Nov. 5, 1957 G. D. D. WILSON 2,812,043

CONTROLS FOR INTERNAL COMBUSTION ENGINES

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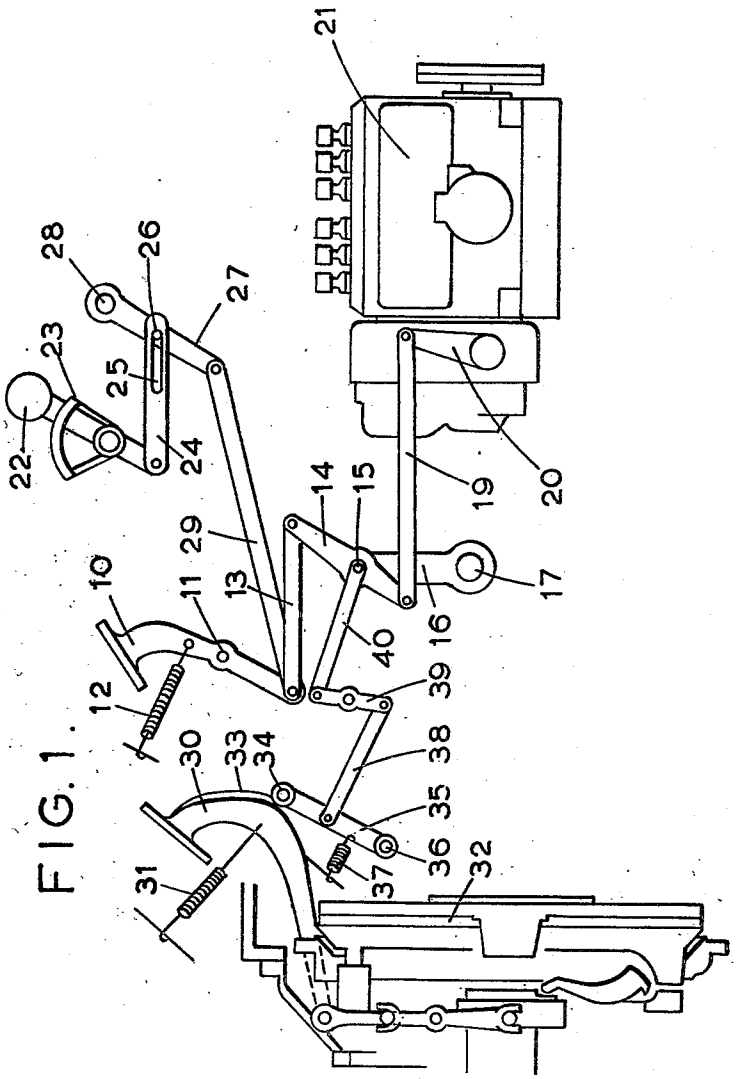


FIG. 1.

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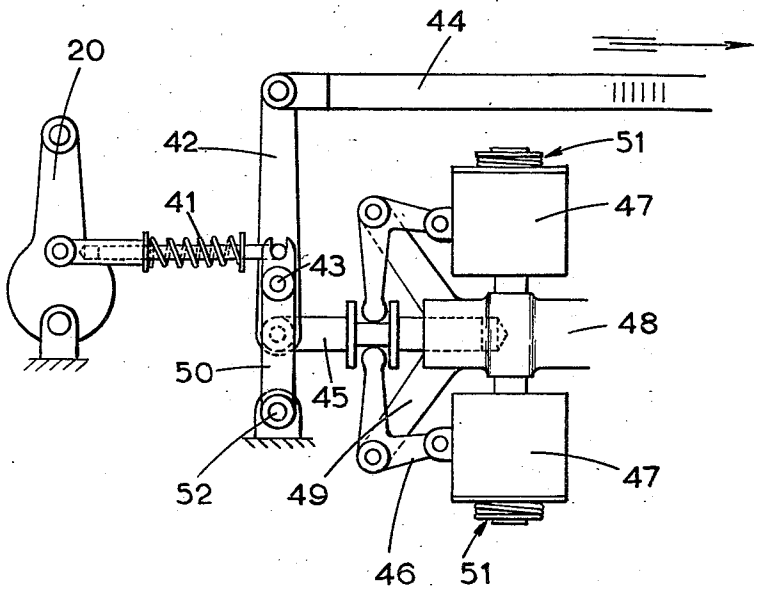
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FIG. 2.



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CONTROLS FOR INTERNAL COMBUSTION ENGINES

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5 Claims. (Cl. 192—.084)

This invention is for controls for internal combustion engines.

It applies to the type of control used on internal combustion engines used for heavy duties as for example those used in earth moving track laying vehicles.

It is usual on such vehicles to provide a governor, centrifugal, hydraulic, pneumatic or a combination of these to control the engine speed and an accelerator pedal by which the governor setting is adjusted.

