

[54] **AUTOMATIC CHOKE**

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[58] Field of Search **261/39 B; 123/119 F**

[56] **References Cited**

UNITED STATES PATENTS

3,606,983	9/1971	Mitchell	261/39 B
2,969,964	1/1961	Highley	261/39 B
2,970,825	2/1961	Smitley	261/39 B
3,544,085	12/1970	Bier	261/39 B
3,272,486	9/1966	Lucas et al.	261/39 B
3,006,617	10/1961	Moseley	261/39 B

3,321,194	5/1967	Carlson	261/39 B
3,279,771	10/1966	Herman et al.	261/39 B
2,988,344	6/1961	Smitley	261/39 B

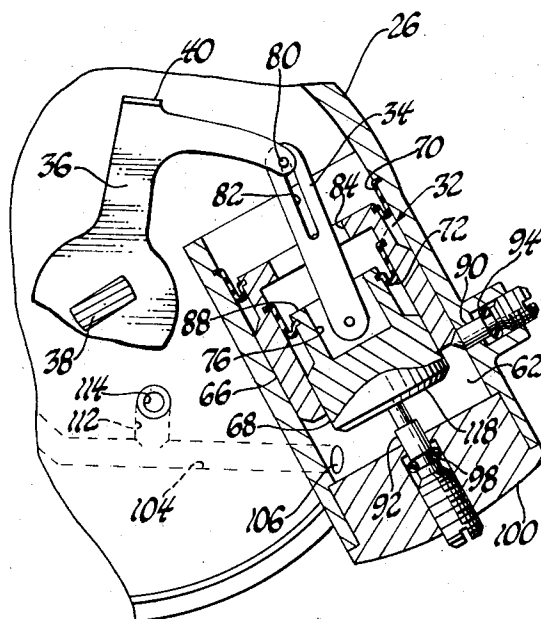
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[57] **ABSTRACT**

An automatic choke for a carburetor includes a thermostatic element for variably urging the choke valve closed, in accordance with decreasing ambient temperatures, and a plurality of vacuum responsive pistons, one slidably received within the other, for moving the choke valve open against the resistance of the thermostatic element; a plurality of abutment means are provided for arresting the motion of one of the pistons while permitting the other piston to continue to a second predetermined position.

