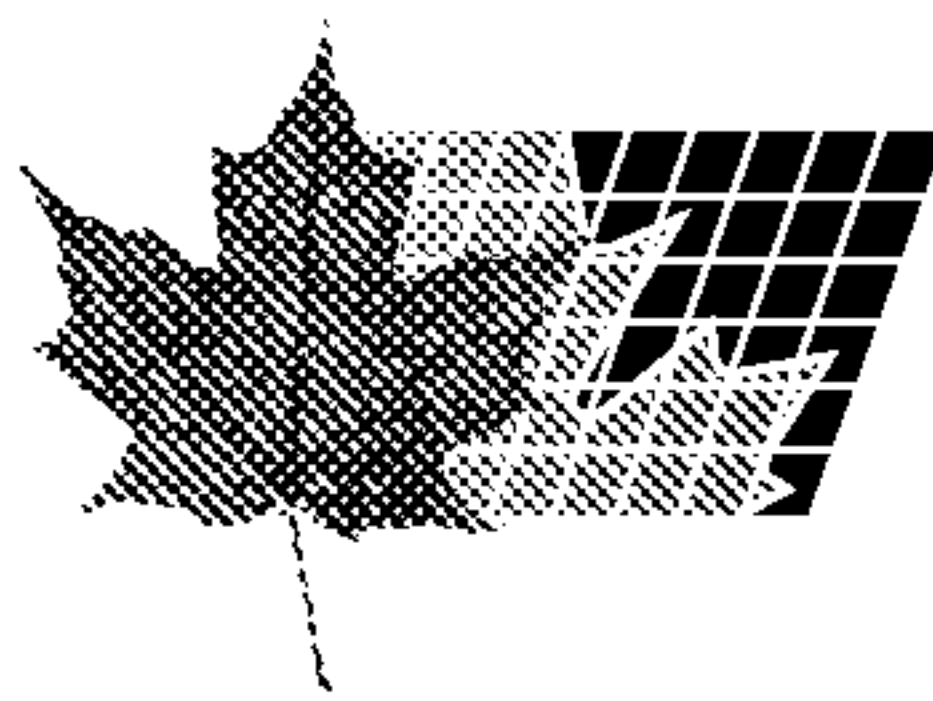




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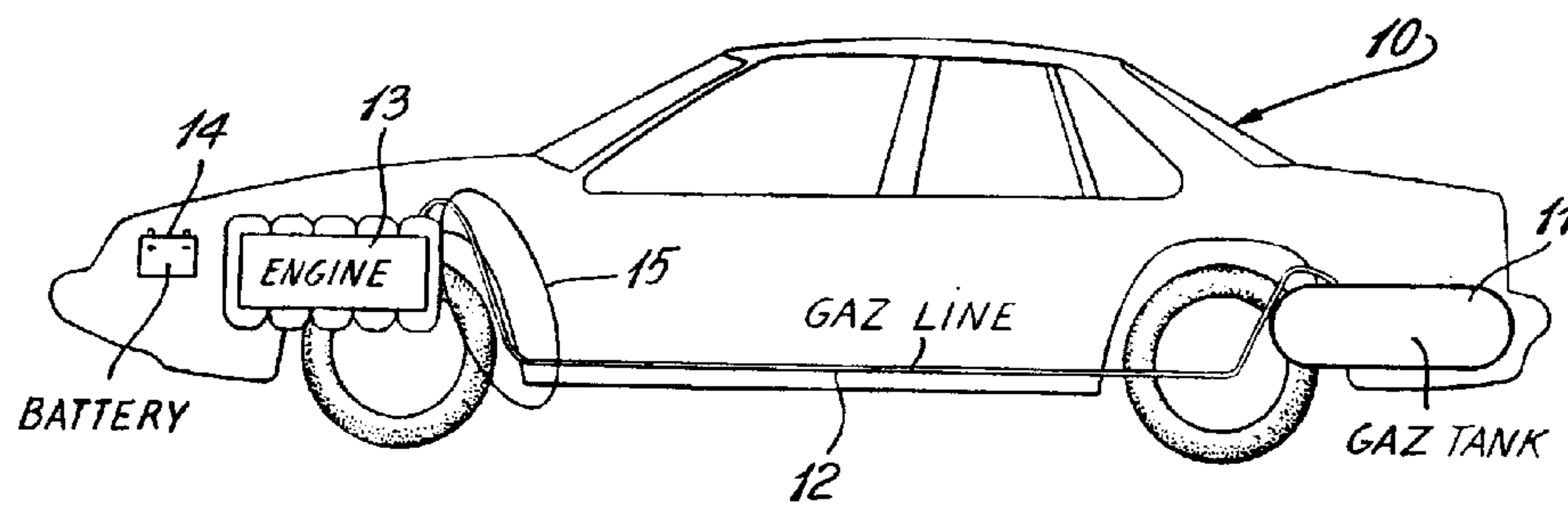
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(54) **DISPOSITIF DE CONDITIONNEMENT DE CARBURANT PAR
IONISATION DU CARBURANT HYDROCARBURE DANS UN
MOTEUR A COMBUSTION INTERNE**