A hand control which may be a hand control overriding the accelerator pedal, is often provided in addition, enabling the driver to select which part of the total engine speed range shall be the "governed" part. This is useful for operation where the load is fairly constant and well within maximum engine power, the operator then selecting the speed which he desires and the governor controlling the engine to maintain it at this speed.

When travelling over rough ground in circumstances where accurate control by the accelerator pedal would be difficult the driver is able to set the governor hand control to give the power required and leave the control of engine speed to the governor.

When the engine is required to drive the machine to move against a heavy static load the driver will normally set the governor control to produce maximum engine revolutions and then let in his clutch.

The maximum torque however of the engine will be produced at something below the maximum revolutions and until the load applied through the clutch, has reduced the engine speed to a speed approaching that at which maximum torque is produced the clutch plates will slip violently under the heavy load. This causes heavy wear on the clutch plates which it is the object of this invention to avoid.

According to this invention control means for an internal combustion engine of a heavy duty vehicle includes a governor which controls the fuel supply to the engine and thereby its maximum speed, a second control (the accelerator control) member operated by the driver by which the supply of fuel to the engine is also controlled and by means of which the governor setting is adjusted and a third control member by which the speed at which the engine is to be controlled by the governor can be selected, said third control operating to move the accelerator control to the position of maximum governed speed and define the extent of its permissible return movement, a clutch operating to connect and disconnect the engine from the members driven by the engine, a control whereby such clutch can be engaged and disengaged and a connection between the clutch control and the control members by which the governor setting is controlled which operates to reduce the governed maximum speed of the engine when the clutch is not fully engaged.

Preferably the speed is not reduced by a greater amount than the difference between the speed at maximum governor setting and a speed slightly in excess of that at which maximum torque is available, so that if the driver has set the hand control at maximum then the maximum torque will be available as soon as the clutch is fully engaged.

In a mechanical arrangement the interconnection may be of a floating lever fulcrumed on an arm which is pivoted on a part of the frame; one end of this floating lever is connected to the accelerator pedal and to the hand control and the other to the governor setting mechanism, and the clutch control operates to displace the arm around its pivot during which movement the floating lever pivots on the end of the accelerator pedal connection.

An example of a mechanical control according to this invention is illustrated diagrammatically in the accompanying drawings in which Figure 1 is a diagram of the various controls outside the governor casing, and Figure 2 a drawing of the controls inside the latter.

10 is the accelerator pedal pivotted at **11** and returning to the idling position under the influence of spring **12**.

The end of the accelerator pedal is connected by a link **13** to a floating lever **14** fulcrumed at **15** to an arm **16** articulated at **17** to the chassis frame.

The other end of lever **14** is connected by a link **19** to arm **20** which operates the governor control. The injection pump is shown at **21**.

22 is the hand control lever moving over a quadrant **23** and connected to a link **24** having a slot **25** in it. In this slot is a pin **26** on a lever **27** pivotted at **28** on the chassis frame and connected by link **29** to the end of the accelerator pedal.

In the position shown in the drawing the lever **22** is at the right hand end of its quadrant **23** and is set to give maximum governed speed. Pin **26** rests against the right end of slot **25**. Putting the lever in this position moves the accelerator pedal and holds it in the fully depressed position which is that illustrated in the drawing. As the lever **22** is moved over its quadrant **23** toward the left, spring **12** will pull back the accelerator pedal which will then be free to move under the control of the driver between the position when pin **26** is at the right end of slot **25** and its fully depressed position. When lever **22** is at the left end of the quadrant, pin **26** will be just clear of the left end of slot **25** and the driver can then move the accelerator pedal over the whole range of its movement.

Spring **12** is not capable of moving lever **22** and can therefore only return the accelerator control to the extent permitted by that lever.

30 is the clutch pedal, moving against the reaction of spring **31** to disengage the clutch **32**. On the front of the clutch pedal is formed a camface **33** on which runs a roller **34** on the end of an arm **35** fulcrumed at **36** on the chassis frame and held against the clutch pedal by spring **37**. Arm **35** is connected by link **38**, lever **39** (fulcrumed at its centre point on the chassis frame) and link **40** to the end of arm **16**.

Springs **12** and **37** in combination with the various leverages are so selected that operation of the accelerator pedal **10** will not disturb lever **35**.