9 Claims, 4 Drawing Figures



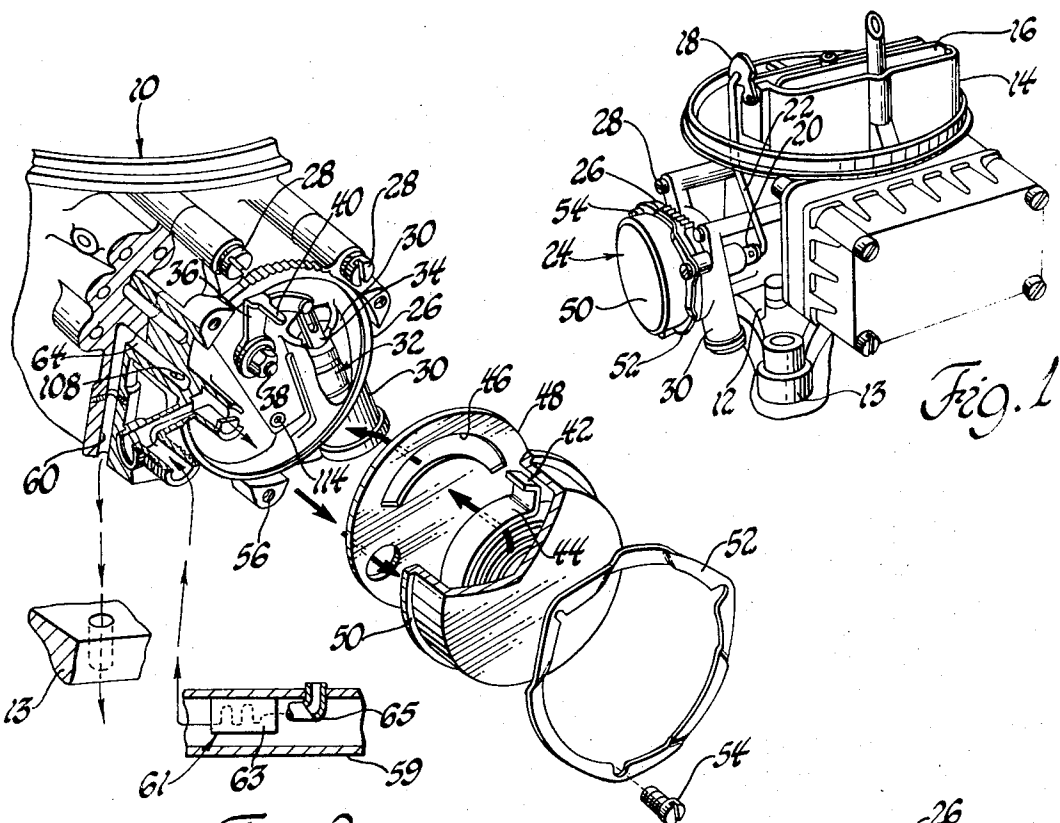


Fig. 2

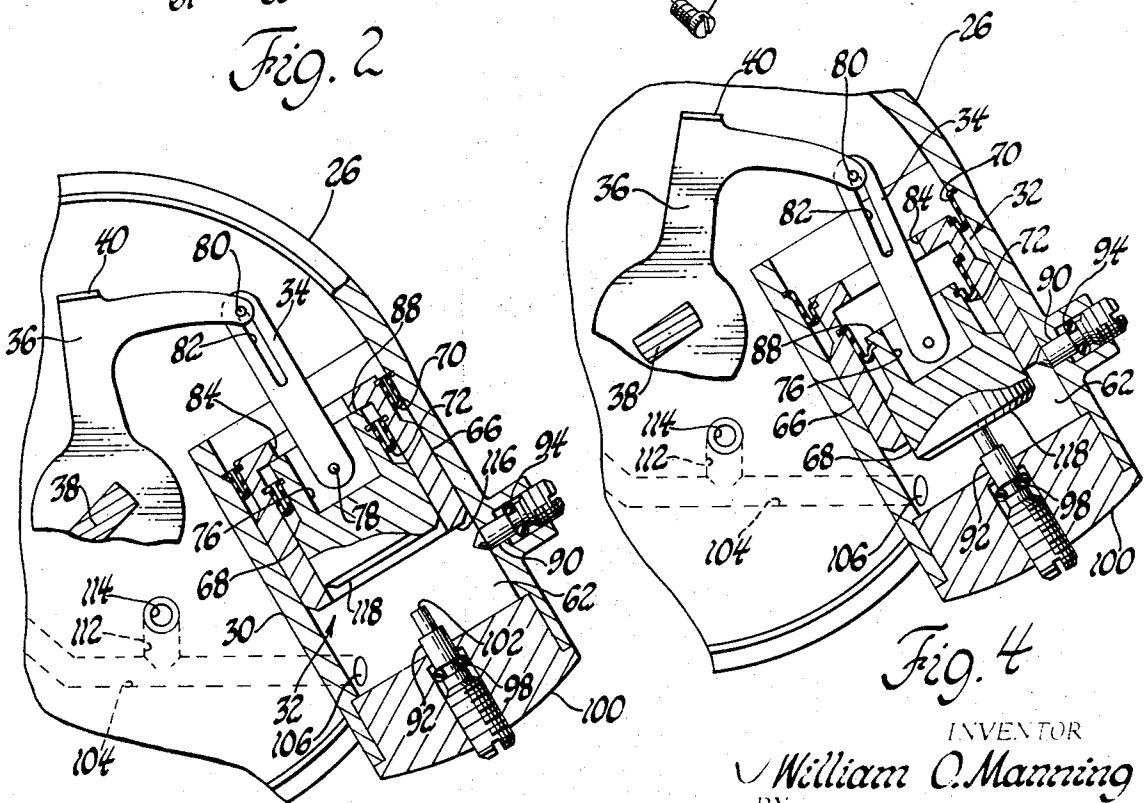


Fig. 3

Fig. 4

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AUTOMATIC CHOKE

BACKGROUND OF THE INVENTION

This invention relates generally to carburetors or other fuel controls for internal combustion engines, and more particularly to means for automatically operating the choking mechanism normally provided therein.

