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[54] **CARBURETOR WITH POWER CHOKE**

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[52] **U.S. Cl.** ..... **261/23 A,** 261/39 A, 261/52

[51] **Int. Cl.** **F02m 1/12**

[58] **Field of Search** ..... 261/23 A, 39 A, 52

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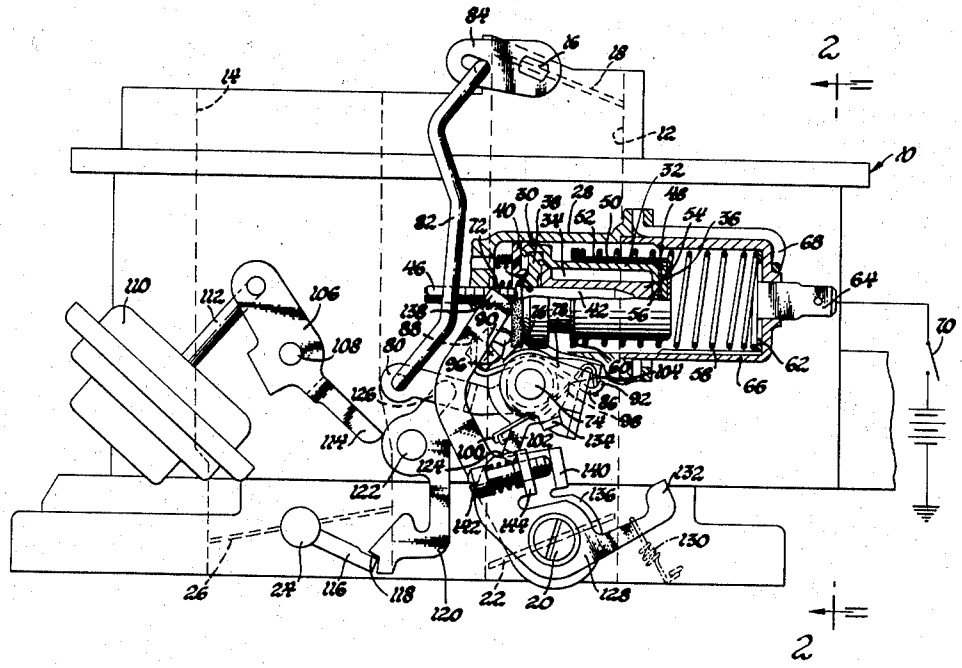
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[57] **ABSTRACT**

A multiple stage internal combustion engine carburetor has an electrically heated power element which positions a fast idle lever to control engine idle speed and which positions a power element lever that acts through a spring operated intermediate lever to position the choke valve. A vacuum break mechanism and a wide open kick tang on a primary throttle lever act on the intermediate lever to open the choke, and a secondary throttle lockout lever is actuated by the power element lever.