Lever **20** is connected to the floating lever **42** (see Figure 2). The connection is through a spring **41** which acts on lever **50** pivoted at a fixed point **52**, and has a pivotal connection at **43** with the said lever **42**. The connection which carries spring **41** is in two parts telescoped together, one part being pivoted to lever **20** and the other connected by a cross pin to a slot in the end of lever **50**. The lower end of floating lever **42**, is pivoted to a guide **45** telescoped into the end of the camshaft **48** on which are cams operating fuel pump plungers, one for each cylinder of the engine. Shaft **48** carries a cross pin or trunnion on which slide two governor weights **47**, their outward movement being resisted by springs **51**. Bell crank levers **46**, engage governor weights **47** and a groove

in guide, 45, by each of their arms respectively, the levers being pivotted between double arms 49 integral or rigid with camshaft 48. The upper end of lever 42 is connected to a sliding rack, 44, which operates to rotate the bushes or cylinders in which the main pump plungers work. These cylinders are provided with specially shaped helical ports, so that their partial rotation varies the quantity of fuel the plungers supply in well known common manner.

Outward movement of the governor weights 47 under centrifugal force rocks lever 42 anti-clockwise, moving rack 44 to the left and reducing the fuel supply. This action also takes place against the action of spring 41, lever 20 being held against movement by friction or by a notched quadrant.

Thus, the action of spring 41 either adds to or reduces the effect of governor springs 51. Each position of lever 20 therefore provides a different position on which the governor weights will reach a state of equilibrium and hold the rack 44.

When the clutch pedal 30 is depressed to disengage the clutch, roller 34 will run on cam face 33. Initial movement of the pedal will then, owing to the shape of the cam face 33 displace arm 35 to the right, the linkage causing displacement of arm 16 to the left to move arm 20 also to the left and reduce the governor controlled speed of the engine. Further movement of the clutch pedal disengages the clutch.

In a particular engine the maximum revolutions are 2000 per minute. The governor controls the speed with about 10 percent increase from full load to no load. The revolutions at full load under the control of the governor are therefore 1800 R. P. M. To maximum torque is at 1300 R. P. M. and it is to a setting just above this, e. g. 1400 R. P. M. to which the governor control is moved during clutch disengagement assuming that the setting of the governor by the driver is at the maximum.

It will be appreciated that by varying the length of arm 35 and the shape of cam 33, the apparatus may be modified to suit the characteristics required in different conditions of engine control.

What I claim is:

1. Control means for an internal combustion engine of a heavy duty vehicle which include a governor having a setting mechanism which controls the fuel supply to the engine and thereby its maximum speed, a second or accelerator control member operated by the driver by which the supply of fuel to the engine is also controlled and by means of which the governor setting mechanism is adjusted and a third or manual control member by which the speed at which the engine is to be controlled by the governor can be selected, said third control member operating to move the accelerator control member to the position of maximum governed speed and define the extent of its permissible return movement, a clutch operating to connect and disconnect the engine from the members driven by the engine, a control whereby said clutch can be engaged and disengaged and a connection between the said clutch control and the said control members by which the governor setting is controlled, said

connection operating to reduce the governed maximum speed of the engine when the clutch is not fully engaged.

2. Control means as claimed in claim 1 which incorporate a lever, an arm articulated to a fixed point to which arm said lever is articulated, a link connection between one end of said lever and said accelerator control member and a connection between the other end of said lever and the governor setting mechanism, and a connection between said clutch control and the said arm so that movement of the clutch control operates to displace the said arm around its pivot during which movement said lever pivots at the end of the link connection to the accelerator control member.

3. Control means as claimed in claim 1 in which there is provided a cam displaceable by said clutch control with a connection between said cam and the governor setting mechanism.

4. Control means for a heavy vehicle internal combustion engine which incorporates, an engine clutch, a governor having a speed setting mechanism, a fuel adjusting device controlled by said governor, an accelerator pedal, a two armed floating lever having a fulcrum on a lever, a fixed fulcrum for the second lever, a link connecting one arm of said floating lever to said pedal, the other end of said floating lever being connected by a linkage to the speed setting mechanism by which the setting of the governor controlling the fuel supply is adjusted, another linkage connected to said accelerator pedal, a control connected to said last mentioned linkage by a pin and slot arrangement whereby the said accelerator pedal can be moved by such control to the position of maximum governed speed and which defines by means of said pin and slot arrangement the permissible return movement of the accelerator pedal, a clutch pedal operating the engine clutch, a linkage between said clutch pedal and the fulcrum of the said floating lever, said linkage being so constructed that movement of the clutch pedal to disengage the clutch will move said lever to which said floating lever is fulcrumed to alter the governor setting to reduce the maximum governed engine speed, while operation of the accelerator pedal or said control operating thereon will not affect said linkage between the clutch pedal and said floating lever.

5. Control means as claimed in claim 4 in which a rod axially adjusted by the governor is connected to one end of a floating lever the other end of which is connected to the fuel adjusting device, said floating lever being fulcrumed on another lever having itself a fixed fulcrum, spring means connecting said last mentioned lever with a third lever similarly fulcrumed, and a connection between said third lever and the control linkage system operated by the said accelerator control.

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