(54) **FUEL CONDITIONING DEVICE FOR IONIZING
HYDROCARBON FUEL IN INTERNAL COMBUSTION
ENGINES**



(57) L'invention concerne un dispositif (15) de conditionnement de carburant destiné à être fixé sur un conduit (12) de carburant d'un moteur à combustion interne (13) ionisant le carburant hydrocarbure (19) s'écoulant dans le conduit de carburant afin d'améliorer le rendement de la combustion. Le dispositif (15) comprend un logement (16) dans lequel est encapsulé un circuit (21) de conditionnement de tension d'alimentation cc ainsi qu'un circuit intégré (23) à oscillateur astable. Un circuit (22) conformateur d'impulsions commande les périmètres de l'oscillateur et présente un condensateur de charge (27) connecté en série à deux résistances (25, 26). Les résistances (25, 26) présentent des valeurs prédéterminées pour fixer la charge du condensateur (27) de sorte que lorsque la charge du condensateur atteint une tension de référence (Vcc) dans le circuit oscillateur, il se décharge par une paire de bobines de fil (17, 17') lesquelles sont enroulées autour du conduit (12) de carburant afin de produire un champ magnétique variable autour du conduit de carburant, lequel est concentré pour ioniser les particules (19') de carburant améliorant ainsi le rendement de combustion et du carburant.