It has been accepted practice, in carburetor assemblies, to include a coil-type thermostatic bimetal for controlling the amount of choke opening according to temperature. Additionally, a manifold vacuum responsive piston or diaphragm usually was employed for initially opening the choke a predetermined degree when the cold engine starts and becomes self-sustaining. The pistons so employed usually had means, such as slots or ports for example, in order to control the extent of their movement. Such arrangements were subsequently improved upon by providing fixed or positive stop means against which the vacuum piston would abut in initially opening the choke valve to some first qualifying or partially opened position upon engine starting. This had the advantage of being able to rely on the choke valve always being initially opened to the same position.

However, the disadvantage of this general arrangement is that the position to which the choke valve is initially opened must, to be safe, be determined for the lowest ambient temperatures which are anticipated for the environment in which the structure is to be employed. This, of course, especially in temperate zones, where winter and summer temperature extremes are encountered, results in an overly rich fuel-air ratio when the ambient temperatures are relatively warm and the choke valve is initially opened to such a single predetermined partially opened position.

Accordingly, the invention herein disclosed and described is directly concerned with the solution of the above as well as other related problems.

SUMMARY OF THE INVENTION

According to the invention, a carburetor for an internal combustion engine comprises a choke valve, means including a heat responsive device to close said choke valve at relatively low temperatures, engine suction responsive means for causing at least a partial opening of said choke valve against the resistance of said heat responsive device upon starting of the engine, and abutment means associated with said suction responsive means adapted to limit the amount of choke opening due to said suction responsive means, said engine suction responsive means comprising a first movable pressure responsive member operatively connected to said choke valve and a second movable pressure responsive member operatively connected to said choke valve, said abutment means comprising a first abutment portion effective to be engaged by said first pressure responsive member upon starting of the engine thereby determining a first partially opened position of said choke valve, and a second abutment portion effective to be engaged by said second pressure responsive member after said choke valve has been opened a predetermined degree in excess of said first partially opened position.

Accordingly, a general object of this invention is to provide, in an automatic choke mechanism, pressure responsive means effective for initially opening the

choke valve to one of at least two distinct partially opened or qualifying positions depending upon the ambient temperature.

Other more specific objects and advantages of the invention will become apparent when reference is made to the following detailed description considered in conjunction with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

In the drawings, wherein for purposes of clarity, certain details may be omitted from one or more views:

FIG. 1 is a perspective view illustrating an engine-mounted carburetor embodying the invention;

FIG. 2 is a fragmentary, perspective exploded view illustrating the details of construction of the left-hand portion of FIG. 1;

FIG. 3 is an enlarged fragmentary elevational view, with portions thereof cut away and in cross-section, illustrating the several elements, shown in FIG. 2, in one operating position; and

FIG. 4 is a view similar to FIG. 3 but illustrating the elements in another operating position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in greater detail to the drawings, FIG. 1 illustrates a carburetor 10 having a throttle body 12, adapted to be mounted on an engine adjacent the induction manifold 13 thereof, an air intake 14 with induction passages therethrough adapted to be influenced by a choke valve 16, which is operatively connected by means of arms 18 and 20 and link 22 to an automatic choke control 24.

FIG. 2 illustrates a housing 26, suitably secured as by screws 28 to the carburetor 10, having a cylinder 30 formed therein containing pressure responsive piston means 32 operatively connected through a linkage 34 to a choke lever 36. A shaft 38, extending through and rotatable in one wall of the housing 26, has secured to it, at one end thereof, the choke lever 36 while its other end is secured to lever 20 (FIG. 1). The choke lever 36 has an outwardly extending projection 40 which is adapted to coact with the free end 42 of a thermostatic element 44 through an arcuate opening 46 in the housing cover plate 48.

The thermostatic housing 50 has a shaft located centrally within and rigidly secured to it to anchor the other end of the thermostatic element 44. Any suitable means such as the clamping ring 52 may be employed to hold the cover plate 48 and housing 50 in alignment with and against the housing 26. The ring 52 may be secured by means of screws 54 and cooperation threaded portions 56.

