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VACUUM ACTUATED SAFETY SYSTEM FOR ENGINES

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FIG. 1

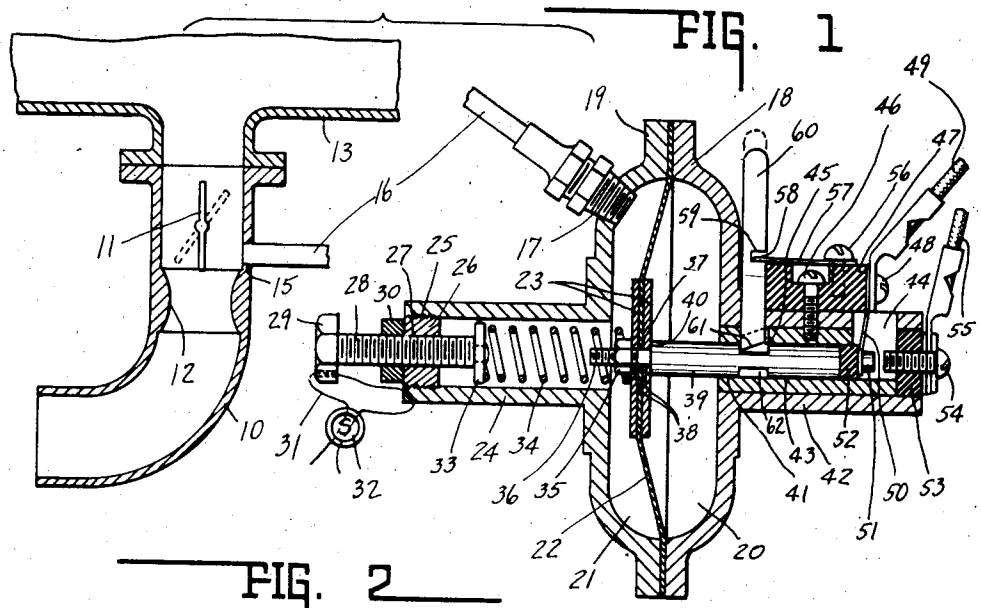
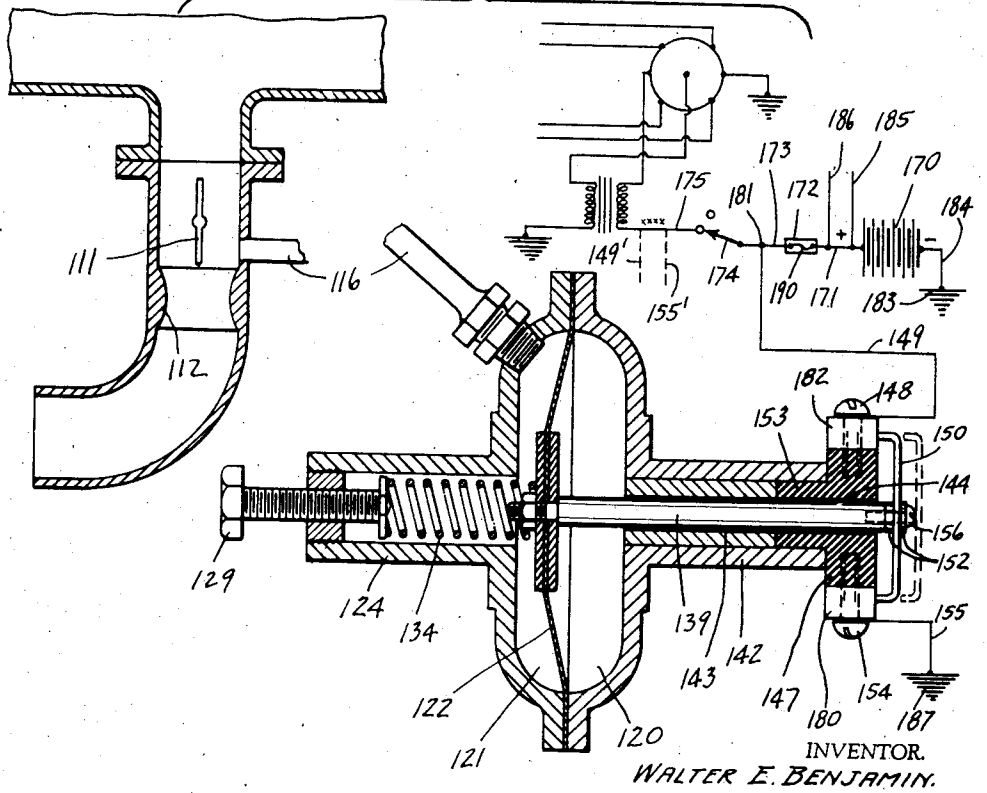


FIG. 2



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VACUUM ACTUATED SAFETY SYSTEM FOR ENGINES

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13 Claims. (Cl. 123—146.5)

This invention relates to a safety device for internal combustion engines and more particularly for an engine provided with a governor, although not necessarily applied thereto.

