Fuel vaporizer

heats the mix to cut emissions

By DAVID SCOTT Pop. Sci.

How do you get an auto engine to give fuel economy and low emissions without sacrificing power and driveability? One way is to make sure that the fuel is completely blended with air when the mix leaves the carburetor. Vapipe, a device designed by Shell Research in England, does just this.

The Vapipe is a hang-on with no moving parts. It uses exhaust heat to vaporize the fuel completely, so a fully homogeneous mixture is fed to the engine.

With fully vaporized fuel, you get smooth running, using a fuel mixture substantially leaner than the normal 18:1 ratio. And you get more even combustion, since there are no heavy drops of liquid gas unbalancing the charge of fuel fed to each cylinder.

A lean mixture, better combustion—these are the keys to lower fuel consumption. Shell reports that Vapipes fitted to different engines in cars and test beds have brought a fuel-economy improvement of 10 percent or greater.

The lean-burn feature also lowers emissions; so does the more complete combustion, which reduces the amount of unburned fuel in the exhaust. Shell claims a dramatic 70- to 80-percent drop in all categories of pollutants. Another benefit claimed is much faster warm-up, which cuts those troublesome emissions after cold starts.

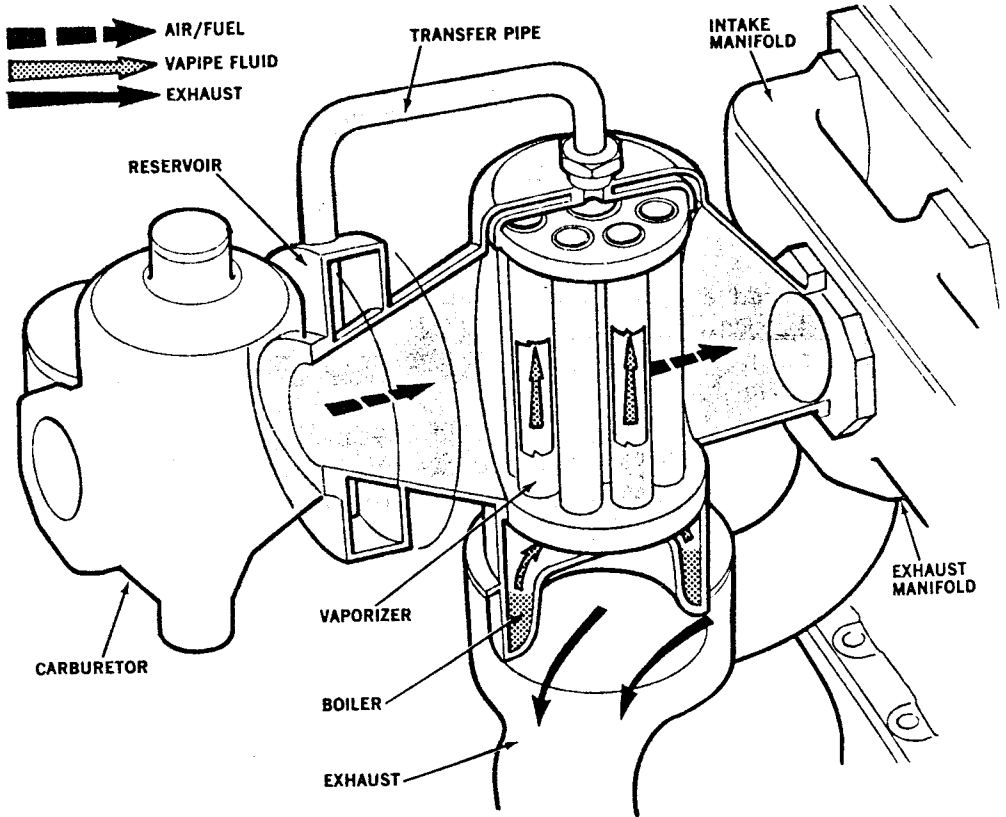
How does Vapipe deliver all these benefits? It's really just a highly refined version of the conventional hot spot at the joint between the intake and exhaust manifold. There, heat-riser valves funnel exhaust heat to the intake manifold, warming the fuel-air mix to speed start-up and to help atomize fuel droplets at idle speeds. But manifold heat controls are closed under full-power conditions, leaving the job of vaporization to be done by engine heat alone.

By contrast, the Shell device gives total vaporization over the engine's entire speed and load range, and is self-adjusting to maintain the optimum temperature for each condition.

Basically, the Vapipe has two parts—(1) a vaporizer housing small, steam-heated pipes, which extend into (2) a boiler. The whole unit fits between the carburetor and the intake manifold. Gas droplets, speeding through on their way to the manifold, bump into the matrix of hot pipes and are rapidly vaporized (see diagram).

As often happens with sound ideas, some penalties go with the gains. The heated mix expands, causing a marginal drop in the engine's volumetric efficiency, which lowers power output a bit. And you need a higher-octane gas with the Vapipe. But these drawbacks could be offset by the benefits of fuel economy and low emissions.

Will you find a Vapipe on the next car you buy? It's possible—several European and Japanese manufacturers are testing the device. PS



Sealed Vapipe system (right) automatically regulates temperatures needed to vaporize the fuel-air mix. When the engine starts, the Vapipe boiler holds a small amount of water and nitrogen gas. As the engine runs, exhaust heat causes the water to boil, and steam rises through the pipes into the vaporizer. The nitrogen, pushed ahead by the steam, is forced through the transfer pipe into the reservoir. This surrounds the inlet duct from the carburetor and is cooled by the fuel-air mix leaving the carburetor. As the fuel-air mix rushes through the vaporizer, it also cools the steam in the pipes. The condensed vapor then trickles back down to the boiler. If the boiler, as it heats up, supplies more heat than the vaporizer needs, the steam can no longer condense. Increased pressure forces the steam through the pipe to the reservoir, where it condenses. Now there is less water in the boiler, reducing its output, so there's less heat transfer from the vaporizer pipes to the fuel-air mix. The pressure between the steam in the pipes and nitrogen in the reservoir reaches a balance, stabilizing vaporizer temperature for the given engine running conditions. If engine speed is lowered, exhaust heat to the boiler decreases, so steam in the pipes condenses faster and the pressure drops. Now the nitrogen forces the water out of the reservoir and back into the boiler. Steam generation then increases despite the lower exhaust temperatures, and a new balance is reached. Whole system conserves fuel, cuts emissions.

Simple Humidity Device Saves Gas; Eases Emissions

THERE are nearly 100 million cars and trucks operating in North America, and no matter what is invented for the future, those vehicles will continue operating for several years.

This means our denizens of the highways will continue polluting and guzzling fuel at the same pace which has caused our present day fuel shortage and outrageously inflated costs.

An invention that improves fuel economy and at the same time helps curb noxious exhaust emissions is needed.

NEWSREAL reports on two such devices -- and they would work well together. One is the electronic device invented by Ben Polo on pages 23 and 24 and the other is the Power Pak, a device invented and developed by Charlie Brown and Robert Whipkey of Florida.

Brown, a retired Air Force pilot, and partner have recently completed ee years of detailed and complex research into fuel consumption and polluting emissions.

The Power Pak evolved from an earlier device called the "Ring of Power," and it is literally an air-conditioner for combustion chambers. The inexpensive, easy to install device works on any car or truck to improve performance, increase mileage and control emissions.

"Vaporizers and the like have been tried, but they don't do the job. Our equipment humidifies the air so that combustion takes place under optimum conditions," Brown explained.

"You cannot see humidity like you can vapor, and that's probably the reason it works so much better."

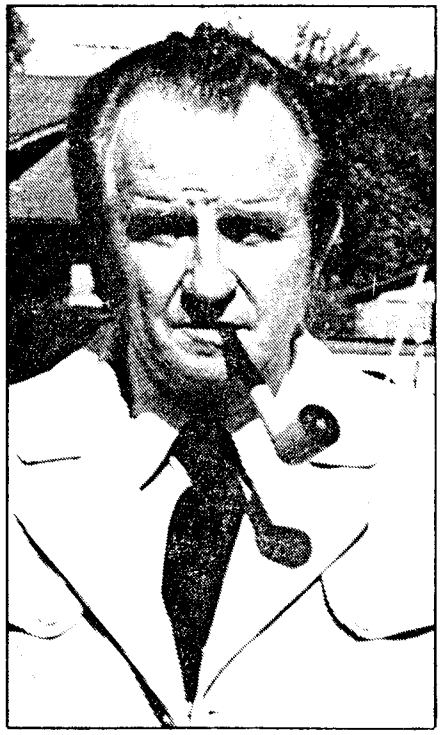
Brown heads the firm of Charlie Brown Enterprises and also a group called Mobile Energy Research Center in Miami.

Everyone knows that a car seems to run better in the rain or when the air is moist. Brown explains it this way:

"Precisely what happens within the engine with humid versus dry air has not been scientifically proven; there are two theories, but nothing positive. We do ow, however, that air between 90 and 95 per cent humidity gets the best performance.

"The fuel/air mixture is optimum, the rate of burn is slower and more effective and we see a reduction of carbon deposits in the engine, a reduction of carbon monoxide and a drastic reduction in the oxides of nitrogen (NOx) that pollutes so badly.

"Additionally, our system results in less engine vibration, longer spark plug life, longer engine life, a quieter engine and increased effective road horsepower and significantly improved gasoline mileage."



Charlie Brown
Carburetion Expert

That statement sounds like an automaker's dream commercial. Can it be true?

"We have spent thousands of hours and many thousands of dollars in very thorough and precise testing," Brown stressed.

For those with technical minds there is a sidebar to this article describing the tests made by Brown and his partner with the help of outside engineers.

