United States Patent

Channing

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[54] INTERNAL COMBUSTION ENGINE GASOLINE INJECTION SYSTEM

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[51] **Int. Cl.**.....**F02d 1/04**

[58] **Field of Search**.....123/119, 139.11, 139.11 A, 123/139.17, 139.18, 140.3, 179 A, 179 L

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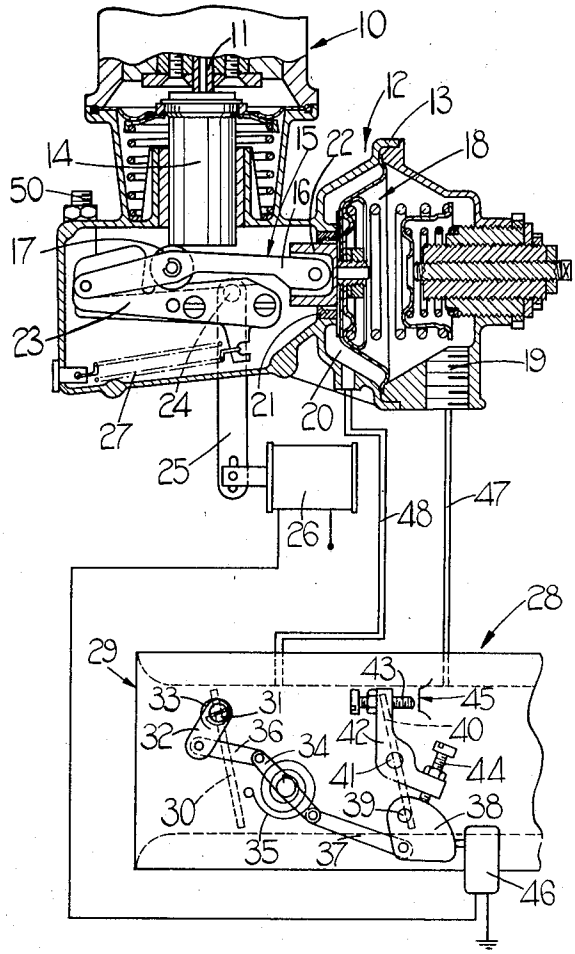
Primary Examiner—Laurence M. Goodridge

