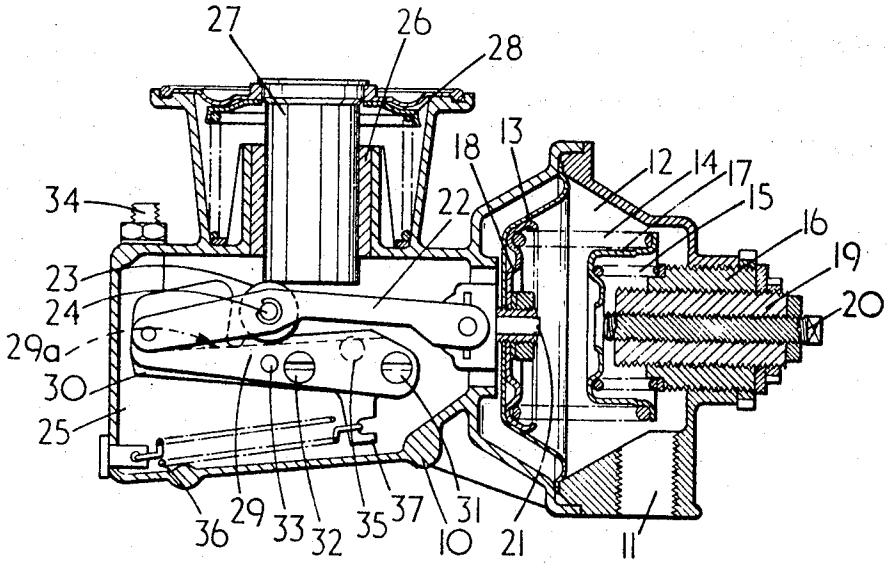
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CONTROL APPARATUS FOR LIQUID FUEL METERING DEVICES

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CONTROL APPARATUS FOR LIQUID FUEL METERING DEVICES

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U.S. Cl. 123—140 4 Claims

ABSTRACT OF THE DISCLOSURE

A control apparatus for a liquid fuel metering device for an internal combustion engine comprising a mechanism responsive to inlet manifold depression and which transfers such response to a displaceable member which controls the fuel metering device. The magnitude of displacement of the member is controlled by an adjustable cam.

Background of invention

This invention relates to control apparatus for metering devices in fuel supply systems for internal combustion engines and particularly though not exclusively to petrol injection systems.

In our U.S. Patent No. 2,891,701, there is described a form of control apparatus having a member arranged to control the stroke of a shuttle-type fuel metering device in accordance with the depression in the inlet manifold of an engine with which the apparatus is to be associated. The apparatus described in U.S. Patent No. 2,891,701 includes a cam and roller mechanism whereby the stroke control of the fuel metering device is achieved and there is also means whereby the response to inlet manifold depression can be modified in accordance with several factors, such as for example when it is desired to start the engine from cold and which operation requires the introduction of an increased amount of fuel.

Summary of invention

An object of the present invention is to provide an alternative form of control apparatus for controlling the metering of fuel in accordance with inlet manifold depression which is simple and convenient.

According to the present invention there is provided control apparatus for a liquid fuel metering device, an internal combustion engine comprising pressure-responsive means displaceable on change in inlet manifold depression, an arm associated with said pressure-responsive means and displaceable in accordance therewith, a displaceable member for effecting control of the fuel-metering device, to which the apparatus is adapted to be attached, a cam with which the arm co-operates to displace the member on movement of the arm by the pressure-responsive means, and means for adjustably positioning the cam in order to determine the magnitude of displacement of the member.

Description of drawing

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawing which is a cross-sectional view of control apparatus constructed in accordance with this invention.

Detail description of invention

The control apparatus comprises a body **10** which is adapted, in a manner not illustrated, to be secured to a shuttle-type liquid fuel metering device as described in our U.S. Patent No. 2,891,701. The body **10** has an inlet **11** which is intended in use to be connected to the inlet manifold of an engine with which the apparatus is to be used, with the inlet **11** communicating with a pressure-responsive mechanism which includes an interior chamber **12** bounded at one side by a diaphragm **13** and the movement of which is responsive to the inlet manifold depression. The diaphragm **13** is supported by a pair of springs **14**, **15** of differing rating and of differing diameter, with the inner smaller spring **15** having one end acting against an adjustable stop **16** located within the body **10** and the other end acting against a sheet metal plate **17**. The larger spring **14** acts at one end against the sheet metal plate **17** and at the other end against a support member **18** for the diaphragm **13**. The arrangement is such that throughout the total permitted travel of the diaphragm **13**, the spring pressures resisting collapse of the diaphragm, under the influence of falling depression in the inlet manifold of the engine, will differ in relation to the ratings of the two springs **14**, **15**. As the diaphragm **13** collapses, the two springs will collapse until the sheet metal plate **17** engages a further adjustable stop **19** which is coaxial with and secured in the stop **16**, whereupon no further compression of the spring **15** will take place and resistance to collapse of the diaphragm will be under the influence of the spring **14** only. The limit of collapse of the diaphragm **13** will be reached when a still further adjustable stop **20** within the stop **19** is engaged by an abutment **21** secured to the center of the diaphragm **13**.