A conduit 58 communicates between a source of heated air as, for example, the exhaust manifold 59 (or some other suitable portion of the related engine) and the chamber formed generally by cover plate 48 and housing 50. As shown diagrammatically in FIG. 2, a stove portion 61 comprising a housing 63 and coiled conduit 65 adapted to receive fresh air to be heated as it passes through the conduit 65 is provided in the exhaust manifold 59. The purpose of the conduit 58 is to deliver air, which is at a temperature indicative of engine temperature, to the thermostatic element 44 in order that the element 44 may react to it and change the position of the choke valve 16 accordingly.

A conduit 60 (FIG. 2) communicates generally between the cylinder 30 and a suitable source of vacuum, such as engine manifold vacuum, in a manner as to draw air through conduit 58 and cause movement of the piston means 32 in a direction so as to result in clockwise rotation of lever 36.

FIG. 3 illustrates in enlarged scale, the details of the choke vacuum piston means 32, cylinder 30 and the conduit means interconnecting the interior 62 of cylinder 30, the chamber defined by housing 26 and plate 48 and branch conduit 64 (FIG. 2) leading to conduit 60. As illustrated, piston means 32 is comprised of an outer pressure responsive sleeve-like piston member 66, slidably received within cylinder 30, which, in turn slidably received a second inner piston 68 therein. If desired, especially where no actual air flow past pistons 66 and 68 is desired, annular pressure responsive flexible diaphragms 70 and 72 may be respectively provided between outer piston 66 and cylinder 30 as well as between inner piston 68 and outer piston 66. The diaphragms 70 and 72 may, of course be retained to the respective cooperating components by any suitable means many of which are well known in the art.

The inner piston 68 may be formed as to have a cavity portion 76 which is adapted to receive linkage 34. The linkage 34 may be secured to the piston means 32, and specifically to the inner piston 68, in any suitable manner such as by a pin 78. The other end of linkage 34 is secured to the choke lever 36, as by a pin 80 slidably retained within a slot 82 formed in linkage 34.

As shown, the outer piston 66 may be provided, at its upper end, with generally inwardly directed abutment means 84 so as to be effective for at times abutting against the upper end 86 of inner piston 68. A plurality of adjustable stop or abutment members 90 and 92 are also provided as to at times be respectively abuttingly engaged by outer piston 66 and inner piston 68. As shown, abutment member 90, provided with a suitable seal 94, may be threadably engaged with and passing through the wall portion of cylinder 30 in a manner having its tapered or contoured end 96 in the path of travel of outer piston 66. The second abutment member 92, also provided with a suitable seal 98, may pass through and be treadably engaged with the end wall 100 of cylinder 30 so as to have its upper end 102 in the path of travel of inner piston 68.

A conduit 104, which may be formed into the body of housing 26, communicates at its one end 106 with the interior 62 of cylinder 30 while the other end 108 thereof (FIG. 2) is in communication with branch conduit 64 leading to conduit 60. The body of housing 26 may contain an additional conduit 112 formed therein which communicates between the chamber formed generally by housing 26 and plate 48 and conduit 104. As shown, for purposes of calibration, a suitable restriction 114 may be provided within conduit 112.

OPERATION OF INVENTION

Assuming, for purposes of illustration, that the engine is cold and is being cranked, the thermostatic element 44 will be in its unwound condition thereby causing its end 42 to position projection 40 of choke lever 36 in its extreme counter-clockwise position as generally illustrated, for example, by FIG. 3. The lever 36, being secured to shaft 38 rotates the shaft and arm

20 counter-clockwise to cause the choke valve 16 to assume a position which substantially closes off the flow of air through the carburetor intake passage 14. All of these elements will continue to occupy these respective positions while the engine is being cranked.