The chief object of this invention is to prevent an engine from "running away" beyond a safe speed which, if governor controlled, is above that speed for which the governor is set to function or maintain.

The chief feature of the invention consists in providing a device in the form of a switch or its equivalent, in the ignition circuit of the engine which switch is normally maintained in closed circuit condition until the engine "runs away" and upon that attempt the switch is actuated to open the circuit and the same is maintained in open circuit relation until the switch is closed or the switching element is replaced, as will hereinafter be pointed out.

It will be apparent from the aforesaid that manual attention is required after switch operation for reconditioning the ignition circuit for subsequent engine operation. Therefore, the system is positive in its action from the standpoint of safety and maintenance.

The full nature of the invention will be understood from the accompanying drawing and the following description and claims.

In the drawing, Fig. 1 is a diagrammatic view of one embodiment of the invention, parts being shown in the open circuit position.

Fig. 2 is a similar view of a modified form of the invention.

In Fig. 1 of the drawing, 10 indicates a carburetor having a throttle or butterfly 11 therein and a venturi 12 in the discharge portion. 13 indicates an intake manifold portion of an engine. 15 indicates an opening in the carburetor discharge to the manifold between the valve or throttle 11 and the venturi 12. 16 indicates a conduit communicating at one end with the opening 15 and at its opposite end having connection as at 17 with a vacuum operable structure, hereinafter to be described in detail.

For a vacuum operable device to properly function as intended, it is necessary the suction tube 16 or rather the opening 15, be positioned between the carburetor venturi and the throttle or butterfly valve, because the vacuum at this point is dependent upon the velocity of the air stream passing through the venturi. The rise in vacuum at this point 15 will increase with the air stream velocity squared. Any movement of the valve 11 from the wide open position to another position, such as shown dotted, will cause a drop in vacuum at the point 15 and at the same time will cause a rapid rise in vacuum above the valve 11 or in the manifold 13.

It is evident, therefore, that when the engine is under governor control and the valve 11 is actuated by the governor to control the motor speed, the rapid rise of manifold vacuum in the manifold, if connected to the vacuum operable device, would shut off the engine. If, however, the conduit 16, connected to the vacuum operable device, is connected as at 15 the vacuum operable device would not be effective during normal valve movement from the full closed position to a position almost wide open. It is only when the valve 11 is wide open, evidencing a governor failure or maximum speed under light load, that the suction is sufficient to operate the valve operable device. If the engine is under full load at wide open throttle, the speed of the engine will not be above the critical speed. Therefore, the velocity of the fuel supply through the venturi will not be that which is attained when the valve 11 is wide open and the engine is under little or lower load. Thus, for an engine which is governed in the event of governor failure and the valve 11 becomes positioned as shown by the full lines in Fig. 1, the vacuum pull is such that it is effective for operating the vacuum device connected to the opposite end of the conduit 16. This device is also effective in cases where an engine is not equipped with a governor and when for some reason or other the normal load is removed and the engine tries to "run away."

Reference will now be had to one form of vacuum operable device which is shown in Fig. 1 and which furthermore is shown as of the diaphragm character although it is to be understood that the same, if desired, may be of cylinder and piston character without departing from the disclosure.

18 indicates a housing, 19 a complementary housing. The two form chambers 20 and 21, respectively, which are separated from each other by the diaphragm 22 having the central metallic reenforced portions 23. The housing 19 is extended and includes a tubular portion 24 threaded as at 25 to receive a threaded member 26 internally threaded as at 27 to receive an adjusting bolt 28 having the head portion 29. The bolt 28 is locked in the adjusted position by the nut 30. The bolt 29 and portion 24 may, if desired, be suitably secured in sealed relation as by the wire 31 and seal member 32. Breakage of this wire indicates tampering with the safety device.

