Aug. 2, 1966 P. E. BRAUN ET AL 3,263,972

AUTOMATIC CHOKE MECHANISM

Filed June 20, 1963 4 Sheets-Sheet 1

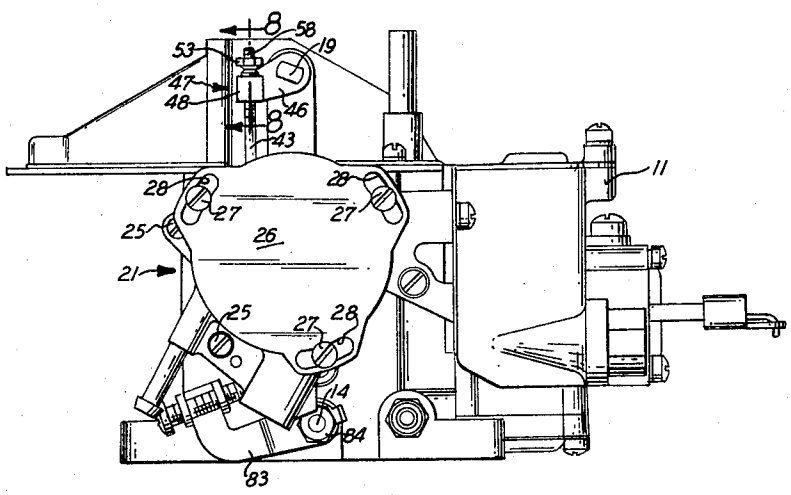


FIG. 1

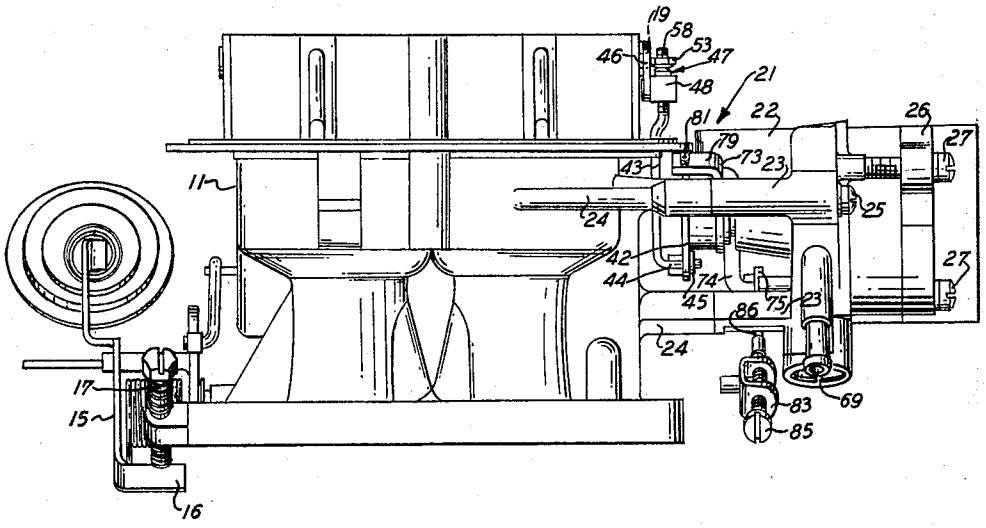


FIG. 2

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AUTOMATIC CHOKE MECHANISM

Filed June 20, 1963 4 Sheets-Sheet 2

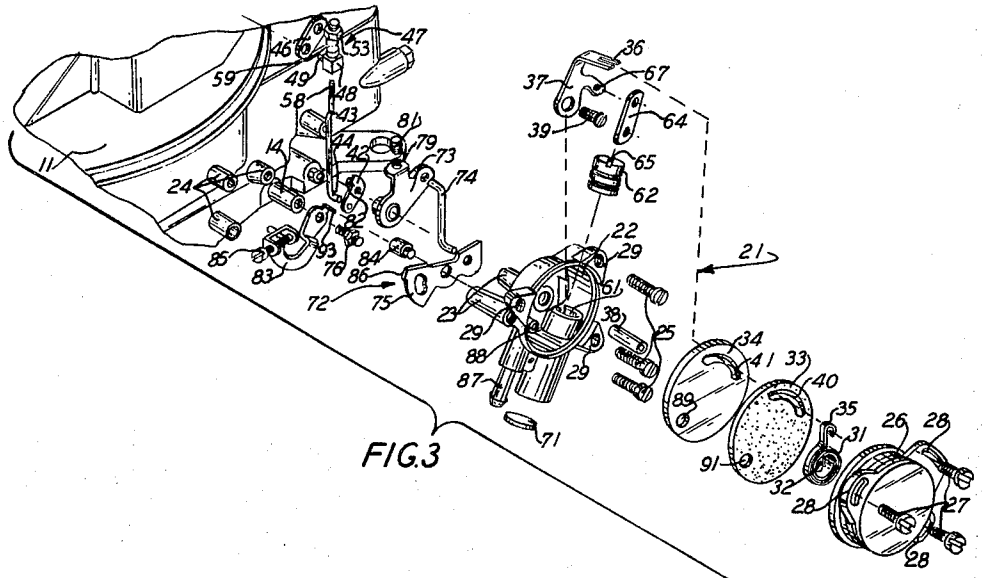


FIG.3

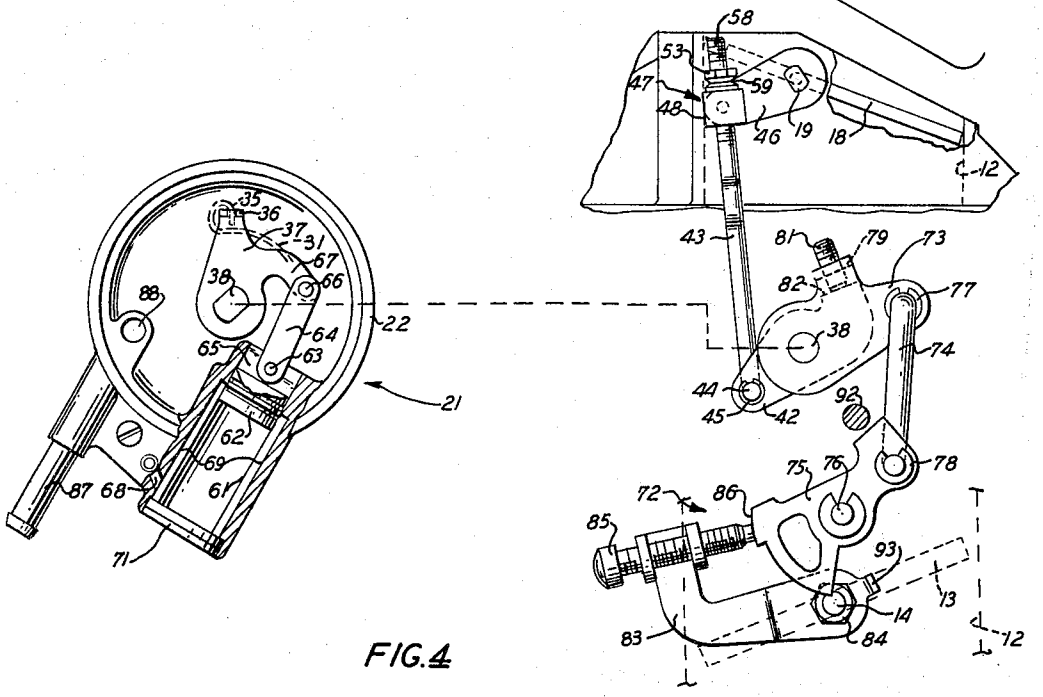


FIG.4

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AUTOMATIC CHOKE MECHANISM

Filed June 20, 1963 4 Sheets-Sheet 3

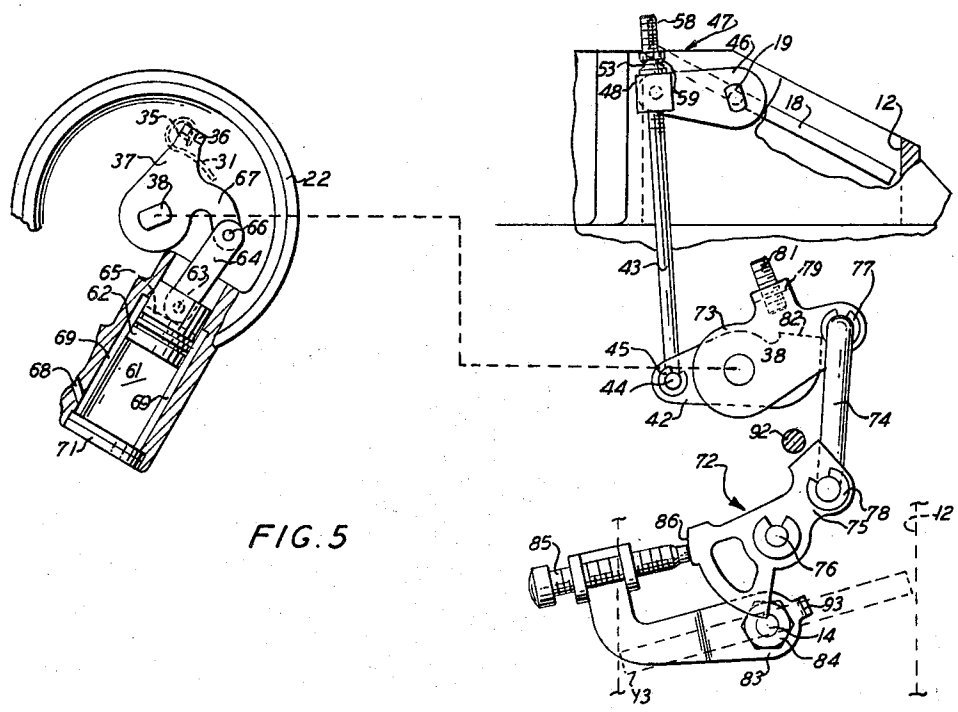


FIG. 5

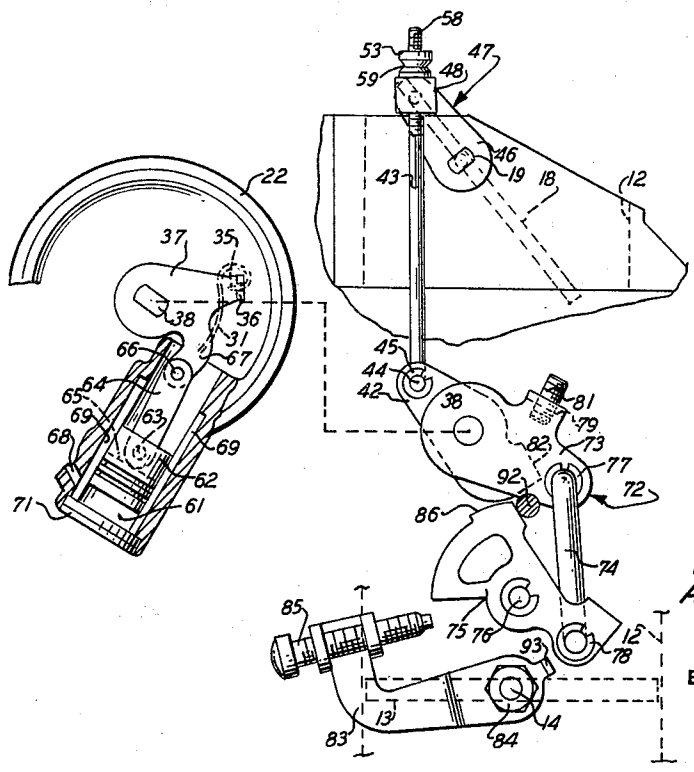


FIG. 6

