

Jan. 3, 1939.

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2,142,172

OVERSPEED FUEL INJECTOR LOCK FOR DIESEL ENGINES

Filed July 6, 1937

3 Sheets-Sheet 1

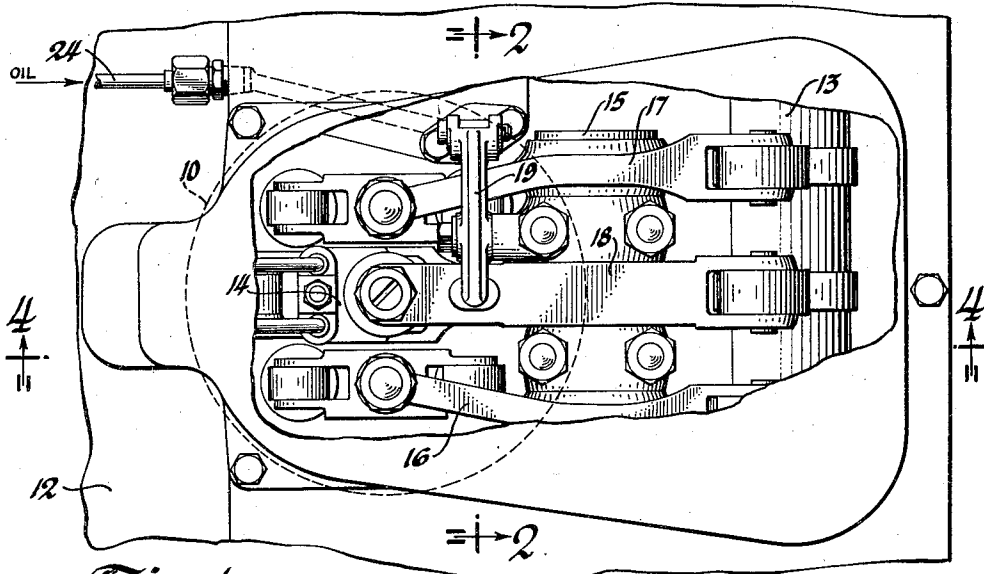


Fig. 1

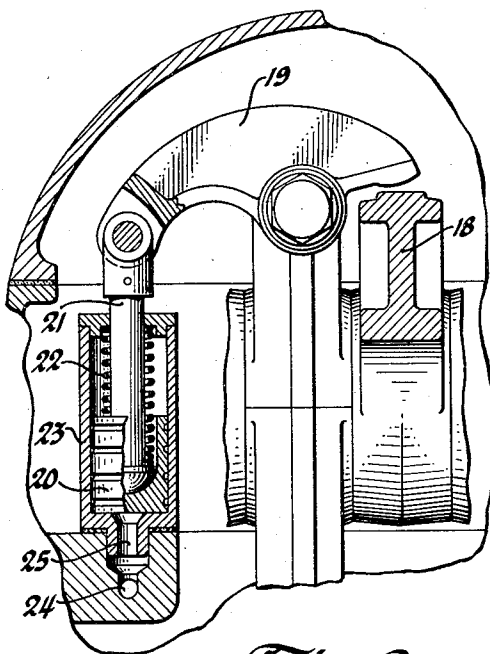


Fig. 2

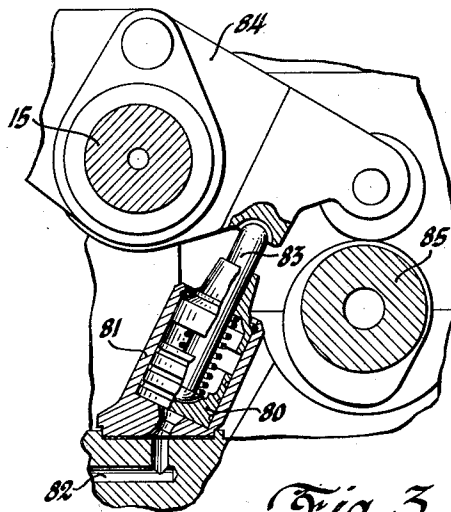


Fig. 3

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3 