7 Claims, 2 Drawing Figures



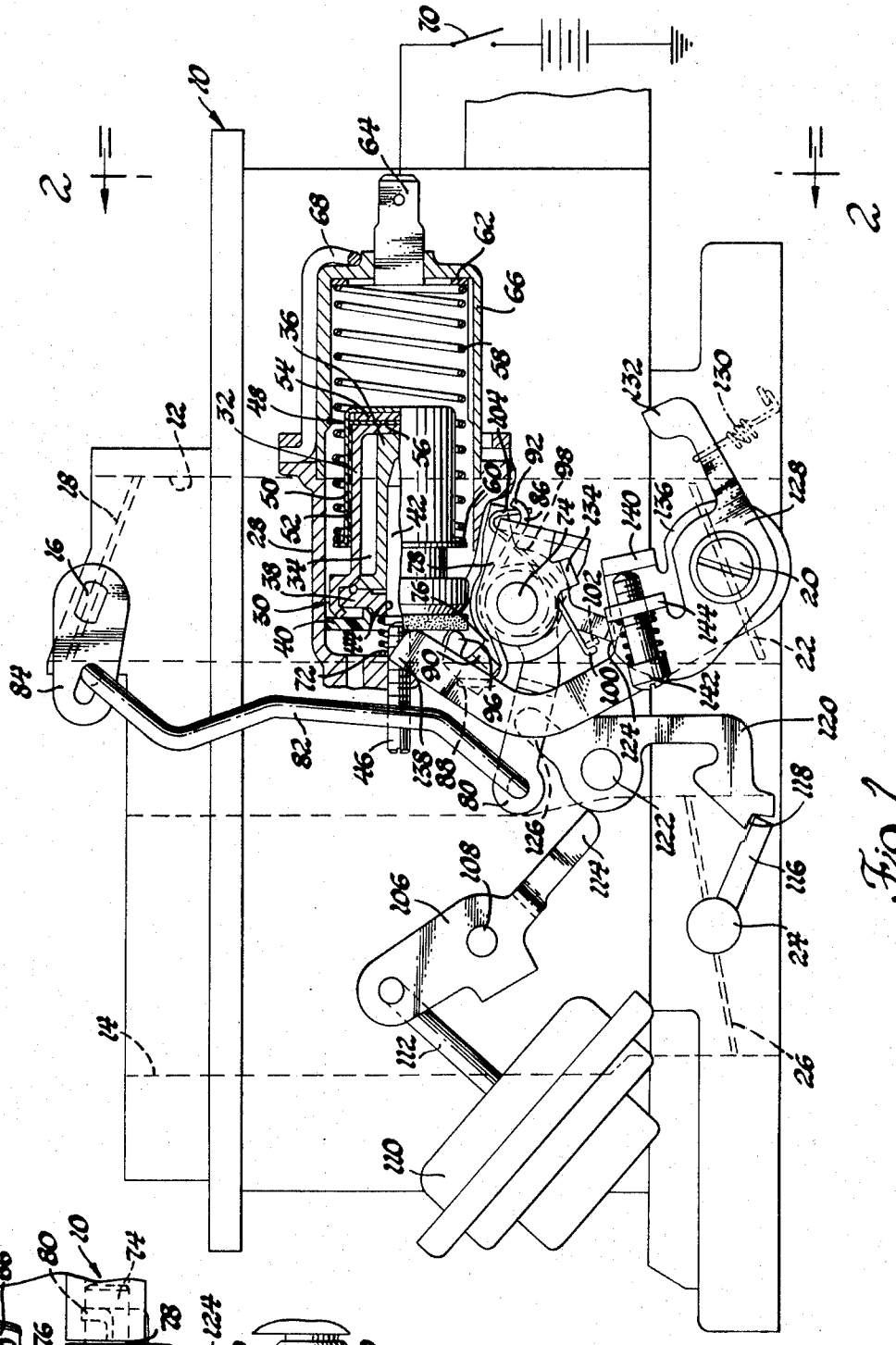


Fig. 1

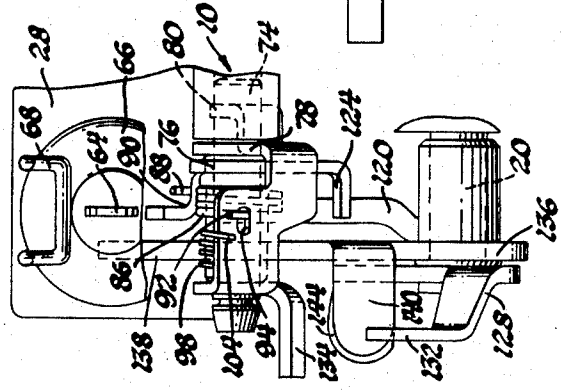


Fig. 2

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CARBURETOR WITH POWER CHOKE

This invention relates to a mechanism for controlling the position of choke and throttle valves in an internal combustion engine carburetor. More particularly, it is directed to a mechanism in which a power element, particularly one heated electrically, controls the positions of a plurality of levers in a compact arrangement that incorporates all the functions provided by conventional automatic choke mechanisms which are operated by a coiled bimetallic strip responsive to engine temperatures.

The details as well as other objects and advantages of this invention are set forth below and shown in the drawings in which:

FIG. 1 is a side elevational view of a carburetor equipped with this power choke mechanism, portions being broken away to show details of the power element construction; and

FIG. 2 is an end view of the power choke mechanism taken generally as indicated along line 2—2 of FIG. 1.

Referring to the drawings, a carburetor **10** has one or more primary mixture conduits **12** and one or more secondary mixture conduits **14.** A choke shaft **16** is rotatably disposed in primary mixture conduit **12,** and a round choke valve blade **18** is secured on choke shaft **16** to control air flow into primary mixture conduit **12.**

A primary throttle shaft **20** also is rotatably disposed in primary mixture conduit **12,** and a primary throttle valve blade **22** is secured on primary throttle shaft **20** to control air and fuel flow from primary mixture conduit **12.** Similarly, a secondary throttle shaft **24** is rotatably disposed in secondary mixture conduit **14,** and a secondary throttle valve blade **26** is secured on secondary throttle shaft **24** to control air and fuel flow from secondary mixture conduit **14.**

An enclosure **28,** which is either a portion of the fuel bowl section casting or a separate casting secured thereto, contains a power element **30.** Power element **30** includes a cup **32** containing a mass of thermally expansible material **34,** such as wax or oil, which is enclosed by a seal **36.** A backing member **38** retains seal **36** within cup **32** and closes the open end of cup **32.** If desired, backing member **38** may include a plastic bearing surface member **40** for the purposes which will be evident below.

