Dec. 1, 1964 M. J. KITTLER 3,159,692

CHOKE MECHANISM

Filed April 2, 1962

FIG. 1

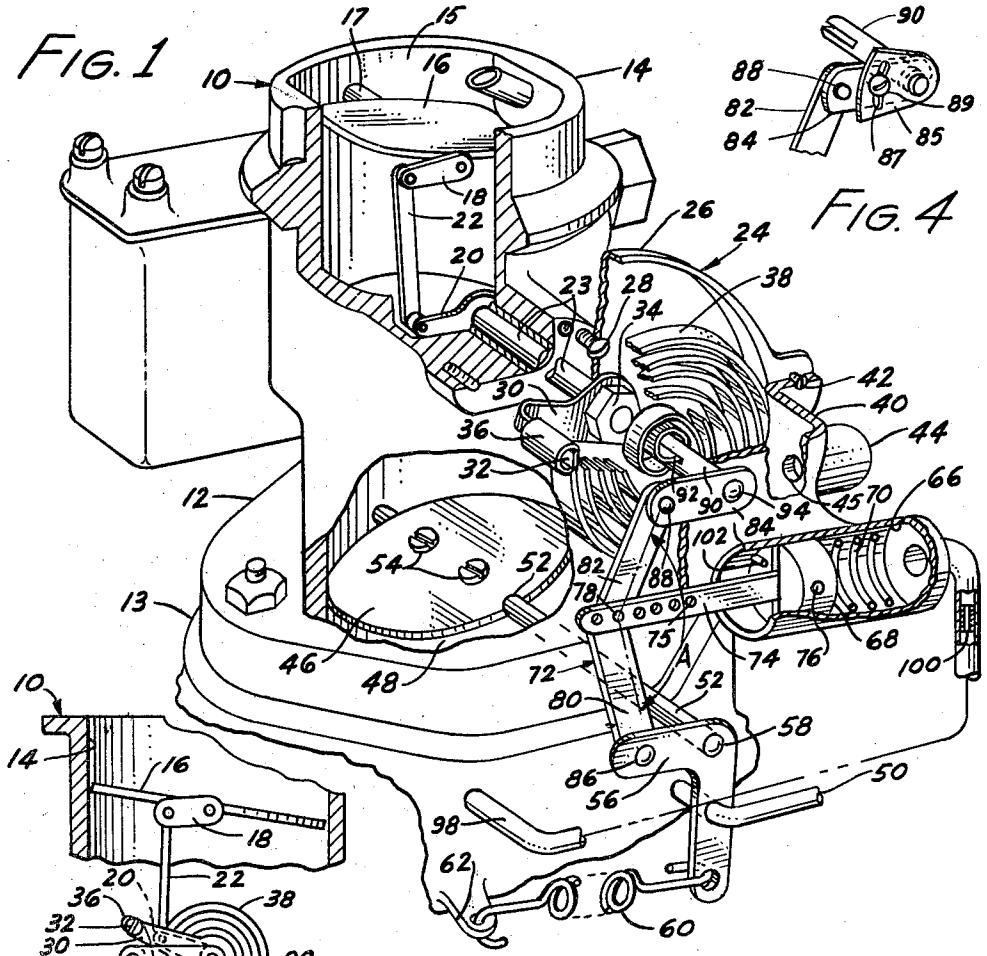


FIG. 4

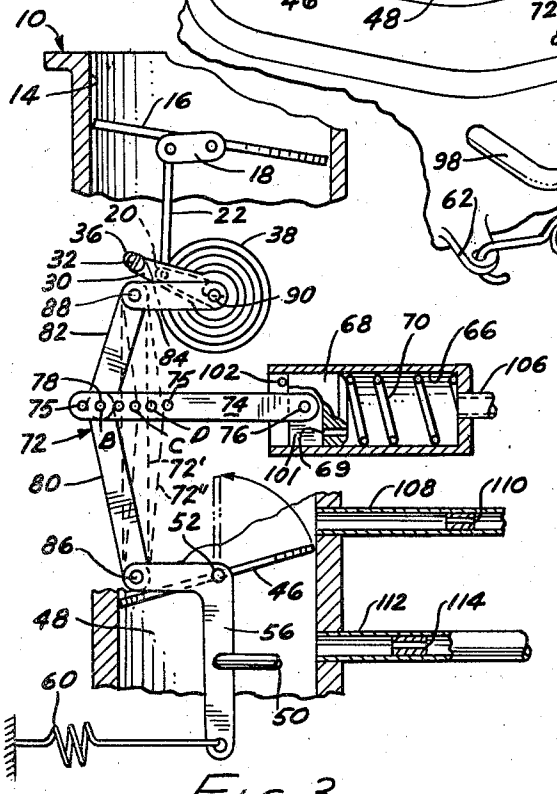


FIG. 3

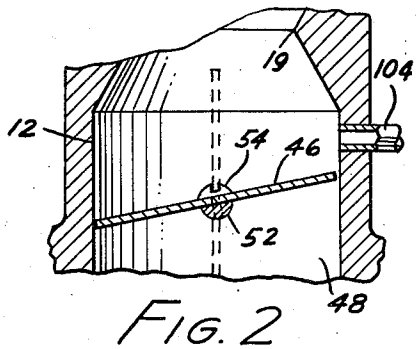


FIG. 2

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CHOKE MECHANISM

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5 Claims. (Cl. 261—39)

This invention relates to internal combustion engines, and it consists particularly in a novel automatic choke control mechanism therefor.

The automatic choke mechanism now customarily used with internal combustion engines of the automotive type has an unbalanced choke valve, a thermostatic coil connected to the choke valve in such a manner as to tend to resiliently close the choke valve when the engine temperature is low, and a suction motor which applies an opening force to the choke valve when the engine starts to run under its own power. This type, as described in greater detail in Smitley Patent No. 2,988,344, is well adapted to manufacture by high production methods and has proven generally satisfactory. However, in some cases, it has been found that during the warm-up period, in case the engine should be subjected to a heavy load, the suction motor and the direct force of air applied to the unbalanced choke are insufficient to hold the choke valve open far enough to insure the supply of a proper, driving mixture. This is because the suction produced by the engine drops when the throttle valve is opened, permitting the insufficiently heated thermostat to move the choke valve toward closed position. The effect becomes quite pronounced as the throttle moves from say, half to full open position and may result in bucking of the engine, or even stalling.

Furthermore, while conventional automatic choke mechanisms have been generally quite satisfactory, they do not always meet special requirements of some engines. This is due to the fact that the required fuel-air mixture is dependent upon a number of variables such as engine heat and manifold vacuum and that these variables are different for different engines.

