July 18, 1933. E. ISDAHL 1,918,913

ADMISSION OF AIR TO THE INDUCTION PIPES OF INTERNAL COMBUSTION ENGINES

Filed March 31, 1932 3 Sheets-Sheet 1

Fig. 1.

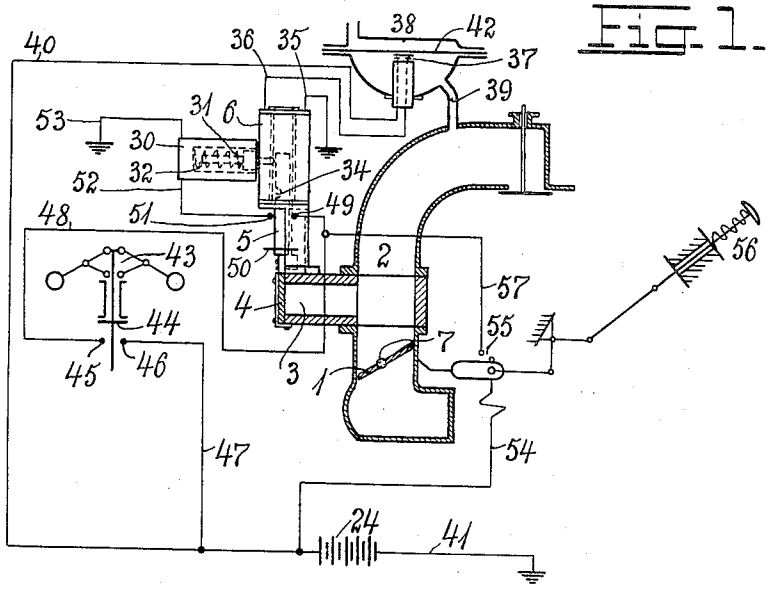
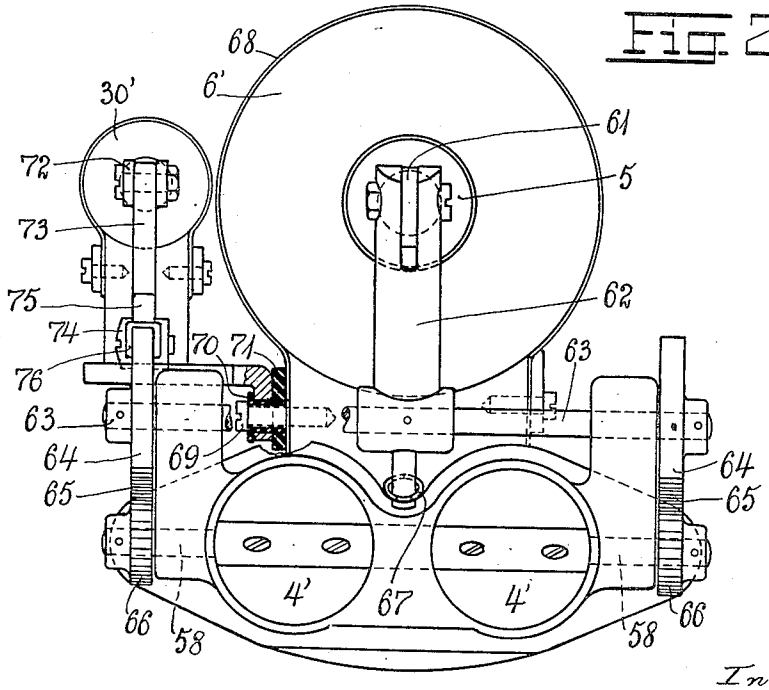


Fig. 2.