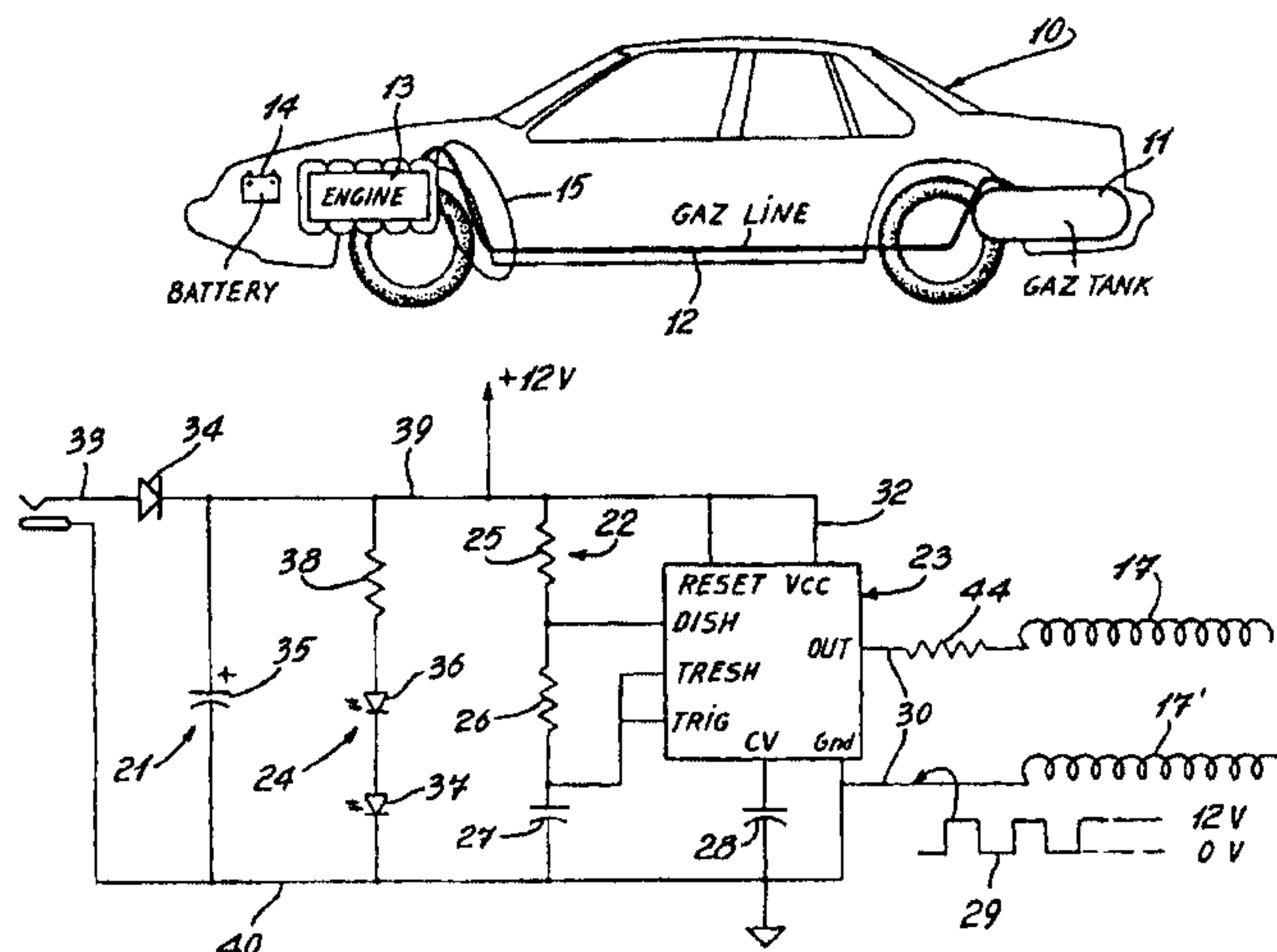
(57) A fuel conditioning device (15) for securement to a fuel line (12) of an internal combustion engine (13) which ionizes hydrocarbon fuel (19) flowing in the fuel line to increase combustion efficiency. The device (15) has a housing (16) in which is encapsulated a d.c. supply voltage conditioning circuit (21) and an astable oscillator integrated circuit (23). A pulse forming circuit (22) controls the perimeters of the oscillator and has a charging capacitor (27) connected in series with two resistances (25, 26). The resistances (25, 26) have predetermined values to fix the charging of the capacitor (27) such that when the charge on the capacitor reaches a reference voltage (Vcc) in the oscillator circuit, it discharges through a pair of wire coils (17, 17') which are coiled about the fuel line (12) or by to produce a varying magnetic field about the fuel line which is concentrated to ionize the fuel particles (19') thereby improving combustion and fuel efficiency.

PCT

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(21) International Application Number: PCT/CA98/00881 (22) International Filing Date: 15 September 1998 (15.09.98) (71) Applicant (for all designated States except US): CHAUFFA-TECH [CA/CA]; Division de 3222641 ,Canada Inc., 2000 rue Cunard, Laval, Quebec H7S 2G5 (CA). (72) Inventors; and (75) Inventors/Applicants (for US only): SIGOUIN, Jean-Paul [CA/CA]; 1705 de Miranda, Laval, Quebec H7M 4L4 (CA). GRAVEL, Lucien [CA/CA]; 29 avenue Bellevue, St-Vincent de Paul, Laval, Quebec H7C 1T2 (CA). (74) Agents: MITCHELL, Robert et al.; Swabey Ogilvy Renault, Suite 1600, 1981 McGill College Avenue, Montreal, Quebec H3A 2Y3 (CA).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>

(54) Title: FUEL CONDITIONING DEVICE FOR IONIZING HYDROCARBON FUEL IN INTERNAL COMBUSTION ENGINES**(57) Abstract**

A fuel conditioning device (15) for securement to a fuel line (12) of an internal combustion engine (13) which ionizes hydrocarbon fuel (19) flowing in the fuel line to increase combustion efficiency. The device (15) has a housing (16) in which is encapsulated a d.c. supply voltage conditioning circuit (21) and an astable oscillator integrated circuit (23). A pulse forming circuit (22) controls the perimeters of the oscillator and has a charging capacitor (27) connected in series with two resistances (25, 26). The resistances (25, 26) have predetermined values to fix the charging of the capacitor (27) such that when the charge on the capacitor reaches a reference voltage (Vcc) in the oscillator circuit, it discharges through a pair of wire coils (17, 17') which are coiled about the fuel line (12) or by to produce a varying magnetic field about the fuel line which is concentrated to ionize the fuel particles (19') thereby improving combustion and fuel efficiency.

