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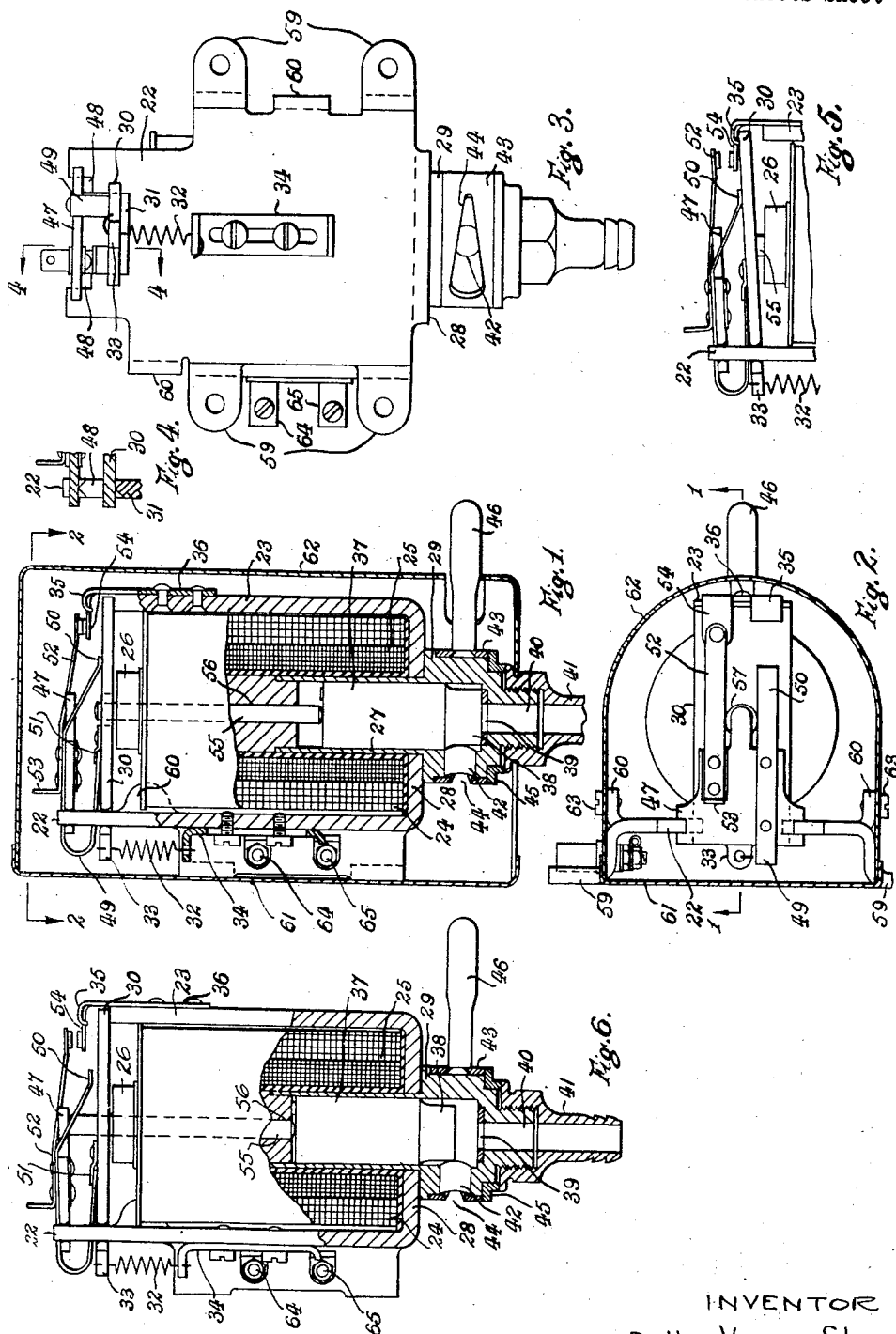
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2,519,607