Further fall in depression will therefore have no effect upon the diaphragm **13** below the value at which the stop **20** and the abutment **21** engage.

Connected to the center of the diaphragm **13**, at the opposite side thereof from the abutment **21**, is an arm **22** carrying a multiple roller element **23** which comprises three rollers (only one being illustrated) disposed upon a common axle **24** secured between two spaced elements which together form the arm **22**. The arm **22** together with the roller element **23** is moved longitudinally within a chamber **25** in the body **10** with changes in depression in the chamber **12** on the opposite side of the diaphragm **13**, with the chamber **25** being open to atmosphere so that atmospheric pressure is exerted on that side of the diaphragm **13**. Extending through a bearing **26** in the body **10** is a plunger **27**, the outer end of which is adapted to engage a movable abutment for the shuttle-type liquid fuel metering device. The plunger **27** is urged, when the apparatus is at rest before the engine is started, outwardly of the body by a compression spring **28** and the inner end of the plunger is engaged by the roller element **23**. During operation of the engine, however, the metering device provides a force tending to hold the plunger **27** against the roller element **23**.

The path of travel of the plunger **27** extends transversely with respect to the longitudinal path of travel of the arm **22**, and to impart such transverse movement to the roller element **23**, as longitudinal movement of the arm **22** takes place, there is provided an adjustably-positioned cam **29** with which the roller element **23** engages. It will readily be apparent that movement of the arm **22** along an inclined effective cam surface **29***a* causes the transverse movement of the plunger **27**.

Adjustment of the position of the cam **29**, to vary the extent of transverse movement of the roller element **23** and thus of the plunger **27** with changing depression in the inlet manifold of the engine, is initially achieved with respect to a mounting plate **30** which is connected to the cam through a pair of screws **31**, **32**. These screws **31**, **32** pass through respective slots in the cam **29** so that relative angular displacement between the cam **29** and the plate **30** can take place about an axis **33**, with an adjusted

position being maintained by tightening the screws **31** and **32**.

The plate **30** together with the cam **29** are pivotable within the body about an axis **35** and the degree of pivotal movement can be controlled by means of an external adjustable limit screw **34**.

An external lever (not shown) is connected to the plate **30** at the position indicated at **35**, and this can be connected to a manual or automatic control device for use during cold starting conditions. A tension spring **36** acts between the body **10** and a lug **37** on the plate **30**.

In use, changes in the depression exerted in the chamber **12** upon the diaphragm **13** transmit longitudinal movement to the arm **22** and to the roller element **23** which rides along the cam surface **29*a*** to urge the plunger **27** outwardly. The angular position of the cam surface **29*a*** with respect to the path of travel of the arm **22** determines the extent of movement of the plunger **27**. Actuation of the manual or automatic external control can be used to pivot the cam **29** about the axis **35** and thus vary temporarily the position of the effective cam surface **29*a*** to increase the quantity of fuel delivered to the engine by increasing the shuttle stroke for cold starting. The extent of over-fueling is at a maximum value with the greatest degree of depression, that is the normal depressions which are recorded in engines under idling conditions.

The external adjusting screw **34** can be used to trim the apparatus in accordance with atmospheric and/or engine temperature conditions or other variables, and can include if desired, a capsule or other device for sensing pressure or temperature conditions within the engine or in the surrounding atmosphere.

What we claim is:

1. Control apparatus for a liquid fuel metering device for an internal combustion engine, comprising pressure-responsive means displaceable on change in inlet manifold depression, an arm operable associated with said pressure-responsive means and displaceable in accordance therewith, a displaceable member for effecting control of the fuel-metering device to which the apparatus is adapted to be attached, a cam roller means mounted on the arm and engaging both the displaceable member and cam operative to displace the member on movement of the arm by the pressure-responsive means, a backing member on which said cam is mounted and relative to which it is adjustable between fixed positions for varying the magnitude of the displacement of the displaceable member, and said cam and backing member being together pivotable for varying temporarily the position of the effective cam surface for permitting an increase in the quantity of fuel delivered to the engine.

2. Apparatus as claimed in claim **1**, within which the pressure responsive means includes a diaphragm which is displaceable on change of inlet manifold depression, the arm being connected to the diaphragm for movement therewith.

3. Apparatus as claimed in claim **1**, in which adjustable means are provided for limiting the pivotal movement of the cam and backing member.

4. Apparatus as claimed in claim **1**, in which the arm comprises a pair of spaced elements between which is mounted said roller means.

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