**FUEL CONDITIONING DEVICE FOR IONIZING HYDROCARBON FUEL
IN INTERNAL COMBUSTION ENGINES**

TECHNICAL FIELD

5 The present invention relates to a fuel conditioning device for securement to a fuel line of an internal combustion engine whereby to ionize hydrocarbon fuel flowing in the fuel line. The fuel conditioning circuit is mounted in a housing which is attached to the fuel line together
10 with two coiled antennas which have a predetermined number of turns wherein a pulsating magnetic field, at a predetermined frequency, is produced to achieve optimum ionization of the fuel flowing in the gas line prior to ignition.

15

BACKGROUND ART

Various devices have been developed in the pass to improve fuel efficiency. It is also known that by ionizing the fuel combustion efficiency is achieved and thus
20 improving fuel economy. This may be achieved by using a rubber fuel line with a magnet attached to it and oriented a certain way to focus a magnetic field on the flowing fuel. Such a method and apparatus is disclosed in US Patents 5,080,080 and 5,271,369. US Patent 4,572,145 also describes
25 a magnetic device using a magnet which is embedded in a U-shaped body of non-magnetic material and which fits over the fuel line.

A disadvantage of such prior art is that the rubber fuel line will be subjected to deterioration due to varying
30 temperature and humid conditions. Also, to install the line it is necessary to cut the existing fuel line. This could cause leakage and bring about serious consequences if the

fuel was to leak on the hot engine during operation. Accordingly, it is difficult to obtain certification of such systems. Such known systems also do not appreciably achieve fuel economy. Most known systems are difficult to install
5 and can cause interference with onboard computers or other such electronic devices when using magnets.

DISCLOSURE OF INVENTION

It is a feature of the present invention to provide a
10 fuel-conditioning device, which overcomes the disadvantages of the known prior art.

Another feature of the present invention is to provide a fuel-conditioning device, which is easy to install.

Another feature of the present invention is to provide
15 a fuel conditioning device which is compact and which attaches directly to the fuel line without having to modify the fuel line.

Another feature of the present invention is to provide a fuel-conditioning device, which does not interfere with
20 electronic devices of an automotive vehicle.

Another feature of the present invention is to provide a fuel-conditioning device which attaches directly to the fuel line of an internal combustion engine and which can provide a fuel economy in the range of 10 to 18%.

25 Another feature of the present invention is to provide a fuel conditioning device which secures directly to the fuel line of an internal combustion engine whether the engine is operated with gas or diesel fuel

According to the above features, from a broad aspect,
30 the present invention provides a fuel conditioning device for securement to a fuel line of an internal combustion

engine to ionize hydrocarbon fuel flowing in the fuel line to increase combustion efficiency. The device comprises a housing having a d.c. supply voltage-conditioning circuit for feeding an astable oscillator integrated circuit. A pulse forming circuit controls the parameters of the oscillator integrated circuit. The pulse forming circuit charges a capacitor connected in series with a first and a second resistance. The series connection of the charging capacitor, the first and second resistance are connected across the d.c. supply voltage of the circuit. The resistances have a predetermined value to fix the charging time of the charging capacitor. The oscillator integrated circuit has a reference voltage connection to which the d.c. supply voltage is connected whereby to provide a reference voltage. A pair of thermally insulated antenna cables are connected to an output of the oscillator integrated circuit. The charging capacitor discharges into the antenna cables when its charge equals the reference voltage whereby to produce a varying magnetic field about the fuel line when the cables are coiled about such fuel line.

BRIEF DESCRIPTION OF DRAWINGS

A preferred embodiment of the present invention will now be described with reference to the accompanying drawings in which:

FIG. 1 is a simplified view illustrating the fuel supply line of an automotive vehicle in relation to the engine of the vehicle;

FIG. 2 is a simplified view illustrating how the fuel conditioning device of the present invention is secured to

the gas line together with its coiled antennas and the connection of the device to the battery of the vehicle; and

FIG 3. is a schematic circuit diagram of the voltage conditioning circuit and the astable oscillator integrated
5 circuit feeding the coil antennas.