AIR INLET VALVE FOR INTERNAL-COMBUSTION ENGINES

Filed Nov. 12, 1947

2 Sheets-Sheet 1



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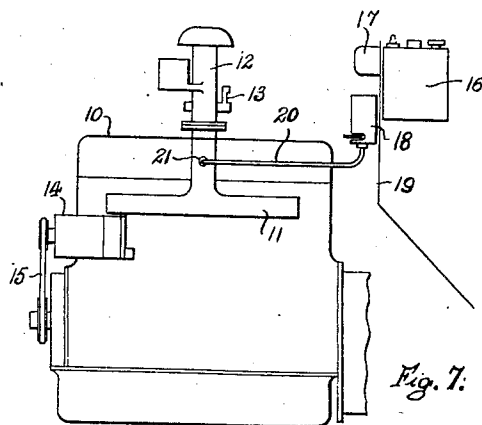
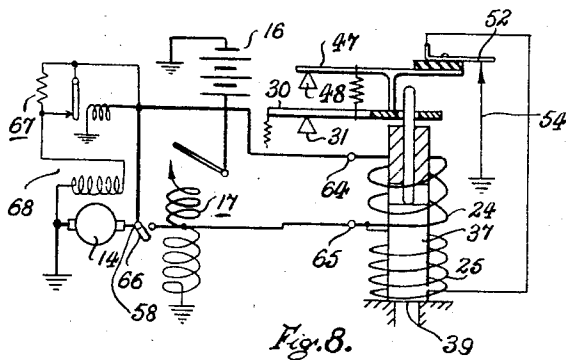
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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AIR INLET VALVE FOR INTERNAL-COMBUSTION ENGINES

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This invention relates to valves for controlling the admission, to the induction systems of throttle-controlled internal-combustion engines of road vehicles, of air supplementary to that admitted through the carburettor or other air-metering device. Such valves, which are commonly termed "extra air inlets," may enable the fuel consumption to be appreciably reduced; nevertheless they are little used owing to a number of disadvantages.

An extra air inlet must be closed when the engine is required to idle, otherwise the mixture is so weakened that the engine stops. Automatic extra air inlets are known, in which a spring-loaded valve is opened in response to increase in the depression in the induction system; if they are so adjusted as to allow the engine to idle satisfactorily, their effect is negligible. A hand-controlled valve, if intelligently used, affords a substantial saving in fuel; nevertheless it is a nuisance in requiring to be shut whenever the engine is required to idle.

An object of this invention is to reduce or avoid these disadvantages.

Another object is to provide an electro-magnetically operated valve, suitable for use as an extra air inlet on a throttle-controlled internal-combustion engine.

Another object is to provide in the combination of a throttle-controlled internal-combustion engine with an electric battery-charging system associated with the engine an electrically actuated extra air inlet arranged to open and close automatically in response to the normal operation of said system.

Another object is to enable a simple air valve of the unbalanced poppet or like type to be used without risk of its being held onto its seat by the induction vacuum and without excessive power consumption by an electro-magnetic actuating device.

Embodiments of the invention will be described by way of example and with reference to the accompanying drawings, in which:

Figure 1 is a side elevation of a preferred form of electro-magnetically actuated extra air inlet in accordance with the invention, partly in section on the line 1-1 in Figure 2.

Figure 2 is a plan of the same valve, in section on the line 2-2 in Figure 1.

Figure 3 is a rear elevation of the same valve, as seen from the left-hand side of Figure 1, and with a casing omitted.

Figure 4 is a section of a detail, taken on the line 4-4 in Figure 3.

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Figure 5 is a side elevation of parts appearing in the upper portion of Figure 1, but in different positions.

Figure 6 is a side elevation of the same valve, with parts in other different positions.

Figure 7 shows diagrammatically an automobile engine equipped with the valve shown in Figures 1 to 6, and:

Figure 8 is an electric circuit diagram of part of the electrical equipment of the engine shown in Figure 7.

In Figure 7 the internal-combustion engine 10 has an induction manifold 11 fed by a carburettor 12 provided with a throttle control 13. A direct-current electric generator 14 is driven by a belt transmission 15 from the engine crankshaft and charges a battery 16 through a cut-out 17. All the above-mentioned elements are arranged in the usual way. An extra air inlet valve, denoted as a whole by 18, is mounted on the front of the automobile dashboard bulkhead 19 and is connected by a flexible tube 20 to a union 21 opening into the interior of the manifold 11.

