PATENT SPECIFICATION

593,035

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PROVISIONAL SPECIFICATION

Improvements in or relating to Lubrication Systems of Internal Combustion Engines

I, FRANK METCALF ASPIN, a British Subject, of Walmer Place, 149, Walmersley Road, Bury, Lancashire, do hereby declare the nature of this invention to be as follows:—

This invention relates to lubrication systems of internal combustion engines.

The modern internal combustion engine is invariably provided with a "pressure" lubrication system the basis of which comprises an oil pump driven by the engine and a pressure-release valve therefor which operates to maintain a substantially constant oil delivery pressure except at idling speed. Such combination is to some extent dictated by the fact a pump of considerable delivery capacity must be fitted to allow for wear, particularly of the big end bearings of the engine so that the normal pressure can be maintained in spite of such wear.

Constant-pressure lubrication does not however really meet the requirements of the engine. This has already been recognised by proposals to make the lubrication pressure vary proportionally with the load, as by mechanism operated by the engine throttle-control mechanism or by mechanism operated by the changes of pressure in the induction system of the engine. An example of such an arrangement is described in the Specification of my co-pending Application for Patent No. 7572/43. Such modification does not however provide for variation of the oil pressure with variation of the engine speed, though such variation is known to be desirable.

The object of the present invention is to provide a pressure lubrication system which is variably controlled by the two variables, namely speed and load.

According to the invention control means for a pressure lubrication system of an internal combustion engine comprises a main oil feed duct between the pump and the engine, a diaphragm-controlled pressure-reducing valve arranged in said duct and loaded, at least in part, as a function of the engine speed so that its outlet or delivery pressure rises and falls with the engine speed, and a cut off valve located in the duct after the said reducing valve and operating to close or open in said duct proportionally with the decrease or increase of engine load. The control means may be characterised in that the pressure reducing valve is diaphragm loaded by pressure varying with the engine speed; or in that the engine is liquid cooled with a liquid circulating pump driven by the engine and in that the pressure-reducing valve is diaphragm loaded from the said liquid circulating pump; or in that the cut-off valve is actuated for opening by a loading spring and for closing by a diaphragm subject to the pressure variations in the induction system of the engine; or in that the cut-off valve is non-responsive to the pressure of the lubricating system.

The accompanying drawing is a longitudinal sectional view of one example of a control unit made in accordance with the invention.

As shown in the drawing, the device comprises a body part 10 having pipe couplings 11 and 12 respectively for connection to the oil pump and to the engine, neither of which are shown. At one end of the body part is a pressure-reducing valve comprising a piston 13 having a waist 14 adapted to register with an inlet passage 11*a* from the coupling 11; and a head 13*a* adapted to close such inlet. A passage 13*b* in the valve provides communication between the waist 14 and the inner end of the cylinder 15. The piston is located in a cylinder 15 formed in one end of a longitudinal through passage 16 leading to the outlet coupling 12. The valve 13 is connected to a diaphragm 17, secured by an end cap 10*a* of the body part, in which is located a compression spring 18 loading the valve into its open position. Fluid pressure, for example from the pump for circulating cooling liquid for the engine is admitted through a pipe coupling 19. Transversely across the passage 16 is arranged a piston-type cut-off valve 20 having a head 20*a* and a waist 21 adapted to register with the passage 16. The valve is connected to a diaphragm 22 secured by a cover 10*b* and is loaded for opening by a spring 23. The diaphragm

is adapted to be loaded by sub-atmospheric pressure from the engine induction manifold through a pipe coupling 24. The under sides of the diaphragm 17 and 22 and the inner end of the piston head 20*a* are open to atmospheric pressure through a passage 25.