MODES FOR CARRYING OUT THE INVENTION

Referring now to the drawings, and more particularly to Figure 1, there is shown an automotive vehicle 10 having
10 a gas tank 11 and a fuel line 12 supplying gas to the internal combustion engine 13. A battery 14, which is utilized for the electrics of the vehicle also, supplies the operating voltage of the fuel-conditioning device of the present invention. The fuel-conditioning device of the
15 present invention is secured within the zone 15 of the fuel line 12 in a selected area not to interfere with onboard electronic devices of the automotive vehicle 10.

With reference now to Figure 2, there is shown at 15 the fuel-conditioning device of the present invention.
20 Essentially, it consists of a housing 16 in which the electronic components are encapsulated and a pair of antenna wires 17 and 17' which are wound or coiled respectively about the fuel line 12. The wound or coiled antenna wires 17 and 17' are attached to the fuel line 12 by electric
25 adhesive tape 18. The d.c. 12v battery 14 of the automotive vehicle 10 supplies voltage to the circuit which is secured within the housing 16. As hereinshown fuel 19 flows within the fuel line 12 in the direction of arrow 20 and when it exits the outlet of the second coiled antenna 17' it has
30 been ionized, that is to say, its particles 19' have been fractioned whereby enhancing the combustion of the gas.

Referring now additionally to Figure 3, there will be described the electronic circuitry which produces a varying magnetic field within the antenna coils 17 and 17'.

As hereinshown the electronic circuit comprises a d.c. supply voltage conditioning circuit 21 and a pulse forming circuit 22. A frequency generator is provided by an oscillator integrated circuit 23. A visual indicating circuit 24 is also provided to indicate the operation of the device.

The heart of the system is the astable oscillator 23 which is provided by an L.M. 555 integrated circuit. Its parameters are controlled by a pair of resistances 25 and 26 and a pair of capacitors 27 and 28. The capacitance 27 is a charging capacitor, which sets the pulsating frequency of the magnetic field produced in the coiled antenna 17 and 17'. With the oscillator circuit operating in the astable mode this assures that the oscillator produces a stable frequency pulsed signal. This pulsating signal is indicated at 29 and as can be seen it produces a square wave pulse having a cycle wherein the pulse occupies 50% of the cycle time and this is controlled by the charging capacitor in the two resistances 25 and 26. This pulsating signal is produced at the output 30 of the oscillator integrated circuit 23 and to which the coils are connected.

The frequency of the output signal 29 is set at 5600Hz. This frequency is adjusted by the resistances R1 and R2 which are 56 kohm and 5.1 kohm respectively and as well as the capacitance 27 which has a value of 0.0022 μ f. The pulsating signal 29 at the output 30 of the oscillator is generated by the charge and discharge of the capacitance 27. The charging time of the pulse is adjusted by the values of

the resistances 25 and 26. The voltage supply line is connected to the battery 14 and is applied across the series connection of the resistances 25, 26 and the capacitor 27. This supply charges the capacitor during a time period of
5 93,153 micro seconds. The discharge of the capacitor occurs when the voltage charge on the capacitor 27 is equal to a reference voltage V_{cc} which is also the 12v supply voltage connected to the terminal 32 of the oscillator circuit 23. When the charge on the capacitor 27 reaches this reference
10 voltage then the capacitor discharges into the resistance 26 and is applied at the output 30. The discharge time is 85,378 micro seconds. By adding the charging time with the discharge time we obtain the total cycle time which is 178,531 micro seconds. Accordingly, the output signal is at
15 a frequency of 5,600 Hz.

The battery 14 is connected to a connector 33 and a protection diode 34 prevents accidental inversion of the polarity of the supply voltage. The diode 34 conducts only when the supply voltage is positive. A protection fuse 31
20 protects the circuit. The capacitor 35 forms part of the conditioning circuit and it acts as a filter and stabilizer for the supply voltage.