The valve 18 is provided with an electro-magnetic actuating device which includes a U-piece stamped out of sheet magnetic material so as to form two limbs 22 and 23 (Figures 1 to 6). Two co-axial solenoid coils 24 and 25 are fitted between the limbs of the U-piece with their axis parallel to and midway between these limbs. A cylindrical pole-piece 26 is fixed in the upper end portion of the coils by a tubular guide 27 which connects the lower end of the pole-piece 26 to the bottom 28 of the U-piece and which is integral with a valve body 29.

A first armature is a flat plate 30 capable of rocking on a knife-edge 31 on the limb 22 of the U-piece and adapted to rest on the limb 23 with its under surface close to the upper end of the cylindrical pole-piece 26. A tension spring 32, tied between a lug 33 on the armature and an adjustable anchorage 34 on the limb 22, urges the free end of this armature upwards against a stop 35 formed by one prong of a fork-shaped plate 36 riveted to the limb 23.

A second armature is constituted by a plunger 37 slidable in the tubular guide 27. The lower end of the plunger is of reduced diameter and forms a valve closure member 38 cooperating with an annular seating in the hollow cylindrical valve body 29. The annular seating is a ring 39 of fibre fitted in a counterbore in the valve body, and it surrounds an outlet port 40 leading to a connector 41 for the flexible tube 20 communicating with the induction manifold of the engine.

An inlet port 42 is bored radially through the valve body 29 above the seating, and a manual control valve is formed by a sleeve 43 rotatably fitted around the valve body and provided with a circumferential tapered slot 44 co-operating with the inlet port 42. The sleeve 43 is located axially by a washer 45 retained by the connector 41, which is screwed to the valve body. A pre-setting lever 46 fixed to the sleeve 43 enables the effective inlet area of the valve to be adjusted.

A contact mounting plate 47 is mounted, on knife-edges 48 on the limb 22, substantially parallel to and above the armature plate 30, and is connected to the armature plate by a hairpin spring blade 49 the upper limb of which is riveted to the upper surface of the plate 47 and extends forwards and downwards to form a stop 50 which prevents the plate 47 from passing down beyond the position in which it is parallel to the plate 30. The lower limb of the spring 49 is engaged under a clip 51 riveted to the armature plate 30 whereby the plate 47 is resiliently biased towards the plate 30. An insulated contact blade 52 provided with a terminal tag 53 is riveted to the mounting plate 47 and projects beyond the front end of the plate for co-operation with a grounded contact 54 which is beneath the free end of the blade 52 and which is formed by a second prong of the fork-shaped plate 36.

A tappet 55 is slidable in a longitudinal bore 56 in the cylindrical pole-piece 26 and rests on the plunger 37; the upper end of the tappet passes through an aperture 57 in the armature plate 30 and is adapted to engage the under side of the contact mounting plate 47.

The coil 24 is a low-resistance holding coil and is connected between the generator line terminal 58 (Figure 8) and the battery 16 on the side of the charging cut-out 17 nearer to the generator. The coil 25 is a boost coil of higher resistance than the holding coil and is connected in series with the contacts 52, 54 and with the contacts of the cut-out 17 across the battery. In the example shown in Figures 1 to 6, in which the diameter of the core 26 is $\frac{5}{8}$ inch, for charging rates up to 16 amperes the holding coil 24 may consist of 110 turns of 14-gauge wire, and a boost coil operating at 6 volts may consist of 300 turns of 22-gauge wire. A switch 66 may be provided to short-circuit the holding coil 24. When this switch is in the open position shown in Figure 8, the extra air inlet can operate. When the switch is closed, the extra air inlet remains shut. The field winding 68 of the generator is energised from the generator line terminal 58 through a constant voltage controller 67 of the usual kind.

The limb 22 is provided with mounting lugs 59 to which are fixed a flanged back plate 61. A casing 62 fits within the flanges of the plate 61 and is held by screws 63 engaged in lugs 60 on the limb 22. Insulated terminals 64 and 65 mounted on the limb 22 project through notches in the cover elements 61 and 62.