In other words, some engines require a slightly richer fuel-air ratio at substantially wide open throttle than they do at part throttle during periods of cold engine operation. However, due to peculiar engine characteristics, other engines may have an opposite requirement; that is, they may require a slightly leaner fuel-air mixture at wide-open throttle than at part throttle during cold operation. Still other engines may require an intermediate fuel-air mixture.

While present automatic choke mechanisms such as that briefly described above are provided with means for adjusting the tension of the thermostatic coil and while the characteristics of the thermostatic coil and the degree to which the manifold vacuum means for initially opening the choke upon starting of the engine may be varied to some extent, there is still not enough variation possible to meet the needs of various peculiar engine requirements without radically altering the choke design. It has been found, however, that this can be accomplished in present design chokes by a very simple adjustment.

Accordingly, a main object of the present invention is to overcome the above mentioned disadvantages sometimes experienced with the use of conventional type automatic choke control mechanisms.

Another object of this invention is to provide means, in an automatic choke mechanism having a thermostatic element resisting choke opening, for varying or modulating the resistance of the thermostatic element to choke opening in accordance with throttle position.

Another object of the invention is to provide such means in which the variation of the setting of the thermostatic element may be modulated.

Another further object of the invention is to provide automatic means responsive to engine vacuum for modulating the effect of throttle position on the resistance to choke opening of the thermostatic element.

A still further object of the invention is to provide such engine vacuum responsive automatic adjusting means in which the degree of engine vacuum may be varied.

Another object of the invention is to provide an automatic choke mechanism in which the usual vacuum responsive means for opening the choke a predetermined amount against the choke closing force of the thermostatic element when the engine first starts may be eliminated, the function of the above vacuum responsive means being supplied by the engine vacuum responsive means provided for varying the effect of the throttle position on the pre-load of the thermostatic element.