"Despite the promise shown by our testing, we have been totally ignored by the various branches of our government that are supposed to be concerned about the problems of fuel economy and pollution," Brown said with smouldering frustration.

"We have offered to supply our units, at no cost whatsoever to anyone except ourselves, to more than a dozen supposedly concerned institutions," Brown added.

Letters offering the device for testing without cost have been sent to the Environmental Protection Agency and the Department of Transportation; the State of Florida; General Motors Corporation; Ford Motor Company; Chrysler Corporation; American Motors; Daimler-Benz AG; Dresser Industries; Texaco Development Corporation; Popular Science Magazine; Mechanix Illustrated Magazine; The National Enquirer; Associated Press and United Press International.

It would seem that if our pollution and fuel problems are so pressing as the powers that be claim they are, then any one or all of the above organizations would have excitedly tested a promising device.

Evidently that's not how it works in our system.

"I don't think all those bureaucrats buzzing around up in Washington have any sort of system," Brown complained. "Both the EPA and the Transportation department flatly refused to test our device or discuss our concept.

"The State of Florida advises us that they cannot test the concept on one of their vehicles because the manufacturer would void the warranty -- can you imagine that?" Brown said with a shake of his head.

"We're protected by patents so the auto manufacturers can surely look into it without threat of a nuisance suit," Brown added. "But they ignore us. It's a mystery to me."

One of the reasons the auto makers may be choosing to ignore Brown and his device -- hoping he'll go away -- is the political pork barrel foisted on the public a few seasons ago known as the "catalytic converter."

American consumers are paying the additional cost of these emissions control units that lower auto efficiency and shave time off engine life.

"If I've ever seen a boondoggle, those catalytic converters are it," Brown noted.

"The thing is expensive -- but profitable for the automakers -- it has no effect on oxides of nitrogen and I've seen tests which indicate the catalytic converters actually add another pollutant to the air -- sulpheric acid particles.

"They only reduce carbon monoxide and hydrocarbons, and then only on cars using unleaded gas. For this we have to pay a price? Beats me!" commented the exasperated pilot and engineer.

The EPA ordered the catalytic ▶

Andrew MacGuire
"narrow band A-fuel ratio control

CANADA

Canadian gadget would boost mileage, cut pollution

Southam News Service

TORONTO — A new gadget design- by a Canadian inventor to boost to gasoline mileage and cut pollu- n is to appear in auto parts stores t fall.

brainchild of Andrew MacGuire, narrow band air-fuel ratio con- has sparked the interest of a or European car maker.

that manufacturer ultimately de- s to make the control a standard will become common in mil- of cars around the world.

of that happens, most of the jobs come the invention creates will in the United States.

The reason is that Andrew MacGuire ars to be another creative Cana- who has been driven into the arms the Americans by cautious Cana- business.

British-born MacGuire, 57, has here for 30 years and has been in- ting since the end of the Second World War. He has 37 patents to his name.

● American firm to reap profits from invention

He put the first prototype of his air-fuel mixture control together in 1964.

As opposed to today's catalytic converters, which cut down pollution by treating engine exhaust, the MacGuire control is designed to deal with the problem before the fuel is burned.

It sucks up air and passes it along to the carburetor where gas and air are mixed before they are sent along to the cylinders for burning.

The control breaks the air into pulses and those pulses, in turn, break up the gas-air mixture into a fine mist.

This mist, says MacGuire, burns more thoroughly and gets more consistent performance out of each cylinder. And that, he maintains, means greater fuel efficiency, higher engine performance and less pollution.

Over the last eight years, says MacGuire, 3,000 controls have been tested under the most rigorous conditions.

In the last two years, they have been subject to computer analysis.

The information, he says, indicates the control will give a well-tuned engine 12 to 19 per cent more mileage.

On the pollution side, he says, "without any trouble at all the device can reduce hydrocarbons by more than 50 per cent and carbon monoxide by more than 75 per cent."

Most computer tests show that when the control and the catalytic converter are used together, hydrocarbon and carbon monoxide emissions are wiped out.

The plastic control, which weighs about three ounces, is expected to sell for about $30 professionally installed.

Over the past nine years Ferry Cap and Screw Set of Cleveland has invested $400,000 on the development of MacGuire's invention.

MacGuire says he went to Ferry after showing the control to two Canadian concerns.

His efforts to find Canadian support were "half hearted" because, over the years, most Canadian firms had reacted slowly and unenthusiastically to his notions.

"Canadian businessmen don't seem to have that flair for trying something out. I've been told, 'We don't have to bother. We'll get it from the United States in a year or two anyway.'

"Large Canadian companies take so long that you could just starve before they made a decision."

Ferry bought his idea, and his basic patent, in 36 hours and "have treated me very generously."

Ferry has had the control pa in most of the industrial countr the world.

The company says it hopes Ca government agencies will buy th trol for their vehicles. The big h through, however, will come European auto maker decides to it standard on cars.

So far, says MacGuire, Nort can auto makers have been coo control.

Their cars have the catalyt verter. Beyond that says Mac they are victims of the "not ins in-the-U.S. syndrome."

Carpenter wins milli

TORONTO (CP) — Jean La 35, a Winnipeg carpenter, colle $1 million prize Wednesday fro April 30 Provincial lottery draw

Al Cusino

amber contains a metal honeycomb filled with crushed pumice. Tiny turbines force the exhaust gases through the pumice, which filters out the spent fuel, scavenges the oxygen, and directs it back to the engine, along with additional outside air and a little fresh gasoline. The pumice gradually changes to obsidian as it absorbs the waste gas fumes. After 60,000 miles, the saturated filter is solid volcanic glass and must be replaced. Even though Cusino's device takes more air and fuel into the engine than it disposes of, apparently defying the laws of physics, this transformation is well within the known possibilities in the realm of alchemy and biological transmutations. The By-Pass Unit has been endorsed by nationally known Hollywood racing engineer Max Balchowsky, L.A. municipal court judge Fred Gabourie, former Monterey mayor Peter Coniglio, and American Indian Movement leader Dennis Banks, among others. Cusino hopes to make the device publicly available by this summer.

Conference, Tokyo Section Meeting, Oct. 16, 1966.

8 Meier Zu Kocker, H., and Huning, R., Brennstoff-Chemie, Vol. 48, No. 1, 1967, p. 9.

9 The ultrasonic devices that were used are described in patent Nos. 3715104, Cottell; 3749318, Cottell; and 3756575, Cottell.

10 Jarvis, T. J., Donohue, M. D., and Katz, J. L., "Bubble Nucleation Mechanisms of Liquid Droplets Superheated in Other Liquids," Journal of Colloid and Interface Science, Vol. 50, 1975, p. 359.

11 Goksoyr and Ross, K., Journal of the Institute of Fuel, Vol. 35, No. 255, 1962, p. 177.

LINDBERG INTERNATIONAL CORPORATION
1052 Dwight Way
BERKELEY, CA 94710

(415) 848-2869

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SALES PRESENTATION OF "OPERATION OF SYSTEM".
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The LINDBERG COMBUSTION CONTROL system is a closed loop fluidic control system that responds instantaneously to the engine's power requirements providing the correct amount of air, PCV products, heat, turbulance and water to the Reactor for conversion into super-heated steam, steam, or warm water droplets, depending upon the engine/car operating conditions at any given time.

This response is activated by the engine's changing needs at varying dynamic operating and power conditions, causing changes of static and dynamic water pressure at the Reservoir aft-located water outlet, increasing pressure during acceleration and decreasing pressure in deceleration as applied to the Magtrol inlet and supported by a water suction created by exhaust flow in the Reactor applied to the Magtrol outlet .

In cold soak and cold start the Magtrol body, having a greater coefficient of expansion than the 440 stainless steel ball shrinks, locking the ball, and closes off all water flow until the engine warms the Magtrol body to open the valve.

These above changes, other than under "cold-start" conditions, create the fluidic conditions within the system necessary to counter the force of the magnet, thus moving the ball away from the magnet and ball seat and allowing a specifically metered amount of water to enter the Reactor where, depending upon the engine's needs at that point in time, the water is converted into steam at low to part throttle, and warm water droplets at full throttle, by heat from the exhaust manifold and the induction of fresh air into the Reactor.

This mixture is then conveyed to a high velocity tornado-like mixing and control device called the Control which is plumbed into the PCV line very close to where it enters below the carburetor. This high velocity mixture is introduced into the carburetor under the butterfly valve and directly into the cylinder through the intake valve for firing. This is a super-volatile mixture injected in a highly agitated state at high velocity into the combustion chamber, giving better combustion and distribution, thus providing the additional power, performance, and economy for which the system is designed.

Power is further increased by the provided water droplets vaporizing and cooling the cylinder charge, allowing further charge to enter before the intake valve closes, thus increasing the charge density, a form of super-charging.

The water in the reservoir acts as a heat energy storage device which, due to its location in the V-engine, keeps the intake maifold warm for many hours after engine is off. This works in conjunction with the system operation of re-cycling waste exhaust heat to aid in providing easier starting and smoother, more economical operation during "cold-start" when the standard car is extremely inefficient.

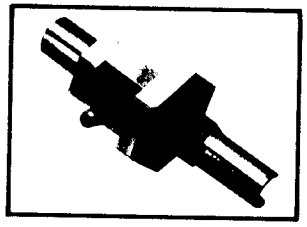
6-4-82

HOW THE SYSTEM WORKS

• The **Lindberg** uses a closed loop fluidic controller to sense and control at each point in static or dynamic operation the correct amount of turbulence, heat, exhaust gas, P.C.V. gases, air and steam to improve the distribution and combustion quality of the mixture under all operating conditions.

