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Clouse

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[54] HORSEPOWER LIMITER AND OVERFUELING CONTROL MECHANISM

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[52] **U.S. Cl.**........................ **123/139 ST**; 123/179 L

[51] **Int. Cl.**^{2}... **F02D 1/06**

[58] **Field of Search**...... 123/179 L, 139 ST, 179 G, 123/139 T, 139 AD, 140 FG

[56] **References Cited**

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[57] **ABSTRACT**

A horsepower limiter and overfueling control mechanism for an internal combustion engine having a fuel pump with a fuel control device operatively associated therewith for regulating the horsepower output of the engine which includes a movable member having a first position disposed in non-interfering relation with the operation of the fuel control device permitting it to move to an overfueling position for starting the engine and a second position restricting the range of operation of the fuel control device to limit the maximum horsepower output of the engine. An adjustment device is operatively associated with the movable member for selectively varying the range of operation of the fuel control device while permitting the movable member freely to move between its first and second positions in all settings of the adjustment device for attaining said horsepower limiting and overfueling functions with a single control.

6 Claims, 2 Drawing Figures

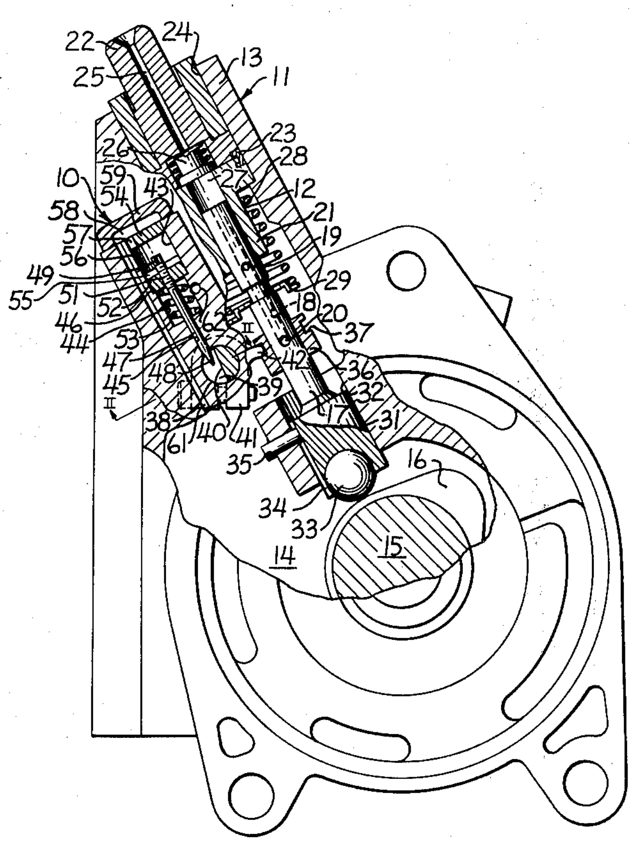

Fig. 1

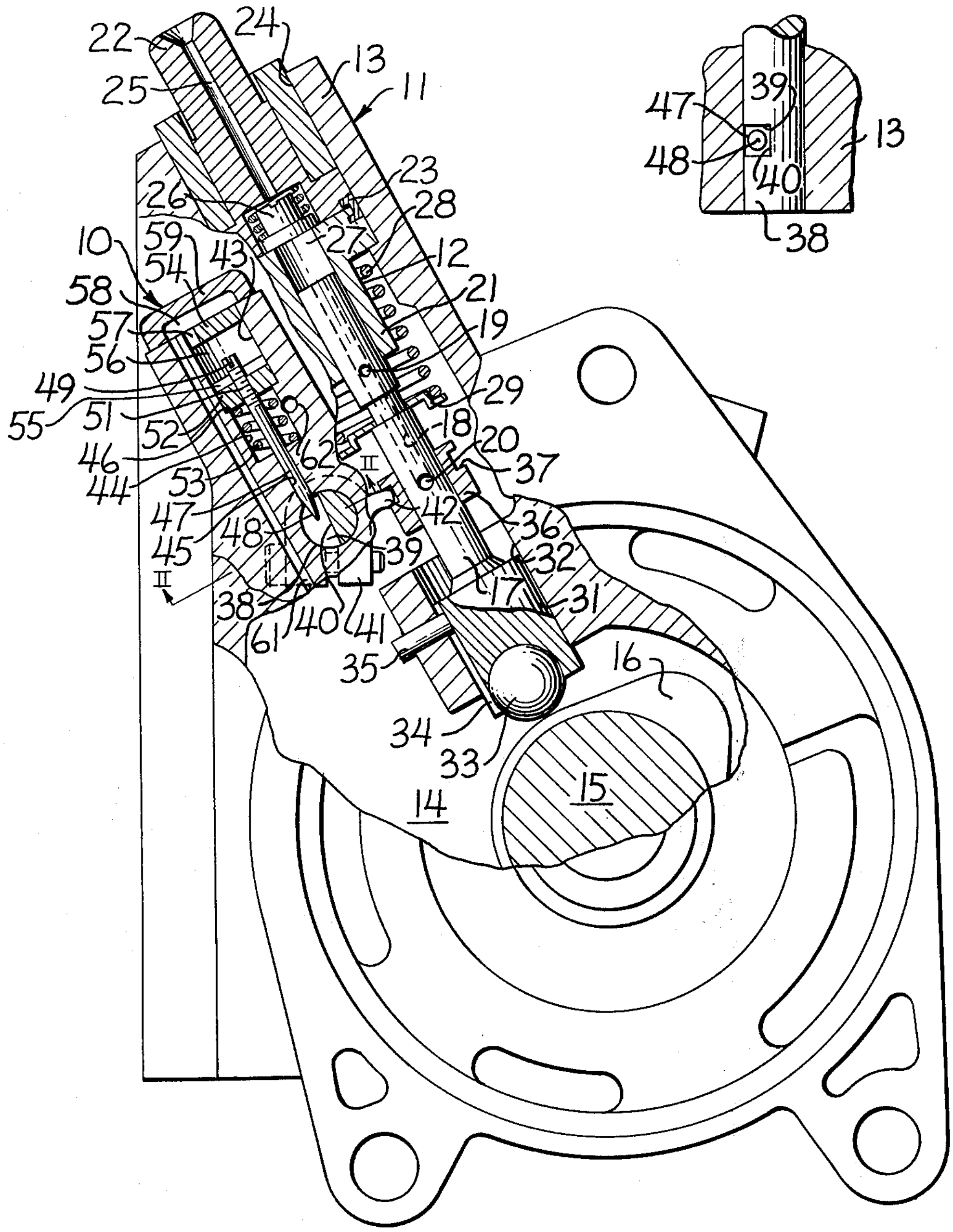
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Fig. 2
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HORSEPOWER LIMITER AND OVERFUELING CONTROL MECHANISM

BACKGROUND OF THE INVENTION

Conventionally, some compression ignition engines can be rated at several different horsepower ratings. Such engines commonly utilize identical fuel injection pumps and the horsepower of a particular engine is set by limiting the maximum fuel output of the pump. This is accomplished by adjustment of a stop member associated with the control rod of the engine governor to indirectly limit the movement of the fuel control member. However, with such arrangements, the maximum fuel output often is insufficient to provide efficient