Sheets-Sheet 2

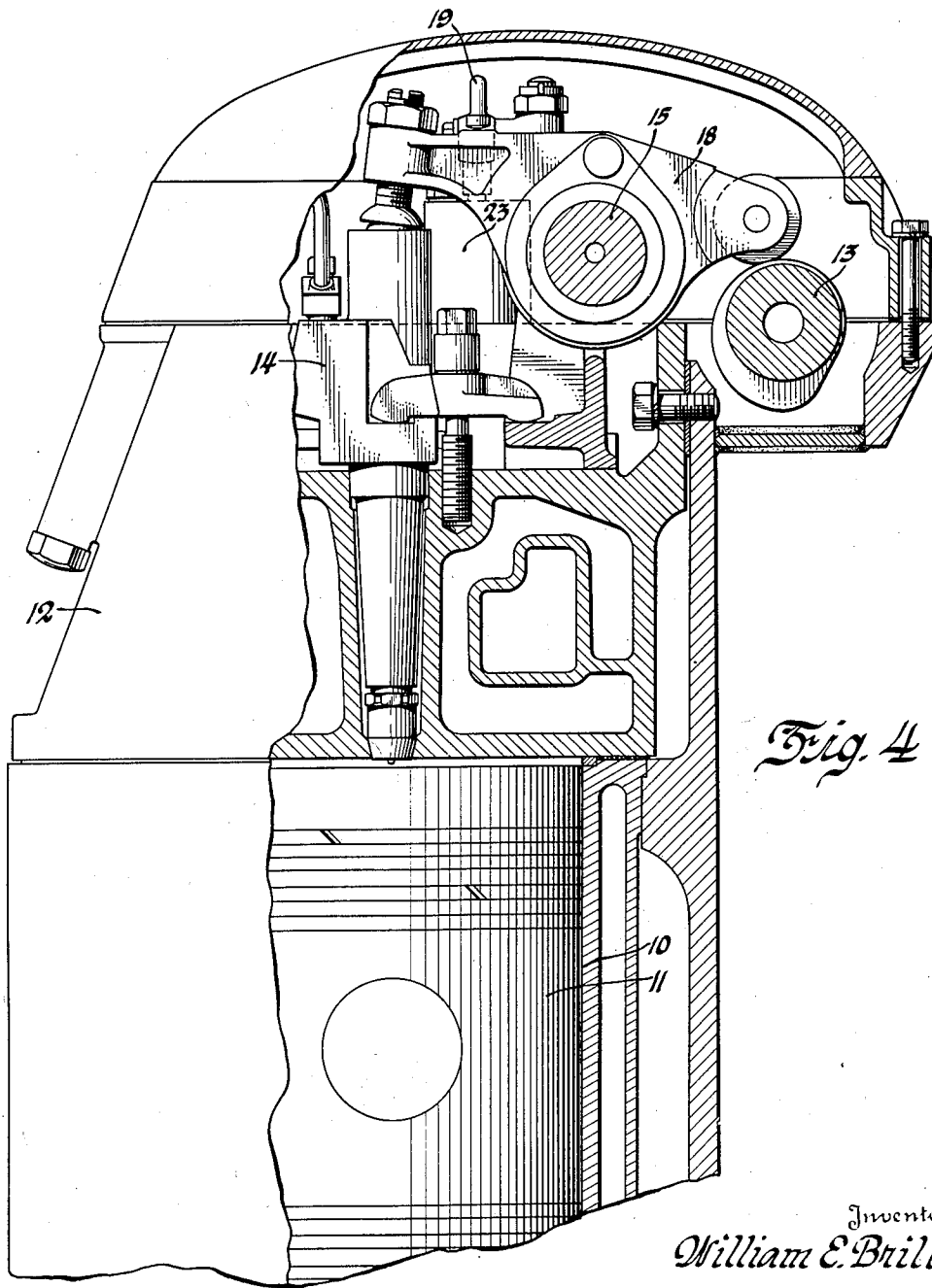


Fig. 4

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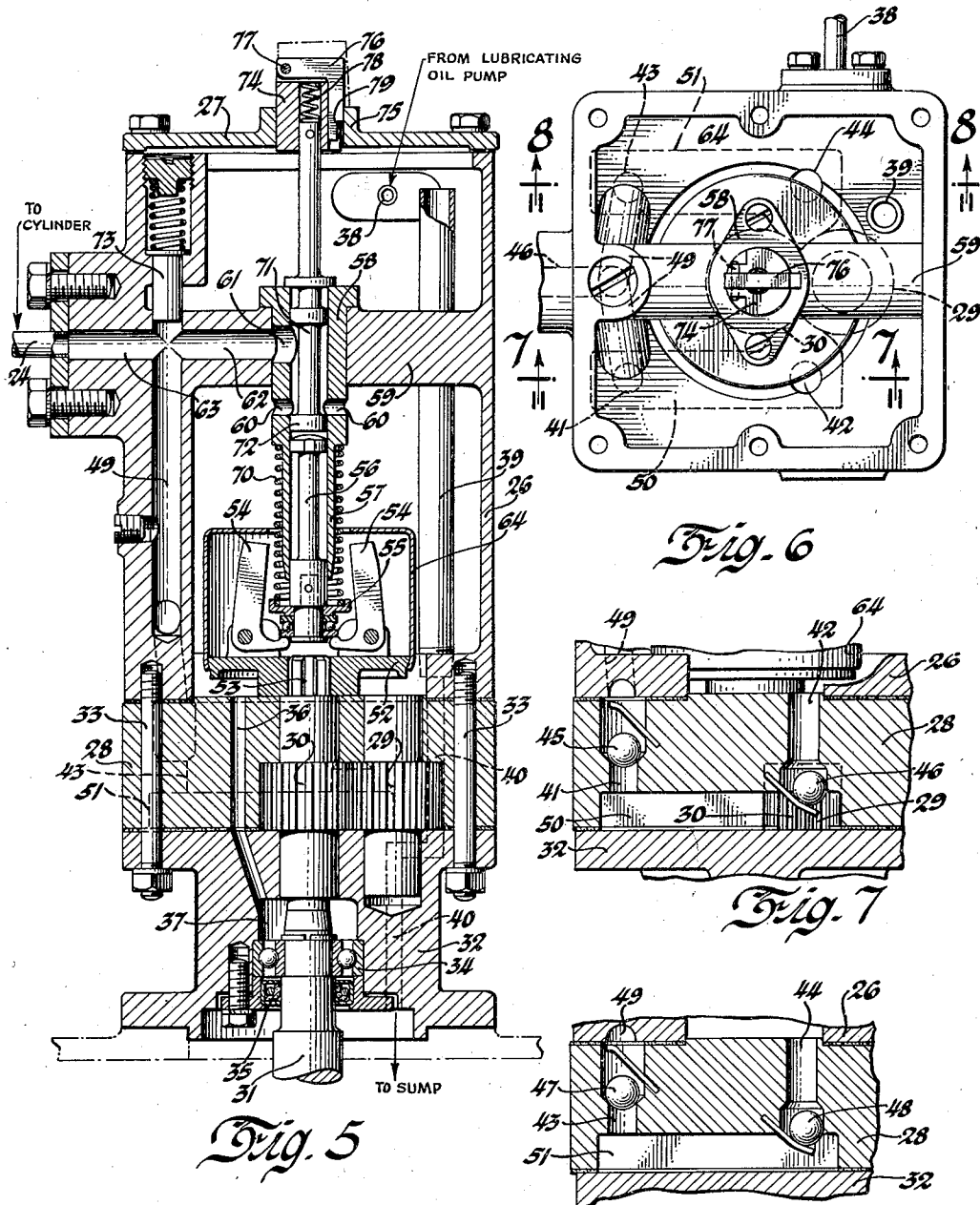