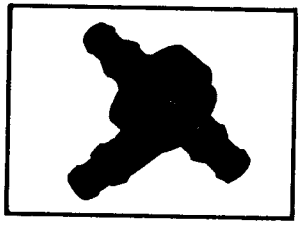
REACTOR

A device which mixes and proportions heat, water, and air into varying forms of steam or hot water droplets and transfers this mixture to the control.



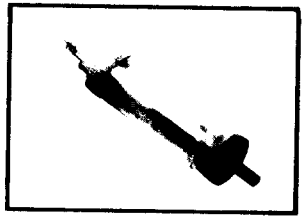
CONTROL

A turbulence inducing device which distributes a mixture of air, fuel, steam, or hot water droplets evenly and selectively to each cylinder as its intake valve opens.



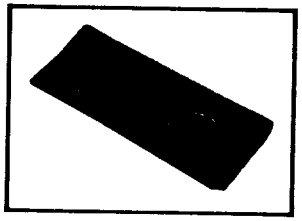
MAGTROL

A magnetic metering valve provides the engine with the precise amount of water it requires under all operating conditions.



RESERVOIR

A heat and tear resistant special plastic container designed to hold water in a purified state.



Manufactured and sold under John E. Lindberg U.S.A. Patent No's: 4,183,338; 4,270,508; 4,112,892; 4,131,134; 4,172,437 and others pending.

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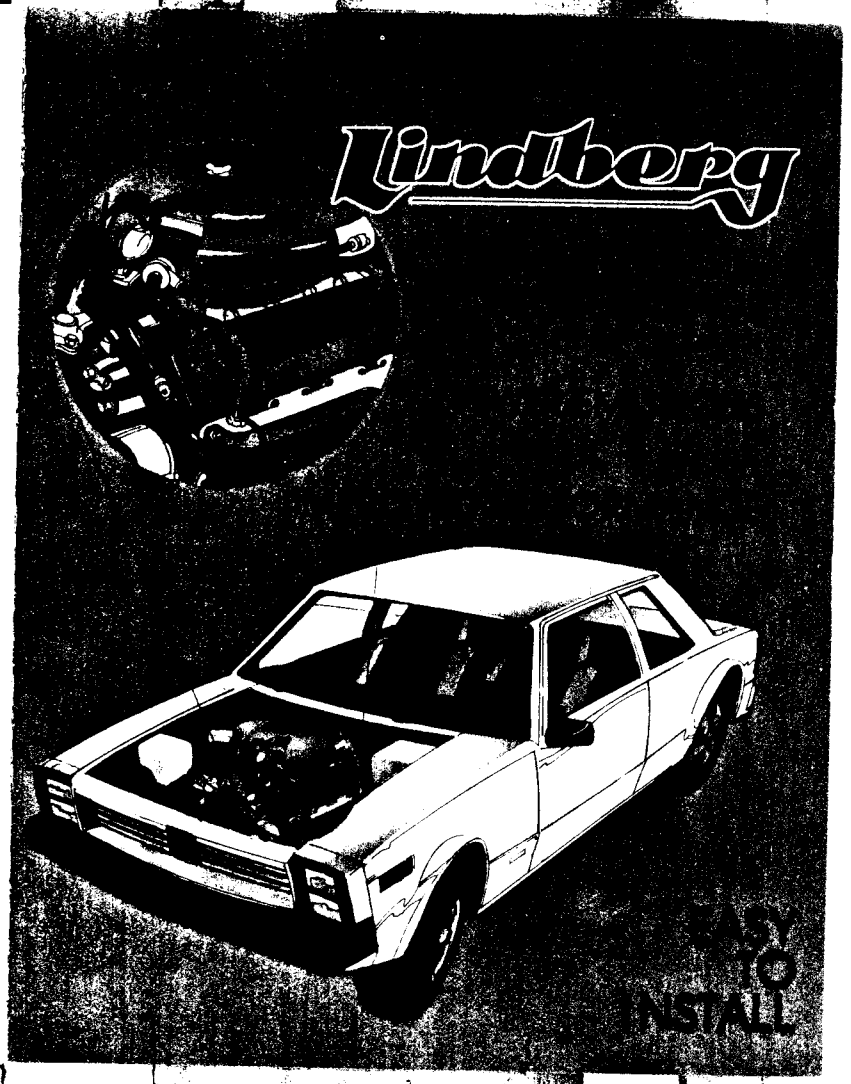
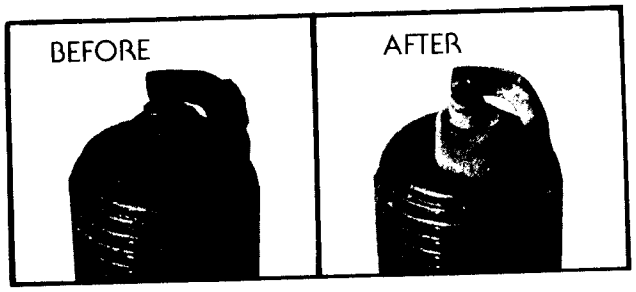


AFTER TWELVE YEARS OF RESEARCH AND DEVELOPMENT

THE Lindberg COMBUSTION CONTROL SYSTEM IS A BREAKTHROUGH IN COMBUSTION TECHNOLOGY

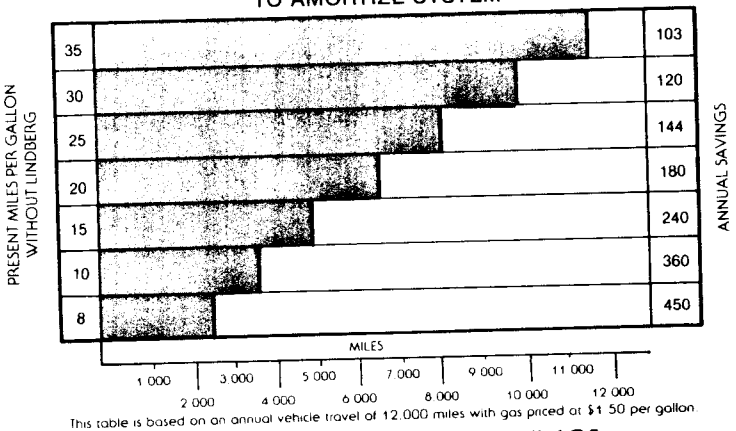
These dramatic photos show the cleaning effect of the Lindberg Combustion Control system after only 60 miles of driving.



• The Lindberg is not just another partially functional water injection system. It is truly a fully functional combustion control system engineered to give economy, performance, and complete combustion under all operating conditions.

INDEPENDENT LABORATORY TESTS SHOW 24.5% BETTER MILEAGE

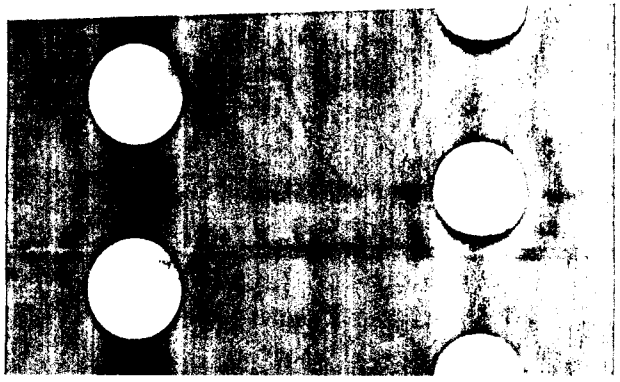
CHART SHOWING MILES REQUIRED TO AMORTIZE SYSTEM

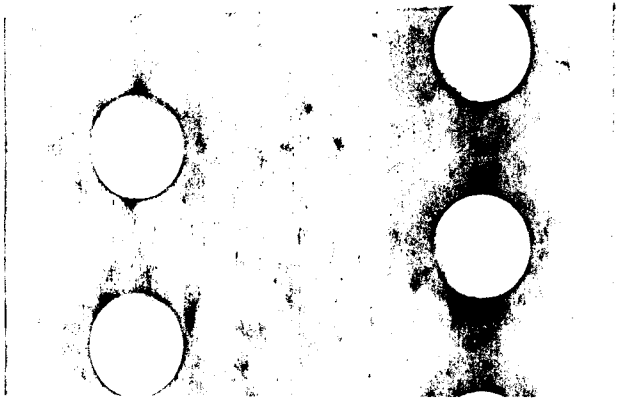


This table is based on an annual vehicle travel of 12,000 miles with gas priced at $1.50 per gallon.

PLUS 10% ADDITIONAL SAVINGS AS SYSTEM CAN USE 10 OCTANE POINTS LOWER GRADE FUEL

• The Lindberg benefits all gasoline powered vehicles through 1979.





Inventor Believes Time Ripe For Fuel Additive That Clears The Air

By JANE WEISMAN STEIN
Staff Writer, The San Diego Union

After 16 years, four fires and expenses of $1 million, John Cameron Davis believes the time is right for his invention.

Davis, 50, a former savings and loan executive, electronics company president and Los Angeles home builder, got the idea many years ago that a fuel catalyst was needed to clean up Southern California's air pollution.

He developed a product called "Clean Power" that, added to a diesel-fuel base, is designed to help oil burn more efficiently and cleaner.

"When gasoline was 28 cents a gallon, who the hell wanted to listen to me?" said Davis in a telephone interview from Honolulu where he was meeting with potential customers. "Now the whole economy has moved around."

He said that although Clean Power is available to motorists, its real benefit will be felt when California utilities burn it along with oil in their generators.

San Diego Gas & Electric Co. is testing Clean Power, but company officials would not discuss it. "We do have the product and we are evaluating it," said a SDG&E spokesman.