These and other objects of the invention will become more apparent when reference is made to the following written description and the accompanying drawings wherein:

FIGURE 1 is a perspective view, with portions thereof cut away, of a carburetor having a choke control mechanism embodying the invention;

FIGURE 2 is a fragmentary cross-sectional view illustrating a modification of the invention;

FIGURE 3 is a fragmentary cross-sectional view illustrating schematically the operation of the invention, as well as another modification of the invention;

FIGURE 4 is a fragmentary perspective view illustrating still another modification of the invention.

Referring to the drawings in greater detail, FIGURE 1 illustrates a carburetor 10 having the usual throttle body section 12 and air intake section 14, the carburetor being mounted on the intake manifold 13 of an engine. The air intake passage 15 is controlled by a choke valve comprising a plate 16 mounted on the pivotable shaft 17 so as to be unbalanced; that is, flow of air to the engine acts to open the choke.

The choke plate position is at all times automatically controlled by mechanism generally similar to the conventional mechanisms described above. More specifically, the automatic choke control mechanism 24 may comprise a first housing member 26 secured in any suitable manner, such as by screws 28, to the carburetor body. A shaft 23 pivotally mounted through the carburetor wall and having one end extending into the housing 26 has secured thereto a lever 20 which is connected through the link 22 to a lever 18 secured to the choke shaft 17. The above linkage is such that pivoting the choke shaft 17 causes rotation of the shaft 23 and corresponding movement of the lever 30 in either a clockwise direction or a counterclockwise direction, depending upon direction of movement of the choke shaft. The opposite end of the shaft 23 has secured thereto a second lever 30 having a laterally projected end 32.

The enclosure for mechanism 24 may be formed from two parts, and a shaft 90 is pivotally mounted in the outer housing portion 40, the end of the shaft 90 extending into the housing 40 being slotted so as to receive and retain the inner end 92 of the bi-metal thermostatic coil spring 38. The outer end of the coil spring may be formed with a loop 36 or other abutment means engaging the laterally extending end 32 of the lever 30.

With the choke control mechanism such as that explained thus far, it is apparent that if the shaft 90 were maintained in a fixed position, then the opening of the unbalanced choke plate 16 will be resisted by the tension of the thermostatic coil spring 38.

The air intake passage 15 contains the usual venturi 19,

and the throttle plate 46 is secured by any suitable means such as screws 54 to the pivotable shaft 52 extending through the throttle body portion 12 of the carburetor. The throttle plate 46 controls the amount of fuel-air mixture that is supplied to the engine, and its position is controlled by movement of the rod 50 pivotally secured to one arm of the bell crank 56 which is fixed at its center portion to the throttle shaft 52. The spring 60 connected between some anchor member 62 on the engine and the same arm of the bell crank 56 to which rod 50 is attached normally maintains the throttle 46 in a closed position. Opening of the throttle 46 is, of course, accomplished by movement of the rod 50 to the right in FIGURE 1 against the force of the spring.

As already explained above and as taught in Patent No. 2,988,344, the conventional automatic choke control mechanism includes a vacuum piston connected to a portion of the lever 30 fixed to the shaft 23 in such a way that engine vacuum created when the engine first starts after cranking rotates the shaft 23 clockwise in FIGURE 1 against the resistance of the thermostatic spring 38 so as to immediately open the choke plate a predetermined amount. Otherwise, the engine could not operate for lack of air. The vacuum piston is formed and connected in such a way that the vacuum acting on the piston also draws air through a stove normally located in the exhaust manifold of the engine, the heated air passing through the chamber containing the thermostatic coil spring, thus progressively decreasing the resistance of the thermostatic spring to choke opening so as to progressively reduce the richness of the fuel-air mixture as the engine approaches normal operating temperature.

It will be noted that the choke control mechanism 24 shown by FIGURE 1 does not contain the usual vacuum piston referred to above. It does, however, contain a conduit 44 and an aligned opening 45 in a housing 26 through which heated air may be supplied to the housing so as to heat the thermostatic coil spring 38 in the usual manner and for the purpose set forth above.

In the conventional automatic choke control mechanism, the shaft to which the inner end of the thermostatic coil spring is essentially fixed. The shaft is usually adjustable, however, to set the proper tension in the thermostatic spring for various seasons of the year; however, this is not a continuously automatic adjustment, but a manual adjustment that is made only occasionally.