Fig. 8
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UNITED STATES PATENT OFFICE

2,142,172

OVERSPEED FUEL INJECTOR LOCK FOR
DIESEL ENGINES

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10 Claims. (Cl. 123—140)

My invention relates to internal combustion engines wherein liquid fuel is forced directly into the cylinder or cylinders thereof, by fuel pumps operated by the engine; and the object thereof is to provide means for interrupting the operation of the engine if and when it attains or tends to attain an excessive speed. Such excessive speed or racing is particularly likely to occur in marine engines when a propeller driven by the engine ceases to be properly submerged, and runs partly or wholly in the air; and my invention is in the nature of safety mechanism for preventing racing of the engine under the conditions mentioned, or under similar circumstances characterized by its load being suddenly thrown off the engine. The regular governor whereby and normally a uniform speed of the engine is maintained is in no way involved in my invention, which contemplates mechanism other than its regular governor for arresting the operation of the fuel supply pumps if and when the engine races, as will hereinafter appear.

Referring now to the drawings wherein the preferred embodiment of my invention is illustrated which drawings, however, show only so much of an engine as is necessary to an understanding of my invention:

Figure 1 is a fragmentary view showing a cylinder head and valve operating mechanism in plan, with my invention associated with the operating mechanism for the fuel pump of the engine.

Figure 2 is a view showing a section upon a vertical plane indicated by the numerals 2—2, Figure 1.

Figure 3 is a fragmentary sectional view showing a different form of my invention than the form shown in Figure 2.

Figure 4 is a view showing a section upon a vertical transverse plane indicated by the numerals 4—4, Figure 1.

Figure 5 is a view taken upon a vertical central plane showing oil pump and governor mechanism made use of in my invention.

Figure 6 is a view showing the mechanism shown in Figure 5 in plan, the cover of the casing having been removed.

Figure 7 is a view showing a section upon a vertical plane indicated by the numerals 7—7, Figure 6.

Figure 8 is a view showing a section upon a vertical plane indicated by the numerals 8—8, Figure 6.

Referring now to the drawings, the numeral 10 designates a cylinder of an internal combustion engine, 11 a piston operating therein, and 12

a head for closing the open upper end of the cylinder. The engine is commonly of the multiple cylinder type having a number of cylinders arranged in line, and 13 is a rotating camshaft extending longitudinally of the engine and having cams for operating the inlet and exhaust valves and the fuel injection pumps; one of which is indicated by the numeral 14; the engine being of the Diesel type wherein liquid fuel is injected into air compressed within the engine cylinders at the beginning of the working strokes of the pistons, to which end the pumps extend through a passage in the cylinder heads, as shown in Figure 4.

The valves and the fuel injection pumps are operated by the camshaft 13 through rocking levers which are supported by a series of aligned short shafts 15 supported by the cylinder heads, as shown in Figure 1, wherein the numerals 16 and 17 designate the valve operating rockers and 18 the rocker for operating the fuel injecting pump 14. The valves and the valve operating mechanisms, however, as well as the particular features of the fuel injection pumps are not shown in detail, as they form no part of the invention to which this present application relates.