Davis said that domestic sales have been slow, but South Korea, Tonga, Sweden and Norway under steady supplies of Clean Power.

He said he is negotiating a $400 million contract with a major South American nation seeking to import three million gallons a year. About one cubic centimeter (cc) of Clean Power treats one gallon of gasoline. One cc costs about two cents, Davis said.

Last month researchers at Brigham Young University's Laie, Hawaii campus released a report that says under normal driving conditions, mileage for a Dodge A [illegible] with a V-8 engine increased 41 percent after adding Clean Power to the fuel. When Clean Power was added to a metered gallon of gasoline, mileage increased 41 percent.

"I was very surprised at first," said Dr. Dale Hammond, a professor of chemistry at BYU's Laie campus. "If we were talking about a 15 percent increase in mileage, I would say it would be OK. I was quite surprised at the results."

Hammond and an auto mechanic were paid as outside consultants to test Clean Power by Ortech Research & Development Co. in Northern California.

"I stand behind the data in the report," said Dr. Hammond. He said Clean Power was unofficially tested by a pilot flying a small airplane and the mileage increased 50 percent.

Davis' life as an inventor has not been easy. He said four times in the past 10 years his laboratory and manufacturing plant have been damaged by unexplained fires.

Clean Power is manufactured in [illegible]. Davis would not divulge the exact location.

Throughout the years, a variety of oil companies and investors have approached Davis, he said, with offers to buy the rights to Clean Power. "I haven't been able to find or deal with a company I can trust," he said — adding that he has not patented the product because he doesn't want to describe the manufacturing process in the patent documents.

The most beneficial effect of Clean Power, Davis said, is that it cleans engines by breaking down carbon deposits. BYU's Hammond said he has color photographs to prove that claim.

Although comprehensive emission tests have not been done, small-scale tests with mice at the University of Houston and the University of Southern California in 1977 showed that mice breathing stabilized car exhaust died within two to eight minutes. Mice breathing exhaust from cars using Clean Power exhibited [illegible] effects, tests from the two universities say.

Clean Power has, he said, been tested with good mileage results by truckers carrying Wonder Bread for ITT Corp., in Yellow Cabs, cargo ships, and by Molokai Electric Co. on that Hawaiian island.

Bruce Yamashita, manager of the company that serves 2,600 on Molokai with its 10-megawatt generating capacity, said that when he used Clean Power in small, 500-horsepower diesel generators, efficiency im-

(Continued on B-4, Co. 1)

B
THE SAN DIEGO UNION
Monday, February 18, 1980

Inventor's Dream May Clear Air

(Continued from B-3)

proved about 12 percent. More power was produced by the same amount of fuel during the tests, he said.

"But it had absolutely no effect on our 3,000-horsepower units," he said.

"We tested our large unit for a month, switching back and forth and found no measurable change at all," he said. "We aren't using it any more, but apparently it does seem to work in smaller units."

Clean Power's proponents said the product is most successful with long-term use. As the engine is cleaned, the fuel burns more efficiently and produces less pollution, Davis said.

Davis, who has no formal chemistry training, said he hopes California power companies will test and use Clean Power to reduce air pollution. "We'll never be able to make an impact by selling it off the shelf," he said.

"I have put everything I own into this. It is my life," Davis said.

NB.
TESTS ON UNTUNED PLANT — NOT VALID — SEE SWEDISH SHIPPING CO REPORT — BIG DIESELS — IN FREIGHTER GOING 8-6% AVERAGES ON ROUNDTRIP WORLD TRIP
T.S.

102

Nov. 22, 1960 C. N. BERGSTROM 2,960,975

METHOD AND APPARATUS FOR PREPARING COMBUSTIBLE FUEL MIXTURES

Filed May 6, 1957

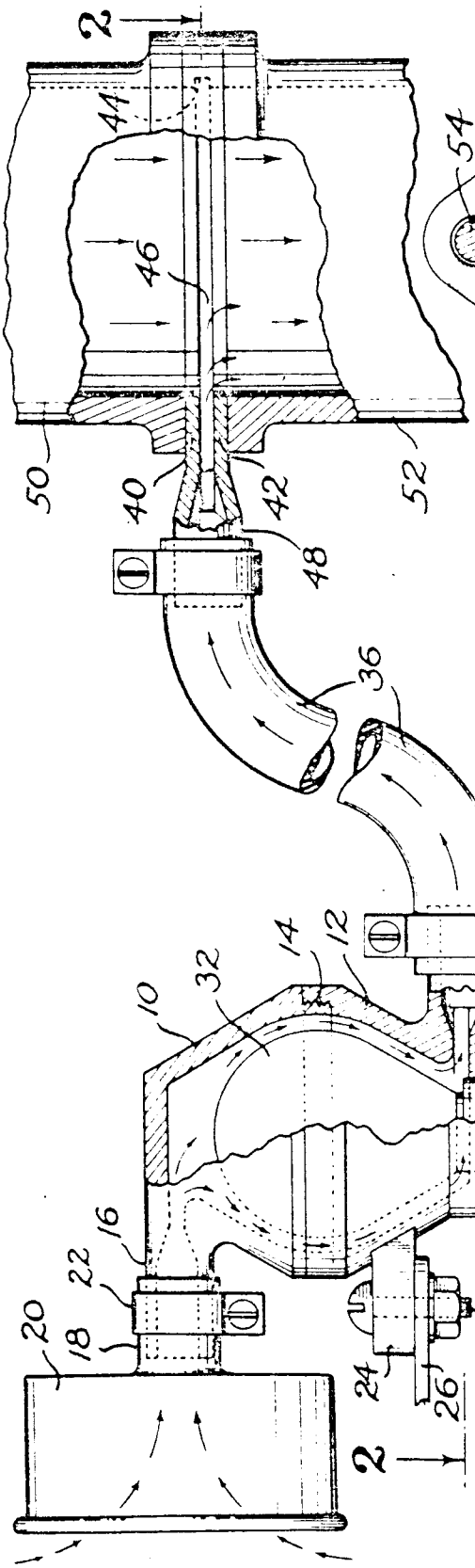


Fig. 1.

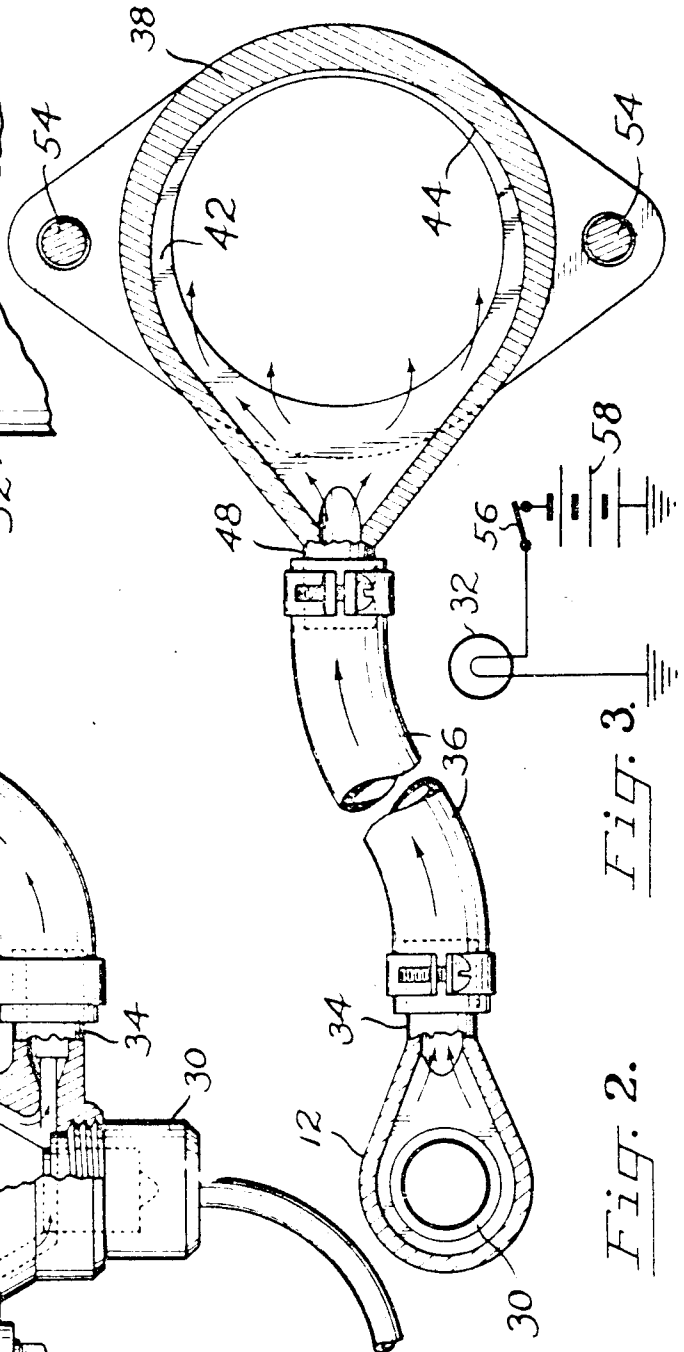


Fig. 2.

Fig. 3.