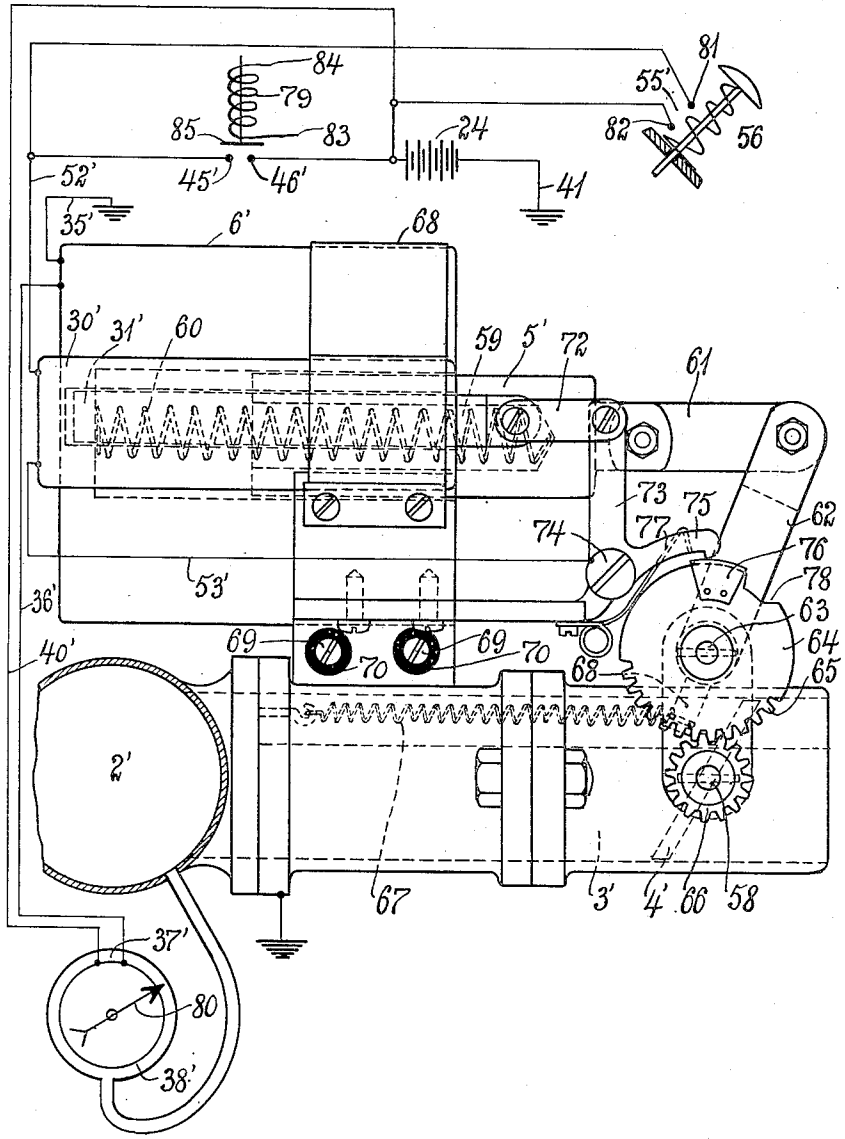
Inventor,
Einar Isdahl
By Thurston & Lee
Attorney.

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Fig. 3.



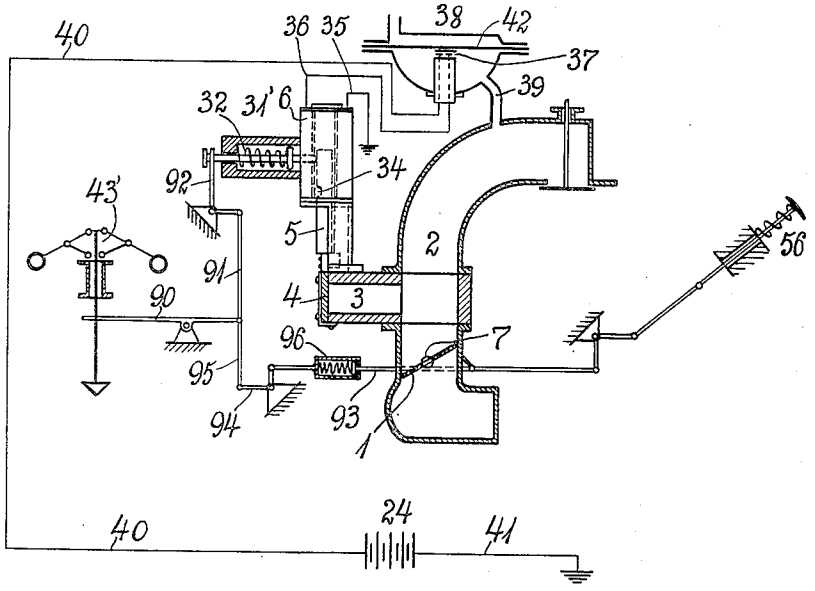
Inventor:
Einar Isdahl
By Lum Pennington & Lee
Attorney