The fuel pump 14 is of the type disclosed in the patent to A. Fielden, for a Fuel pump, No. 1,981,913, November 27, 1934, in that it includes a spring which tends always to force the plunger upward, so that the stroke which results in filling of the pump is due to a spring within the pump, even though the supply of fuel to the pump is under pressure; and my invention contemplates means for holding the rocker arm which operates the pump in the position which it assumes at the end of the discharge stroke of the pump, so that the spring aforesaid cannot force the piston of the pump upward to accomplish the filling thereof; the operation of the pump being interrupted as long as the operating lever or rocker is thus held in the position it takes at the end of the discharge stroke of the pump. The amount of fuel discharged during each forcing stroke of the pump is controlled by a governor to maintain a normally constant engine speed, as appears in said patent, and my invention is in the nature of a safety device independent of the regular speed governing means for the engine which acts to interrupt the action of the fuel pump if and when the regular governor does not act, or does not act quickly enough, as when a propeller driven by a marine engine is temporarily not fully submerged and runs partly or wholly in the air with consequent racing of the engine. While my im-

proved safety device is illustrated as associated with one fuel pump, the application thereof is ordinarily extended to the fuel pumps of all the cylinders of the engine, so that the operation of all of them will be interrupted if and when the engine races or its speed tends to become too high.

Referring to Figures 1, 2 and 4, my invention includes a rocking lever 19 supported above the cylinder head, and which lever is operated by a piston 20 through a piston rod 21 operatively associated with one end thereof, and the other end of which lever lies above and normally out of engagement with the fuel pump operating rocker lever 18; said lever 19 being held normally in the inactive position shown by a spring 22 which surrounds the rod 21 and is housed within an operating cylinder 23 supported also above the head of the engine. The piston 20 operates in said cylinder 23 to which oil under pressure is supplied through a supply conduit 24 and passage 25; from which it follows that when oil under pressure is supplied to said cylinder the right-hand end (Figure 2) of the lever 19 will be depressed into engagement with the pump operating rocker lever 18 and will hold left-hand end (Figures 1 and 4) of said lever in its lowermost position, thus interrupting the operation of the fuel pump 14 as long as oil pressure is maintained in the rocker operating cylinder 23.

The mechanism whereby oil under pressure is supplied to the cylinder 23 through the conduit 24 and passage 25 is illustrated in Figures 5, 6 and 7 wherein the numeral 26 designates a hollow casing having a cover 27 and a base 28 which is shaped to provide a pumping chamber for intermeshing gear members 29 and 30, the latter of which is driven by a shaft 31 which in turn is driven from the crankshaft of the engine and preferably drives said member 30 through a suitable spline driving connection. The gear members 29, 30 have upper hubs which rotate in bearings in the base 28, and lower hubs which rotate in bearings in a pedestal 32 which supports the base 28 and casing 26, the three being held together by bolts 33 as shown and the pedestal having a bearing 34 for the drive shaft 31 and a packing 35 for preventing the flow of oil from the casing down through a passage 36 and into a chamber 37 above the bearing 34, and along the shaft 31 and into the interior of the cylinder block.

A restricted flow of oil from the force feed lubricating system of the engine and into the casing 26 takes place through a supply pipe 38, and overflow from the casing occurs through a stand pipe 39 and passage 40 into the interior of the engine block.

The base 28 has four oil flow passages extending through it, passages 41, 42 being shown in Figure 7, and passages 43, 44 being shown in Figure 8; these passages being controlled by ball check valves 45, 46, 47, 48 which, when the pump 29, 30 is not operating, occupy the positions in which they are shown in Figures 7 and 8.

The pump 29, 30 will discharge into an upwardly extending passage 49, which is branched at its lower end so as to communicate with both the passages 41 and 43, whichever the direction of rotation of the driving pump member 30 may be. That is the flow of oil may be down through the passage 44 into a chamber 51 formed in the base and around the pump chamber in one direction and into a second chamber 50, and therefrom through the passage 41 to the passage 49, in

which case the valves 48 and 45 will be open and the valves 46 and 47 will be closed; or the flow may be down through the passage 42 into the chamber 50 and around the pump chamber in the other direction and into the chamber 51, and therefrom through the passage 43 to the passage 49, in which case the valves 46 and 47 will be open and the valves 48 and 45 will be closed. It will be appreciated that when the pump is not in operation the valves 45, 47 will be seated, and that the valves 46, 48 will be off their seats so that oil will flow freely into the chambers 50, 51 thus keeping the pumping members 29, 30 submerged and the pump primed when it is not in operation.