starting of the engine, particularly in cold weather. To aid in starting, the governors of newer engines having a high idle spring are frequently provided with an additional spring mechanism automatically to move the fuel control member to the full travel, maximum supply position, commonly known as the overfuel position, which provides an increased fuel flow during start up. However, the additional spring mechanism adds to the cost and complexity of the governor and often requires other mechanisms to prevent the fuel control rack from being moved to the overfueling position during certain lugging conditions of the engine.

Another problem encountered is that an engine adjusted at the factory to operate at a higher horsepower than another engine of the same size has certain heavier duty components such as piston rings, bearings, valves, etc., than the engine intended for operation at a lower horsepower rating not including their fuel pumps which are identical. Should the engine rated at the lower horsepower be adjusted during use in the field for operation at a higher horsepower, its operational life would be drastically shortened with the lighter weight components. Thus, care must be taken to insure that after leaving the factory the power output setting of a lower horsepower engine cannot be conveniently increased or made greater than the rating at which it is intended to operate.

OBJECTS OF THE INVENTION

Accordingly, an object of this invention is to provide an improved horsepower limiter and overfueling control mechanism.

Another object of this invention is to provide such an improved horsepower limiter and overfueling control mechanism which permits the maximum horsepower rating of an engine to be readily adjusted at the factory but which cannot be conveniently adjusted thereafter so as to minimize the possibility of overrating the engine in the field.

Another object of this invention is to provide an improved horsepower limiter and overfueling control mechanism of the character described having an adjustment device for establishing the maximum fuel output of the fuel pump for selectively varying the maximum horsepower output of the engine while permitting conditioning of the fuel pump for overfueling during starting of the engine with a single control.