The bolt 28 suitably mounts or abuts a spring

bearing plate 33 against which bears one end of a spring 34, the major portion of the spring being nested in the tubular portion 24 of the housing member 19. The other end of the spring bears against the central reenforcement 23 of the diaphragm 22 in the chamber 21. A nut 35 has threaded engagement with the stem 36 and bears against the face of the member 23 in the chamber 21. The threaded stem 36 extends through the central aperture 37 in the diaphragm and the aligned apertures 38 in the reenforcement plates 23. The nut 35 in the present instance, is shown nested within the spring 34.

A reciprocating member 39 in the chamber 20 provides a shoulder 40 for the bearing against the reenforcing member 23 in the chamber 20. Herein the threaded extension 36 which passes through the apertures 37 and 38, is an extension of the portion 39. The portion 39 is slidably supported in the bore 41 in the housing 18 and is axially aligned with the spring and adjusting bolt, before mentioned.

Conduit 16, previously referred to, communicates as at 17 with the chamber 21. The spring 34 normally constrains the diaphragm to the right and, therefore, the plunger 39 is constrained to the right, the purpose therefor being set forth hereinafter.

When the suction or vacuum reaches the critical amount for which the device is set to operate as determined by the load imposed through the adjustment of bolt 26, and spring 34, the vacuum overcomes the spring pressure and moves the central portion of the diaphragm to the left, as shown in Fig. 1, and holds the same in that position as long as this critical vacuum pull is imposed upon chamber 21. When the vacuum imposed falls below the limit determined by the spring, et cetera, the diaphragm 22 through the spring 34 tends to return to its original position which, however, is prevented in the present form of the invention.

The housing 18 includes an extension or bracket 42 and the same is of tubular character, forming the bore therein aligned with the bore 41 before mentioned. A lateral aperture 44 is provided near the free end of the bracket 42. Another lateral aperture 45 is provided immediately adjacent the opposite end.

Suitably secured as at 46 is an insulation member 47 which supports a terminal stud 48 to which one wire 49 is connected. The stud also supports a spring member 50 terminating in a contact 51. The member 39, before mentioned, is elongated and mounts on its free end, the insulation member 52 normally contacted by the current carrying spring member 50.

Mounted within the bore 43 at the extreme end of the bracket 42 is the insulation member 53 and mounted therein is the stud 54 which constitutes another contact aligned with contact 51 and in electrical connection with the line 55 as shown.

Suitably secured as at 56 and to the insulation member 47 is a spring structure 57 which extends toward the housing 18 and has its free end 58 nested in a slot 59 in a reciprocable member 60, the same being slidably supported in the aperture 45 and provided with the biased end 61. The biased end 61 projects into the bore 43. The slidable member 39 is grooved or channeled as at 62.

As shown, the member 60 projects upwardly a considerable distance and constitutes a manual engageable portion. In normal operation, the member 60 is held elevated manually until member 39 has moved to the right sufficient for the groove 62 to be out of registration with the biased end 61 of member 60. The biased end 61 then rides upon the member 39. The diaphragm it will be understood is then either centrally positioned or positioned to the right of the center of the central plane between the two housings. When in this "normal" position, the contact 51 is in engagement with the terminal stud 54 and the electrical circuit is completed through the wires 49 and 55. Thus, the ignition system is closed so far as the protective device is concerned.

In the event of governor failure or the like, as before set forth, and upon the application of sufficient vacuum to the amount necessary to oppose spring and diaphragm tension, if any, the diaphragm 22 is moved to the left into the position shown in Fig. 1. This movement is permitted because at this time the member 60 is held elevated thereby for it rides on the portion 39 and is held elevated in opposition to spring 57. When the groove 62 registers with the member 60, spring 57 becomes effective and forces the plunger or catch downwardly as the device is herein illustrated, so that the biased end 61 engages in the groove 62 of the member 39 and thus locks member 39 in the so-called retracted position, and when in that position and held in that position, the circuit through the contacts 51 and 54 is open and maintained in open circuit relation.

This catch prevents the return of the member 39 to the right which it would normally do were it not for the fact it is held by this catch. The reason for such return is as follows:

When the ignition circuit is open and held open, the engine no longer operates and gradually comes down in speed and thus the vacuum which is subjected to chamber 21 is reduced until the spring 34 would normally be effective for returning the member 39 to its original closed circuit position. However, member 39 being locked in the so-called open circuit positioned diaphragm 22 and member 39 are prevented from so returning and, therefore, the circuit through lines 49 and 55 is maintained in open circuit relation. This is maintained until such time as the operator manually elevates the member 60 as illustrated herein, or in other words, retracts the catch 61 from the groove 62 whereupon spring 34 becomes effective, and since there no longer is sufficient vacuum pull in said chamber to hold the diaphragm in the position shown in Fig. 1, the circuit is reestablished through members 51 and 54.