The upper hub of the gear member 30 drives a governor disc 52 through a spline connection at 53; and 54, 54 are governor weights carried by said disc and having arms which engage and lift a spring pressed collar 55 as the speed of the pump driving shaft 31 increases. This collar in turn lifts a valve operating member 56 which operates within a tubular guide sleeve 57 which is integral with and depends from a tubular valve sleeve 58 which is supported by a transverse bridge 59 inside the housing 26. The valve casing has normally open ports 60 discharging into the interior of the housing, and a port 61 which communicates with a passage 62 formed in the bridge 59 and which communicates with the upper end of the passage 49. Another passage 63 communicates with the passages 49 and 62 and with the conduit 24 as shown; from which it follows that the conduit 24 which supplies oil to the cylinders 23 is in normally free or open communication with the interior of the casing 26 through the ports 60. It will be appreciated that the conduit 24 has branches leading to operating cylinders like the cylinder 23 associated with each cylinder of the engine, such a cylinder and means for preventing the fuel pump from filling as hereinbefore explained being commonly provided for each of the several cylinders of the engine.

The governor weights 54 are shown as enclosed within a shield 64 carried by the governor disc 52, and upward movement of the collar 55 is opposed by a spring 70 acting between the same and an abutment upon a depending part of the tubular valve sleeve 58, as shown in Figure 5; and the upper end of the valve operating member 56 engages the lower end of a reciprocating controlling valve 71 which operates within the tubular valve sleeve 58, and has a head 72 for controlling the normally open ports 60 of said valve sleeve. A spring pressed relief valve 73 opens and permits oil discharged by the pump to flow from the passage 49 back into the interior of the casing 26 after the pistons 20 have been forced upward and the pump operating rocker arms 18 depressed to prevent the pumps from filling, as hereinbefore explained; at which time the pressure in the oil supply conduit 24 rises, as will be understood.

The controlling valve 71 has a flange which limits its downward movement, and an upwardly extending stem the upper end of which is connected with a latch carrying sleeve 74 which is slidable in a guide 75 provided in the cover 27 of the casing 26, and which sleeve carries a right angularly shaped latch member 76 which is pivotally secured to said sleeve at 77. This latch is pressed upward and its lower end is swung outward by a spring 78 within a passage in the sleeve 74; and said lower end has a shoulder at 79 which, by the action of the spring 78, moves over the

upper end of the guide 75 and prevents downward movement of the sleeve and the valve 71 after said sleeve and valve have been lifted by upward movement of the valve lifting member 56; in which upwardly held position the head 72 closes the ports 60.

Figure 3 illustrates a modification of my invention wherein a piston 80 operating in a cylinder 81 to which oil under pressure is supplied through a passage 82 the equivalent in every respect to the passage 24, 25 in Figure 2, acts through its rod 83 directly against the under side of the right-hand end of the fuel pump operating rocker lever 84 to lift said end away from the camshaft 85, so that the fuel pump or pumps will be prevented from filling as in the form of my invention hereinbefore described; the left-hand of said lever acting to operate a fuel pump precisely as in Figure 4. Because in this form of my invention the pressure operated piston acts directly upon the pump operating rocker to move it so that it will not be operated by the valve and pump operating camshaft 85, it follows that no rocking lever such as the lever 19, Figures 1 to 4, is used, and that the mechanism is to that extent cheapened and simplified.

When the engine is running under the controlling action of its regular governor, which maintains a constant speed by varying the quantities of fuel oil supplied to engine cylinders by the fuel pumps, the fuel pump cut-out mechanism will be in the position shown in the various figures in which positions the head 72 of the valve member 71 does not close the ports 60 to an extent sufficient to build up pressure in the oil supply conduit 24; under which condition oil pumped by the oil pump 29, 30 will flow through the ports 60 back into the casing 26, and the operation of the fuel supply pumps will not be interrupted. The supply conduit 24, however, will be kept full of oil so that the cut-out mechanism will be in condition to operate without delay if the engine races, because the casing 26 is full of oil and the overflow pipe 39 maintains a sufficient head of oil to keep the supply conduit 24 full of oil.

