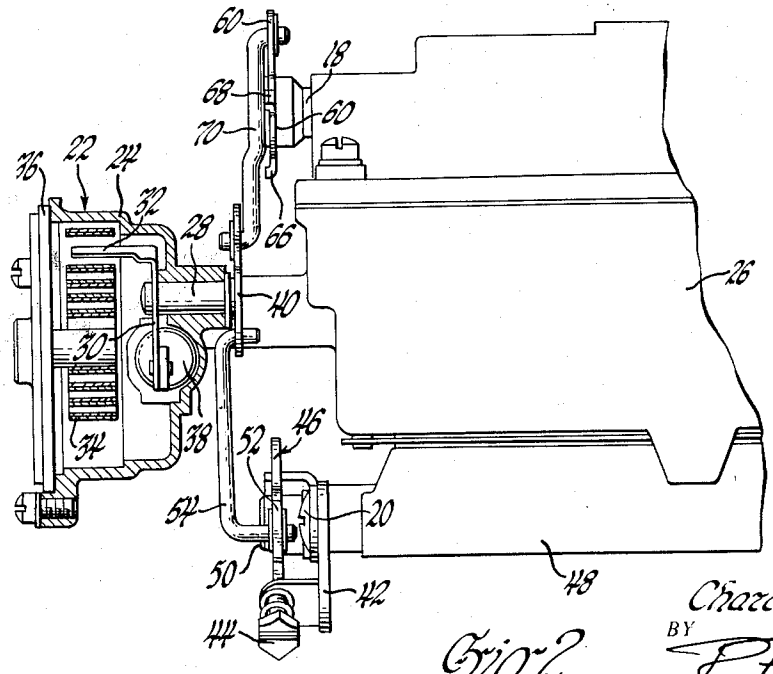


Fig. 2

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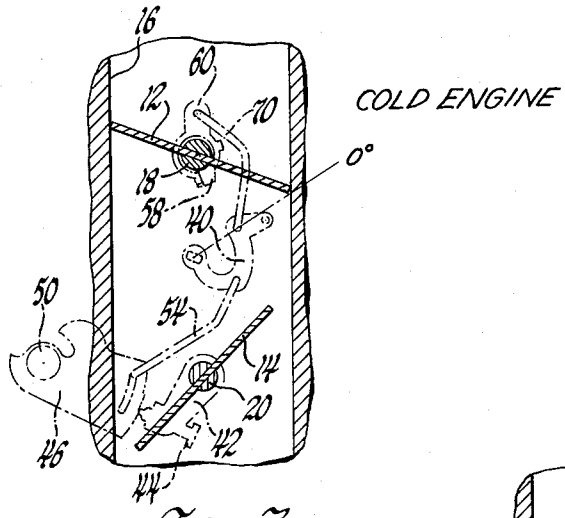