In view of the fact that an ignition system is illustrated in Fig. 2, the ignition system, including lines 49 and 55, of Fig. 1 is intentionally omitted but it is to be understood that these two lines constitute an extension of a standard ignition system and operable by the primary supply line which is opened, one end being designated by the numeral 149' at the opening and the other end at the opening being designated by the numeral 155 in Fig. 2.

In Fig. 2 numerals of the 100 series indicate like or equivalent parts. The conduit 116 is connected to the vacuum device in substantially the same manner as previously described and also to the fuel system of the engine substantially as previously described, and in substantially the same relationship with respect to the venturi and butterfly valve, 112 and 111, respectively.

The parts illustrated in the vacuum device to the left of the diaphragm 122, are substantially identical to that illustrated to the left of diaphragm 22 in Fig. 1.

In the present form of the invention slidable member 139 extends beyond the end of the tubular bracket portion 142 having the bore 143 therein. The end of this bore is open and mounts an insulation member 153 which is enlarged laterally and externally of the bore as at 147. The integral member 147—153 is press fitted into the bore and includes the aperture 144. The end of the member 139 supports in insulated manner by means of the fibre washers 152 and screw 156 a U-shaped jumper or circuit bridging member 150. Terminal stud 148 secures terminal contact 182 to the insulation member 147. In a like manner, the terminal stud 154 secures the contact member 180 to the insulation member 147. Line 155 is in electrical connection with contact 180 through the stud 154. In a like manner line 149 is in electrical connection with the contact member 152.

When the diaphragm 122 is moved to the left as shown in Fig. 2 through the application of sufficient vacuum to the chamber 121 in opposition to spring 134 contact member 150 bridges contacts 182 and 180 and completes the circuit through lines 149 and 155 which accomplishes the result hereinafter to be specified. Immediately upon the engine attaining a lower speed by reason of the function of the system, as hereinafter pointed out, the diaphragm 122 moves to its median plane or adjacent thereto under the influence of spring 134. When so actuated the bridging member 150 assumes the dotted line position. This is the open circuit or normal position. This would immediately permit the engine to gain speed and endeavor to again "run away."

Therefore, it will be noted the distinctions between the two forms of the invention is that the one illustrated in Fig. 1 is of the mechanical lock-out type whereas in Fig. 2 there is no mechanical lock-out. The lock-out, however, in this form of the invention is of the electrical character and one form of which is conventionally illustrated.

In this form of the invention 170 indicates a battery, 171 a supply line therefrom leading to a switch structure 172. Leading therefrom is the line 173 connected to a switch 174 which represents the conventional ignition switch controlling the engine, said switch 174 when connected to line 175 permitting engine operation.

The line 149 is connected to line 173 at 181. The line 155 is grounded as at 187. The battery 170 is grounded as at 183 by line 184. The result is as follows:

Under normal engine operation the circuit is from the battery 170 through the switch device 172, through the ignition switch 174 and by line 175 to the usual ignition circuit. Whenever the engine "runs away", for example, member 139 moves the bridging contact 150 from the dotted line position to the full line position to complete the circuit between the lines 149 and 155. This creates a temporary short circuit which immediately is registered in the switch device 172, so that the latter opens the ignition circuit and maintains it open until it is manually actuated. Hence, after the engine has attained that lower speed where the spring 134 becomes operative upon the plunger and diaphragm 139—120, the circuit is held open between lines 155 and 149 but since the ignition circuit is now open between lines 171 and 173, no energy is supplied to line 175 so that the engine cannot again attain an excessive speed until the switch device 172 has been actuated to close the ignition circuit.

Line 185 diagrammatically indicates a supply line from the battery to the starter of the engine. Line 186 diagrammatically indicates a supply line to the lighting system et cetera, of the motor vehicle in which the engine is mounted.

The switch device indicated generally by the numeral 172 is herein shown as a fuse 190. The short circuit breaks or burns out this fuse and requires the removal of the old fuse and the manual substitution of a new fuse. Thus, the engine is positively protected. While the fuse 190 is herein illustrated as the embodiment of the electrical switch which is of the character indicated, other switch means may be employed which have the same function, to-wit, upon a short circuit occurring as it were by means of lines 149 and 155 being electrically connected by the bridging contact 150, the switch 172 is automatically opened and is maintained open until it is manually closed.