Other objects and advantages of the present invention will become more readily apparent upon reference to the accompanying drawings and following description.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a sectional view of a horsepower limiter and overfueling control mechanism embodying the principles of the present invention in association with a sleeve metering fuel pump.

FIG. **2** is a fragmentary sectional view of the horsepower limiter and overfueling control mechanism taken along line II—II of FIG. **1**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more particularly to the drawing, a horsepower limiter and overfueling control mechanism embodying the principles of the present invention is generally indicated by the reference numeral **10** in association with a sleeve metering fuel pump assembly **11**. The fuel pump assembly has a plurality of fuel pumps, one of which is shown at **12**, contained within a fuel pump housing **13**. The fuel pump housing has a chamber **14** which is filled with fuel delivered thereto by an engine driven transfer pump, not shown. A camshaft **15** is suitably journaled in the housing and has a plurality of cams, one of which is shown at **16**.

Each fuel pump **12** includes an elongated plunger **17** having a longitudinal passage **18** extending from the upper end thereof. A fill port **19** and a spill port **20** are transversely disposed intermediate the ends of the plunger **17** and communicate with the longitudinal passage **18**. The plunger is disposed for reciprocal motion within a pump barrel **21** which is suitably secured to a bonnet **22** such as by an annular clamp **23**. The bonnet **22** is disposed within a bore **24** formed in the pump housing **13** and has an outlet passage **25** adapted for communicating with the combustion chamber, not shown, of the engine. A spring check valve **26** is slidably disposed within the bonnet and normally closes the pump barrel to define a chamber **27** above the plunger. The check valve **26** is opened to admit fuel to the outlet passage **25** only when the pressure in the barrel attains a predetermined value. A spring **28** is disposed between a shoulder on the exterior of the barrel and a spring seat **29** secured to the plunger **17** to urge the plunger toward the camshaft **15**.

The lower end of the plunger **17** seats in a cam follower **31** which is slidably disposed in a suitable bore **32** formed in the pump housing **13** and carries an antifriction roller **33** for engagement with its respective cam **16** on the camshaft **15**. A groove **34** is formed longitudinally on the periphery of the cam follower **31** to receive a pin **35** extending into the bore **32** to prevent rotation of the cam follower. A metering sleeve **36** slidably surrounds the plunger and has a circumferential groove **37** formed thereon. A fuel control shaft **38** extends longitudinally through the pump housing adjacent to the metering sleeve **36** and is adapted to be rotated by a governor, not shown, in the usual manner. As best shown in FIG. **2**, a notch **39** is provided in the fuel control shaft **38** and is disposed transversely to its longitudinal axis for forming a stop surface **40**. A sleeve adjusting lever **41** is clamped onto the fuel control shaft adjacent to each metering sleeve **36** and has an extending finger **42** projecting into the groove **37** of the metering sleeve.

The horsepower limiter and overfueling control mechanism **10** is housed within a plurality of co-axially disposed stepped bores **43, 44** and **45** which are formed in the pump housing 13 with the bore 45 being located adjacent to the fuel control shaft 38. The axis of the bores is substantially normal to the longitudinal axis of the fuel control shaft and in line with the notch 39 of the fuel control shaft. The bore 43 terminates in an annular shoulder 46. An elongated adjustable stop rod 47 slidably extends through the bore 45 and has a conical tip 48 formed on one of its ends for extension into the notch 39. The opposite end of the rod 47 has a slot 49 and a screw-threaded portion 51. A piston 52 is screw-threadably attached to the threaded portion of the rod and is slidably disposed in the bore 43. A tool receiving notch 55 is formed in the upper axial end of the piston 52 to permit the piston to be rotationally restrained by its receipt of a suitable tool while the adjustable stop rod 47 is rotated relative thereto for a later defined purpose. A compression spring 53 is disposed in the bore 44 and resiliently urges the piston and rod in a direction away from the fuel control shaft.

A rigid non-removable plug 54 is pressed into the bore 43 forming a chamber 56 between the piston 52 and the plug. A slot 57 is formed in the periphery of the plug and communicates the chamber 56 with a cavity 58 formed by a cover 59 suitably secured to the pump housing. A passage 61 connects cavity 58 with the pump housing chamber 14. A drain passage 62 is formed in the pump housing and communicates the bore 44 with the intake side of the transfer pump to drain leakage fuel from the bore and to provide a pressure differential between the chamber 56 and the bore 44.