Fig. 3

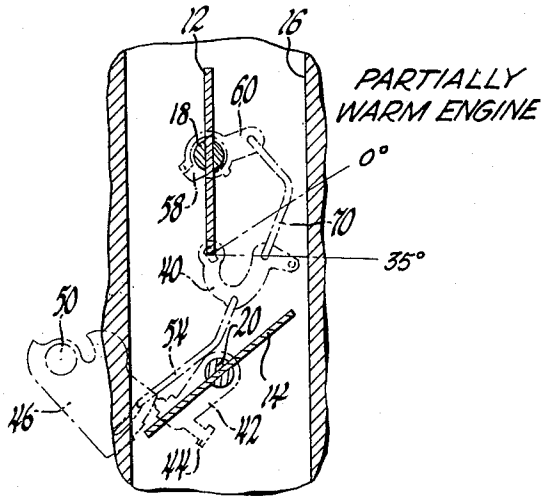


Fig. 4

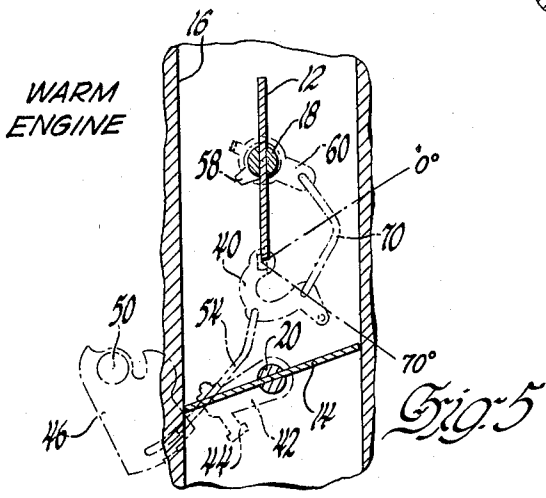


Fig. 5

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FAST OPENING CHOKE MECHANISM

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11 Claims. (Cl. 123—119)

The present invention relates to a carburetor which employs a thermostatic mechanism for controlling the operation of both a choke and a throttle fast idle cam for insuring proper operation of the carburetor under cold running conditions. More specifically the present invention relates to a single thermostatic coil or automatic choke device for controlling the operation of a choke valve and fast idle cam.

The improvement in the subject device resides in the provision of a unique thermostat control linkage mechanism whereby the control of the choke valve is actually independent of or split from the operation of the fast idle cam under certain operating conditions. As will be more apparent from the discussion which follows, the advantage of the present mechanism is to considerably improve the operating economy of the carburetor by permitting the choke valve to open or come off more quickly than has been possible in the past due to the previous necessity for coupling the choke and fast idle cam together for more or less simultaneous operation.

It has been discovered that one of the contributing factors to the uneconomical operation of carburetors using automatic chokes is attributable to the fact that the choke valve frequently remains on or active to provide an enriched fuel/air mixture for a considerably longer period than actually required by the engine. This situation has occurred due to the fact that the fast idle cam, operated by the same temperature sensing device, must be operative to maintain the engine running at an increased idling speed longer than it is necessary for the choke valve to provide an enriched fuel/air mixture.

This differential requirement between control of the choke valve and the throttle fast idle cam is due to the fact that an engine has been found to require an enriched fuel/air mixture for only a very short period, usually just long enough to wet the induction system. On the other hand, it is necessary to maintain above normal idling speeds for a longer period to overcome the increased engine friction when the engine is cold. Since, however, it has been the practice to operate both the choke valve and the fast idle cam by the same automatic choke mechanism, the operation of both the choke valve and fast idle cam have in general followed the same operating pattern.

The present device provides a unique linkage control mechanism which is still controlled by a single temperature responsive member and which permits the normal operation of the fast idle cam when the engine is warming but further which permits the choke valve to be opened independently of and in advance of the come-off of the fast idle cam.

The result of this improved mechanism is that where in the past the choke valve has been maintained in a closet or partially closed position for a distance of two or three miles, the distance through which the fast idle cam must be operated, the present mechanism permits the choke to come off within a fraction of a mile. Further, since an engine is running at approximately ten to twelve times its

normal enrichment when the choke valve is fully closed and progressively less as the engine warms, it is apparent that getting the choke off as soon as possible can result in a considerable fuel saving.

Other objects and advantages of the present invention will be apparent from a perusal of the detailed description which follows.

In the drawings:

Figure 1 is an elevational view of a carburetor showing the present invention;

Figure 2 is a side elevational view of Figure 1; and

Figures 3 through 5 show various stages in the operation of the subject choke valve and fast idle cam control mechanism.

The present invention may be utilized with any carburetor employing a choke valve and fast idle cam which are controlled by a common temperature responsive mechanism. Except insofar as hereinafter described, the carburetor, per se, forms no part of the present invention and may be of any well known type such as that shown in Patent Number 2,771,282, Olson et al.

The carburetor is shown generally at **10** and includes a choke valve **12** and a throttle valve **14** rotatably disposed in an induction passage **16**. Choke valve **12** is of the unbalanced type so as to be opened by the flow of air therepast and is mounted on a shaft **18**. Throttle **14** is of the balanced type and mounted on a shaft **20**.

While any type of temperature responsive mechanism may be employed, an automatic choke device of the type shown in Patent 2,705,484, Jorgensen, has been used for illustrative purposes. The automatic choke mechanism **22** includes a casing **24** suitably mounted on the carburetor float bowl body **26** and disposed vertically intermediate choke valve **12** and the throttle valve **14**.