Lines 149' and 155' indicate the application of lines 49 and 55, respectively, to a standard ignition circuit as previously described.

If two carburetors are employed, two vacuum devices may be employed and in that event they may be as shown in Figs. 1 and 2 and connected electrically in the ignition circuit as shown in Fig. 2. In this event dual protection is provided.

It thus will be apparent that both forms of the invention hereinbefore described and herein illustrated are vacuum operable devices for protecting an engine from "running away" and for imposing an open circuit condition upon the ignition system of the engine upon the engine attaining that critical speed for which this vacuum operable device is adjusted to operate and having once effected such open circuit, the same is maintained until manual operation is employed to close the said open circuit.

While the invention has been illustrated and described in great detail in the drawing and foregoing description, the same is to be considered as illustrative and not restrictive in character.

The several modifications described herein as well as others which will readily suggest themselves to persons skilled in this art, all are considered to be within the broad scope of the invention, reference being had to the appended claims.

The invention claimed is:

1. In a safety system for preventing "running away" of an internal combustion engine having an intake system with a control valve and Venturi means in juxtaposition thereto and provided with an ignition system, the combination of a vacuum operable device, an ignition circuit opening structure operable thereby, and means connecting the vacuum operable device to the intake system between the valve and Venturi means.

2. A system as defined by claim 1, characterized by the vacuum operable device including a load spring normally opposed to the vacuum operation, and means for adjusting the spring force.

3. A system as defined by claim 1, characterized by the vacuum operable device including a load spring normally opposed to the vacuum operation, means for adjusting the spring force, and means for sealing the adjusting means in the adjusted position.

4. A system as defined by claim 1, characterized by the ignition circuit opening structure in-

cluding a normally closed switch movable upon vacuum operable device operation to open circuit position and including latch means for retaining the switch in open circuit position upon device operation following vacuum operable device release upon engine acceleration.

5. A system as defined by claim 1, characterized by the ignition circuit opening structure including a closed circuit maintaining short circuit operable arrangement, and switch means associated therewith and operable upon vacuum operable device operation to short circuit the arrangement for opening the ignition circuit.

6. A system as defined by claim 1, characterized by the ignition circuit opening structure including a closed circuit maintaining short circuit operable arrangement, and switch means associated therewith and operable upon vacuum operable device operation to short circuit the arrangement for opening the ignition circuit, said arrangement being of fuse character.

7. A system as defined by claim 1, characterized by the ignition circuit opening structure including a closed circuit maintaining short circuit operable arrangement, and switch means associated therewith and operable upon vacuum operable device operation to short circuit the arrangement for opening the ignition circuit, said arrangement being included in series connection in the ignition circuit and said switch means being in multiple connection therewith.

8. A system as defined by claim 1, characterized by the vacuum operable device being of diaphragm type.

9. A system as defined by claim 1, characterized by the vacuum operable device being of diaphragm type, the ignition circuit opening means and device operable connection including a plunger secured at one end to the diaphragm, and load spring means opposing vacuum operation of the diaphragm, said plunger localizing the spring means.

10. A system as defined by claim 1, characterized by the ignition circuit opening structure including a normally closed switch movable upon vacuum operable device operation to open circuit position and including latch means for retaining the switch in open circuit position upon device operation following vacuum operable device release upon engine acceleration, said vacuum operable device being of diaphragm type.

11. A system as defined by claim 1, characterized by the ignition circuit opening structure including a closed circuit maintaining short circuit operable arrangement, and switch means associated therewith and operable upon vacuum operable device operation to short circuit the arrangement for opening the ignition circuit, said vacuum operable device being of diaphragm type.

12. A system as defined by claim 1, characterized by the ignition circuit opening structure including a closed circuit maintaining short circuit operable arrangement, and switch means associated therewith and operable upon vacuum operable device operation to short circuit the arrangement for opening the ignition circuit, said arrangement being of fuse character, said vacuum operable device being of diaphragm type.

13. A system as defined by claim 1, characterized by the ignition circuit opening structure including a closed circuit maintaining short circuit operable arrangement, and switch means associated therewith and operable upon vacuum operable device operation to short circuit the arrangement for opening the ignition circuit, said arrangement being included in series connection in the ignition circuit and said switch means being in multiple connection therewith, said vacuum operable device being of diaphragm type.

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