The light emitting diodes 36 and 37 together with the series connected limiting resistance 38 forms the visual
25 indicating circuit 24. They indicate the proper functioning of the device. This series connection is applied between the 12v supply line 39 and ground 40. The first light emitting diode 36 has an internal circuit which make it flash approximately twice a second. The second diode 37
30 only lights when the first diode is "on" and will cause the current to flow thereto. The resistor 38 limits the current

to approximately 12 milliamps. The light emitting diodes therefore light simultaneously depending on the speed of the first diode 36. Therefore, when the supply voltage is present both LEDs will flash. The oscillator integrated
5 circuit is thus fed a supply voltage and it produces a square wave 12v signal at a frequency of 5,600 Hz with the pulse cycle time fixed at 50%.

For proper operation of the fuel-conditioning device, it is important that each of the coil wires 17 and 17' be
10 wound about the fuel line 12 with each having 20 turns. Any excess wire can then be cut off. The wire is also preferably a multi-strand wire capable of being deformed. Although these coiled antennas, when taped about the fuel line provide support for the housing 16, a tie wrap 41 as
15 shown in Figure 2, may be secured about the fuel line 12 and an eyelet 42 provided on the outer wall 43 of the housing 16. The electronic circuitry within the housing is also protected by an encapsulated epoxy.

For optimum fuel efficiency it has been found, that
20 with different types of fuel used, the pulsating magnetic field should preferably have the following parameters. It has been found that for a standard type gas internal combustion engine, the pulsating magnetic field should have a frequency of 4.40 Hz and a peak voltage of 9.55v. When
25 orange diesel fuel is utilized the pulsating magnetic field should have a frequency of 5.30 and a peak voltage of 10.40. This has been found to be most efficient. When the diesel fuel is a red fuel it has been found that the frequency should be increased to 9.30 Hz with the voltage set at
30 10.80. These settings, as previously described, are set by the values of the resistances 25 and 26. Resistance 44

connected to the output line 30' sets the peak voltage. As illustrated in Figure 3 the voltage pulses can be set between 0v to +12v.

5 It is within the ambit of the present invention to cover any obvious modifications of the preferred embodiment described herein, provided such modifications fall within the scope of the appended claims.

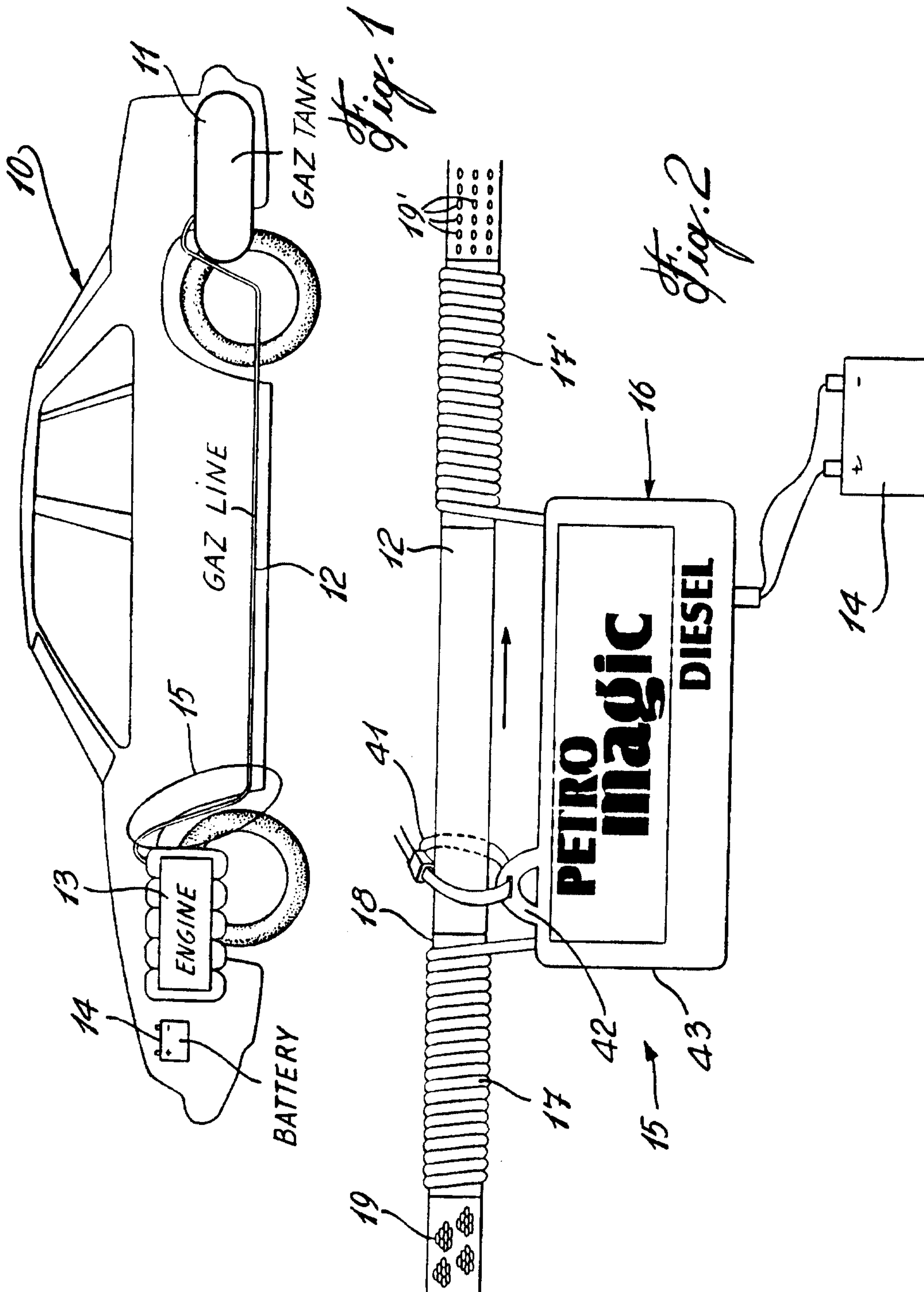
Claims:

1. A fuel conditioning device for securement to a fuel line of an internal combustion engine to ionize hydrocarbon fuel flowing in said fuel line to improve combustion efficiency, said device comprising a housing having a d.c. supply voltage conditioning circuit for feeding an astable oscillator integrated circuit housed in said housing, a pulse forming circuit to control the parameters of said oscillator integrated circuit, said pulse forming circuit charging a capacitor connected in series with a first and a second resistance, said series connection of said charging capacitor and said first and second resistance being connected across said d.c. supply voltage, said resistances having predetermined values to fix the charging time of said charging capacitor, said oscillator integrated circuit having a reference voltage connection to which said d.c. supply voltage is connected to provide a reference voltage, a pair of thermally insulated antenna cables connected to an output of said oscillator integrated circuit, said charging capacitor discharging into said antenna cables when its charge equals said reference voltage whereby to produce a varying magnetic field about said fuel line when said cables are coiled about said fuel line.
2. A fuel conditioning device as claimed in claim 1 wherein said d.c. supply voltage conditioning circuit includes a filtering capacitor to filter and stabilize

said d.c. supply voltage and a protection device to maintain a constant polarity of said supply voltage.

3. A fuel conditioning device as claimed in claim 2 wherein said conditioning circuit further comprises a voltage indicator circuit comprised of a pair of light emitting diodes connected in series with a current limiting resistance to indicate the operating status of said oscillator circuit.
4. A fuel conditioning device as claimed in claim 3 wherein said astable oscillator circuit is an LM555 integrated circuit controlled by said first and second resistance, and a pair of capacitors one of which is said charging capacitor to make it oscillate in an astable mode.
5. A fuel conditioning device as claimed in claim 1 wherein said oscillator integrated circuit produces a square wave output pulsating voltage oscillating at a frequency of 5,600 Hz, said pulsating voltage having a 50% pulse cycle with a maximum voltage of 12 volts.
6. A fuel conditioning device as claimed in claim 1 wherein said antenna cables are multi-strand cables, each said cables being coiled about said fuel line to provide a concentrated pulsating magnetic field, said coils each having twenty turns, and means to fix said coils to said fuel line.

7. A fuel-conditioning device as claimed in claim 6 wherein said means to fix said coils to said fuel line is comprised by adhesive tape.
8. A fuel-conditioning device as claimed in claim 6 wherein said conditioning circuit and oscillator circuit are encapsulated in said housing.
9. A fuel-conditioning device as claimed in claim 6 wherein said housing is secured to said fuel line by securement means.
10. A fuel conditioning device as claimed in claim 9 wherein said securement means is a tie wrap.
11. A fuel-conditioning device as claimed in claim 1 wherein said d.c. supply voltage is provided by a 12 volt d.c. automotive battery.
12. A fuel conditioning device as claimed in claim 1 wherein said pulsating output voltage has the following pulse characteristics;
 - i) for gas 4.40 khz with an amplitude of 9.55v
 - ii) for orange diesel 5.30 khz with an amplitude of 10.40v
 - iii) for red diesel 9.30 khz with an amplitude of 10.80v.