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AUTOMATIC CHOKE MECHANISM

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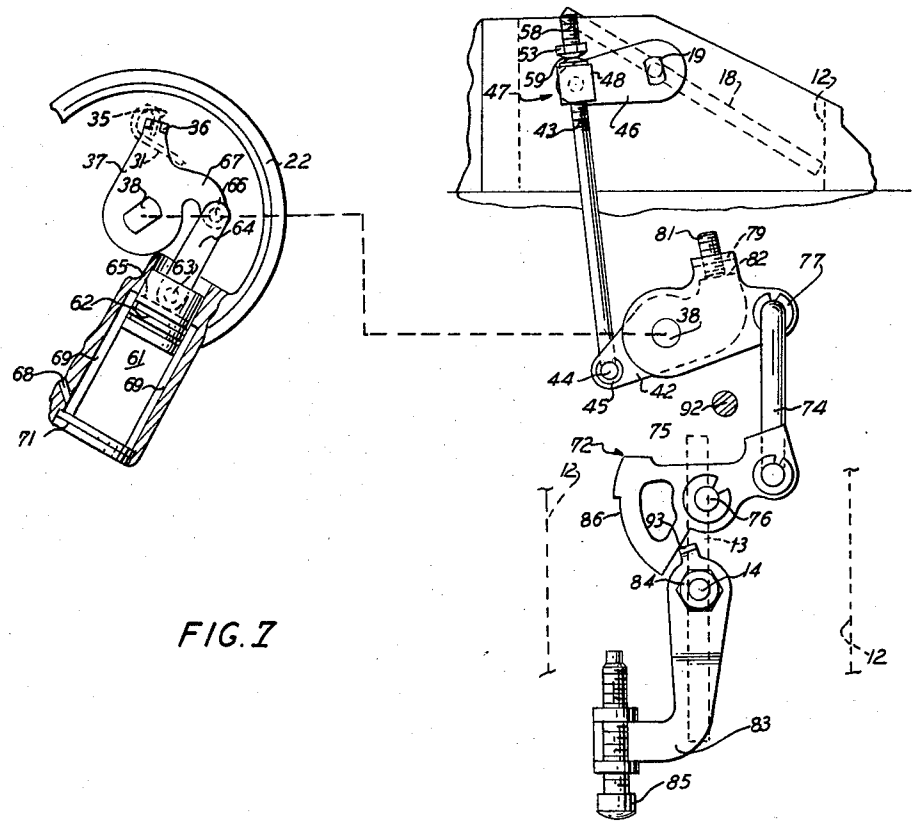


FIG. 1

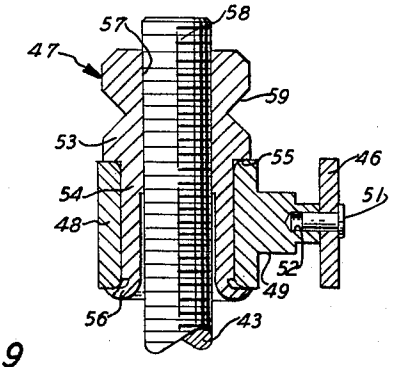


FIG. 9

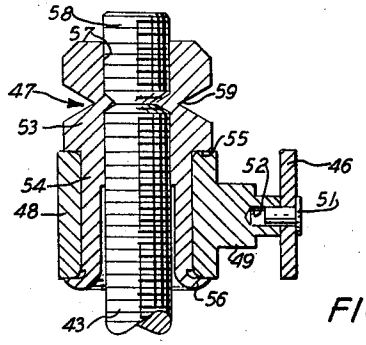


FIG. 8

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United States Patent Office 3,263,972 Patented August 2, 1966

3,263,972

AUTOMATIC CHOKE MECHANISM

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Filed June 20, 1963, Ser. No. 289,258
6 Claims. (Cl. 261—39)

This invention relates to an automatic choke mechanism for an internal combustion engine carburetor and more particularly to an adjustable linkage for an automatic choke mechanism.

The thermally responsive element of a conventional automatic choke mechanism positions both a choke valve and a fast idle mechanism. The fast idle mechanism increases the engine idle speed during the initial stage of warm up to prevent stalling. It is desirable to provide for adjustment of the choke valve and fast idle mechanism relative to the thermally responsive element to compensate for production variations and differing engine requirements. Adjustment of the choke valve is particularly required when the choke mechanism employs a suction motor to partially open the choke valve when a cold engine first commences to run. The adjustment is necessary to calibrate the degree of choke valve opening or "pull down" effected by the suction motor.

Automatic choke mechanisms previously known frequently have not permitted the fast idle mechanism and the degree of choke valve "pull down" to be independently adjusted. In addition it was often necessary to permanently deform a portion or portions of the choke linkage to produce the desired adjustments. Deformation of the linkage could only be accomplished through the use of special tools and did not permit the exacting degree of adjustment required.