A shaft **28** is rotatably mounted in casing **24** and includes a lever **30** fixed to one end thereof. Lever **30** includes a laterally projecting portion **32** at one end adapted to coact with the free end of a thermostatic coil element **34**. The other end of coil **34** is grounded to casing **24** through an adjustable cover plate **36**. The other end of lever **30** is suitably articulated to a vacuum piston **38** adapted to modify the actuation of lever **30** by the temperature responsive element **34** as described in the aforementioned Jorgensen patent. A second lever **40** is fixed at the other end of shaft **28** externally of casing **24**.

Referring now to Figure 1, the throttle valve shaft **20** has a lever **42** fixed thereto. The outer or free end of lever **42** has an adjustable screw **44** mounted thereon and which is adapted to coact with a fast idle cam **46** to control the idle position of the throttle valve **14** during cold starting and running conditions. Fast idle cam **46** is pivotally mounted on throttle body **48** through a stud **50**. The fast idle cam includes a stepped cam surface **52** disposed proximate throttle adjusting screw **44** and with which stepped cam surface the screw is adapted to coact to determine the idling speed of the engine when the latter is not fully warm. The steps of cam surface **52** proceed from a high step, with which fast idle screw **44** is cooperating in Figures 1 and 3, to progressively lower steps as the cam moves in a clockwise direction about stud **50** under the influence of gravity.

Inasmuch as the position of fast idle cam **46** is to be varied in accordance with engine temperature, a link **54** is articulated between cam **46** and lever **40** controlled by the temperature responsive mechanism **22**. Lever **42** and screw **44** are normally biased against cam surface **52** by a throttle closing spring, not shown, with sufficient force to inhibit gravity actuation of the cam until the throttle is opened sufficiently to move the screw away from the cam surface. Therefore, in order not to delay or otherwise inhibit opening of the choke valve by lever **40**, link

54 is connected to the fast idle cam through an arcuate slot 56. In this way a lost motion connection is provided between the link and the cam.

The choke valve shaft 18 includes a lever 58 fixed thereon and which is adapted to coact with a second lever 60 loosely mounted on the choke shaft. The loosely mounted lever 60 is bifurcated to provide a pair of circumferentially spaced legs 62 and 64 which respectively terminate in tabs 66 and 68. The loosely mounted lever 60 and the temperature actuated lever 40 are operatively connected by a link 70 articulated therebetween.

With the engine cold the various links and levers will be positioned as shown in Figure 1 in which the tab 66 of lever 60 will engage lever 58 to retain choke valve 12 in a closed position. Under the same circumstances the fast idle cam will be maintained in its uppermost position in which the cold idle adjustment screw 44 abuts against the high step of the cam opening the throttle, Figure 3, to maintain the engine at a relatively high idling speed. As the engine temperature warms it is desired to permit the choke valve to be opened by air flow and also to permit the fast idle cam to present progressively lower cam steps to the cold idle adjustment screw. As already noted, in the past choke valve and fast idle cam operation have been coordinated such that they were operated together. The manner in which the present device will permit choke valve and fast idle cam operation to be split will now be considered in greater detail.

Again referring to the temperature controlled lever 40, particularly as seen in Figure 1, it will be noted that the lever is of a general bell crank configuration. It is also to be noted that the respective links 54 and 70 are articulated to lever 40 at angularly spaced points thereon. While the extent to which such exists depends on the type of correlated action desired with respect to the various levers, in the present modification, the points of articulation of the links 54 and 70 to lever 40 are at slightly different radial distances with respect to the axis of rotation of the latter lever. In this particular instance the radial distance between the axis of rotation of lever 40 and the point of articulation of link 70 to the lever is slightly greater than the corresponding distance with respect to the point of articulation of link 54. It is also to be noted that the points of articulation of links 54 and 70 to lever 40 are laterally offset with respect to a line-of-centers between the axes of rotation of the choke shaft 18 and lever 40.