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ADMISSION OF AIR TO THE INDUCTION PIPES OF INTERNAL COMBUSTION ENGINES

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Fig. 4.



Inventor:
Einar Isdahl
By Lucius Powell Ide
Attorney

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1,918,913

UNITED STATES PATENT OFFICE

EINAR ISDAHL, OF OSLO, NORWAY

ADMISSION OF AIR TO THE INDUCTION PIPES OF INTERNAL COMBUSTION ENGINES

Application filed March 31, 1932, Serial No. 602,287, and in Norway February 11, 1932.

The present invention relates to apparatus for preventing the formation of a vacuum in the cylinders of internal combustion engines and more particularly the engines of motor vehicles of all kinds.

The invention has for its object to prevent the formation of smoke and fumes in the exhaust gases, which occurs when the throttle valve between the carburetter and the cylinders is suddenly closed, either when the speed is reduced or changed.

In the two circumstances above referred to, the throttle valve is closed and this results in the production within the cylinder, in which the pistons reciprocate due to the weight of the vehicle or to the kinetic energy of the flywheel of an exceedingly high vacuum which both draw lubricating oil into the compression chamber and excess gasoline through the idle running jet.

As soon as the throttle valve is again opened and the combustible mixture supplied to the cylinders, the excess quantity of gasoline and lubricating oil in the combustion chambers cause the presence in the exhaust gases of large quantities of CO and oil in more or less burnt or cracked condition. These half burnt oil products pass through the exhaust pipe as blue smoke which has a very unpleasant odour and pervades the surrounding air. Attempts have been made in various ways to overcome the formation of smoke, which is particularly troublesome in large towns with heavy omnibus traffic and large numbers of private vehicles. Thus for example it has been proposed in the specification of my prior application for patent, U. S. Ser. No. 561,789 to provide in the induction pipe between the throttle valve and the cylinders, a valve the mechanism for opening which is positively connected with the mechanism for opening the throttle valve in such manner that the first-mentioned valve cannot be opened before the throttle valve is closed and vice versa. An intermediate position of the valve has no object and would cause the apparatus to function less satisfactorily.

A disadvantage of this apparatus consists in this that it is operated either entirely or partly manually, and the result obtained is therefore more or less dependent on the skill and attention of the driver.

The essential object of the present invention is an apparatus which effects automatic opening of the air valve, when the throttle valve is closed, the said valve being automatically closed directly before or simultaneously with the opening of the throttle valve.

In accordance with the present invention there are used for this purpose preferably two electro-magnets or solenoids of which one, which directly controls the said valve, is supplied with current by a switch which is controlled by a vacuum indicator connected with the induction pipe leading to the cylinders in such manner that when the negative pressure in this pipe rises to a certain extent above the normal negative pressure corresponding to idle running, a circuit is closed as the result of which the solenoid opens the valve, while the other solenoid, which operates a snap mechanism which at the moment when the valve is opened locks the latter in the open position, is connected by a contact device with a source of current which contact device in dependence on the speed of rotation of the engine is controlled for example directly by means of a centrifugal device or indirectly by means of a relay, which receives current from the usual generator associated with the engine.

As soon as the speed of the engine falls to such an extent that the relay or the centrifugal device provides a closed circuit from the source of current to the releasing solenoid, the latter releases the valve which is then closed and the engine is again ready to receive the combustible mixture from the carburetter under the control of the throttle valve.