In contrast to conventional automatic chokes, the shaft 90 anchoring the inner end of the thermostatic coil spring 35 in the choke control mechanism 24 embodying the invention is pivotally mounted through the wall of the housing 40, and it has secured thereto a lever 84. The rotation of lever 84 will cause the shaft 90 to rotate, thus changing the tension in the coil spring 38. The lever 84 is connected to the other arm of the bell crank 56 connected for rotation with the throttle shaft by the link system 72, which comprises an upper link 82 pivotally connected to the lever 84 at 88 and a lower link 80 pivotally connected to the bell crank 56 at 86.

It is apparent that if the links 80 and 82 were solidly connected to one another so as to constitute a single member, then opening of the throttle plate 46 would cause the shaft 90 to which the inner end of the thermostatic coil 38 is connected to rotate counterclockwise, thus winding up the thermostatic coil 38 so as to decrease its resistance to choke opening and thus allow the choke plate 16 to open more fully at any given temperature. Conversely, closing of the throttle plate 46 would cause the shaft 70 to rotate clockwise so as to unwind the thermostatic coil 38 and increase its resistance to opening of the choke plate. The prior art contains generally similar constructions wherein movement of the throttle plate at any given temperature always has a predetermined effect on the tension of the thermostatic coil spring. However, manifold vacuum has no effect on such a single link between the throttle plate and the thermostatic coil, the only effect of vacuum being through the usual vacuum piston.

In contrast to these prior art structures, the invention contemplates the provision of a vacuum cylinder 66 which may be formed integral with the outer housing 40. A piston 68 is positioned in the cylinder, the piston being movable against the force of a spring 70 positioned between the piston 68 and the end of the cylinder 66 in response to manifold vacuum communicated to the cylinder through the conduit 98 which may have a calibrated restriction 100 therein to eliminate the effect of any temporary fluctuations in manifold vacuum. A stop 102 may be provided in the cylinder on the opposite side of the piston 68 to limit the forward movement of the piston under the urging of the spring 70. The piston 68 may have a slot 101 formed therein to receive the link 74, which is pivotally secured to the piston by means such as a pin 76. The other end of the link 74 extending out of the cylinder 66 is provided with a series of pivot openings 75. The upper link 82 which is provided with a pivot hole at its lower end, the lower link 80 provided with a pivot hole at its upper end and the link 74 pivotally connected to the piston 68 are then all pivotally connected by means such as the pin 78.

With the above described construction shown by FIGURE 1, it will be seen that the link system 72 comprising the upper link 82 and the lower link 80 operates to automatically vary the tension of the thermostatic coil 38 in accordance with throttle position. As in the case of the prior art, this variation of the tension in the coil spring 38 is in addition to the variation in tension caused by changes in temperature, and it may be adjusted by changing the pivot hole 75 in the link 74 into which the pin 78 is inserted.

In contrast to the prior art, however, this variation in the effect of thermostat coil tension due to throttle position is itself automatically and constantly varied in response to the manifold vacuum acting on the piston. In other words, when manifold vacuum (an indication of engine load) increases, the piston 68 will move to the right in FIGURE 1 against the force of the spring 70 to cause the link system 72 comprising the upper and lower links 80 and 82, respectively, to initially increase in length so long as the links 80 and 82 are connected to link 74 so as to form an initial included angle A of less than 180°. This effective increase in length serves to increase the resistance of the thermostatic coil 38 to further opening of the choke plate 16 for any given throttle position. The converse is also true; that is, any decrease in manifold vacuum is chamber 66 aids the spring 70 in moving the piston 68 to the left in FIGURE 1 so as to decrease the effective length of the link system 72, thus decreasing the resistance of the coil 38 to choke opening.

The above operation is shown schematically in FIGURE 3, wherein the initial solid line position of the link system 72 is the same as that shown in FIGURE 1 and wherein the higher vacuum (increased length) condition of link system 72 is shown by the intermediate dotted line position 72'. It will be seen from FIGURE 3, however, that still further increases in manifold vacuum can again shorten the link system 72 so as to again decrease the resistance of the coil 38 to choke opening, as shown by the right hand dotted line position 72''.