When the engine races the governor weights 54 will lift the valve operating member 56 and the controlling valve 71 to an extent such that the head 72 will close the ports 60, after which and without appreciable delay oil flows through the conduit 24 and into the cylinders 23 or 81 and builds up pressure therein, thus interrupting the operation of the fuel supply pumps by preventing them from filling. Excessive pressure in the conduit 24, due to high speed of the engine and increased discharge of oil by the oil pump 29, 30 is prevented by the relief valve 73 which opens under excess pressure and permits the oil to flow back into the casing 26 as hereinbefore explained.

The sequence of operations which results in stopping the engine leaves the sleeve 74 held in its uppermost position by the latch member 76, and the ports 60 closed by the head 72; which is a matter of importance as otherwise the head 72 would descend and open the ports 60 as the speed of the engine decreased and cause it to resume its operation before the circumstances which resulted in racing are corrected. So long as the ports 60 remain closed by the head 72, however, oil under pressure is trapped in the conduit 24 and cylinders 23, 81 and the fuel supply pumps are prevented from operating; and the engine remains in its stopped condition until the engineer releases the sleeve 74 by pressing the latch mem-

ber 76 inward, whereupon the valve 71 descends into the position in which it is shown in Figure 5, the ports 60 are opened, oil pressure in the conduit 24 and cylinders 23, 81 is relieved and the fuel pumps are no longer prevented from filling. The engine may then be re-started and will resume its normal operation.

Having thus described and explained my invention I claim and desire to secure by Letters Patent:

1. In an internal combustion engine and in combination with a pump for supplying liquid fuel to the engine cylinder, and means for operating said fuel pump; separate and independent means adapted to engage said fuel pump operating means to thereby interrupt the operation thereof and of said fuel pump when the engine races; an oil pump operated by the engine; an oil supply conduit leading from said oil pump to said interrupting means; a governor operated by the engine; and a valve operated by said governor for controlling the flow of oil through said conduit.

2. In an internal combustion engine and in combination with a pump for supplying liquid fuel to the engine cylinder, and means for operating said fuel pump; separate and independent means adapted to engage said fuel pump operating means to thereby interrupt the operation thereof and of said fuel pump when the engine races; an oil pump operated by the engine; an oil supply conduit leading from said oil pump to said interrupting means; a normally open by-pass passage communicating with said conduit; a governor operated by the engine; and a valve operated by said governor for closing said by-pass passage.

3. In an internal combustion engine and in combination with a pump for supplying liquid fuel to the engine cylinder, and means for operating said fuel pump; an oil pump operated by the engine; means for interrupting the operation of said fuel pump operating means when the engine races; an oil supply conduit leading from said oil pump to said interrupting means; a normally open by-pass passage communicating with said conduit; a governor operated by the engine; a valve operated by said governor for closing said by-pass passage; and means for holding said valve in its closed condition after it has been operated by said governor to close said by-pass passage.

4. In an internal combustion engine and in combination with a pump for supplying liquid fuel to the engine cylinder, and means for operating said fuel pump; a hollow oil containing casing; an oil pump located below and which derives its supply of oil from said casing, and which oil pump is operated by the engine; means separate and independent of said fuel pump operating means and adapted to engage said pump operating means to thereby interrupt the operation of said fuel pump when the engine races; an oil supply conduit leading from said oil pump to said interrupting means; a normally open by-pass passage communicating with said conduit and discharging into said oil containing casing; a governor arranged within said casing and which governor is operated by the engine; and a valve located within said casing and operated by said governor for closing said by-pass passage.