In operation, the valve 13 operates as a pressure reducing valve in such manner that the pressure at the delivery end of the valve through its passage 13*b* is in part proportional to the engine speed because when the engine speed is higher there is more pressure on the diaphragm 17 of the piston 13, helping to hold it in the open position against the back pressure on the end of the piston head 13*a*. The lubrication pressure in the through passage 16 is therefore proportional in part to the engine speed. The valve 20 merely acts as a restriction the intensity of which increases with the reduction of pressure in the induction manifold of the engine and therefore substantially with the reduction of the B.M.E.P. of the engine. Consequently, the pressure of oil in the outer end of the passage 16, i.e. after the valve 20 varies in the first place as a function of the engine speed through the action of the valve 13 and as a function of the engine load or B.M.E.P. through the action of the valve 20.

The engine lubrication pump will have its pressure release valve set to a predetermined maximum, or in order to avoid power loss, the piston 13 may operate as a pressure release valve by providing a release port adapted to be uncovered by the waist 14 instead of acting to shut off the passage 11*a*.

The invention is obviously not limited to all the details of the construction above described, many of which may be modified without departing from the nature of the invention. For example instead of the valve 20 being non-sensitive to the pressure of the lubricant it could also operate in part as a pressure reducing valve, in part loaded by pressure from the cylinder 15 so that the ultimate delivery pressure would still be a composite function.

Dated this 16th day of November, 1944.
For the Applicant:
WILSON, GUNN. & ELLIS,
54/56, Market Street, Manchester, 1.

COMPLETE SPECIFICATION

Improvements in or relating to Lubricating Systems of Internal Combustion Engines

I, FRANK METCALF ASPIN, a British Subject, of Walmer Place, 149, Walmersley Road, Bury, Lancashire, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to lubrication systems of internal combustion engines.

The modern internal combustion engine is invariably provided with a "pressure" lubrication system the basis of which comprises an oil pump driven by the engine and a pressure-release valve therefor which operates to maintain a substantially constant oil delivery pressure except at idling speed. Such combination is to some extent dictated by the fact that a pump of considerable delivery capacity must be fitted to allow for wear, particularly of the big end bearings of the engine so that the normal pressure can be maintained in spite of such wear.

Constant-pressure lubrication does not, however, really meet the requirements of the engine. This has already been recognised by proposals to make the lubrication pressure vary proportionally with the load, as by mechanism operated by the engine throttle-control mechanism or by mechanism operated by the changes of pressure in the induction system of the engine. An example of such an arrangement is described in the Specification of my co-pending Application for Patent No. 7512/43 (Serial No. 566,305). Such modification does not, however, provide for variation of the oil pressure with variation of the engine speed, though such variation is known to be desirable.

The object of the present invention is to provide a pressure lubrication system which is variably controlled by the two variables, namely speed and load.

According to the invention control means for a pressure lubrication system of an internal combustion engine comprises a main oil feed duct between the pump and the engine, a diaphragm-controlled pressure-reducing valve arranged in said duct and loaded, at least in part, as a function of the engine speed so that its outlet or delivery pressure rises and falls with the engine speed, and a cut off valve located in the duct after the said reducing valve and operating to close or open in said duct proportionally with the decrease or increase of engine load. The control means may be characterised in that the pressure reducing valve is diaphragm loaded by pressure varying with

the engine speed; or in that the engine is liquid cooled with a liquid circulating pump driven by the engine and in that the pressure-reducing valve is diaphragm loaded from the said liquid circulating pump; or in that the cut-off valve is actuated for opening by a loading spring and for closing by a diaphragm subject to the pressure variations in the induction system of the engine; or in that the cut-off valve is non-responsive to the pressure of the lubricating system.

The drawing filed with the Provisional Specification is a longitudinal sectional view of one example of a control unit made in accordance with the invention.