INVENTOR.
Carl N. Bergstrom
deceased
BY Bartlett F. Cole
Executor
Agent

United States Patent [19]

Persinger

[11] 4,308,844

[45] Jan. 5, 1982

[54] METHOD AND APPARATUS FOR IMPROVING EFFICIENCY IN COMBUSTION ENGINES

[76] Inventor: **James G. Persinger**, 910 S. Harrison, Hugoton, Kans. 67951

[21] Appl. No.: **46,754**

[22] Filed: **Jun. 8, 1979**

[51] **Int. Cl.**³ **F02B 51/04**

[52] **U.S. Cl.** **123/539**; 123/537

[58] **Field of Search** 123/536, 539, 537

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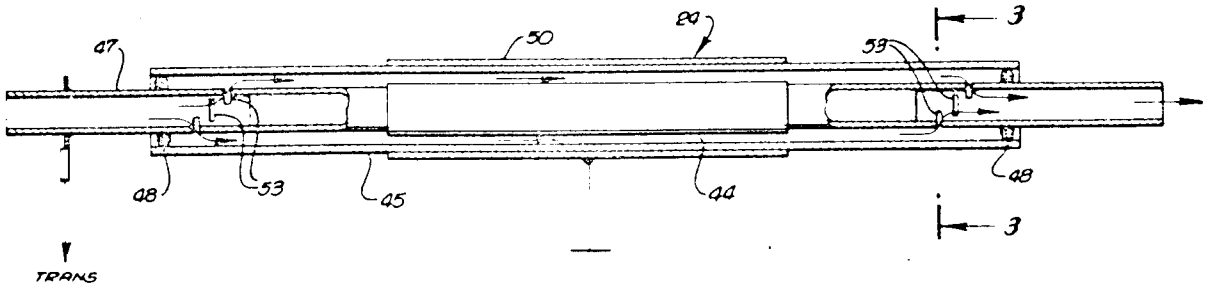
Primary Examiner—Ronald H. Lazarus

Attorney, Agent, or Firm—Frank Frisenda, Jr.

[57] **ABSTRACT**

A method and apparatus for improving the efficiency of an internal combustion engine by producing ozone gas and positively charged air particles in a supply of air to an engine. The apparatus comprises an ozone generator cell suitably positioned with respect to the engine so that an air supply to the engine passes between adjacent plates of the ozone generator. In one embodied form, the apparatus comprises a tubular ozone generator cell for charging and ionizing a relatively small volume of air to the engine. The air supply to the generator may be first treated to substantially remove ambient moisture by means of a suitable air dryer. Optionally, a plurality of generators may be connected in sequence to provide an increased source of ozone gas to the engine thereby to commensurately reduce fuel consumption and exhaust gas emissions.

8 Claims, 3 Drawing Figures



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Oct. 23, 1962 SABURO MIYATA MORIYA 3,059,910

MEANS FOR IONIZING FLOWING FLUIDS

Filed Dec. 16, 1960

MAGNETIC

Fig. 1

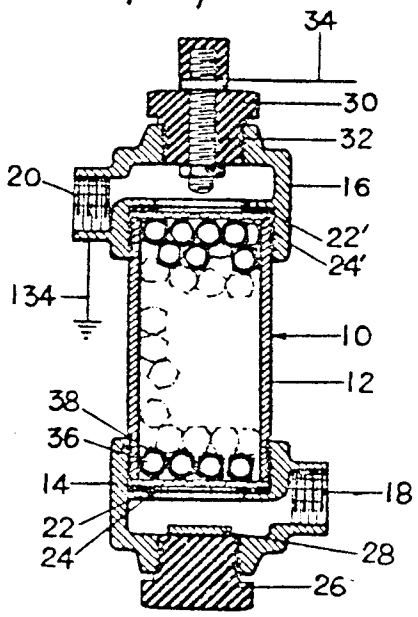


Fig. 2

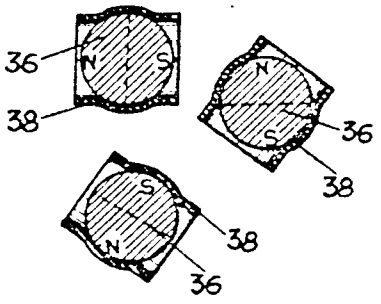


Fig. 3

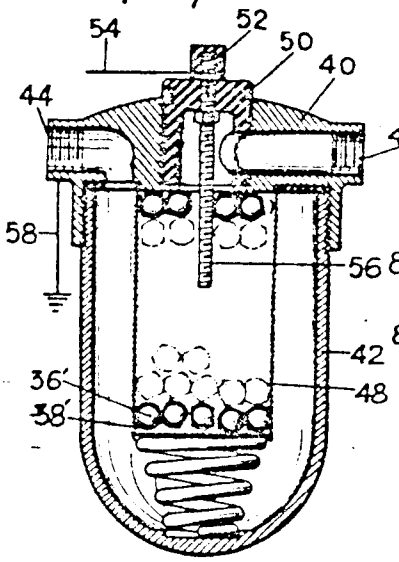
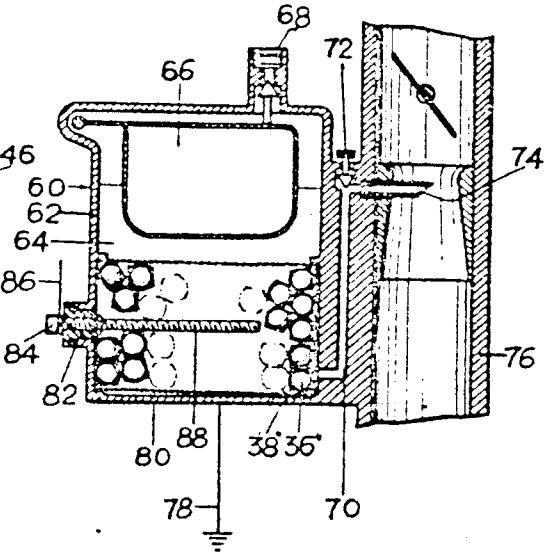


Fig. 4



heterogeneous magnets

INVENTOR.
S. Miyata Moriya.
BY C. Chandlee Pidgeon
AGENT

United States Patent [19]

Ruizzo, Jr.

[11] 4,308,847

[45] Jan. 5, 1982

48

[54] COMBUSTION DEVICE FOR IC ENGINE

[76] Inventor: Gladio Ruizzo, Jr., 200 Windmill St., Providence, R.I. 02904

[21] Appl. No.: 96,999

[22] Filed: Nov. 23, 1979

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 863,787, Dec. 23, 1977, abandoned.

[51] Int. Cl.³ F02M 25/06

[52] U.S. Cl. 123/573; 123/536

[58] Field of Search 123/572, 573, 536, 537, 123/574

[56] **References Cited**

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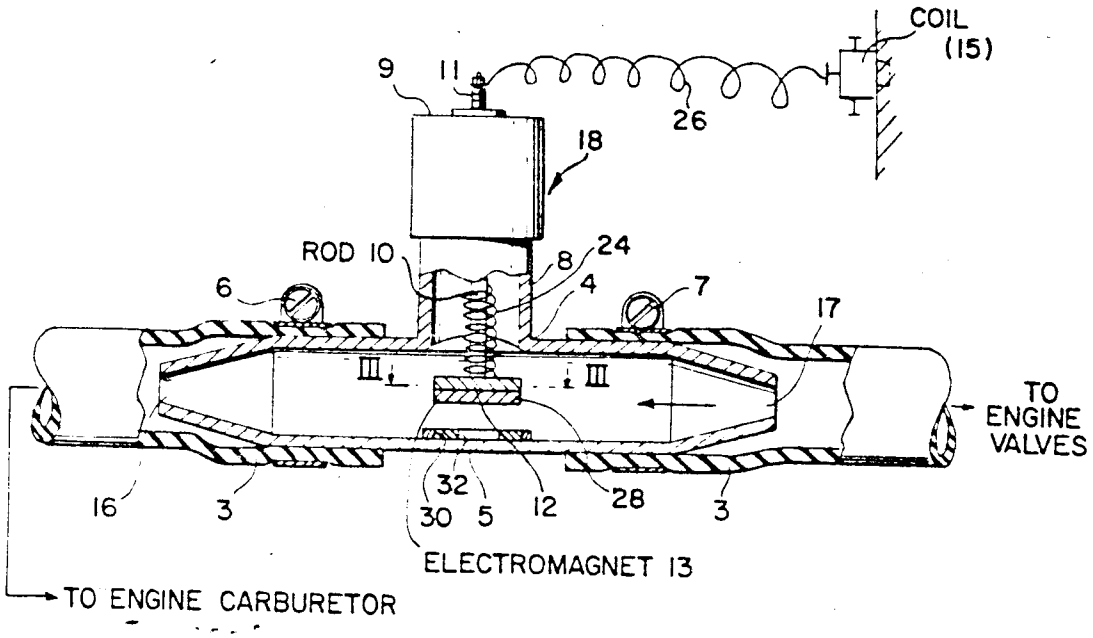
Primary Examiner—Ronald H. Lazarus

Attorney, Agent, or Firm—Robert J. Doherty

[57] **ABSTRACT**

A device for disposition in a loop for transporting gaseous material between the crankcase and the intake of the carburetor of an IC engine at a location downstream from the normal disposition of a PCV valve, i.e. on or slightly downstream from the valve cover. The device includes a generally T-shaped body adapted for coupling at opposite sides thereof to a tube in part comprising the gaseous loop. A specific constructional arrangement which applies a magnetic field to the gaseous material passing through the body of the device includes a rod, a disc-shaped electromagnet attached at one end thereof and a permanent magnet in turn affixed to the electromagnet. Spaced from the magnets is an annular metal member. The gaseous materials flowing between the magnets and the annular member are subjected to a magnetic field which enables such gases to be more completely burned in the IC engine so as to both reduce the level of CO and NO_x pollutants and to increase power output, thus increasing effective gas mileage.

