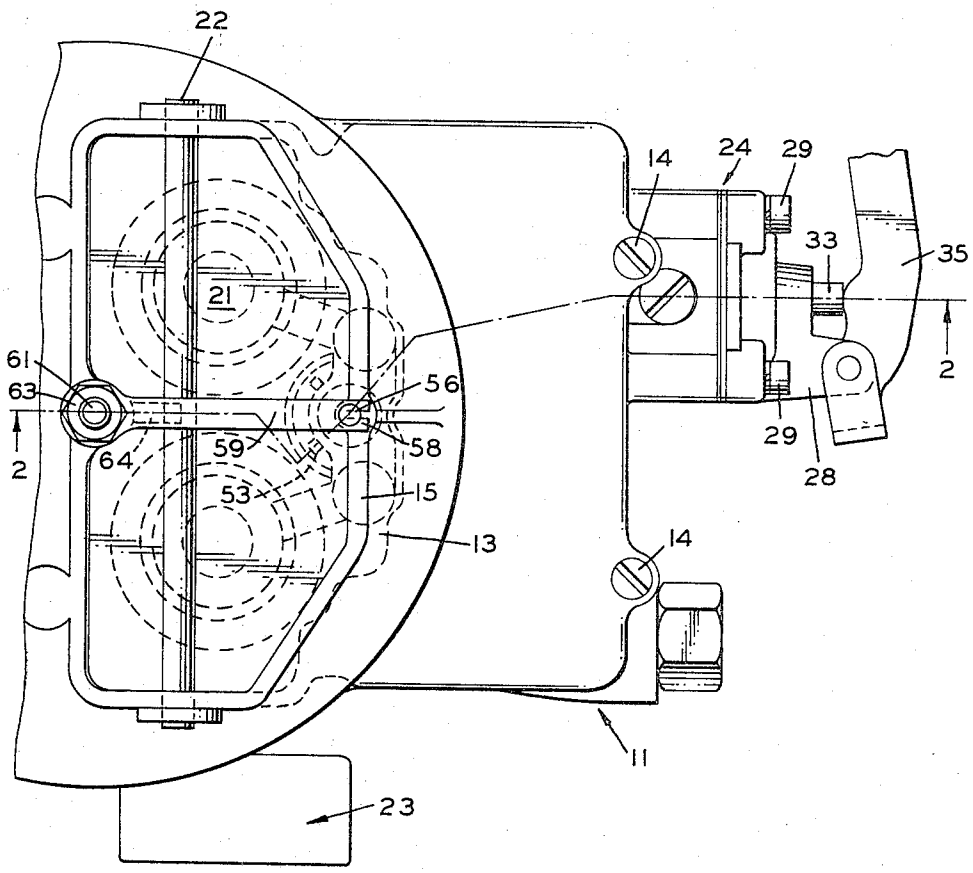
Oct. 31, 1967 E. L. SCALA, JR 3,350,071

TEMPERATURE COMPENSATED ACCELERATING PUMP

Filed Nov. 18, 1964 3 Sheets-Sheet 1

FIG. 1



EUGENE L. SCALA JR.
INVENTOR

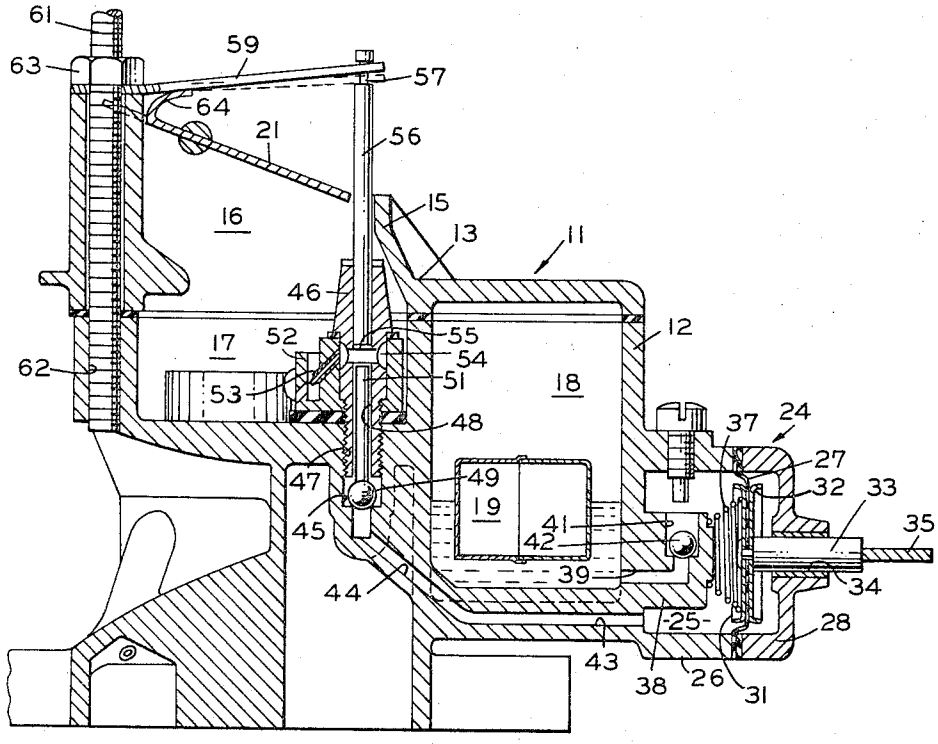
BY John R. Faulkner
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TEMPERATURE COMPENSATED ACCELERATING PUMP

Filed Nov. 18, 1964 3 Sheets-Sheet 2

FIG. 2



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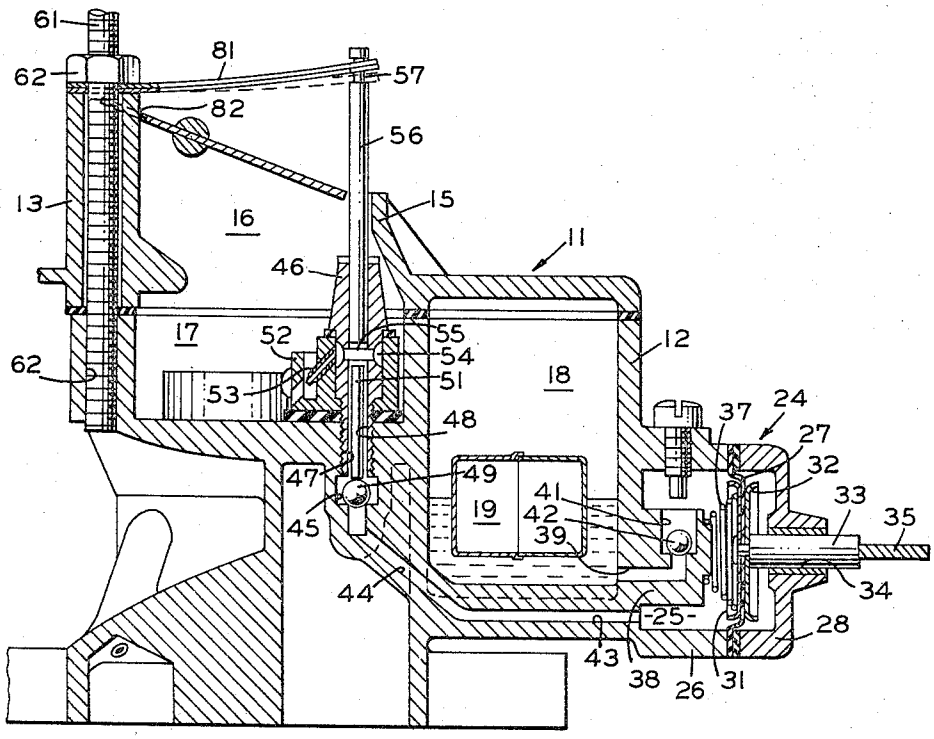
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TEMPERATURE COMPENSATED ACCELERATING PUMP

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FIG. 3



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United States Patent Office 3,350,071
Patented Oct. 31, 1967

3,350,071

TEMPERATURE COMPENSATED ACCELERATING PUMP

Eugene L. Scala, Jr., Southfield, Mich., assignor to Ford Motor Company, Dearborn, Mich., a corporation of Delaware

Filed Nov. 18, 1964, Ser. No. 412,177
7 Claims. (Cl. 261—34)

ABSTRACT OF THE DISCLOSURE

This accelerating pump delivers an amount of fuel to the engine that is related to the engine temperature. A tang or cam formed on the choke blade contacts linkage controlling the position of a valve in the accelerator pump discharge conduit. The conventional thermally responsive element positioning the choke blade according to the engine temperature thus acts through the cam on the choke blade to regulate the quantity of fuel supplied by the engine. Also disclosed is an arrangement in which a bimetal is located in the carburetor air intake and connected to the valve in the accelerator pump discharge conduit.