A plunger **42** extends through an opening **44** in backing member **38** and is received by seal **36.** Upon thermal expansion of material **34,** backing member **38** and cup member **30** are axially displaced with respect to plunger **42,** plunger **42** remaining immobile due to its abutment with adjusting screw **46** threadedly received by enclosure casting **28.**

Power element **30** is received in a heater assembly **48.** Heater assembly **48** includes a cupped aluminum housing **50** spaced from the sides of power element cup **32** by a sleeve **52** of Mylar which thermally and electrically insulates the sides of cup **32.** The bottom of cup **50** contains a copper disc **54** and a sintered barium titanate heating disc **56.** Cup **50** and thus disc **56** are biased against cup **32** of power element **30,** and thus power element assembly **30** is biased leftwardly, by a spring **58** which seats between a flange **60** on cupped housing **50** and an annular portion **62** of an electrical terminal **64.** Terminal **64** is secured in place, and power element assembly **30** and heater assembly **48** are enclosed within enclosure **28,** by a cover **66** retained by a bail **68.**

Upon closure of the ignition, oil pressure or the like switch **70,** current is provided through terminal **64,** spring **58,** cupped housing **50,** copper and barium titanate discs **54** and **56,** power element cup **32,** backing member **38,** and a light spring **72** to enclosure casting as which is grounded through the engine block. Current flow through disc **56** increases its temperature and causes it to heat power element **30.** Disc **56** has a resistance of perhaps 25 ohms at 77° F., which resistance increases only gradually until the temperature approaches 250° F. and increases very rapidly above 250° F. Thus heat is provided to power element **30** until the temperature of disc **56** reaches about 250° F., and thereafter the current passing through disc **56** is only sufficient to maintain a temperature of about 250° F. A period of perhaps 4 minutes may be required for the temperature to increase from 0° to 250° F. Over that temperature range, the material **34** will expand sufficiently to displace cup **32** and backing member **38** less than approximately one-half inch with respect to plunger **42.**

An intermediate shaft **74** is secured against rotation in carburetor **10,** and a power element lever **76** and an intermediate lever **78** are journalled on intermediate shaft **74.** Intermediate lever **78** has an arm **80** connected by a link **82** to a lever **84** secured to choke shaft **16** whereby clockwise movement of intermediate lever **78** causes opening movement of choke valve **18.** A choke closing torsion spring **86** is wound about intermediate shaft **74** and has one end **88** hooked over an arm **90** of power element lever **76** with the opposite end **92** hooked through a slot **94** in intermediate lever **78.** Torsion spring **86** biases power element lever **76** counterclockwise to cause a tang **96** on arm **90** to engage the plastic bearing portion **40** of backing member **38** and biases intermediate lever **78** counterclockwise to close choke valve **18.** It will be noted that during decreasing temperatures, with the concomitant contraction of thermally expansible material **34,** spring **58** will cause leftward movement of power element assembly **30** and counterclockwise movement of power element lever **76** to increase the choke closing force of torsion spring **86.**

A second torsion spring **98** also is wound about intermediate shaft **74** and has one end **100** hooked over a stationary abutment, here indicated for example as at **102,** while the other end **104** is hooked over intermediate lever **78.** Torsion spring **98** thereby exerts a light force on intermediate lever **78** tending to open choke **18.** Actually, however, the force exerted by torsion spring **98** is insufficient to overcome the force of either torsion spring **86** or power element spring **58.** Thus torsion spring **98** effectively only acts through intermediate lever **70** and torsion spring **86** to bias power element lever **76** against bearing plate portion **40** of power element backing member **38.**

It will be appreciated, therefore, that upon increasing temperatures, power element cup **32** and backing member **38** will move toward the right against the bias of spring **58,** power element lever **76** will rotate clockwise, tending to relax the choke closing force of torsion spring **86,** thereby permitting clockwise movement of intermediate lever **78** to allow opening movement of choke valve **18.**

A vacuum break lever **106** is journalled on a vacuum break shaft **108** secured in carburetor **10.** A vacuum break unit **110,** acting through a link **112,** causes coun-

terclockwise movement of vacuum break lever **106**, and a tang **114** on vacuum break lever **106** engages either arm **80** of intermediate lever **78** or a turned end of link **82** to cause opening movement of choke valve **18**.