SUBSTITUTE SHEET (RULE 26)

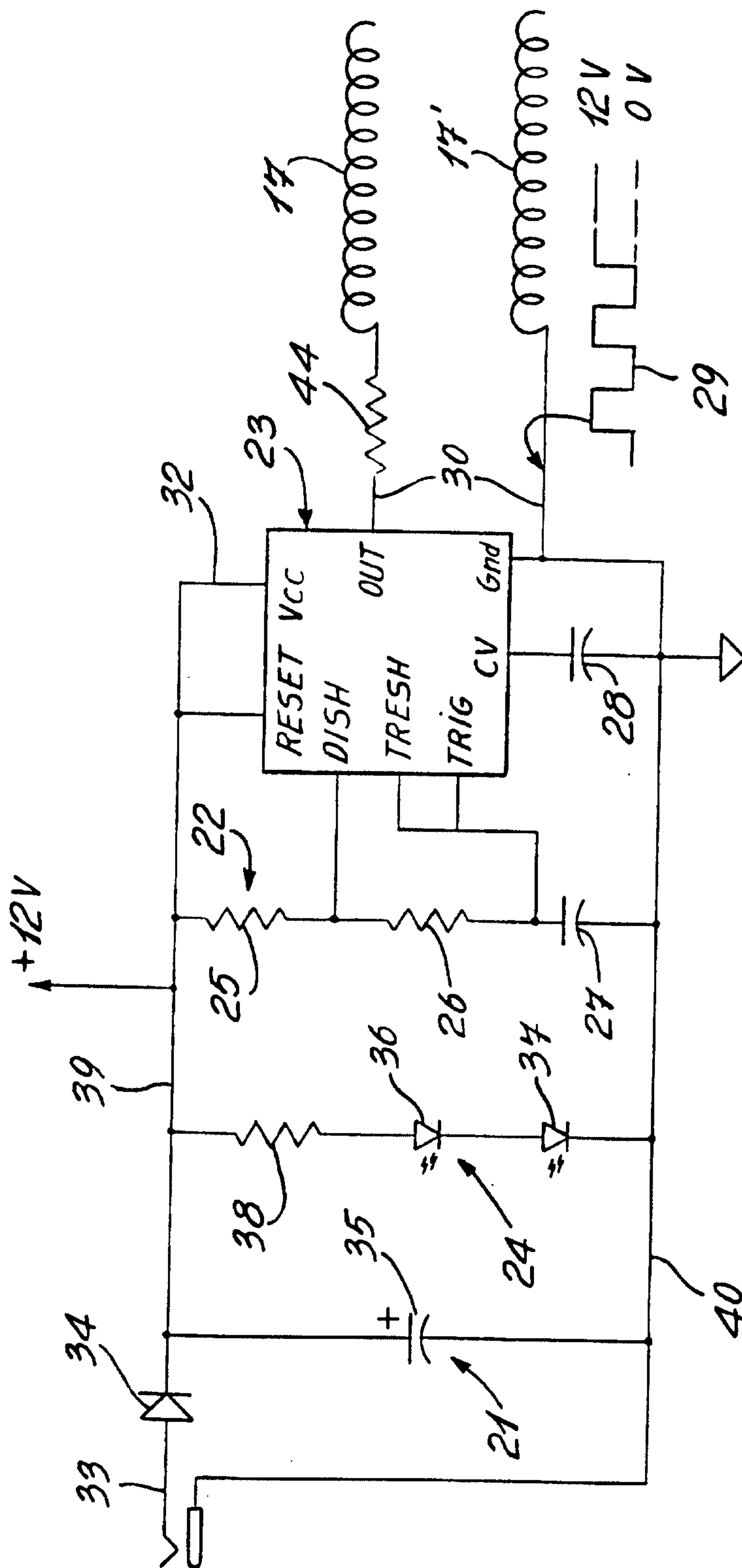


Fig. 3

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