Referring again to FIGURE 3, it will be seen that the solid line and dotted line positions of the link system 72 illustrate also another feature of the invention. In the first place, it will be seen that if an adjustment hole 75 (identified as B) in link 74 is selected so that the initial position (closed throttle and closed choke) of the link system 72 is that shown by the solid lines, then increased manifold vacuum will, depending upon the rate of the spring, first lengthen the link system 72 so as to increase resistance of the coil 38 to choke opening and then subsequently decrease the length of link system 72 so as to reduce the resistance of the coil to choke opening. The

degree of this modulating effect of manifold vacuum will, of course, depend upon which adjustment hole 75 is selected. On the other hand, an adjustment hole 75 (identified as C) may be selected so that initial position of the link system 72 at low manifold vacuum is such that links 80 and 82 are substantially in alignment, as shown by the dotted lines 72', or if a hole 75, such as that identified as D, were selected, the initial position of links 80 and 82 would be in an opposite relation such as that shown by the dotted lines 72''. In the case of the latter two initial positions, the effect of increased manifold vacuum can only be to progressively decrease the length of link system 72 so as to wind up the coil 38 and decrease its resistance to choke opening.

It is thus apparent that the piston 68 and link system 72 combination provides a feature not provided by the prior art; that is, it may be used to vary the effective length of the link system 72 between the throttle plate 46 and the thermostatic coil spring 38. The initial effective length is provided by selecting the desired adjustment hole 75 in link 74; the subsequent modulation of that length is automatically responsive to engine manifold vacuum (engine load) conditions.

It should also be noted that, while the piston 68 proposed by the invention may be in addition to the usual vacuum piston employed in present automatic choke control devices, the design may be such that piston 68 also performs the prior art function of initially opening the choke valve 16 a predetermined amount when the engine is first started.

It may be apparent from FIGURE 3 that connecting the adjacent ends of the upper and lower links 80 and 82, respectively, to any desired adjustment hole 75 in the link 74 connected to the piston 68 may present some problems in alignment of the three holes for the pin 78 since the free ends of the links 80 and 82 strike an arc as they are pivoted from the solid line positions to the dotted line positions. Also, since these links are pivotally connected to levers fixed to the throttle and thermostatic coil spring, it is apparent that selecting a different pivot hole 75 in the link 74 may cause the choke valve 16 and/or the throttle valve 46 to be held in a partially opened initial position. If this is undesirable, FIGURE 4 illustrates a manner in which it can be eliminated.

In FIGURE 4, the lever 84 is not fixed to the shaft 90 to which the inner end of the coil spring 38 is attached; rather, it is pivotally mounted thereon, and the additional lever 85 having the arcuate slot 87 formed therein is fixed to the shaft 90. The initial setting is made by loosening the screw 89 so as to free lever 84, selecting the desired adjustment hole 75 in the lever 74 connected to the piston 68, holding the throttle and the choke valve in the desired positions, and then tightening the screw 89 so that lever 84 is in effect fixed to the shaft 90 by reason of its being clamped to the lever 85 which is itself fixed to the shaft 90.

In FIGURE 1, the vacuum line 98 is obviously connected to the manifold 13 or to the carburetor 12 at a position below the closed throttle plate 46. Variations in the degree of applied manifold vacuum, and thus the operation of the piston 68 and the mechanism 24, can be accomplished by obtaining the vacuum from different positions in the carburetor induction passage 15.

In FIGURE 2, for example, the vacuum line 104 leading to the cylinder 66 is connected to the carburetor at a point just above the closed throttle valve 46 so that manifold vacuum effective to operate the piston 68 is applied thereto after the throttle plate 46 has opened some predetermined amount.

FIGURE 3 illustrates a combination of FIGURES 1 and 2 in that vacuum is obtained both below the closed throttle plate 46 through the branch line 112 and after the throttle plate 46 has opened some predetermined amount through the branch line 108, the branch lines 112 and 108 being connected to a common conduit 106 leading to the cylinder 66. A calibrated passage 69 may also be provided in the piston 68 if it is desired to have some degree of continuous flow of air therethrough.

It is apparent that use of the invention provides an automatic choke control mechanism having a much greater degree of flexibility than presently used mechanisms so as to be adaptable through simple adjustments to meet the demands of a greater variety of engines. In other words, any given choke control mechanism embodying the invention may be easily adjusted to provide a great variety of choke characteristics, even to the extent of satisfying the unusual engine requirements.