This invention relates to a temperature compensated accelerating pump for the charge forming device of an internal combustion engine.

The function of an accelerating pump, to inject a small amount of liquid fuel into the induction passage of a charge forming device during rapid opening of its throttle valve, is well known. It is equally well known that the required amount of fuel discharge of an accelerating pump is considerably less at high temperatures than at low temperatures. For this reason, it has been proposed to vary the output of an accelerating pump either seasonally through a mechanical adjustment or automatically in response to temperature variations. The automatic mechanisms heretofore provided have required some form of temperature responsive element for their operation. It has been common practice to provide a separate temperature responsive element that acts only upon the accelerating pump.

It is an object of this invention to provide a temperature compensated accelerating pump that does not necessitate the provision of a separate, thermally responsive element.

Charge forming devices incorporating a first embodiment of this invention include an induction passage and a throttle valve for controlling the flow of mixture through the induction passage. Fuel discharge means are provided to discharge fuel into the induction anterior to the throttle valve. A choke valve is provided in the induction passage anterior to the fuel discharge means for controlling the flow of air through the induction passage. Accelerating pump means having a pump member operatively connected to the throttle valve deliver a metered charge of fuel to the induction passage upon a predetermined degree of opening of the throttle valve. Means including linkage means are provided to operatively connect the choke valve to accelerating pump means for regulating the amount of fuel discharged by the accelerating pump means in a given degree of opening of the throttle valve in response to changes in the position of the choke valve.

In a further embodiment of this invention, automatic means including a temperature responsive element may be provided for positioning the choke valve. The automatic means also will control the amount of discharge of the accelerating pump means through a linkage system.

The temperature compensated accelerating pump mechanisms heretofore proposed for the most part have embodied some form of structure for altering the stroke of

the accelerating pump mechanism. A more accurate and more positive control may be provided through the use of a metering valve in the accelerating pump discharge circuit. In an embodiment of this invention, a metering valve provided in the accelerating pump discharge circuit may be operatively connected to the choke valve so that it is positioned in accordance with variations in the position of the choke valve.

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

FIGURE 1 is a top plan view of a portion of a charge forming device of an internal combustion engine embodying this invention.

FIGURE 2 is a cross sectional view taken along the line 2—2 of FIGURE 1.

FIGURE 3 is a cross sectional view, in part similar to FIGURE 2, showing another embodiment of this invention.

Referring now in detail to the drawings and in particular to the embodiment shown in FIGURES 1 and 2, a charge forming device for an internal combustion engine is indicated generally by the reference numeral **11**. The charge forming device **11** includes a body portion **12** and a cover plate **13** that is affixed to the body member by a plurality of screws **14**. The cover plate **13** has a raised air horn section **15** that forms an air inlet passage **16** that is in communication with one or more induction passages formed in the body portion **12**. The body portion induction passages are shown partially in FIGURE 2 and are identified by the reference numeral **17**. A fuel bowl **18** is formed in the body portion **12**. A float **19** and float valve assembly (not shown) is provided to maintain a uniform head of fuel in the fuel bowl **18**. Fuel is discharged from the fuel bowl **18** into the induction passages **17** by any suitable fuel discharge means. A throttle valve (not shown) may be provided at the lower end of the induction passages **17** posterior to the discharge end of the fuel discharge means for controlling the rate of mixture discharge from the charge forming device **11**.

A choke valve **21** is supported for rotation about an axis that extends transversely to the air inlet passage **16** by a choke valve shaft **22**. The choke valve shaft **22** is journaled at its opposite ends in the cover plate **13**. An automatic choke actuating mechanism, indicated generally by the reference numeral **23** and embodying a temperature responsive element (not shown), may be suitably connected to the choke valve shaft **22** to position the choke valve **21** in response to temperature variations. The specific automatic choke actuating mechanism employed does not form a part of this invention.