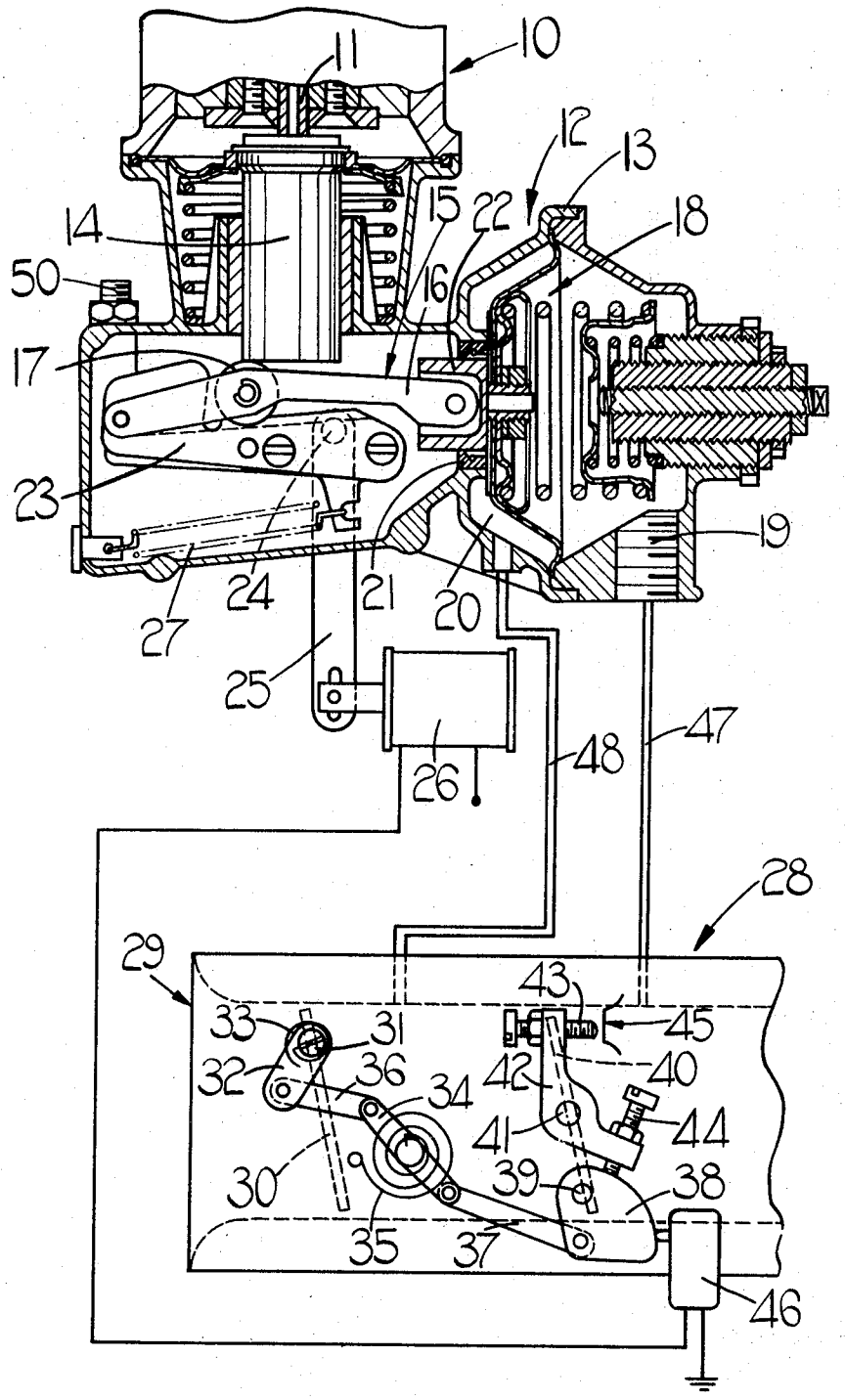
Attorney—Holman & Stern

[57] **ABSTRACT**

The invention relates to a gasoline injection system for an internal combustion engine. A control stop for a shuttle-type metering pump is responsive to a cam follower movable by a diaphragm. The diaphragm is in turn responsive to the pressure drop across the engine intake throttle. An airflow control device is carried in the intake, upstream of the throttle. The control device is operable by an element sensitive to engine temperature to reduce the pressure drop and thereby increase fuel supply at low temperatures. A cam track engaged by the cam follower is energizable during engine starting to further increase the fuel supply.

1 Claim, 1 Drawing Figure





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INTERNAL COMBUSTION ENGINE GASOLINE INJECTION SYSTEM

BACKGROUND OF THE INVENTION

This invention relates to an internal combustion engine petrol injection system and has as an object to provide such a system in a convenient form.

SUMMARY OF THE INVENTION

A system in accordance with the invention includes a temperature sensing element which is sensitive to the temperature of the engine, an airflow control device actuable by the temperature sensing element to restrict airflow upstream of the throttle of the engine when the engine is cold, means actuable by the temperature sensing element to open the throttle from its normal slow running position when the engine is cold and a fuel control device for controlling the quantity of fuel supplied to the engine, said fuel control device including a control element sensitive to the air pressures on opposite sides of the throttle and arranged to decrease fuel flow as the pressure difference across the throttle increases, said airflow control device serving to reduce the pressure difference when the engine is cold.

In addition, the fuel control device may include means actuable under the control of the temperature sensing device to increase the fuel flow during starting of the engine.

BRIEF DESCRIPTION OF THE DRAWINGS

An example of the invention is illustrated in the accompanying drawing in which the sole FIGURE is a diagrammatic view, partly in elevation and partly in cross-section.

The system illustrated incorporates a metering pump **10** for a gasoline injection system. The pump **10** is of known type having an adjustable stop **11** displaceable by a control device **12**. The device **12** includes a body **13**, a piston-like member **14** slidable within the body **13**, and engaging at its respective ends the stop **11** and a cam follower **15**. The cam follower **15** comprises a pair of arms **16** supporting a roller **17** and pivotally mounted on a diaphragm assembly **18**. The diaphragm assembly **18** defines within the body **13** a pair of chambers **19**, **20**, with sealing means **21** being interposed between a part **22** of the diaphragm assembly **18** and an adjacent portion of the body **13**. The cam follower roller **17** engages a cam track **23** mounted on a pivot **24** in the body **13**. The cam track **23** is rotatable about the pivot **24** by means of a lever **25** actuable by a solenoid **26**. The cam track **23** is biased clockwise as seen in the drawing, towards an adjustable limit screw **50** by a spring **27**. A terminal **26***a* of the solenoid **26** is connected to a terminal of a starter solenoid (not shown), for the engine.