OPERATION

While the operation of the present invention is believed clearly apparent from the foregoing description, further amplification will subsequently be made in the following brief summary of such operation. When the engine is running, the fuel in the pump housing chamber 14 is under moderate pressure. When the plunger 17 is in the retracted position shown in FIG. 1, the fuel enters the fill port 19 and passage 18 of the plunger and is admitted to the chamber 27 above the plunger. The spill port 20 is covered by the sleeve 36 with the plunger in the retracted position. Upon rotation of the camshaft 15, the plunger advances into the barrel 21, closing the fill port, trapping and pressurizing the fuel in the chamber until the check valve 26 opens and the fuel is expelled through the outlet passage 25 to the combustion chamber. When the plunger advances to a position where the spill port is uncovered from the sleeve 36, the remaining fuel in the chamber 27 is vented through the passage 18 and spill port 20 into the pump housing chamber and the check valve closes. This concludes the delivery of fuel from the pump with the volume of fuel delivered during each stroke being determined by the position of the sleeve.

Adjustment of the sleeve 36 is accomplished by rotation of the fuel control shaft 38 causing lever 41 and the extending finger 42 to move the sleeve longitudinally on the plunger and varies the time at which the spill port 20 is opened. This may be accomplished manually or automatically in response to engine requirement as sensed by the engine governor. Rotation of the control shaft in a counterclockwise direction moves the sleeve upwardly to increase the volume of fuel expelled during each stroke while clockwise rotation of the control shaft decreases the volume of fuel expelled during each stroke.

Prior to engine start up, the fuel in the pump housing chamber 14 is not pressurized and the spring 53 urges the adjustable stop rod 47 and piston 52 upwardly against the plug 54 so that the conical tip 48 of the rod is disposed in non-interfering relation with the operation of the fuel control shaft 38. This permits the control shaft to be rotated counterclockwise to its maximum operational position to provide maximum fuel flow during each plunger stroke for starting the engine. Such a condition is commonly called "overfueling".

When the engine starts, the fuel in the pump housing chamber 14 is elevated to the desired operating pressure by the transfer pump and transmitted through passage 61, cavity 58 and the slot 57 of the plug 54 into the chamber 56. The pressurized fuel urges the piston 52 and adjustable stop rod 47 downwardly, causing the conical tip 48 slidably to engage the periphery of the fuel control shaft 38. Such contact does not impair the operation of the fuel control shaft so that when the engine reaches operating speed, the governor rotates the fuel control shaft clockwise to reduce the volume of fuel delivered each stroke of the plungers 17. This permits the piston and rod to be forced downwardly until the piston contacts the annular shoulder 46 and the conical tip 48 of the rod extends into the notch 39 of the fuel control shaft. Thereafter, as the control shaft is rotated counterclockwise, the stop surface 40 of the notch will subsequently engage the conical tip. This restricts the range of operation of the fuel control shaft to establish the maximum fuel output of the fuel pump. Since the horsepower output of a particular compression ignition engine is determined, at least in part, by the amount of fuel delivered to the combustion chambers, the rod 47 is effective in limiting the maximum horsepower thereof.

The maximum horsepower output of the engine is increased by adjusting the adjustable stop rod 47 upwardly so that the stop surface 40 of the notch of the fuel control shaft engages the conical tip closer to its apex permitting greater counterclockwise rotation of the fuel control shaft thereby allowing greater maximum fuel output of the pump. Conversely, adjusting the conical tip downwardly decreases the maximum horsepower output by decreasing the permissible counterclockwise rotation of the fuel control shaft. The horsepower setting is made by rotating the rod relative to the piston 52 to vary the disposition of the conical tip relative to the piston. After the adjustment has been made, the plug 54 is non-removably pressed into the bore 43 at the factory permanently to seal the bore to prevent tampering or readjustment of the adjustable stop rod.

In view of the foregoing, it is readily apparent that the structure of the present invention provides an improved horsepower limiter and overfueling control mechanism which can be readily adjusted at the factory adjustably to set the power output of an engine at its rated horsepower with the mechanism then being permanently sealed to preclude the possibility of its being readjusted to a higher horsepower setting in the field. The mechanism limits the maximum horsepower output of the engine to its rated horsepower during engine operation while permitting conditioning of the fuel pump for overfueling during starting of the engine. The mechanism combines an adjustable horsepower limiter and an overfueling control into a single control which is simple to adjust and economical to manufacture.

While the invention has been described and shown with particular reference to the preferred embodiment, it will be apparent that variations might be possible that would fall within the scope of the present invention which is not intended to be limited except as defined in the following claims.