The manner of articulation and positioning of links 54 and 70 in relation to lever 40 is such as to insure a differential rate of actuation between choke lever 60 and cam 46. The organization of the elements being such that lever 60 is moved at a considerably faster rate during initial engine warming than is cam 46. This relationship is fundamental to assuring rapid choke opening while maintaining the fast idle cam in condition to control engine idling speed until the engine is fully warmed.

In order for choke valve 12 to move from a fully closed to a fully opened position it must be rotated through approximately 70°. Further, it is desired that the 70° actuation of the choke valve take place before the fast idle cam is rendered inoperative to control engine idle speed. Accordingly, it is necessary to achieve the aforenoted differential rate of angular movement between lever 60 and cam 46. In this case the amount of lateral offset of the point of articulation between link 70 and lever 40 is such that when thermostatic coil 34 has warmed sufficiently to cause 35° of opening movement of the lever, that lever 60 and hence leg tang 66 will be moved through 70°. Thus with the engine partially warm choke valve 12 may be moved to a fully opened position. This first 35° of movement of lever 40 may be considered to be the first warming stage of the engine.

While the first 35° of movement of lever 40 will permit gravity to move the fast idle cam 46 to one of the lower steps of the cam, as viewed in Figure 4, the cam will still be operative to increase the engine idling speed above normal idle though to a lesser extent than to when the engine is completely cold. As the engine continues to warm, lever 40 will move through the remaining 35° of movement, or second warming stage, under which circumstance the fast idle cam will be moved to present progressively lower steps to the cold idle screw 44 and finally to permit the cam to descend to an inoperative position relative to the screw permitting the throttle to be moved to its normal idle position as illustrated in Figure 5. Thus, during the first 35° of warming movement of lever 40 both the choke valve and the fast idle cam are controlled by the temperature responsive element 34, however, during the remaining or final 35° of movement element 34 only controls the actuation of the fast idle cam since the choke is already fully open or inoperative.

In order to prevent unnecessary movement of the fast idle cam beyond the point at which it becomes inoperative to control throttle valve 12, the tang 63 on leg 64 of lever 60 engages lever 58 which stops further rotation of lever 40, link 54 and fast idle cam 46.

It is apparent that structural variations in the illustrated embodiment of the subject device are possible within the scope of the hereinafter appended claims.

I claim:

1. A charge forming device for an internal combustion engine comprising an air intake passage, a choke valve, a throttle valve, a cam device for controlling the idling position of the throttle valve, an engine temperature responsive device, first linkage means operatively connecting said cam device and said temperature responsive device to permit the throttle to be moved from a partially opened to a closed position as engine temperature increases, and second linkage means operatively connecting the temperature responsive device and the choke valve to permit the choke valve to open as engine temperature increases, said first and second linkage means cooperating with the temperature responsive device to permit the choke valve to be fully opened before the throttle valve is closed during idling conditions.

2. A charge forming device for an internal combustion engine comprising an air intake passage, a choke valve, a throttle valve, a cam device for controlling the idling position of said throttle valve, a first lever fixed to the choke shaft, a second lever mounted on said choke shaft for relative movement thereto, an engine temperature responsive element, a lever operatively connected to said element, a first link means operatively connecting said temperature actuated lever to said idle cam, second linkage means operatively connecting said temperature responsive lever with said second lever, said second lever being adapted to coact with said first lever to limit the opening movement of said choke valve in accordance with engine temperature, a lost motion connection intermediate said first link means and said cam to permit said temperature responsive lever to actuate said second lever without causing actuation of said cam member, said temperature responsive lever and said second lever being so arranged that said temperature responsive lever is operative only during a part of the operation thereof to limit the opening movement of said choke valve, the operation of said cam member being limited at all times by the position of said temperature responsive lever.

3. A charge forming device as set forth in claim 1 in which the first linkage means includes a lost motion connection permitting limited movement of the temperature responsive device relative to the cam device.

4. A charge forming device is as set forth in claim 1 in which the choke valve is unbalanced and the second linkage means includes a first lever fixed for movement with the choke valve, and a second lever mounted for relative movement with respect to the choke valve, said second lever being adapted to engage with and limit the

choke opening movement of said first lever, said second lever being connected to the temperature responsive device.