It is therefore the principal object of this invention to provide an automatic choke mechanism in which independent adjustment of the choke valve and fast idle mechanism with respect to the thermally responsive element is possible.

It is a further object of this invention to provide a simplified choke linkage adjustment mechanism that permits delicate adjustments to be made.

A carburetor embodying this invention comprises an induction passage containing throttle and choke valves. A temperature responsive element is connected to the choke valve by an adjustable length link to actuate the choke valve in response to temperature variations. A lever rotatable with the throttle valve is adapted to engage a fast idle cam to establish a fast idle position for the throttle valve. The fast idle cam is adjustably connected to the temperature responsive element.

Further objects and advantages of this invention will become more apparent when considered in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a side elevational view of an internal combustion engine carburetor incorporating this invention.

FIGURE 2 is a front elevational view of the carburetor shown in FIGURE 1;

FIGURE 3 is an exploded view showing the automatic choke mechanism incorporated in the carburetor.

FIGURES 4–7 are partially exploded side elevational views of the choke mechanism, with portions shown in cross section, illustrating the sequence of operation.

FIGURE 4 shows the mechanism during cranking of a cold engine.

FIGURE 5 shows the position of the mechanism immediately after the engine has started.

FIGURE 6 shows the choke mechanism as it appears when the engine approaches its operating temperature.

FIGURE 7 illustrates a position the mechanism may take to permit manual opening of the choke valve to start a flooded engine.

FIGURE 8 is a cross sectional view taken along line 8—8 of FIGURE 1.

FIGURE 9 is a cross sectional view in part similar to FIGURE 8 showing the elements prior to final adjustment.

Referring now in detail to the drawings, a carburetor is indicated generally by the reference numeral **11**. Formed within the carburetor **11** is at least one induction passage **12**. A throttle valve **13** is rotatably supported in the induction passage **12** upon a throttle valve shaft **14**. The throttle valve shaft **14** extends from each side of the carburetor **11** and one side is connected through throttle linkage **15** to an accelerator mechanism to permit adjustment of the speed of the associated engine (not shown). An inturned tang **16** of the throttle linkage **15** contacts an adjustable screw **17** to establish a normal engine idle speed.

Positioned in the induction passage **12** anterior to the throttle valve **13** is a choke valve **18**. The choke valve **18** is rotatably supported upon a choke valve shaft **19** that extends outwardly at one side of the carburetor **11**. The choke valve **18** is rotatably positioned in the induction passage **12** in response to temperature variations by an automatic choke mechanism indicated generally at **21**.

The automatic choke mechanism **21** includes a choke housing **22** having a plurality of inwardly extending, apertured bosses **23**. Outwardly extending bosses **24** formed upon the carburetor **11** are tapped to receive bolts **25** that extend through the apertured bosses **23** to secure the choke housing **22** to the carburetor **11**. A cover plate **26** encloses the choke housing **22** and is secured thereto by a plurality of bolts **27** that pass through elongated apertures **28** in the choke housing cover **25**. The bolts **27** are threaded into tapped holes **29** formed around the periphery of the choke housing **22**.

A coiled thermally responsive spring **31** is contained within the cover plate **26** and has its inner end **32** affixed thereto. The thermally responsive spring **31** is insulated from the interior of the choke housing **22** by a composition disc **33** and steel disc **34** that are interposed between the cover plate **26** and the choke housing **22**.

The outer end **35** of the thermally responsive spring **31** is affixed to a bifurcated arm **36** of a choke actuating lever **37**. The choke actuating lever **37** is affixed by a screw **39** to a choke actuating shaft **38** that is journaled in the choke housing **22**. The bifurcated arm **36** extends through arcuate slots **40** and **41** formed in the composition and steel discs **33** and **34**, respectively.

The choke actuating shaft **38** extends inwardly toward the carburetor **11** and has a lever **42** affixed to its inner end. A link **43** has an outturned end **44** that extends through an aperture in the lever **42**. The outturned end **44** of the link **43** is retained in the aperture by a snap ring **45** to permit the transmission of motion from the lever **42** to the link **43**. The upper end of the link **43** is pivotally connected to a lever **46** that is affixed for rotation with the choke shaft **19** by an adjustable swivel mechanism indicated generally at **47**.