6 Claims, 4 Drawing Figures



TR7K XR 3,349,354

49

au 34a

Oc. 24, 1967

SABURO MIYATA

3,349,354

MEANS FOR IMPOSING ELECTRIC AND MAGNETIC FIELDS ON FLOWING FLUIDS

Filed June 2, 1965

MAGNETIC

FIG. 1.

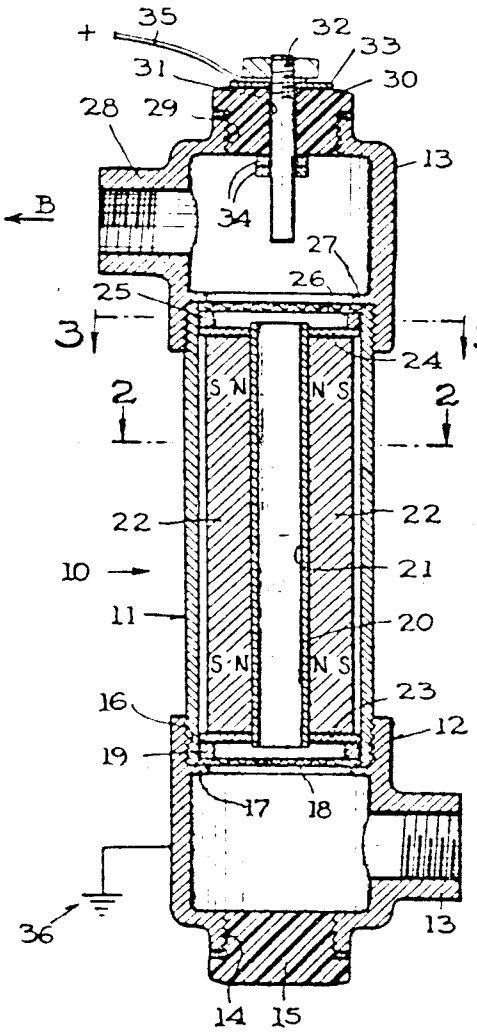


FIG. 2.

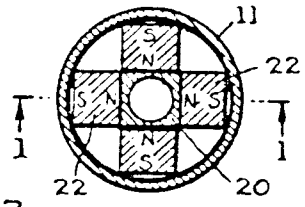


FIG. 5.

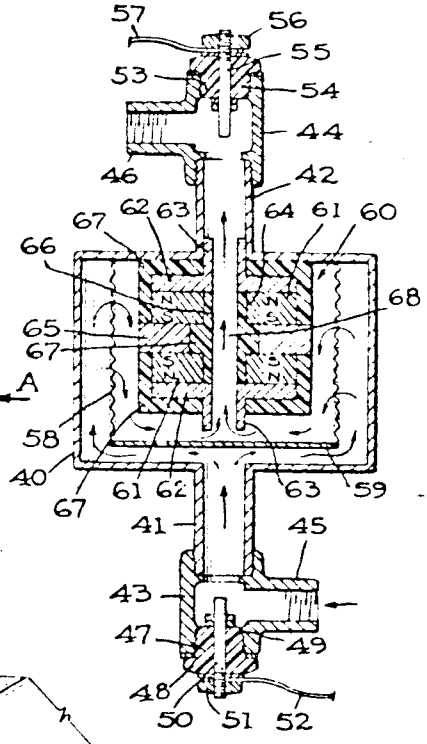


FIG. 3.

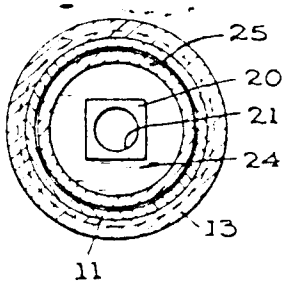
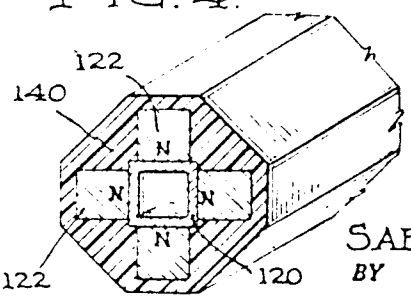


FIG. 4.



INVENTOR.
SABURO MIYATA

BY

C. Chandlee Pidgeon
AGENT

Treats fuel

50

[54] APPARATUS FOR ELECTROSTATIC FUEL MIXING

[75] Inventor: James D. Cole, Dundee, Ill.

[73] Assignee: F. D. Farnam Co., Lyons, Ill.

[21] Appl. No.: 784,550

[22] Filed: Apr. 4, 1977

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 549,947, Feb. 14, 1975, Pat. No. 4,023,544.

[51] Int. Cl.² F02M 29/00; F02C 7/22

[52] U.S. Cl. ..... 123/119 E; 123/141; 60/39.71

[58] Field of Search ..... 123/119 E, 141, 131; 60/39.71; 431/2; 261/76, DIG. 12; 48/180 R

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4,023,544	5/1977	Cole	123/119 E
4,088,104	5/1978	Ibbott	123/141

FOREIGN PATENT DOCUMENTS

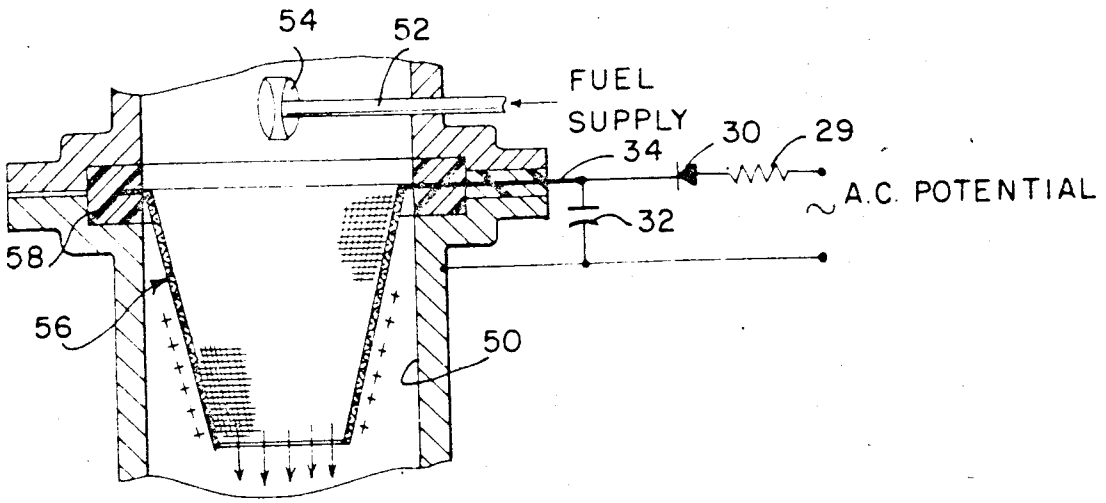
1190803	5/1970	United Kingdom	123/141

Primary Examiner—Carlton R. Croyle
Assistant Examiner—Thomas I. Ross
Attorney, Agent, or Firm—Mason, Kolehmainen, Rathburn & Wyss

[57] ABSTRACT

A method and apparatus for mixing fuel and an oxidizing agent includes an electrically charged electrode which forms an electrostatic field through which a stream of fuel is passed so that the fuel particles become electrostatically charged and subsequently repel one another to disperse into and mix with an oxidizing agent and vaporize on contact with a heat source such as the wall surface of an intake manifold of an internal combustion engine or the walls of fuel burning apparatus, or combustion chambers of jet or rocket engines and the like. Fuel particles passing through the electrostatic field are charged by induction charging and in addition may also be electrostatically charged by direct contact with the electrode, which is provided with an open outlet end to permit a relatively unobstructed flow of intermixed fuel and oxidizing agent with a minimum of flow resistance and little possibility of ice formation.

12 Claims, 7 Drawing Figures



United States Patent [19]
McMahon

[11] 4,073,273
[45] Feb. 14, 1978

[54] METHOD AND APPARATUS FOR IMPROVING ENERGY FUELS

[76] Inventor: Roy C. McMahon, 7300 Jarboe, Kansas City, Mo. 64114

[21] Appl. No.: 796,032

[22] Filed: May 11, 1977

Related U.S. Application Data

[63] Continuation of Ser. No. 536,639, Dec. 26, 1974, abandoned

[51] Int. Cl.[2] F02M 27/04
[52] U.S. Cl. ..... 123/119 E; 123/27 GE
[58] Field of Search ..... 123/27 GE, 119 E, 119 EC, 123/119 ED, 119 EE