Should the driver of the vehicle wish to supply combustible mixture to the engine before the speed of the engine has fallen to an extent such as above mentioned, the valve must be closed earlier than above stated. For this purpose, in accordance with the invention a circuit is provided which serves also for the supply of current to the releasing solenoid and this circuit is closed me-

chanically, for example under the influence of the usual throttle valve operating mechanism. In the circuit of the releasing solenoid in order to prevent the solenoid remaining under current when not desired, there is provided an auxiliary contact which opens the circuit when the valve is closed and by which the circuit is closed when the valve is opened.

Although the use of the other solenoid is to be preferred, it is clear that it can be replaced by a mechanically acting locking and releasing mechanism, which for example is controlled by a centrifugal device and/or a mechanical connection with the accelerator or gas pedal.

The invention is also concerned with certain details of construction of the automatically acting apparatus above described. In order that it may be fully understood, the invention is hereinafter described with reference to the accompanying drawings, which illustrate diagrammatically several arrangements of the invention together with an embodiment of the preferred construction of the automatically acting device.

In the drawings, Fig. 1 illustrates diagrammatically one form of the automatically acting apparatus.

Fig. 2 is an end view of a preferred construction of the valve device, while

Fig. 3 shows the valve device in side elevation, the different electric contacts and connections which are necessary for operation of the apparatus being indicated diagrammatically, and

Fig. 4 illustrates a modified embodiment of apparatus as shown diagrammatically in Fig. 1.

Referring to the drawings and particularly to Fig. 1, 1 indicates the throttle valve provided in the induction pipe 2 of an engine, not shown. The carburetter which is also omitted from the drawings is located beneath the throttle valve. Above the throttle valve there is provided in the induction pipe 2 an air supply conduit 3, which is closed to the atmosphere by means of a valve 4, movable in a vertical direction. The valve 4 is connected at its upper end with an armature 5 which can move in a vertical direction in an electro-magnet coil 6.

There is also provided a releasing magnet 30 with an armature 31 which is under the influence of a helical spring 32 tending to push the armature 31 outwards. The electromagnet 6 and the releasing electromagnet 30 are arranged in such relation to one another that the armature 31, when the armature 5 is attracted, drops into a recess 34 in the armature 5 and will thus lock the valve 4 in open position. In order that the valve 4 can fall again into the closed position, the armature 31 must be retracted. The electromagnet 6 is earthed by means of a conductor 35 and is connected by means of a conductor 36 with a switch device 37 in a vacuum indicator 38. The vacuum indicator 38 is connected by means of a conduit 39 with the induction pipe 2 above the throttle valve 1.

The other side of the switch device 37 is connected by means of a conductor 40 with the battery 24, the other end of which is earthed by the line 41. When the pressure decreases in the induction pipe 2 to a certain extent, the diaphragm 42 is drawn downwards and an electric connection effected between the contacts in the switch device 37 so that a circuit is formed from earth at one end through the line 41, battery 24, line 40, contact device 37, line 36, coil of the electromagnet 6 and line 35 to earth. The armature 5 is thereby raised and the armature 31 engages in the recess 34 and holds the valve open in this position. As soon as the valve 4 is opened, the pressure in the induction pipe 2 increases and the electric connection through the switch device 37 is interrupted. The supply of current to the electromagnet 6 will therefore only continue for a moment or two.