An accelerating pump mechanism, indicated generally by the reference numeral **24**, is provided to discharge a metered quantity of fuel into the induction passages **17** between the throttle valve and the choke valve **21** during opening of the throttle valve. The accelerating pump mechanism **24** comprises an annular pumping cavity **25** that is formed within a cylindrical projection **26** that extends from one side of the carburetor body portion **12**. A flexible diaphragm **27** is positioned across the mouth of the pumping cavity **25** and is held in place by an accelerating pump cover **28** that is affixed to the cylindrical projection **26** by a plurality of bolts **29**. The diaphragm **27** is clamped between a pair of rigid discs **31** and **32** that are affixed, in turn, to an accelerating pump plunger **33**. The pump plunger **33** is guided for reciprocation in a bore **34** formed within the accelerating pump cover **28**. An accelerating pump drive linkage including a pump operating lever **35** is provided to transmit motion from the throttle valve to the accelerating pump plunger **33** and diaphragm **27**.

The diaphragm **27** and accelerating pump plunger **33** are normally urged in an outward direction by a coil spring **37** that engages the disc **31** and a cylindrical boss **38** that extends coaxially within the pumping cavity **25**. When the throttle valves are moved to an open position, the accelerating pump drive linkage, including the pump operating lever **35**, urges the accelerating pump plunger **33** and diaphragm **27** inwardly to decrease the volume of the pumping cavity **25**.

During the outward movement of the diaphragm **27**, fuel may be drawn into the pumping cavity **25** through a horizontal passage **39** that extends from the lower end of the fuel bowl **18** and an intersecting, vertical passage **41** that is formed within the cylindrical boss **38**. A ball check valve **42** is provided within the passage **41** so that fuel may flow into the pumping cavity **25** through the passages **39** and **41** but cannot return to the fuel bowl **18** from the pumping cavity **25**.

During opening of the throttle valve, the diaphragm **27** is deflected inwardly to impel fuel from the pumping cavity **25** through a horizontal passage **43** that extends through the body portion **12** below the fuel bowl **18**. The passage **43** is intersected by a vertical passage **44** that terminates at the lower end of a vertical passage **45** that is formed adjacent to the induction passages **17**. A cap screw **46** is threaded into a tapped hole **47** formed in the body portion **12** at the upper end of the passage **45**. The cap screw **46** is formed with a vertically extending passage **48** that extends completely therethrough. A ball check valve **49** is positioned within the passage **45** and a weighted rod **51** is positioned within the passage **48** of the cap screw **46** to provide a flow restriction to the discharge of the accelerating pump mechanism **24**.

An accelerating pump discharge nozzle assembly **52** is affixed to the body portion **12** by the cap screw **46**. A pair of pump shooters **53** positioned within the nozzle assembly **52** are directed downwardly to discharge into the induction passages **17**. The upper ends of the pump shooters **53** register with an annular recess **54** that is formed around the cap screw **46**. The recess **54** is intersected by a horizontal passage **55** so that fuel flowing past the rod **51** may be discharged from the pump shooters **53**.

A metering rod **56** is supported in the upper end of the passage **48** formed in the cap screw **46**. The metering rod **56** is adapted to move into the intersection of the passages **48** and **55** to offer a further restriction to the flow of fuel to the pump shooters **53** and thus act as a metering valve. The upper end of the metering rod **56** is notched, as at **57**, for receipt within a forked end **58** of a leaf spring **59**. The other end of the leaf spring **59** is formed with an aperture through which an air cleaner hold-down stud **61** passes. The air cleaner hold-down stud **61** is affixed within a tapped hole **62** formed within the carburetor body portion **12**. A cinch nut **63** is positioned at the upper end of the air cleaner hold-down stud **61** to affix the leaf spring **59** relative to the cover plate **13**.