[56] References Cited

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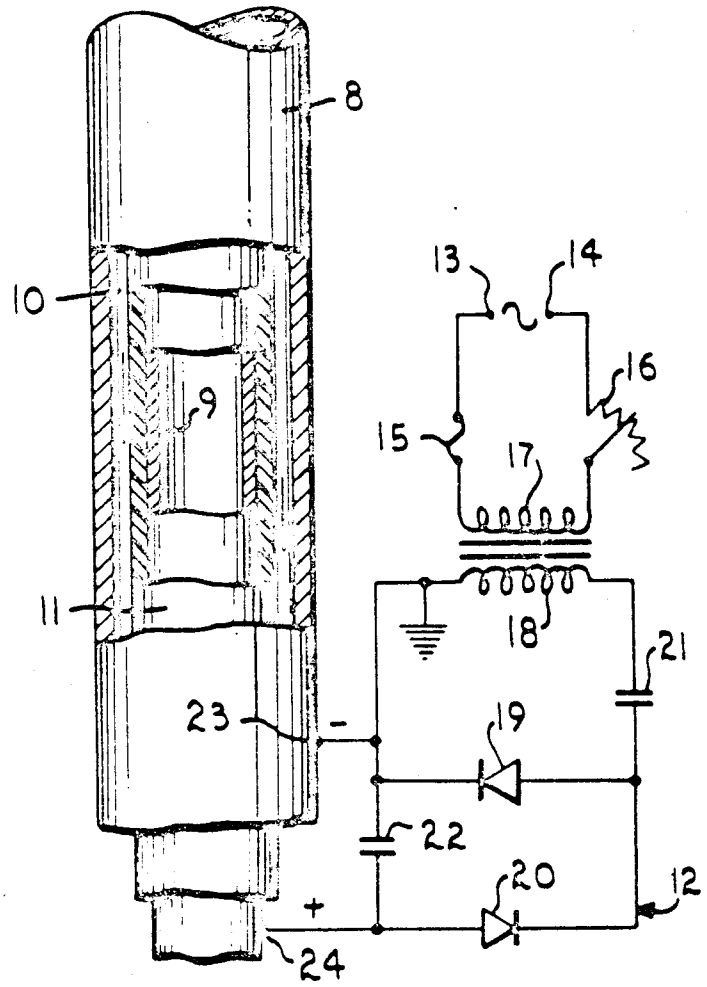
3,761,062	9/1973	King	123/119 E X
3,805,492	4/1974	King	123/119 E X
3,830,621	8/1974	Miller	123/119 E X

Primary Examiner—Charles J. Myhre
Assistant Examiner—Ira S. Lazarus
Attorney, Agent, or Firm—Fishburn, Gold & Litman

[57] ABSTRACT

The application of an electrostatic field across energy fuels subsequently burned in a reciprocating internal combustion engine improves anti-knock characteristics, thereby increasing available energy for engine operation.

1 Claim, 2 Drawing Figures



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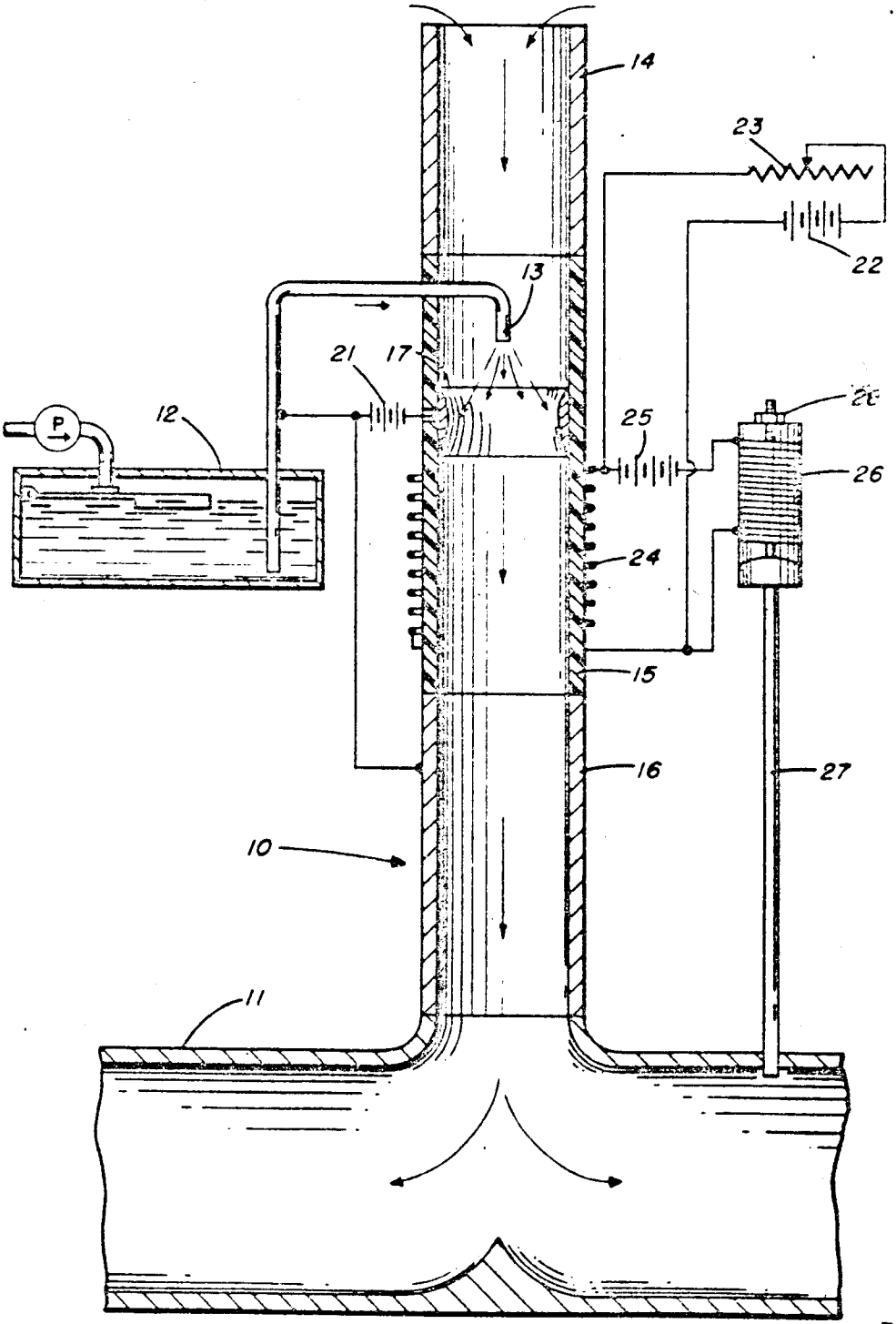
Aug. 16, 1966 M. A. KNIGHT 3,266,703

ELECTRIC CARBURETOR

Filed Dec. 30, 1964



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BY Claude Funkhouser
ATTORNEY
Richard D. Thauer
AGENT

0266 -00 04-01-80 18845

02-25-80 084633 78147.0 04195606 0770

53

ited States Patent [19]

[11] 4,195,606

[45] Apr. 1, 1980

lis, Jr. et al.

METHOD AND APPARATUS FOR TREATING AIR FOR INTERNAL COMBUSTION ENGINES

Inventors: Thomas F. Wallis, Jr., 5623 Boaz St., Apt. 91, Dallas; Asa M. Pearson, 4117 Lovers La., University Park, both of Tex. 75209; Robert C. Wallis, 1074 Hartford Turnpike, North Haven, Conn. 06473

] Appl. No.: 852,080

2] Filed: Nov. 17, 1977

1] Int. Cl.[2] F02M 7/00

2] U.S. Cl. ..... 123/119 E; 123/1 R; 60/274; 60/275

8] Field of Search ..... 123/119 E, 1; 60/274, 60/275

[56] References Cited

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4,043,308	8/1977	Cerkanowicz	123/143 R

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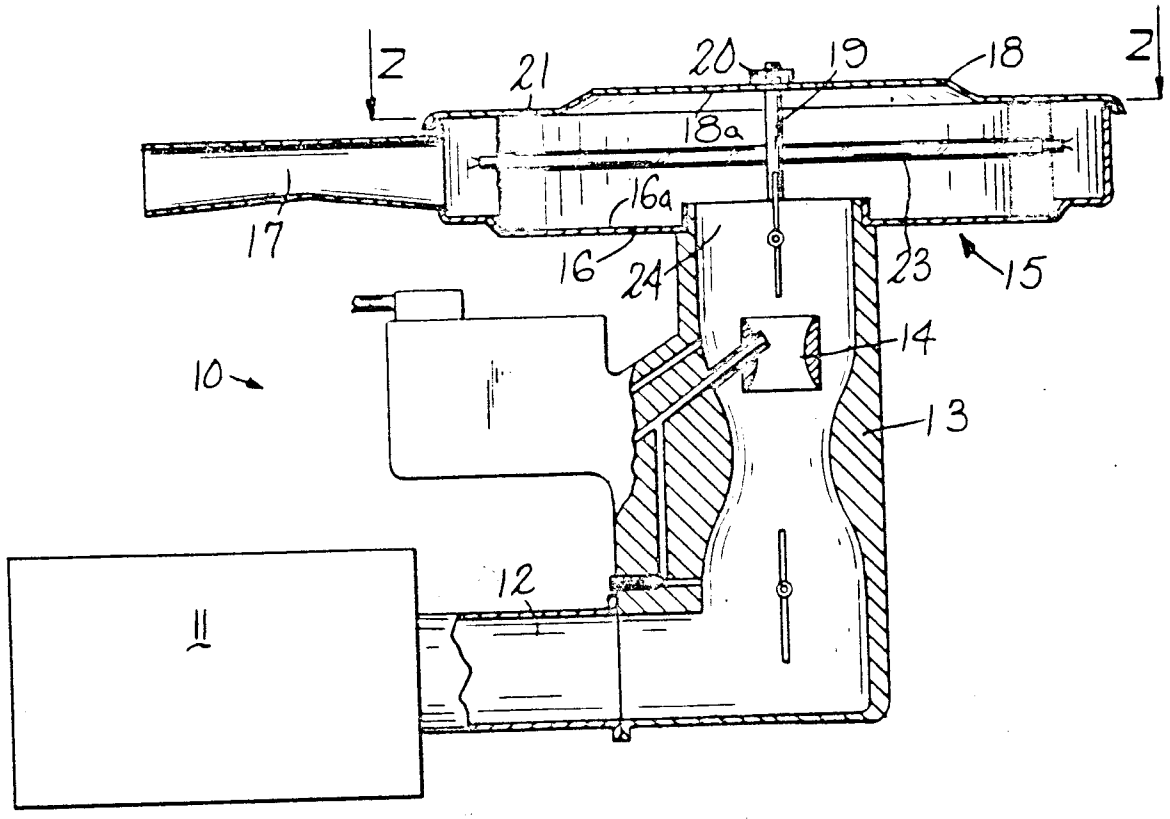
1285249	12/1968	Fed. Rep. of Germany	123/119 E
269808	4/1927	United Kingdom	123/119 E

Primary Examiner—Wendell E. Burns
Attorney, Agent, or Firm—DeLio and Montgomery

[57] ABSTRACT

Combustion air for an internal combustion engine is treated to activate the oxygen molecules prior to mixing with the fuel. The oxygen is photochemically activated by ultraviolet radiation.