As shown in the drawing, the device comprises a body part 10 having pipe couplings 11 and 12 respectively for connection to the oil pump and to the engine, neither of which are shown. At one end of the body part is a pressure-reducing valve comprising a piston 13, having a waist 14 adapted to register with an inlet passage 11*a* from the coupling 11; and a head 13*a* adapted to close such inlet. A passage 13*b* in the valve provides communication between the waist 14 and the inner end of the cylinder 15. The piston is located in a cylinder 15 formed in one end of a longitudinal through passage 16 leading to the outlet coupling 12. The valve 13 is connected to a diaphragm 17, secured by an end cap 10*a* of the body part, in which is located a compression spring 18 loading the valve into its open position. Fluid pressure, for example from the pump for circulating cooling liquid for the engine, is admitted through a pipe coupling 19. Transversely across the passage 16 is arranged a piston-type cut-off valve 20 having a head 20*a* and a waist 21 adapted to register with the passage 16. The valve is connected to a diaphragm 22 secured by a cover 10*b* and is loaded for opening by a spring 23. The diaphragm is adapted to be loaded by a sub-atmospheric pressure from the engine induction manifold through a pipe coupling 24. The under sides of the diaphragm 17 and 22 and the inner end of the piston head 20*a* are open to atmospheric pressure through a passage 25.

In operation, the valve 13 operates as a pressure reducing valve in such manner that the pressure at the delivery end of the valve through its passage 13*b* is in part proportional to the engine speed because when the engine speed is higher there is more pressure on the diaphragm 17 of the piston 13, helping to hold it in the open position against the back pressure on the end of the piston head 13*a*. The lubrication pressure in the through passage 16 is therefore proportional in part to the engine speed. The valve 20 merely acts as a restriction, the intensity of which increases with the reduction of pressure in the induction manifold of the engine and therefore substantially with the reduction of the B.M.E.P. of the engine. Consequently, the pressure of oil in the outer end of the passage 16, i.e. after the valve 20 varies in the first place as a function of the engine speed through the action of the valve 13 and as a function of the engine load or B.M.E.P. through the action of the valve 20.

The engine lubrication pump will have its pressure release valve set to a predetermined maximum, or in order to avoid power loss, the piston 13 may operate as a pressure release valve by providing a release port adapted to be uncovered by the waist 14 instead of acting to shut off the passage 11*a*.

The invention is obviously not limited to all the details of the construction above described, many of which may be modified without departing from the nature of the invention. For example instead of the valve 20 being non-sensitive to the pressure of the lubricant it could also operate in part as a pressure reducing valve, in part loaded by pressure from the cylinder 15 so that the ultimate delivery pressure would still be a composite function.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. Control means for a pressure lubrication system of an internal combustion engine comprising a main oil feed duct between the pump and the engine, a diaphragm - controlled pressure - reducing valve arranged in said duct and loaded, at least in part, as a function of the engine speed so that its outlet or delivery pressure rises and falls with the engine speed, and a cut-off valve located in the duct after the said reducing valve and operating to close or open in said duct proportionally with the decrease or increase of engine load.

2. Control means for a pressure lubrication system of an internal combustion engine according to Claim 1, characterised in that the pressure reducing valve is diaphragm loaded by pressure varying with the engine speed.

3. Control means for a pressure lubrication system of an internal combustion engine according to Claim 1 or 2, characterised in that the engine is liquid cooled with a liquid circulating pump driven by the engine and in that the pressure-

reducing valve is diaphragm loaded from the said liquid circulating pump.

4. Control means for a pressure lubrication system according to any of the preceding claims characterised in that the cut-off valve is actuated for opening by a loading spring, and for closing by a diaphragm subject to the pressure variations in the induction system of the engine.

5. Control means for a pressure lubrication system according to any of the preceding Claims characterised in that the cut-off valve is non-responsive to the pressure of the lubricating system.

6. Control means according to any of the preceding claims characterised in that the same is incorporated in a unit adapted to be inserted in the lubrication system between the pump and the engine.

7. A control unit for a pressure lubrication system comprising a body part having pipe couplings for its insertion in the main supply duct and a through passage, a pressure reducing valve located in one end of the said through passage, a spring loading said valve, a diaphragm also adapted to load said valve and pipe coupling means for admitting a fluid pressure, such as that of the liquid cooling system, varying with the engine speed and a cut-off valve arranged in the said through passage after the pressure reducing valve, a loading spring operating to hold the valve open, in opposition to a diaphragm connected to said valve and pipe coupling means for subjecting the said diaphragm to sub-atmospheric pressures obtaining in the engine induction system.