The action is as follows. Figure 5 shows the condition of the device when the engine is idling and the cut-out is open. The switch 66 being open, when the engine is accelerated and the battery charging rate rises to a value determined by the setting of the biasing spring 32 and the position of the stop 35, the flux due to the holding coil 24 causes the armature plate 30 to be attracted to the pole-piece 26, and the contacts 52, 54 are thereby closed and complete the circuit which connects the boost coil 25 across the

battery; the parts are now in the positions shown in Figures 1, 2 and 3. As the boost coil is energised directly from the battery, the additional excitation due to it is independent of the charging rate at the instant of cutting-in and is sufficient to raise the plunger 37 against the restraint due to the induction vacuum acting on the closure member 38. As the plunger rises, the tappet 55 raises the contact mounting plate 47 and opens the contacts as shown in Figure 6, so that the boost coil 25 is de-energised, the plunger being retained in its raised position by the attraction due to the charging current in the holding coil 24.

The valve continues to admit extra air until the charging current falls to a predetermined value, whereupon the armature plate 30 is raised by its biasing spring 32 and thereafter the plunger 37 drops and closes the air valve. Since the tappet 55 does not drop until after the armature plate 30 has risen, the boost coil 25 is not re-energised.

When the switch 66 is closed, no current flows through the holding coil 24, and the boost-coil circuit remains interrupted at the contacts 52, 54. The valve therefore will not open.

I claim:

1. An electro-magnetically actuated valve including a valve body having a seating, a closure member movable axially of said seating, a solenoid co-axial with said seating and having a holding coil, a boost coil of higher resistance than said holding coil, a plunger armature and a rocking armature, said plunger armature being directly connected with said closure member in such a manner that when said plunger armature is operated it opens the valve, a fixed contact, a movable contact resiliently mounted on said rocking armature for engagement with said fixed contact when said rocking armature is operated, an operative connection between said movable contact and said plunger armature for maintaining said contacts open when said plunger armature is operated, and an electrical connection between one of said contacts and one terminal of said boost coil.

2. An extra air inlet arrangement for use with an internal-combustion engine having a throttle-controlled induction system, said arrangement comprising the combination of an electric storage battery, a battery-charging generator for driving connection with the engine, an electric circuit including a battery-charging cut-out connecting said generator to said battery, an electrically actuated air inlet valve including an electromagnetic actuating device having a holding coil in series in said circuit, a boost coil, contacts, a first armature capable when operated of closing said contacts and a second armature capable when operated of opening said valve and opening said contacts, and a second electric circuit including said contacts for connecting said boost coil across said battery, said first armature operating alone in response to energizing of said holding coil due to closing of said cut-out, said second armature operating in response to energizing of said boost coil due to closing of said contacts, and the flux developed by said holding coil being capable of maintaining said second armature in the operated position.

3. An extra air inlet arrangement for use with an internal-combustion engine having a throttle-controlled induction system, said arrangement comprising the combination of an electric storage battery, a battery-charging generator for

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driving connection with the engine, an electric circuit including a battery-charging cut-out connecting said generator to said battery, an electromagnetically actuated air inlet valve having a holding coil in series in said circuit, a boost coil, contacts for connecting said boost coil across said battery, a first armature capable when operated of closing said contacts, and a second armature capable when operated of opening said valve and opening said contacts, the valve being so proportioned that, when said holding coil is energized as a result of closing of said cut-out, said first armature operates and closes said contacts and the resulting increase in energizing of the valve causes the second armature to operate and thereby open the valve and re-open the contacts, said second armature thereupon remaining held in the operated condition by the action of said holding coil.

4. An electromagnetically actuated valve including a valve body having a tubular valve guide, an outlet port co-axial with said guide and surrounded by an annular valve seating, and an inlet port opening into said body between said seating and said guide, a pole piece fixed co-axially with said guide at the end thereof

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remote from said seating, a solenoid coil surrounding said pole piece, a yoke of magnetic material connected by a path of low magnetic reluctance to the end of said pole piece remote from said seating, said yoke having an apertured portion fixed to said valve body between said pole piece and said seating and penetrated by said guide, and a plunger armature slidable in said guide and having one end shaped to form a closure member for cooperation with said seating, said plunger armature being slidable between an unoperated position in which it closes said outlet port and an operated position in which it engages said pole piece to establish a substantially closed solenoid flux circuit including said pole piece, said yoke and said plunger armature.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,018,425	Taber	Oct. 22, 1935