Secondary throttle shaft **24** has a pin **116** which engages in a notch **118** of a secondary throttle lockout lever **120** journalled on a lockout shaft **122** secured in carburetor **10**. In the position shown, engagement of pin **116** in notch **118** prevents opening movement of secondary throttle valve **26**. As power element cup **32** and backing member **38** move rightwardly to the fully warmed position, clockwise rotation of power element lever **76** brings a tang **124** thereof into engagement with a tang **126** on lockout lever **120**. The resulting counterclockwise rotation of lockout lever **120** moves lockout lever **120** out of the path of pin **116** and permits counterclockwise rotation of pin **116** and secondary throttle shaft **24**.

A primary throttle lever **128** is secured to primary throttle shaft **20** and is biased clockwise by the usual throttle return spring, here represented by **130**. As primary throttle **22** approaches the wide open position, a wide open kick tang **132** on throttle lever **128** engages a tang **134** on intermediate lever **78** to cause clockwise, choke opening, movement of intermediate lever **78**.

A fast idle lever **136** is journalled on primary throttle shaft **29** and has an arm **138** engaging bearing portion **40** of backing member **38**. Fast idle lever **136** includes a tang **140** which is engaged by an idle speed adjusting screw **142** carried by a tang **144** on primary throttle lever **128**.

It will be noted that power element assembly **30** is shown in the lowest temperature position whereby fast idle lever **136** has been rotated counterclockwise and is thereby acting through adjusting screw **142** to rotate primary throttle lever **128** counterclockwise, against the bias of return spring **130**, to open primary throttles **22** to a fast idle position. As power element **30** is heated, cup **32** and backing member **38** will move rightwardly to allow clockwise movement of fast idle lever **136** and primary throttle lever **128**, thereby moving primary throttle **22** toward a closed position to reduce engine idle speed.

From the foregoing, it will be appreciated that this invention has provided a power choke mechanism which is compact and yet which provides all of the functions expected of a modern automatic choke mechanism.

We claim:

1. A carburetor comprising a mixture conduit, a choke shaft rotatably disposed in said mixture conduit, a choke valve secured on said shaft, a choke lever secured to said choke shaft, a power element having a cup member open at one end, a mass of thermally expansible material disposed in said cup member, a seal enclosing said material in said cup member, a backing member retaining said seal in said cup member and closing the open end of said cup member and having an opening, and a plunger extending through said opening and received by said seal, said backing and cup members being axially displaceable from said plunger upon thermal expansion of said material, an intermediate shaft, a power element lever rotatably mounted on said intermediate shaft, an intermediate lever rotatably mounted on said intermediate shaft, a link connecting said intermediate lever and said choke lever, a choke closing torsion spring disposed about said intermediate shaft and having one end connected to said intermediate lever and the other end connected to said power element lever whereby said power element lever is biased into engagement with said backing member and whereby said intermediate lever, said link, and said choke lever are biased in a choke valve closing direction, a choke opening torsion spring disposed about said intermediate shaft and having one end connected to an abutment and the other end connected to said intermediate lever whereby said intermediate lever, said link, and said choke lever are biased in a choke valve opening direction, and a power element spring biasing said backing and cup members against axial displacement from said plunger, whereby said backing and cup members and said power element lever are biased to increase the torsion of said choke closing spring to thereby bias said intermediate lever, said link, and said choke lever in a choke closing direction against the bias of said choke opening spring, and whereby upon thermal expansion of said material said backing and cup members are axially displaced from said plunger against the bias of said power element spring and said power element lever is moved to reduce the torsion of said choke closing spring to thereby permit the bias of said choke opening spring to move said intermediate lever, said link, and said choke lever in a choke opening direction.

2. The carburetor of claim **1** which further comprises a throttle shaft rotatably disposed in said mixture conduit, a throttle valve secured on said throttle shaft, and a throttle lever secured to said throttle shaft, said throttle lever having an arm engageable with said intermediate lever for moving said intermediate lever, said link, and said choke lever in a choke opening direction as said throttle lever is moved in a throttle opening direction.

3. The carburetor of claim **1** which further comprises a vacuum break shaft, a vacuum break lever rotatably mounted on said vacuum break shaft and engageable with said intermediate lever for moving said intermediate lever, said link, and said choke lever in a choke opening direction, and a vacuum break unit connected to said vacuum break lever for moving said vacuum break lever into engagement with said intermediate lever.

4. The carburetor of claim **1** which further comprises a throttle shaft rotatably disposed in said mixture conduit, a throttle valve secured on said throttle shaft, a throttle lever secured to said throttle shaft, and a fast idle lever rotatably mounted on said throttle shaft and engageable with said throttle lever and said power element backing member to limit movement of said throttle lever in a throttle valve closing direction in accordance with the position of said backing member.