8. Control means for a pressure lubrication system of internal combustion engine constructed and arranged substantially as herein described with reference to and as illustrated in the drawing filed with the Provisional Specification.

Dated this 4th day of December, 1945.

For the Applicant:
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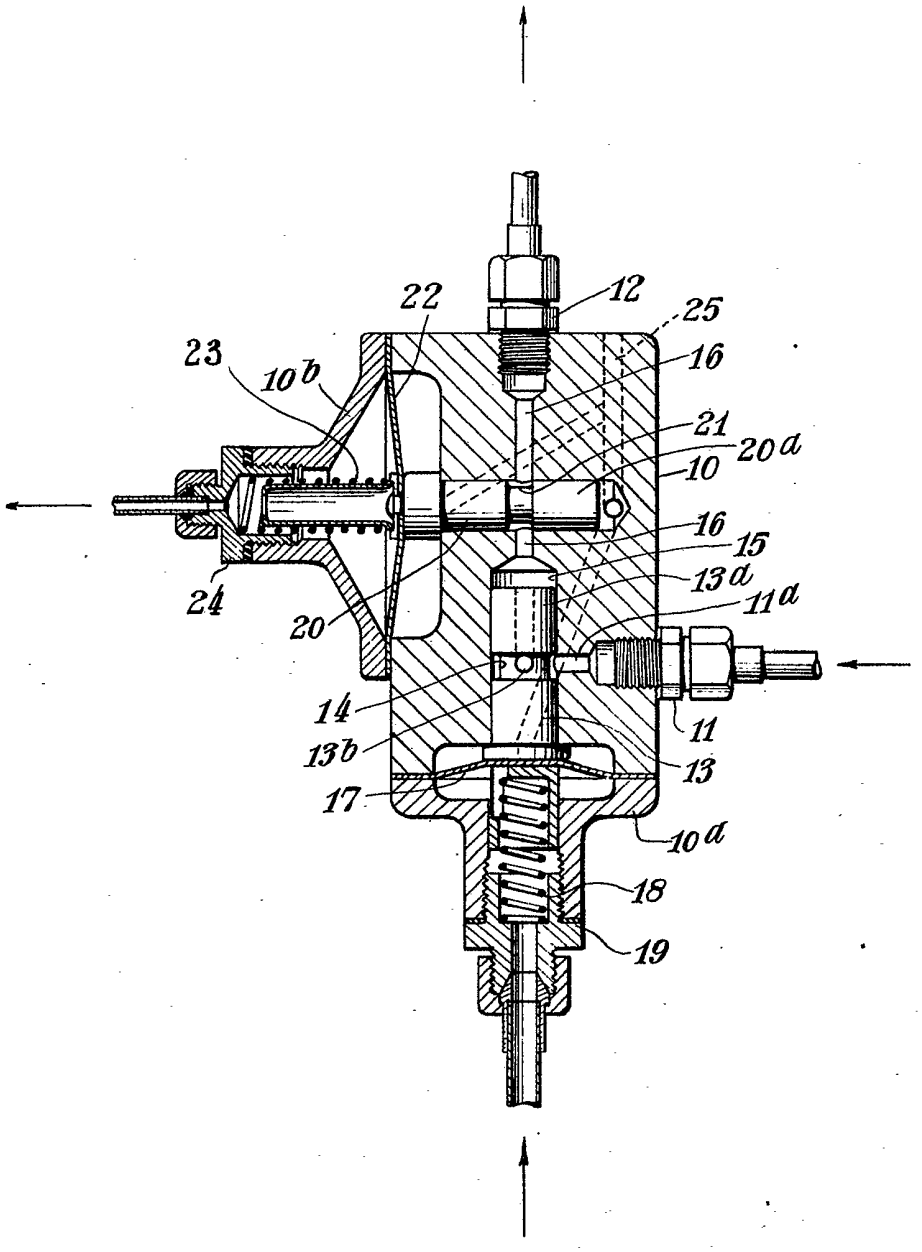

[This Drawing is a reproduction of the Original on a reduced scale.]

H.M.S.O. (Ty.P.)