As soon as the engine fires and becomes self-sustaining, manifold vacuum in conduits 60, 64 and 104 rises to a value sufficient to move the piston means 32 (both inner piston 68 and outer piston 66) downwardly in opposition to the force of thermostat 44. The extent of such initial movement of the pistons 66 and 68, during such times as when the ambient temperature is relatively cold, will be determined by the point at which the lower end 116 of outer piston 66 abuts against stop member 90. Since the ambient temperature is assumed to be relatively cold, the tension of the thermostatic element 44 will be correspondingly relatively high thereby offering a greater resistance to the opening movement of the choke valve 16 caused by the piston means 32. Accordingly, no further opening of the choke valve 16 by piston means 32 will occur until the air flow from stove 61 past the thermostatic element 44, as generally depicted by the heavy arrows in FIG. 2, and through conduit 112 into conduit 104 becomes sufficiently heated by the engine in order to in turn warm the thermostatic element thereby causing the thermostat 44 to begin to relax. As the thermostatic element 44 becomes warmed and reduces its resistance to further movement of the choke valve 16 by the piston means 32, the pressure differential across the smaller effective area of inner piston 68 is sufficient to enable the inner piston 68 to progressively move the choke valve 16 to a second opened position which is less than fully opened but opened to a degree greater than that initially established by the outer piston 66 abutting against stop 90. Such second opened position of the choke valve 16 is determined by the lower end 118 of inner piston 68 abutting against stop member 92 as illustrated in FIG. 4.

Even though further movement of both pistons 66 and 68 is prevented, further rotation of the choke valve 16 due to both gravity and the force of the air flow through intake 14 is made possible by the lost motion connection comprised of the slotted link 34 and sliding pin 80 within slot 82. That is, as the air from the stove 61 is drawn about bimetal 44, the thermostatic element 44 continues to be further heated and continues to relax in accordance therewith causing end 42 of the thermostatic element to tend to move away from arm portion 40 of choke lever 36 thereby permitting the choke valve to continue movement toward its wide open position during which time pin 90 freely slides downwardly through slot 82.

The above is, of course, under the assumed condition of cold ambient temperatures. However, when the ambient temperature is at some intermediate value, that is sufficiently cold to have the thermostatic element 44 close the choke valve 16 but not so cold as to have the thermostatic element 44 create a substantial resilient pre-load force against the closed choke valve 16, the above described mechanism will exhibit a slightly different action.

That is, with intermediate or relatively warmer ambient temperatures, after the engine is cranked and started, the vacuum applied to chamber 62 of cylinder

30 causes the pistons 66 and 68 to move in unison until outer piston 66 engages stop member 90 and inner piston 68 continues, without interruption in motion, until it engages the second stop member 92. Consequently, it can be seen that at such relatively warmer ambient temperatures, the pressure responsive piston means 32 is effective for causing the choke valve 16 to be initially opened to a greater extent than the initial opening determined by the outer piston 66 during relatively cold ambient temperatures.

Accordingly, in view of the above, it can be seen that the invention provides means effective for pulling the choke valve to a first qualifying or partially open position in order to provide a relatively enriched fuel-air ratio required for supporting engine operation during low ambient temperatures, and also effective for pulling the choke valve to a second qualifying or partially open position (greater than the first qualifying position) to provide a lesser fuel-air ratio required for supporting engine operation, without excessive exhaust emission, during higher ambient temperatures.

The invention herein disclosed has been illustrated as being embodied within a rather unified assembly containing the thermostatic element and vacuum piston means 32. However, it should be obvious that the invention could be practiced equally well in an arrangement wherein the thermostatic element and the pistons 66 and 68 are divorced; that is, the elements are not contained in the same general mechanism or housing but are rather located in some spaced relationship to each other and in their own particular housings as is generally well known in the art.

Even though only one preferred embodiment of the invention has been disclosed and described, it is apparent that the embodiments and modifications of the invention are possible within the scope of the appended claims.

I claim:

1. A carburetor for an internal combustion engine, comprising a choke valve, means including a heat responsive device to close said choke valve at relatively low temperatures, engine suction responsive means for causing at least a partial opening of said choke valve against the resistance of said heat responsive device upon starting of the engine, and abutment means associated with said suction responsive means adapted to limit the amount of choke opening due to said suction responsive means, said engine suction responsive means comprising a first movable pressure responsive member operatively connected to said choke valve and a second movable pressure responsive member operatively connected to said choke valve, said abutment means comprising a first abutment portion effective to be engaged by said first pressure responsive member upon starting of the engine thereby determining a first partially opened position of said choke valve, and a second abutment portion effective to be engaged by said second pressure responsive member after said choke valve has been opened a predetermined degree in excess of said first partially opened position.

2. A carburetor according to claim 1, wherein said first abutment portion comprises a first adjustably positioned stop member, said first stop member including a contoured abutment surface for abutably engaging said first pressure responsive member, and wherein said

second abutment portion comprises a second adjustably positioned stop member.