It is assumed that the vehicle at this moment is driving the engine at a higher speed than the idle running speed of the engine. As the vehicle is braked, the speed of the vehicle and consequently the speed of rotation of the engine also falls. When the speed of rotation of the engine falls to the usual idle running speed, there is no longer any reason for holding the valve 4 open. At this moment it is thus desirable that current should be supplied to the releasing magnet 30 and for this purpose according to the invention a centrifugally controlled switch device 43 may be provided, which is connected directly or indirectly with the crank shaft of the engine. When the centrifugal weights fall due to the fall in speed, an electric connection is formed by the contact plate 44 between the contacts 45 and 46. The contact 46 is connected by means of a line 47 with the one side of the battery 24 and the contact 45 is connected by means of a line 48 with a contact 49, which, when the armature 5 is attracted, is connected by means of a contact plate 50 with a contact 51 which is connected by means of a line 52 with the coil of the electromagnet 30, the other side of which is earthed by means of line 53. At this moment, therefore, the armature 31 is retracted and the armature 5 will fall and the valve 4 will close the air supply inlet 3 and the engine will operate in the usual manner. When the armature 5 falls, the connection between the contacts 49 and 51 will consequently be interrupted as the contact plate 50 falls with the armature. The supply of current to the releasing magnet 30 will thus only be momentary.

In order that the driver may set the engine at normal running before the speed of the

vehicle has reached the idle running speed of the engine, a circuit is provided from one side of the battery 24 through line 54 to a contact device 55 which is controlled by the accelerator or gas pedal 56 and which will provide a connection between line 57 which will supply current to the coil 30 through the contact 49, plate 50, contact 51, and line 52 and will release the armature 5, when the accelerator or gas pedal 56 is depressed so that the valve 4 is closed and the engine can be driven in the normal way.

In Fig. 4 the same apparatus is shown; but here the release mechanism is arranged to operate mechanically instead of electrically.

For this purpose the centrifugal mechanism 43′ is arranged to act against an arm and bell crank system 90, 91, 92, for retracting the plunger 31′ from its engagement with the armature 5.

And another system of arm and bell cranks 93, 94, 95 serves to connect the gas pedal with the release mechanism. It may here be good to arrange a resilient connection 96 to take up unnecessary movements of the parts.

The operation of this embodiment is self-evident for anybody, after having studied the operation of the embodiment shown in Fig. 1 in the above description.

It will thus be understood that when the different devices have once been fitted in place and have been adjusted to suit the requirements of the engine, they will operate entirely automatically without the operator requiring to do anything to the mechanism himself.

In Figs. 2 and 3 is shown a detailed embodiment of a preferred construction of the mechanism which has been described diagrammatically above.

In Fig. 3 the mechanism is shown also in conjunction with diagrammatically shown electric connections which indicate how the whole apparatus works.

The embodiment illustrated in Figs. 2 and 3 is intended for use in conjunction with an engine having two induction pipes 2′, each serving a group of cylinders. Two valves 4′ are therefore provided in two corresponding inlet pipes 3′ which are connected to the induction pipes 2′. The valves are arranged as ordinary throttle valves, i. e. they are mounted to rotate about a spindle 58 which is operated by means of toothed gearing hereinafter described.

The main magnet 6′ is provided with an armature 5′ which is provided with a bore 59, in which is provided a helical spring 60 which serves to force the armature out of the magnet. At the outer end the armature 5′ is connected by means of a link 61 with an arm 62 which is mounted on a shaft 63, at the other end of which is provided a partly toothed disk 64. The teeth 65 of this disk mesh with a pinion 66 which is mounted on the spindle 58, to which the valve 4′ is secured.

When the armature 5′ is drawn inwards, a rotary movement is imparted to the disks 64, which is transmitted by the teeth 65 and the pinion 66 to the spindle 58 in such manner that the valve 4′ is opened. In order further to ensure that the armature 5′ will be pushed outwards with sufficiently great force, a helical spring 67 is provided which is secured to an extension 68 of the arm 62 at one end and at the other to the connecting part between the two induction pipes 3′. The magnet 6′ is connected to the remainder of the apparatus by means of a strap or band 68.