The choke valve **21** is fromed with an upsturned cam portion **64** that is adapted to engage the leaf spring **59** and deflect it upwardly when the choke valve **21** is in its closed or choked position as shown in the solid line view in FIGURE 2. When the leaf spring **59** is deflected upwardly, the metering rod **56** will be raised so that it will not interfere with the free flow of fuel from the accelerating pump mechanism **24** out of the pump shooters **53**. When the engine is warm and the choke valve **21** is moved to its open or unchoked position by the automatic choke actuating mechanism **23**, the cam portion **64** will permit the leaf spring **59** to deflect downwardly to the dotted line position shown in FIGURE 2. In this position, the lower end of the metering rod **56** will obstruct the communication between the passages **48** and **55** to restrict the amount of fuel discharged into the induction passage by the accelerating pump mechanism **24** for a given degree of opening of the throttle valve. The desired relationship between the position of the choke valve **21** and the meter rod **56** may be selected by appropriately forming the cam portion **64**.

In the previously described embodiment, the metering valve that controlled the discharge of the accelerating pump mechanism was responsive to the position of the choke valve. If the choke valve is operated by an automatic choke mechanism that is responsive to engine temperature, the rate of discharge of the accelerating pump also will be responsive to engine temperature. In some instances, it may be desirable to regulate the rate of pump discharge in response to the temperature of the intake air flowing through the air horn induction passage **16**. The embodiment shown in FIGURE 3 provides this result.

In the embodiment shown in FIGURE 3, the construction of the carburetor in general, the accelerating pump and the accelerating pump metering rod are the same as that shown in FIGURES 1 and 2. The common parts have been identified by the same reference numerals and will not be described again.

In place of the leaf spring in the previous embodiment, a bimetallic leaf spring **81** is clamped between the cinch nut **63** and the carburetor cover plate **13**. The outer end of the bimetallic leaf spring **81** is forked to receive the notched area of the metering rod **56**. The choke valve **21** is provided with a slot **82** so that the choke valve **21** may move between its open and closed positions without contacting the bimetallic leaf spring **81**.

When the temperature of the bimetallic leaf spring **81** is cold, indicating a low temperature of intake air, the outer end of the leaf spring **81** will deflect upwardly to the solid line position shown in FIGURE 3. In this position, the metering rod **56** will permit substantially unrestricted fuel flow between the passages **48** and **55** so that a full charge of fuel may be discharged from the accelerating pump **24** through the pump shooters **53**. As the temperature of the intake air increases, the bimetallic leaf spring **81** will deflect downwardly to the dotted line position so that the metering rod **56** will restrict the flow of fuel from the accelerating pump **24** through the pump shooters **53**.

It is to be understood that this invention is not limited to the exact constructions shown and described, but that various changes and modifications may be made without departing from the spirit and scope of the invention, as defined by the appended claims.

I claim:

1. A charge forming device for an internal combustion engine comprising an induction passage, a throttle valve controlling the flow of mixture through said induction passage, fuel discharge means for discharging fuel into said induction passage anterior to said throttle valve, a choke valve in said induction passage anterior to said fuel discharge means for controlling the flow of air through said induction passage, accelerating pump means having a pump member operatively connected to said throttle valve for delivering a metered charge of fuel to said induction passage upon a predetermined degree of opening of said throttle valve, and means including linkage means operatively contacted by cam means on said choke valve for regulating the amount of fuel discharged by said accelerating pump means in a given degree of opening of said throttle valve in response to the position of said choke valve.

2. A charge forming device for an internal combustion engine comprising an induction passage, a throttle valve controlling the flow of mixture through said induction passage, fuel discharge means for discharging fuel into said induction passage anterior to said throttle valve, a choke valve in said induction passage anterior to said fuel discharge means for controlling the flow of air through said induction passage, automatic choke positioning means operatively connected to said choke valve for positioning said choke valve in response to temperature variations, accelerating pump means having a pump member operatively connected to said throttle valve for

delivering a metered charge of fuel to said induction passage upon a predetermined degree of opening of said throttle valve, and means including linkage means operatively contacted by cam means on said choke valve for regulating the amount of fuel discharged by said accelerating pump means in a given degree of opening of said throttle valve in response to the position of said choke valve.