3. A carburetor according to claim 1, wherein said first pressure responsive member comprises a first piston member, wherein said second pressure responsive member comprises a second piston member, and cooperating cylinder means slidably receiving said first and second piston members.

4. A carburetor according to claim 1, wherein said first pressure responsive member includes a first pressure responsive diaphragm member, and wherein said second pressure responsive member includes a second pressure responsive diaphragm member.

5. A carburetor according to claim 1, wherein said first pressure responsive member comprises a first piston member, wherein said second pressure responsive member comprises a second piston member, first cylinder means slidably receiving said first piston member, a second cylinder formed in said first piston axially thereof, and slidably receiving therein said second piston member, and means carried by at least one of said piston members for at times effecting axially directed abutting engagement between said first and second piston members.

6. A carburetor according to claim 1 wherein said first pressure responsive member comprises a first outer annular piston member, a cylinder slidably receiving said first piston member, wherein said second pressure responsive member comprises a second piston member slidably received within said first outer annular piston member, additional abutment means carried by said outer annular piston member effective for at times engaging said second piston member, and linkage means operatively interconnecting said second piston member and said choke valve, said first outer annular piston and said additional abutment means being effective upon the admission of said suction to said cylinder to abuttingly engage said second piston and to move axially in unison with said second piston until said first outer annular piston engages said first abutment portion, and said second piston being effective after said first outer annular piston engages said first abutment portion to continue moving with respect thereto until engagement with said second abutment portion.

7. A carburetor according to claim 1, wherein said heat responsive device comprises a coiled thermostatic bimetal, said coiled bimetal including a hooked portion at the outer end thereof freely positioned in accordance with the temperature of said bimetal, lever means operatively connected to said choke valve for rotation therewith, said lever means including an arm portion adapted to be operatively connected to said bimetal hooked portion for rotational positioning thereby, wherein said second pressure responsive member comprises a first piston, including lost-motion linkage means interconnecting said first piston and said lever means for enabling further rotation of said lever means in the choke opening direction after said first piston has abuttingly engaged said second abutment portion, and wherein said first pressure responsive member comprises a second piston, said second piston including passage means formed therethrough for slidably receiving said first piston therein, and a radially inwardly directed flange portion carried by said second piston for engaging said first piston in order to thereby

transmit a choke opening force therethrough said first piston and said linkage means to said lever means.

8. A carburetor according to claim 1, wherein said first pressure responsive member comprises a first generally annular piston, a cylinder slidably receiving said first piston, a first seal operatively connected to said cylinder and said first piston for precluding flow therebetween, wherein said second pressure responsive member comprises a second piston slidably received within said first annular piston, a second seal operatively connected to said annular piston and said second piston for precluding flow therebetween, and lost motion linkage means operatively interconnecting said second piston and said choke valve.

9. A carburetor according to claim 1, wherein said heat responsive device comprises a coiled thermostatic bimetal, said coiled bimetal including a hooked portion at the outer end thereof freely positioned in accordance with the temperature of said bimetal, lever means operatively connected to said choke valve for rotation therewith, said lever means including an arm portion adapted to be operatively connected to said bimetal hooked portion for rotational positioning thereby, wherein said first pressure responsive member comprises a first piston, wherein said second pressure

responsive member comprises a second piston, a first cylinder slidably receiving said first piston therein, a second cylinder formed in said first piston for slidably receiving said second piston therein, wherein said first abutment portion comprises a first adjustably positioned screw threadably engaged with and extending through a wall portion of said first cylinder so as to be positioned generally in the path of travel of said first piston, wherein said second abutment portion comprises a second adjustably positioned screw threadably engaged with and extending through a wall portion of said first cylinder so as to be positioned generally in the path of travel of said second piston, including lost-motion linkage means interconnecting said second piston and said lever means for enabling further rotation of said lever means in the choke opening direction after said second piston has abuttingly engaged said second adjustably positioned screw, and a radially inwardly directed flange portion formed on said first piston for abuttingly engaging said second piston upon starting of said engine in order to thereby transmit a choke-opening force through said second piston and said lost-motion linkage means to said lever means.

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