Adjacent the magnet 6′ there is provided a releasing magnet 30′. This magnet and the part supporting it are insulated from the remainder of the apparatus being secured thereto by means of screws 69 which pass through insulating sleeves 70 and bear against an insulating washer 71. In the releasing magnet 30′ is provided an armature 31′ which is connected by means of a link 72 with bell crank arm 73 which is rotatably secured by means of a screw 74 to the part, to which the releasing magnet 30′ is secured. At the free end arm 73 is provided with a hook 75 which when the valve 4′ is closed, bears against an insulating plate 76. A blade spring 77 is provided which tends to press the hook 75 against the said insulating plate 76. In the disk 64 spaced somewhat from the insulating plate 76 is provided a notch 78 which serves to form a stop for the hook 75 when the disk 64 is rotated by the arm 62. When thus current is supplied to the magnet 6′, the disk 64 will turn towards the left in the drawings until the hook 75 engages in the notch 78 and thereby will lock the armature 5′ in the attracted position, so that the valve 4′ will remain open. At the same time an earth connection is provided between the releasing magnet 30′ and the remaining part of the apparatus.

The electric control system of the above described electromagnetic devices comprises a vacuum indicator or gauge 38′ with a contact device 37′, a relay 79, battery 24 and an accelerator or gas pedal 56. The operation is substantially the same as above described in connection with the diagrammatic example, but is hereafter again described with reference to the drawings, so that it will be clearly understood.

The one side of the electro-magnet 6′ is earthed by means of line 35′. The other side of the magnet 6′ is connected by means of line 36′ with the one side of the contact device 37′ in the vacuum gauge 38′. The other side of this contact device is connected by means of line 40′ with the one side of the battery 24, the other side of which is earthed by means

of line 41′. When the negative pressure in the induction pipe 2′ has reached a certain degree, the pointer 80 will close a circuit through the contact device 37′, so that electric energy will be supplied to the magnet 6′ and the valves 4′ will be opened as above described. The hook 75 will as above described lock the valves in open position at the same time as an earthed connection from the auxiliary magnet 30′ through line 53 will be effected by the hook. The other side of the releasing magnet 30′ is connected by means of line 52 with the one contact 45′ of the relay 79 and with the one contact 81 of the contact device 55′ of the accelerator or gas pedal 56. The other contact 46′ of the relay 79 and the contact 82 of the contact device 55′ are both connected with one side of the battery 24. The relay 79 which is shown in diagram form in the drawings may be a special voltage relay, of which both ends 83 and 84 are connected through the usual generator of the motor, or in some cases will be the usual device connecting the generator for charging the battery when the speed of the generator is sufficiently high to do so. In both cases the operation is the same; as long as the generator runs at a high enough speed, the voltage between the two sides of the relay will be large enough to ensure that the contact plate 85 is not in contact with the contacts 45′ and 46′. As soon as the speed of the engine fal's to a predetermined point, the voltage will be too small and an electric connection between the two said contacts will be effected. As soon as this happens, current is supplied to the releasing magnet from the battery whereupon the hook 75 is raised from engagement with the notch 78 and the springs 60 and 67 ensure that the valve 4′ is again closed. Should the accelerator or gas pedal 56 be depressed before this happens, a circuit is formed between the contact device 55′ which will have the same effect as above described. In both cases the valves 4′ will be closed. Thus there are no current supplying conductors in the whole system except at the moment when the apparatus is operating.

I claim:—

1. An apparatus for preventing the formation of a vacuum in the cylinders of an internal combustion engine when the throttle valve is closed, comprising an opening, closed by a valve in the induction pipe between the throttle valve and the cylinders and means to open said valve, when the vacuum in the induction pipe exceeds normal idle running vacuum, said means comprising an electric magnet with an armature connected to said valve and a vacuum gauge, connected to the induction pipe and controlling the circuit, through which electric current is furnished to the said magnet, and a snap mechanism, serving to lock the said valve in open position and means controlled by the speed of the motor for releasing the said snap mechanism.

2. An apparatus for preventing the formation of a vacuum in the cylinders of an internal combustion engine when the throttle valve is closed, comprising an opening, closed by a valve in the induction pipe between the throttle valve and the cylinders and means to open said valve, when the vacuum in the induction pipe exceeds normal idle running vacuum, said means comprising an electromagnet with an armature connected to said valve and a vacuum gauge, connected to the induction pipe and controlling the circuit, through which electric current is furnished to the said magnet, and a snap mechanism, serving to lock the said valve in open position, said snap mechanism comprising an electromagnet with a spring actuated armature, the electric circuit of which is closed by a relay influenced by the speed of the motor.