An engine air intake **28** has adjacent its upstream end **29** an airflow control device in the form of a disc **30** mounted within the bore of the intake **28** upon a pivot **31** which is spaced both from the axis of the bore and the axis of the disc **30**. An arm **32** is mounted on the pivot **31** and is coupled thereto by a light torsion spring **33**, whereby the disc **30** may be moved independently of the arm **32**. A lever **34** is pivotally mounted externally of the intake **28**. A bi-metallic coil **35** is arranged to be heated by the exhaust system of the engine and has one end anchored to the intake **28**. The other end of the coil **35** engages the lever **34**. One end of lever **34** is connected by a link **36** to the arm **32**.

The other end of lever **34** is connected by a link **37** to a cam **38**, mounted externally of the intake **28** about a pivot **39**. A throttle **40**, downstream of the disc **30** is rotatable about a pivot **41** by a lever **42**. The lever **42** has a pair of adjustable abutments **43**, **44** which respectively coact with a stop **45** and with the cam **38**. The arrangement is such that, when the engine is cold, the cam **38** operates to open the throttle **40** slightly from its normal slow running position as determined by the stop **45**.

A microswitch **46**, connected in series with the solenoid **26** coacts with the cam **38** so that when the engine is cold, the switch **46** is closed to engage the solenoid **26**. A pair of passages **47**,**48** respectively extend between the chambers **19**,**20** and the bore of the inlet **28** upstream and downstream of the throttle **40**. In use, during cold starting, the lever **34** is in the position shown and cam **38** holds switch **46** on. The solenoid **26** is thus energized while the starter is energized, rotating the cam track **23** counter-clockwise about the pivot **24** to allow extra fuel to be supplied to the engine. The throttle **40** is held slightly open by the cam **38**. The disc **30** moves under the influence of airflow through the intake **28** to a position dependent on the magnitude of the airflow and on the spring **33**. The airflow is restricted by both the disc **30** and throttle **40**, instead of by the throttle alone, as is usual. The diaphragm assembly **18** is responsive only to the pressure drop across the throttle **40**, instead of the total pressure drop. The cam follower is thus moved to a lesser extent in a direction to reduce the fuel supply to the engine, and overfuelling results.

As the engine becomes warm, the lever **34** is rotated clockwise and the disc **30** has less effect in the airflow. The pressure drop across the throttle thus increases, progressively reducing overfuelling with rise in temperature.

During warm starting, above the temperature at which the switch **46** operates, solenoid **26** is not energized, and overfuelling is dependent only on any reduction in the pressure drop across the throttle **40**, as described.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. An internal combustion engine gasoline injection system in which the engine is provided with an air supply passage and a throttle in the air supply passage, the system including a bi-metal coil sensitive to the temperature of the engine, a disk constituting an air flow control device, pivot means mounting the disk within the air supply passage adjacent the upstream end of the air supply for pivotal movement about an axis which is spaced from the axis of the disk and the longitudinal axis of the air supply passage, an arm, a torsion spring coupling the arm to the pivoting means whereby the disk may be moved independently of the arm, means attaching one end of the bi-metal coil to the air supply passage, a lever pivotally mounted externally of the air supply passage, the other end of the bi-metal coil engaging the lever, means connecting one end of the lever to the arm, a cam pivotally mounted externally of the air supply passage, means connecting the other end of the lever to the cam, said throttle being located downstream of the disk, a pivot about which the throttle is rotatable, a second lever for rotating the throttle, an adjustable abutment for each end of the second lever, a stop with which one of the adjustable abutments coacts, the other adjustable abutment coacting with the cam so that when the engine is cold, the cam functions to open the throttle slightly from its normal slow running position as determined by the stop, a fuel control device for controlling the quantity of fuel supplied to the engine, said fuel control device including a body, a diaphragm providing a pair of chambers in the body, passage means providing communication between the air supply passage upstream of the throttle and one of the chambers, second passage means providing communication between the air supply passage downstream of the throttle and the other of the chambers, a cam track pivotally mounted in the body, a cam follower engaging the cam track and being movable relative thereto by the diaphragm, a shuttle-type metering pump, a control stop for the metering pump, means for transmitting the position of the cam follower to the control stop, a solenoid, means operably connecting the solenoid to the cam track to move the cam track about its pivotal mounting, and a microswitch connected in series to the solenoid and cooperable with the cam so that when the engine is cold, the microswitch is closed to engage the solenoid to energize the solenoid to rotate the cam track and allow extra fuel to be supplied to the engine.

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