3. A charge forming device for an internal combustion engine comprising an induction passage, a throttle valve controlling the flow of mixture through said induction passage, fuel discharge means for discharging fuel into said induction passage anterior to said throttle valve, a choke valve in said induction passage anterior to said fuel discharge means for controlling the flow of air through said induction passage, accelerating pump means having a pump member operatively connected to said throttle valve for delivering a metered charge of fuel to said induction passage upon a predetermined degree of opening of said throttle valve, a metering valve in the discharge circuit of said accelerating pump means for regulating the amount of fuel discharge by said accelerating pump means in a given degree of opening of said throttle valve, and means including linkage means operatively contacted by cam means on said choke valve to adjust said metering valve in response to changes in the position of said choke valve.

4. A charge forming device for an internal combustion engine comprising an induction passage, a throttle valve controlling the flow of mixture through said induction passage, fuel discharge means for discharging fuel into said induction passage anterior to said throttle valve, automatic choke positioning means operatively connected to said choke valve for positioning said choke valve in response to temperature variations, accelerating pump means having a pump member operatively connected to said throttle valve for delivering a metered charge of fuel to said induction passage upon a predetermined degree of opening of said throttle valve, a metering valve in the discharge circuit of said accelerating pump means for regulating the amount of fuel discharged by said accelerating pump means in the predetermined degree of opening of said throttle valve, and means including linkage means contacted by cam means on said choke valve and connected to said metering valve for adjusting said metering valve in response to changes in the position of said choke valve.

5. A charge forming device for an internal combustion engine comprising an induction passage, a throttle valve controlling the flow of mixture through said induction passage, fuel discharge means for discharging fuel into said induction passage anterior to said throttle valve for controlling the flow of air through said induction passage, accelerating pump means having a pump member operatively connected to said throttle valve, an accelerating pump discharge circuit extending from said accelerating pump means to said induction passage for delivering a metered charge of fuel to said induction passage upon a predetermined degree of opening of said throttle valve, said accelerating pump discharge circuit including a first passage intersected adjacent one of its ends by a second passage, a metering rod supported for reciprocation within said first passage at said one end, said metering rod being movable between a first position wherein flow between said passages is restricted to a second position wherein flow between said passages is substantially unrestricted, and means operatively connecting said metering rod to said choke valve for moving said metering rod from its first position to its second position in response to movement of said choke valve from its open to its closed position.

6. A charge forming device for an internal combustion engine comprising an induction passage, a throttle valve controlling the flow of mixture through said induction passage, fuel discharge means for discharging fuel into said induction passage anterior to said throttle valve, a choke valve in said induction passage anterior to said fuel discharge means for controlling the flow of air through said induction passage, automatic choke positioning means operatively connected to said choke valve for positioning said choke valve in response to temperature variations, accelerating pump means having a pump member operatively connected to said throttle valve, an accelerating pump discharge circuit extending from said accelerating pump means to said induction passage for delivering a metered charge of fuel to said induction passage upon a predetermined degree of opening of said throttle valve, said accelerating pump discharge circuit including a first passage intersected adjacent one of its ends by a second passage at said one end, a metering rod movable from a first position wherein flow between said passages is restricted to a second position wherein flow between said passages is substantially unrestricted, and means operatively connecting said metering rod to said choke valve for movement of said metering rod from its first to its second position upon movement of said choke valve by said automatic choke positioning means from its opened to its closed position.

7. A charge forming device for an internal combustion engine comprising an induction passage, a throttle valve controlling the flow of mixture through said induction passage, fuel discharging means for discharging fuel into said induction passage anterior to said throttle valve, a choke valve supported in said induction passage for movement about a pivotal axis that extends transverse to the longitudinal axis of said induction passage for movement from an opened to a closed position, accelerating pump means having a pump member operatively connected to said throttle valve for delivering a metered charge of fuel to said induction passage upon a predetermined degree of opening of said throttle valve, a spring member affixed at one of its ends to said charge forming device at one side of said induction passage, said spring member extending in a direction normal to the pivot axis of said choke valve, cam means formed on said choke valve, said cam means being in contact with said spring member for deflecting said spring member upon movement of said choke valve between its opened and its closed position, and means operatively connecting said spring member to said accelerating pump means for regulating the amount of fuel discharged by said accelerating pump means in a given degree of opening said throttle valve in response to the position of said choke valve.

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