What is claimed is:

1. A horsepower limiter and overfueling control mechanism, for an internal combustion engine having a fuel pump and a fuel control device operatively associated therewith for regulating the horsepower output of the engine, comprising;

a stop surface formed on such fuel control device;

an elongated movable rod disposed adjacent to the fuel control device, said movable rod having opposite ends and a first position disposed in non-interferring relation with said stop surface to permit the fuel control device to be moved to an overfueling position for starting such engine and movable to a second predetermined positively located position in which one of said ends is adapted for selective direct engagement with said stop surface for restricting the range of operation of the fuel control device to establish the maximum fuel output of such fuel pump to limit the maximum horsepower output of the engine;

means responsive to operation of the engine for moving said movable rod to said second position including a reciprocatable piston operatively attached to said movable rod and disposed coaxial therewith;

a housing having a first cylindrical bore disposed adjacent to the fuel control device with said movable rod being slidably disposed in said cylindrical bore, a second cylindrical bore disposed coaxially with said first cylindrical bore and terminating in an annular shoulder, said piston being disposed in said second cylindrical bore for moving said movable rod between said first and second positions with said second position being established by engagement between said piston and said annular shoulder, and a third bore formed between said first and second cylindrical bores;

a source of pressurized fluid in communication with said second bore for moving said piston to said second position;

biasing means disposed in said third bore for resiliently urging said piston and said movable rod to said first position when said source of pressurized fluid is interrupted; and

adjustment means integral with said movable rod including a threaded portion formed on the other of said ends of said elongated rod and screw-threadably received coaxially by said piston for adjustably attaching the other end of said elongated rod to said piston, a tool receiving notch formed in said piston and tool receiving means formed in said other end of said elongated rod for effecting rotation of said elongated rod relative to said piston to vary the disposition of said one end of said elongated rod relative to said stop surface on the fuel control device and said piston when said piston is in said second position for selectively varying the range of operation of the fuel control device to vary said maximum horsepower output of the engine when the movable rod is in its second position while maintaining the non-interferring relation between the movable rod and the stop surface in all settings of the adjustment means for obtaining said horsepower limiting and overfueling functions with a single control.

2. The horsepower limiter and overfueling control mechanism of claim 1 wherein said adjustment means includes a conical tip formed on said one end of said elongated rod adapted for adjustable variable engagement with said stop surface.

3. The horsepower limiter and overfueling control mechanism of claim 2 wherein the fuel control device includes an elongated shaft, having a notch formed therein transverse to its longitudinal axis for forming said stop surface of the fuel control device.

4. The horsepower limiter and overfueling control mechanism of claim 1 including a plug fixedly secured within said second bore of said housing to limit the movement of said piston toward said first position and forming a chamber in said housing for receiving said pressurized fluid, said plug having a passage formed therein, and said housing including a passageway formed therein for communicating said passage of said plug with said source of pressurized fluid.

5. The horsepower limiter and overfueling control mechanism of claim 1 wherein said housing is a fuel pump housing.

6. A horsepower limiter and overfueling control mechanism, for an internal combustion engine having a fuel pump and a fuel control device operatively associated therewith for regulating the horsepower output of the engine, comprising;

a stop surface formed on such fuel control device;

a housing having a first cylindrical bore disposed adjacent to the fuel control device, and a second cylindrical bore disposed coaxial with said first bore and terminating in an annular shoulder;

an elongated movable rod slidably disposed in said first bore having opposite ends;

a reciprocatable piston slidably disposed in said second bore and operatively attached to said movable rod for moving it between a first position in non-interferring relation to said stop surface and a second positively located position in which one of said ends is adapted for selective direct engagement with said stop surface, said second position being established by engagement between said piston and said annular shoulder;

a source of pressurized fluid in communication with said second bore for moving said piston and said movable rod to said second position;

biasing means for resiliently urging said piston and said movable rod to said first position when said source of pressurized fluid is interrupted; and

adjustment means intergral with said movable rod including a threaded portion formed on the other of said ends of said elongated rod and screw-threadably received coaxially by said piston for adjustably attaching said elongated rod to said piston, a tool receiving notch formed in said piston and tool receiving means formed in said other end of said elongated rod for effecting rotation of said elongated rod relative to said piston to vary the disposition of said one end of said elongated rod relative to said stop surface on the fuel control device and said piston when said piston is in said second position for selectively varying the range of operation of the fuel control device to vary the maximum horsepower output of the engine.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 3,913,546
DATED : October 21, 1975
INVENTOR(S) : Jerry A. Clouse

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the Title Page, Item [73], change the spelling of the assignee's corporate name from "Caterpillar Tractor Company" to ---Caterpillar Tractor Co.---.

Signed and Sealed this

third **Day of** *February 1976*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks

UNITED STATES PATENT OFFICE

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