The adjustable swivel mechanism **47**, which is shown in greater detail in FIGURES 8 and 9, permits the relative positions of the choke valve **18** and choke actuating shaft **38** to be adjusted. The adjustable swivel mechanism **47** includes a first generally cylindrical shaped element **48** having an inwardly extending boss **49**. A headed rivet **51** extends through an aperture formed in the lever **46** and is fixed in an aperture **52** formed in the inwardly extending boss **49**. The rivet **51** pivotally connects the lever **46** to the element **48**.

A second element **53** of the adjustable swivel mechanism **47** has a cylindrical portion **54** that extends through

and is journaled in the internal bore of the first element **48**. The second element **53** is axially fixed with respect to the first element **48** by the contact of a shoulder **55** with the upper surface of the e'ement **48** and the contact of an overturned flange **56** with the lower surface of the element **48**. The second element **53** is internally threaded, as at **57**, to cooperate with threads **58** formed on the upper end of the link **43**.

The relative positions of the choke valve **18** and choke actuating shaft **38** may be adjusted by rotating the internally threaded element **53**. Rotation of the element **53** causes the adjustable swivel mechanism **47** to move axially along the link **43** to adjust the effective length of the link **43**. Once the desired relative positions of the choke valve **18** and choke actuating shaft **38** are obtained, the adjustable swivel **47** may be rigidly fixed upon the link **43**. For this purpose, a groove **59** is formed around the periphery of the element **43** adjacent its internal threads **57**. By engaging a tool with the groove **59** and compressing the element **53**, the threads **57** are deformed (FIGURE 8) to fix the adjustable swivel mechanism **47** in position. By staking the adjustable swivel mechanism **47** to the link **43**, play is eliminated from the choke actuating linkage. The adjustment of the effective length of the link **43** also determines the degree of the vacuum pull down of the choke valve **18** effected by the suction motor now to be described.

The choke housing **22** is formed with a cylindrical bore **61** that slidably receives a vacuum actuated piston **62**. The piston **62** is pivotally connected by a pin **63** to a link **64**. The piston **62** is transversely slotted, as at **65**, to provide clearance for the link **64**. The upper end of the link **64** is pivotally connected by a pin **66** to an extending arm **67** of the choke actuating lever **37**.

The cylindrical bore **61** is exposed to engine intake manifold vacuum by means of a port **68** that opens into one of the longitudinal grooves **69** formed at each side of the bore **61**. The port **68** extends through one of the choke housing bosses **23** and carburetor bosses **24** to a point in the induction passage **12** below the throttle valve **13**. The lower end of the cylindrical bore **61** is closed by a disc **71**. The intake manifold vacuum acting on the head of the piston **62** modulates the position of the choke valve **18** in the manner which will be described as this description proceeds.

The thermally responsive spring **31** is also adapted to provide an increased engine idle speed during the initial stage of engine warm up by means of the fast idle mechanism indicated generally at **72**. The fast idle mechanism **72** comprises a lever **73** that is rotatably journaled on the choke actuating shaft **38** between the lever **42** and the choke housing **22**. A link **74** transmits motion between the lever **73** and a fast idle cam **75** that is pivotally journaled upon the carburetor **11** by a pin **76**. The link **74** is fixed relative to the lever **73** and the fast idle cam **75** by snap rings **77** and **78**, respectively. The lever **73** has an inturned tang **79** through which is threaded an adjustable screw **81**. The adjustable screw **81** is adapted to abut at times an upper surface **82** of the lever **42**. A lever **83** is affixed to the outwardly extending side of the throttle valve shaft **14** adjacent the automatic choke mechanism **21** by a nut **84**. An adjustable screw **85** is threaded through the lever **83** and is adapted to engage the stepped cam surface **86** formed on the fast idle cam **75**. Adjustment of the screw **81** permits variation in the position of the fast idle cam **75** with respect to the choke actuating shaft **38**.