5. In an internal combustion engine and in combination with a pump for supplying liquid fuel to the engine cylinder, and means for operating said fuel pump; a hollow oil containing

casing; an oil pump located below and which derives its supply of oil from said casing, and which oil pump is operated by the engine; means for interrupting the operation of said fuel pump when the engine races; an oil supply conduit leading from said oil pump to said interrupting means; a governor arranged within said casing and which governor is driven from said oil pump; a tubular valve sleeve within said casing and located above said governor; a normally open by-pass passage communicating with said conduit and discharging through a port in said valve sleeve and into said casing; a vertically movable valve within said sleeve and arranged to close said port; and a vertically movable valve operating member operated by said governor and through which said valve is operated to close said port.

6. In an internal combustion engine and in combination with a pump for supplying liquid fuel to the engine cylinder, and means for operating said fuel pump; a hollow oil containing casing; an oil pump located below and which derives its supply of oil from said casing, and which oil pump is operated by the engine; means for interrupting the operation of said fuel pump when the engine races; an oil supply conduit leading from said oil pump to said interrupting means; a governor arranged within said casing and which governor is driven from said oil pump; a tubular valve sleeve within said casing and located above said governor; a normally open by-pass passage communicating with said conduit and discharging through a port in said valve sleeve and into said casing; a vertically movable valve within said sleeve and arranged to close said port, and which valve has an upwardly extending stem; a vertically movable valve operating member operated by said governor and through which said valve is operated to close said port; and latch mechanism associated with said stem for holding said valve in its closed condition after it has been moved as aforesaid to close said port.

7. In an internal combustion engine and in combination with a pump for supplying liquid fuel to the engine cylinder, and an oscillating lever for operating said fuel pump; a cylinder arranged adjacent said lever; a piston within said cylinder; means separate and independent from said oscillating lever and operated by said piston for arresting the operation of said oscillating lever when the engine races; an oil pump operated by the engine; an oil supply conduit leading from said oil pump to said cylinder; a governor operated by the engine; and a valve op-

erated by said governor for controlling the flow of oil through said conduit.

8. In an internal combustion engine and in combination with a pump for supplying liquid fuel to the engine cylinder, and an oscillating lever for operating said fuel pump; a cylinder arranged adjacent said lever; a piston within said cylinder; means separate and independent of said oscillating lever and operated by said piston for arresting the operation of said oscillating lever when the engine races; an oil pump operated by the engine; an oil supply conduit leading from said oil pump to said cylinder; a normally open by-pass communicating with said conduit; a governor operated by the engine; and a valve operated by said governor for closing said by-pass passage.

9. In an internal combustion engine and in combination with a pump for supplying liquid fuel to the engine cylinder, and an oscillating lever for operating said fuel pump; a second oscillating lever arranged adjacent but normally out of engagement with said fuel pump operating lever, and which second lever is adapted to engage said first mentioned lever to thereby arrest the operation thereof and of the fuel pump when the engine races; a cylinder arranged adjacent said levers; a piston within said cylinder; a piston rod through which said piston operates said second mentioned lever; an oil pump operated by the engine; an oil supply conduit leading from said oil pump to said cylinder; a governor operated by the engine; and a valve operated by said governor for controlling the flow of oil through said conduit.

10. In an internal combustion engine and in combination with a pump for supplying liquid fuel to the engine cylinder, and an oscillating lever for operating said fuel pump; a second oscillating lever arranged adjacent but normally out of engagement with said fuel pump operating lever, and which second lever is adapted to engage said first mentioned lever to thereby arrest the operation thereof and of the fuel pump when the engine races; a cylinder arranged adjacent said levers; a piston within said cylinder; a piston rod through which said piston operates said second mentioned lever; an oil pump operated by the engine; an oil supply conduit leading from said oil pump to said cylinder; a normally open by-pass passage communicating with said conduit; a governor operated by the engine; and a valve operated by said governor for closing said by-pass passage.

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