5. A charge forming device as set forth in claim 4 in which said second lever includes a first stop adapted to coact with said first lever to limit the opening movement of said choke valve, and a second stop adapted to coact with said first lever after the choke valve is fully opened to render the temperature responsive device inoperative.

6. A charge forming device for an internal combustion engine comprising an air intake passage, a choke valve, a throttle valve, a cam device for controlling the idling position of the throttle valve, an engine temperature responsive device, first linkage means operatively connecting said cam device and said temperature responsive device to permit the throttle to be moved from a partially opened to a closed position as engine temperature increases, and second linkage means operatively connecting the temperature responsive device and the choke valve to permit the choke valve to open as engine temperature increases, said temperature responsive device including two stage operation when the engine is warming, the temperature responsive device coacting during the first warming stage with the first and second linkage means to limit both the opening of the choke valve and closing of the throttle valve, the temperature responsive device coacting during the second warming stage with only the first linkage means to limit the closing of the throttle valve.

7. A charge forming device as set forth in claim 6 in which the choke valve is unbalanced and is adapted to be fully opened at the end of the first warming stage of the temperature responsive device.

8. A charge forming device for an internal combustion engine comprising an air intake passage, a choke valve, a throttle valve, a cam device for controlling the idling position of said throttle valve, a first lever fixed to the choke shaft, a second lever mounted on said choke shaft for relative movement thereto, an engine temperature responsive element, a lever operatively connected to said element, a first link means operatively connecting said temperature actuated lever to said idle cam, second linkage means operatively connecting said temperature responsive lever with said second lever, said second lever being adapted to coact with said first lever to limit the opening movement of said choke valve in accordance with engine temperature, a lost motion connection intermediate said first link means and said cam to permit said temperature responsive lever to actuate said second lever without causing actuation of said cam member, the first and second linkage means being respectively connected to the cam device and the second choke shaft lever so that the temperature responsive lever differentially controls the opening rate of the choke valve and the closing rate of the throttle valve as the temperature responsive element warms.

9. A charge forming device for an internal combustion engine comprising an air intake passage, a choke valve, a throttle valve, a cam device for controlling the idling position of said throttle valve, a first lever fixed to the choke shaft, a second lever mounted on said choke shaft for relative movement thereto, an engine temperature responsive element, a lever mounted on a fixed pivot, said lever operatively connected to said element for rotation about said pivot, said lever being rotatable between first and second positions respectively representing a cold and a warm engine, a first link means operatively connecting said temperature actuated lever to said idle cam, second linkage means operatively connecting said temperature responsive lever with said second lever, said second lever being adapted to coact with said first lever to limit the opening movement of said choke valve in accordance with engine temperature, said second linkage means being connected to the second choke shaft lever and the temperature responsive lever such that the choke valve may be fully opened when the latter lever reaches a position intermediate its first and second positions.

10. A charge forming device for an internal combustion engine comprising an air intake passage, a choke valve, a throttle valve, a cam device for controlling the idling position of said throttle valve, a first lever fixed to the choke shaft, a second lever mounted on said choke shaft for relative movement thereto, an engine temperature responsive element, a lever mounted on a fixed pivot, said lever operatively connected to said element for rotation about said pivot, said lever being rotatable between first and second positions respectively representing a cold and a warm engine, a first link means operatively connecting said temperature actuated lever to said idle cam, second linkage means operatively connecting said tempertaure responsive lever with said second lever, said second lever being adapted to coact with said first lever to limit the opening movement of said choke valve in accordance with engine temperature, said second linkage means being connected to the second choke shaft lever and the temperature responsive lever such that the choke valve may be fully opened when the latter lever reaches a position intermediate its first and second positions, a lost motion connection intermediate said first link means and said cam to permit said temperature responsive lever to limitedly actuate said second lever without causing actuation of said cam member.

11. A charge forming device as set forth in claim 9 in which the first linkage means is connected to the cam device and the temperature responsive lever such that the temperature responsive element is adapted to limit the closing of the throttle valve for a limited interval after the choke is fully opened.

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