Operation

When the engine has been standing for a long duration under low ambient temperatures, the automatic choke mechanism **21** is permitted to appropriately position the choke valve **18** by opening the throttle valve **13**. Opening of the throttle valve **13** permits the linkage to move free of interference from the fast idle mechanism **72**. If the temperature is sufficiently low, the thermally responsive spring **31** will rotate the choke actuating lever **37** and choke actuating shaft **38** in a counterclockwise direction an amount sufficient to fully close the choke valve **18** (FIGURE 4). The contact of the upper surface **82** of lever **42** with the adjustable screw **81** also causes the lever **73** to be rotated in a counterclockwise direction. This motion is transmitted through the link **74** to the fast idle cam **75**. When the throttle valve **13** is closed, the adjustable screw **85** will contact the high portion of the cam surface **86** on the fast idle cam **75** to cause the throttle valve **13** to be held in a more fully opened position than the normal idle speed.

The linkage remains in the position shown in FIGURE 4 during cranking of the cold engine. During this time the intake manifold vacuum exerted through the port **68** below the piston **62** is insufficient to have any effect on the position of the choke actuating shaft **38**. When the engine commences to run, however, the intake manifold vacuum increases significantly. The increase in vacuum exerted in the cylindrical bore **61** causes the piston **62** to be drawn downwardly and rotate the choke actuating lever **37** in a clockwise direction (FIGURE 5). This motion opens the choke valve **18** slightly to permit sufficient air flow through the induction passage **12** for sustained engine operation. The opening of the choke valve **18** may also be assisted by unbalancing the choke valve **18** upon choke valve shaft **19**.

The degree of movement of the piston **62** is limited by registry of the transverse slot **65** in the piston **62** with the longitudinal grooves **69** formed in the cylinder **61**. When this happens, a vacuum bleed will occur past the piston **62** and further downward movement of the piston can only occur upon a significant increase in manifold vacuum.

The vacuum bleed occurring past the piston **62** is utilized to draw heated air into the choke housing **22** for heating the thermally responsive spring **31** in response to engine operation. Air heated by an exhaust manifold stove (not shown) is drawn through an inlet tube **87** formed integrally with the choke housing **22**. The inlet tube is ported through a conduit **88** into the choke housing. The conduit **88** registers with apertures **89** and **91** formed in the steel and composition discs **34** and **33**, respectively. The heated air is drawn from the exhaust stove through the inlet tube **87** and conduit **88** into the choke housing cover **26**. The heated air passes across a thermally responsive spring **31** and passes through the slotted apertures **39** and **41** into the choke housing **22**. From the choke housing **22** the heated air bypasses the piston **62** and is discharged into the induction system of the engine through the port **68**.

As the thermally responsive spring **31** is heated in response to engine operation, its tension decreases and the choke actuating lever **37** and choke actuating shaft **38** are rotated in a clockwise direction. The clockwise rotation of the choke actuating shaft **37** is transmitted through the lever **42** and link **43** to the choke valve **18** (FIGURE 6).

The lever **73**, link **74** and fast idle cam **75** are unbalanced so that gravity tends to rotate the fast idle cam **75** in a clockwise direction. The clockwise rotation is limited by the contact of the adjustable screw **81** with the upper surface **82** of the lever **42**. A fast idle speed is not required after the initial stage of engine warm up and, accordingly, the fast idle cam **75** is permitted to rotate free from contact with the adjustable screw **85**. The rotation of the fast idle cam **75** is limited by contact of the fast idle cam **75** with an inwardly extending boss **92** formed on the choke housing **22**. The choke actuating mechanism may continue to rotate, however. Continued opening of the choke valve **18** causes the lever **42** to move away from the adjustable screw **81** (FIGURE 6).

If the engine is stopped, the thermally responsive element will cool and cause the choke valve **18** to rotate toward a closed position. Continued rotation will even-

tually cause the lever 42 to again contact the adjustable screw 81 and actuate the fast idle cam 75. The time of actuation may be varied by adjustment of the screw 81.

It is possible that, due to improper starting procedure, the cold engine may be flooded. Provision is made, therefore, for manual opening of the otherwise closed choke valve 18 to permit unflooding and starting of the engine. For this purpose, the lever 83 is formed with an outwardly extending tang 93. By rotating the throttle valve 13 into a fully opened position (FIGURE 7), the tang 93 is brought into abutment with the fast idle cam 75. The contact causes the fast idle cam 75 to be rotated in a clockwise direction and this motion is transmitted through the link 74 to the lever 73. The clockwise rotation of the lever 73 is transmitted through the adjustable screw 81 to clockwise rotation of the lever 42 to open the choke valve 18 slightly and permit starting.