3. An apparatus for preventing the formation of a vacuum in the cylinders of an internal combustion engine when the throttle valve is closed, comprising an opening, closed by a valve in the induction pipe between the throttle valve and the cylinders and means to open said valve, when the vacuum in the induction pipe exceeds normal idle running vacuum, said means comprising an electromagnet with an armature connected to said valve and a vacuum gauge, connected to the induction pipe and controlling the circuit, through which electric current is furnished to the said magnet, and a snap mechanism, serving to lock the said valve in open position, said snap mechanism comprising an electromagnet, the voltage supply to which is supplied through the current relay on the usual generator.

4. An apparatus for preventing the formation of a vacuum in the cylinders of an internal combustion engine when the throttle valve is closed, comprising an opening, closed by a valve in the induction pipe between the throttle valve and the cylinders and means to open said valve, when the vacuum in the induction pipe exceeds normal idle running vacuum, said means comprising an electromagnet with an armature connected to said valve and a vacuum gauge, connected to the induction pipe and controlling the circuit, through which electric current is furnished to the said magnet, and a snap mechanism, serving to lock the said valve in open position, said snap mechanism comprising an electromagnet with a spring actuated armature, the electric circuit of which is closed by a relay influenced by the speed of the motor and by a contact mechanism, operated by the gas pedal.

5. An apparatus for preventing the formation of a vacuum in the cylinders of an internal combustion engine when the throttle valve

is closed, comprising an opening, closed by a valve in the induction pipe between the throttle valve and the cylinders and means to open said valve, when the vacuum in the induction pipe exceeds normal idle running vacuum, said means comprising an electromagnet with an armature connected to said valve and a vacuum gauge, connected to the induction pipe and controlling the circuit, through which electric current is furnished to the said magnet, and a snap mechanism, serving to lock the said valve in open position, said snap mechanism comprising an electromagnet with a spring actuated armature, the electric circuit of which is closed by a relay influenced by the speed of the motor, the electric circuits of the two electromagnets above mentioned passing through contacting mechanisms, which will cause the electric circuits to be broken, as soon as the action of the electromagnets has been completed.

6. An apparatus as claimed in claim 2, characterized by this that the main magnet controls the valve by a lever and a disk with teeth which mesh with a pinion on the spindle of the valve and that the valve is locked in open position by means of a hook, which is arranged for this purpose to engage with a notch in the disk.

7. An apparatus as claimed in claim 2, characterized by this that the main magnet controls the valve by a lever and a disk with teeth which mesh with a pinion on the spindle of the valve and that the valve is locked in open position by means of a hook, which is arranged for this purpose to engage with a notch in the disk, and that the hook is connected with an armature in a releasing magnet in such manner that it is brought out of engagement with the notch, when current is supplied to the releasing magnet.

8. An apparatus as claimed in claim 2, characterized by this that the main magnet controls the valve by a lever and a disk with teeth which mesh with a pinion on the spindle of the valve and that the valve is locked in open position by means of a hook, which is arranged for this purpose to engage with a notch in the disk, and that the hook is connected with an armature in a releasing magnet in such manner that it is brought out of engagement with the notch, when current is supplied to the releasing magnet and its various parts being insulated from the remainder of the apparatus, when the valves are closed.

9. An apparatus as claimed in claim 2, characterized by this that the main magnet controls the valve by a lever and a disk with teeth which mesh with a pinion on the spindle of the valve and that the valve is locked in open position by means of a hook, which is arranged for this purpose to engage with a notch in the disk, and that the hook is connected with an armature in a releasing magnet in such manner that it is brought out of engagement with the notch, when current is supplied to the releasing magnet, the said releasing magnet and its various parts being insulated from the remainder of the apparatus, when the valves are closed, and the said hook bearing against an insulating plate on the said disk, when the valve is closed.

EINAR ISDAHL.