5. The carburetor of claim **1** which further comprises a secondary mixture conduit, a secondary throttle shaft rotatably disposed in said secondary mixture conduit, a secondary throttle valve secured on said secondary throttle shaft, a stop pin secured to said secondary throttle shaft, a lockout shaft, and a lockout lever rotatably mounted on said lockout shaft and engaging said stop pin to prevent movement of said stop pin in a secondary throttle opening direction, and wherein said power element lever includes means engageable with said lockout lever for moving said lockout lever out of engagement with said stop pin as said power element

lever is moved to reduce the torsion of said choke closing spring.

6. The carburetor of claim 1 wherein said power element spring, said backing member, and said cup member are electrically conductive, and which further comprises an electrically conductive heating element disposed adjacent the opposite end of said power element cup member, an electrically insulating sleeve disposed about the sides of said cup member, an electrically conductive cupped housing enclosing said heating element and said insulating sleeve, said housing having a flange receiving said power element spring, and means for passing an electric current through said power element spring, said housing, said heating element, said cup member, and said backing member to energize said heating element and thereby cause thermal expansion of said thermally expansible material.

7. A carburetor comprising primary and secondary mixture conduits, a choke shaft rotatably disposed in said primary mixture conduit, a choke valve secured on said choke shaft, a choke lever secured to said choke shaft, primary and secondary throttle shafts respectively rotatably disposed in said primary and secondary mixture conduits, primary and secondary throttles respectively secured on said primary and secondary throttles, a primary throttle lever secured to said primary throttle shaft, a power element having a cup member open at one end, a mass of thermally expansible material disposed in said cup member, a seal enclosing said material in said cup member, a backing member retaining said seal in said cup member and closing the open end of said cup member and having an opening, and a plunger extending through said opening and received by said seal, said backing and cup members being axially displaceable from said plunger upon thermal expansion of said material, an intermediate shaft, a power element lever rotatably mounted on said intermediate shaft, an intermediate lever rotatably mounted on said intermediate shaft, a link connecting said intermediate lever and said choke lever, a choke closing torsion spring disposed about said intermediate shaft and having one end connected to said intermediate lever and the other end connected to said power element lever whereby said power element lever is biased into engagement with said backing member and whereby said intermediate lever, said ink, and said choke 'ever are biased in a choke valve closing direction, a choke opening torsion spring disposed about said intermediate shaft and having one end connected to an abutment and the other end connected to said intermediate lever whereby said Intermediate lever, said link, and said choke lever are biased in a choke valve opening direction, a power element sPring biasing said backing and cup members against axial displacement from said plunger whereby said backing and cup members and said power element lever are biased to increase the torsion of said choke closing spring to thereby bias said intermediate lever, said link, and said choke lever in a choke closing direction against the bias of said choke opening spring, said backing and cup members being axially displaced from said plunger against the bias of said power element spring upon thermal expansion of said material and said power element lever being moved thereby to reduce the torsion of said choke closing spring and permit the bias of said choke opening spring to move said intermediate lever, said link, and said choke lever in a choke opening direction, said primary throttle lever having an arm engageable with said intermediate lever for moving said intermediate lever, said link, and said choke lever in a choke opening direction as said throttle lever is moved in a throttle opening direction, a vacuum break shaft, a vacuum break lever rotatably mounted on said vacuum break shaft and engageable with said intermediate lever for moving said intermediate lever, said link, and said choke lever in a choke opening direction, a vacuum break unit connected to said vacuum break lever for moving said vacuum break lever into engagement with said intermediate lever, a fast idle lever rotatably mounted on said primary throttle shaft and engageable with said primary throttle lever and said power element backing member to limit movement of said primary throttle lever in a primary throttle valve closing direction in accordance with the position of said backing member, a stop pin secured to said secondary throttle shaft, a lockout shaft, a lockout lever rotatably mounted on said lockout shaft and engaging said stop pin to prevent movement of said stop pin in a secondary throttle opening direction, said power element lever including means engageable with said lockout lever for moving said lockout lever out of engagement with said stop pin as said power element lever is moved to reduce the torsion of said choke closing spring, said power element spring, said backing member, and said cup member being electrically conductive, an electrically conductive heating element disposed adjacent the opposite end of said power element cup member, an electrically insulatinG sleeve disposed about the sides of said cup member, on electrically conductive cupped housing enclosing said heating element and said insulating sleeve, said housing having a flange receiving said power element spring, and means for passing an electric current through said power element spring, said housing, said heating element, said cup member, and said backing member to energize said heating element and thereby cause thermal expansion of said thermally expansible material.

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