While only a few embodiments of the invention have been shown and described for purposes of illustration, it is apparent that other modifications may be made without exceeding the scope of the appended claims.

What I claim as my invention is:

1. In a carburetor comprising an induction passage, a choke valve pivotally mounted in said induction passage, a thermostatic coil spring variably resisting the opening of said choke valve in accordance with temperature, a throttle valve pivotally mounted in said induction passage downstream of said choke valve, means comprising linkage connected between said throttle valve and said thermostatic coil spring for varying the tension of said spring in accordance with throttle position, said linkage including a broken link, engine vacuum means for varying the length of said broken link so as to vary the effect of throttle position on tension of said spring, a connection between said vacuum means and said broken link, and means for changing the length of said connection between said vacuum means and said broken link so as to enable variations in the effect of said vacuum means on said broken link.

2. A carburetor, comprising a body having an induction passage with a venturi formed therein, a choke valve pivotally mounted in said induction passage upstream of said venturi, said choke valve being unbalanced so that air flow to said engine tends to open said choke valve, a thermostatic coil spring connected to said choke valve so that the tension thereof tends to oppose choke opening in accordance with engine temperature, a throttle valve pivotally mounted in said induction passage downstream of said venturi, means connecting said throttle valve to the inner end of said thermostatic coil spring so that the tension of said coil spring is varied in accordance with throttle valve position, said means including a pair of levers, one of said levers being pivotally connected at its one end to said inner end of said coil spring and the other of said levers being pivotally connected at its one end to said throttle plate with the other end of each of said levers being pivotally connected to each other, and means for varying the effect of throttle position on the tension of said thermostatic coil spring in accordance with engine vacuum, said means comprising a vacuum responsive device connected by a link to said pivotal connection between said pair of levers so that movement of said vacuum responsive means changes the effective length of said broken link.

3. In a carburetor comprising an induction passage, a choke valve pivotally mounted in said induction passage, a thermostatic coil spring variably resisting the opening of said choke valve in accordance with temperature, and a throttle valve pivotally mounted in said induction passage downstream of said choke valve, means comprising a plurality of links connected between said throttle valve and said thermostatic coil spring for varying the tension of said spring in accordance with throttle position, two of said plurality of links forming a broken link, engine vacuum means for varying the effective length of said broken link so as to vary the effect of throttle position on the tension of said spring, an additional link fixedly attached at its one end to said engine vacuum means, a plurality of holes formed along said additional link from the other end thereof to some

intermediate point thereon, said broken link being pivotally connectable to any one of said plurality of holes so as to enable variations in the effect of said vacuum means on said broken link.

4. A carburetor, comprising a body having an induction passage with a venturi therein, a choke valve pivotally mounted in said induction passage upstream of said venturi, said choke valve being unbalanced so that air flow to said engine tends to open said choke valve, a thermostatic coil spring connected to said choke valve so that the tension thereof tends to oppose choke opening in accordance with engine temperature, a throttle valve pivotally mounted in said induction passage downstream of said venturi, a first lever operatively secured to said throttle valve, a first link pivotally connected at its one end to said first lever, a second link pivotally connected at its one end to the other end of said first link, a second lever pivotally connected at its one end to the other end of said second link and having its other end operatively connected to the center of said thermostatic coil spring, vacuum responsive means and a third link operatively connected at its one end to said vacuum responsive means and at its other end to the pivotal connection between said first and second links.

5. A carburetor, comprising a body having an induction passage with a venturi therein, a choke valve pivotally mounted in said induction passage upstream of said venturi, said choke valve being unbalanced so that air

flow to said engine tends to open said choke valve, a thermostatic coil spring connected to said choke valve so that the tension thereof tends to oppose choke opening in accordance with engine temperature, a throttle valve pivotally mounted in said induction passage downstream of said venturi, a pair of levers pivotally connected to each other with one of said pairs of levers being pivotally connected to said throttle valve and the other of said pair of levers being pivotally connected to the inner end of said thermostatic coil spring, vacuum responsive means, and a third link connected at its one end to said vacuum responsive means and at its other end to the pivotal connection between said first and second links.

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