It is to be understood that various changes and modifications may be made from the described, preferred embodiment of the invention without departing from the spirit and scope of the invention as defined by the appended claims.

We claim:

1. A carburetor for an internal combustion engine comprising an induction passage, a throttle valve and a choke valve rotatably supported in said induction passage, a temperature responsive element, an adjustable length link operably connecting said temperature responsive element to said choke valve for moving said choke valve between an opened and a closed position in response to temperature changes, a lever rotatable with said throttle valve, a fast idle cam adapted to be engaged by said lever to establish a fast idle position for said throttle valve, and an operative connection between said temperature responsive element and said fast idle cam for positioning said fast idle cam to be engaged by said lever at low temperatures, said last named operative connection comprising an adjustable abutment screw to permit adjustment of the relative positions of said temperature responsive element and said fast idle cam independent of adjustment of the relative positions of said temperature responsive element and said choke valve.

2. A carburetor for an internal combustion engine comprising an induction passage, a throttle valve rotatably supported in said induction passage, a choke valve rotatably supported in said induction passage anterior to said throttle valve, a temperature responsive element, a first lever connected to said temperature responsive element for movement in response to temperature variations, an adjustable length link operatively connecting said first lever to said choke valve, a second lever having an adjustable lost motion connection with said link, said lost motion connection being adjustable independently of said adjustable length link, said connection including adjustable screw means, a fast idle cam positioned by said second lever, and a third lever operatively connected to said throttle valve, said third lever being adapted to engage said fast idle cam at low temperatures to establish a fast idle position for said throttle valve.

3. A carburetor for an internal combustion engine comprising an induction passage, a throttle valve, a choke valve rotatably supported in said induction passage upon

a choke valve shaft, a temperature responsive element, a first lever operatively connected to said temperature responsive element for movement in response to temperature variations, a second lever fixed for rotation with said choke valve shaft, a link having pivotal connections with said levers for transmitting motion between said temperature responsive element and said choke valve, at least one of said pivotal connections comprising a first element pivotally connected to the lever and a second element rotatable with respect to said first element, said first and second elements being connected for simultaneous axial movement, said second element having a threaded connection with said link for adjustment of the axial position of said elements upon said link, a third lever in adjustable abutment with said first lever, and a fast idle cam positioned by said third lever, said cam positioning said throttle valve to establish a fast idle position.

4. A carburetor as defined by claim 3 wherein said second element is permanently deformable to permit it to be locked in its adjusted position upon the link.

5. A carburetor for an internal combustion engine comprising an induction passage, a throttle valve rotatably supported upon a throttle valve shaft in said induction passage, a choke valve rotatably supported upon a choke valve shaft in said induction passage anterior to said throttle valve, a temperature responsive element, a first lever rotatably positioned by said temperature responsive element in response to temperature variations, a second lever fixed for rotation with said choke valve shaft, a link pivotally connected to said first and second levers for positioning said choke valve in response to temperature variations, a fast idle cam pivoted with respect to said carburetor, a third lever pivoted with respect to said carburetor and having an adjustable abutment adapted to contact said first lever, a second link pivotally connected to said fast idle cam and said third lever, said fast idle cam, said second link and said third lever being unbalanced for pivotal movement to bring said adjustable abutment into engagement with said first lever when the choke valve is in a closed position, and a fourth lever fixed for rotation with said throttle valve shaft and having an adjustable abutment adapted to engage said fast idle cam to establish a fast idle position for said throttle valve under low ambient temperatures.

6. A carburetor as defined by claim 5 wherein one of the pivotal connections between said first link and said first and second levers is adjustable to change the relationship between said first lever and said choke valve.

References Cited by the Examiner

UNITED STATES PATENTS

2,124,778	7/1938	Hunt	261—52 X
2,136,353	11/1938	Weber	261—52
2,555,124	5/1951	Gothberg	74—586 X
2,747,848	5/1956	Kehoe	261—52
3,151,189	9/1964	McSeveny	261—39

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