9 Claims, 9 Drawing Figures



Nov. 17, 1964 G. S. MITTELSTAEDT 3,157,172

OZONIZING MEANS IN COMBUSTION ENGINES

Filed May 16, 1963 2 Sheets-Sheet 2

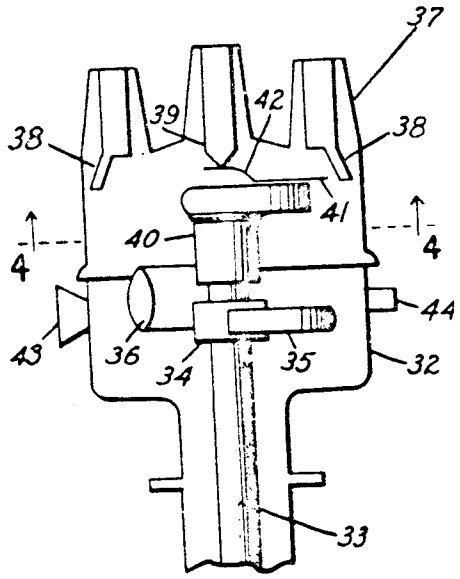


FIG. 3

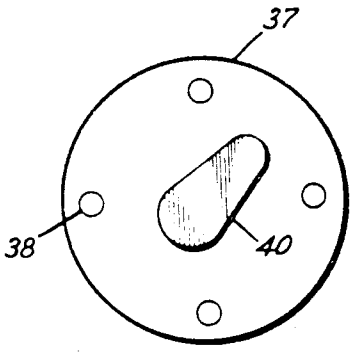


FIG. 4

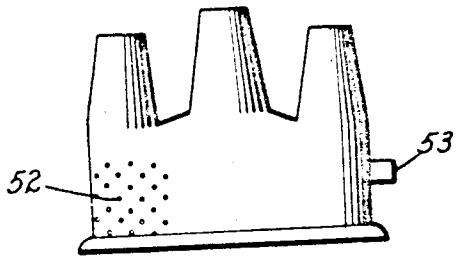
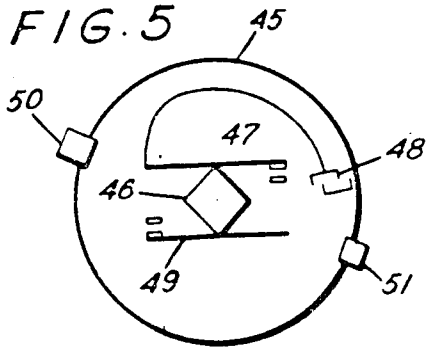


FIG. 6

FIG. 5



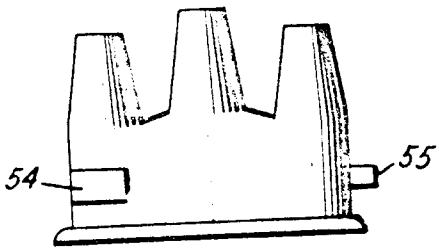


FIG. 7

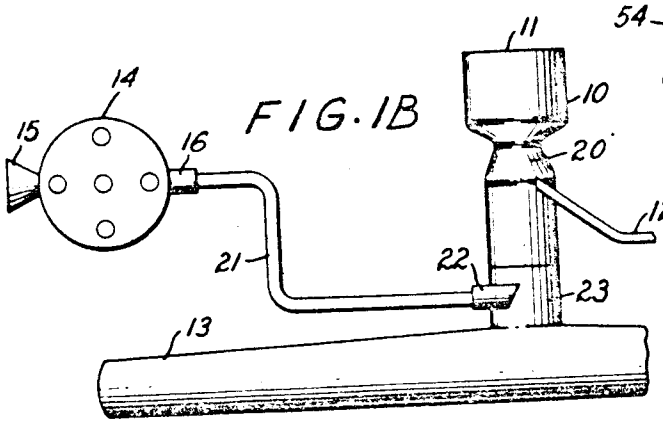


FIG. 1B

INVENTOR

George Mittelstaedt

United States Patent [19]

Trevaskis et al.

[11] **4,119,062**

[45] **Oct. 10, 1978**

[54] **AUTOMOTIVE HYDROCARBON AND WATER VAPOR INJECTOR SYSTEM AND UNIVERSAL HOSE CONNECTOR MEANS FOR SAME**

[76] Inventors: **William T. Trevaskis**, 3674 Colonial Ave., Los Angeles, Calif. 90066; **William J. Olson**, 8262 DePalma St., Downey, Calif. 90241

[21] Appl. No.: **667,503**

[22] Filed: **Mar. 17, 1976**

[51] **Int. Cl.**[2] **F02D 19/00**

[52] **U.S. Cl.** ..... **123/25 R**; 123/119 A; 261/18 A

[58] **Field of Search** ..... 123/25 R, 25 A, 25 B, 123/25 D, 25 L, 119 A; 261/18 A; 285/5, 189, 192, 197-199, 260

[56] **References Cited**

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3,856,901	12/1974	Neumann et al.	123/25 R X
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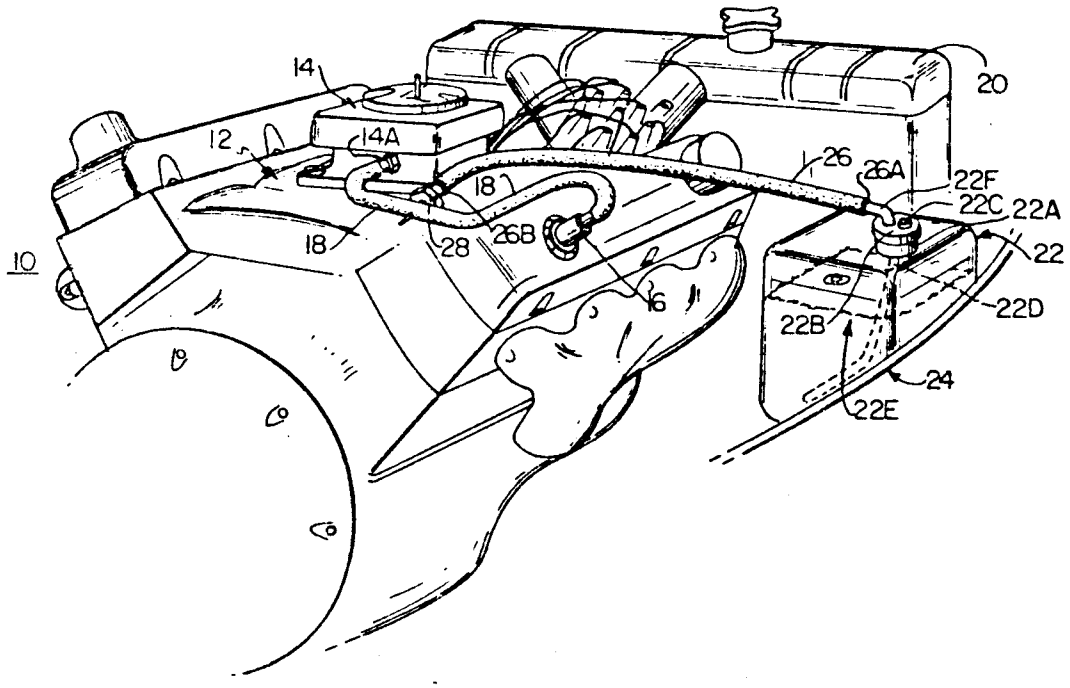
3,891,150	6/1975	Hoff et al.	285/197 X
3,933,170	1/1976	Olson, Jr.	285/197 X

Primary Examiner—Charles J. Myhre
Assistant Examiner—Ira S. Lazarus
Attorney, Agent, or Firm—Blakely, Sokoloff, Taylor & Zafman

[57] **ABSTRACT**

A simplified methanol or other hydrocarbon water-vapor injection system and kit for installing it with a minimum of part and effort are provided. A universal hose connector which precludes the necessity for cutting existing hoses on the automobile engine or any hose to which it is desired to connect another is also provided. This connector is constructed to pierce one or both walls of the hose into which connection is desired and place a metering orifice within that hose to thereby inject vapors or the like therein at predetermined rates and reduce vacuum pressure in side of the hose and reservoir of the injector system.

9 Claims, 7 Drawing Figures



United States Patent [19]

McMahon

[11] 4,373,494

[45] Feb. 15, 1983

[54] **TREATMENT OF FLUID HYDROCARBON FUELS WITH ELECTRIC FIELDS**

[75] Inventor: **Roy C. McMahon, Kansas City, Mo.**

[73] Assignee: **Electrostatic Equipment Company, Kansas City, Mo.**

[21] Appl. No.: **181,689**

[22] Filed: **Aug. 27, 1980**

[51] **Int. Cl.**[3] **F02M 27/04**

[52] **U.S. Cl.** **123/538**; 123/537

[58] **Field of Search** 123/536, 537, 538, 539; 204/86, 136, 302

[56] **References Cited**

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2921498	6/1979	Fed. Rep. of Germany	123/538

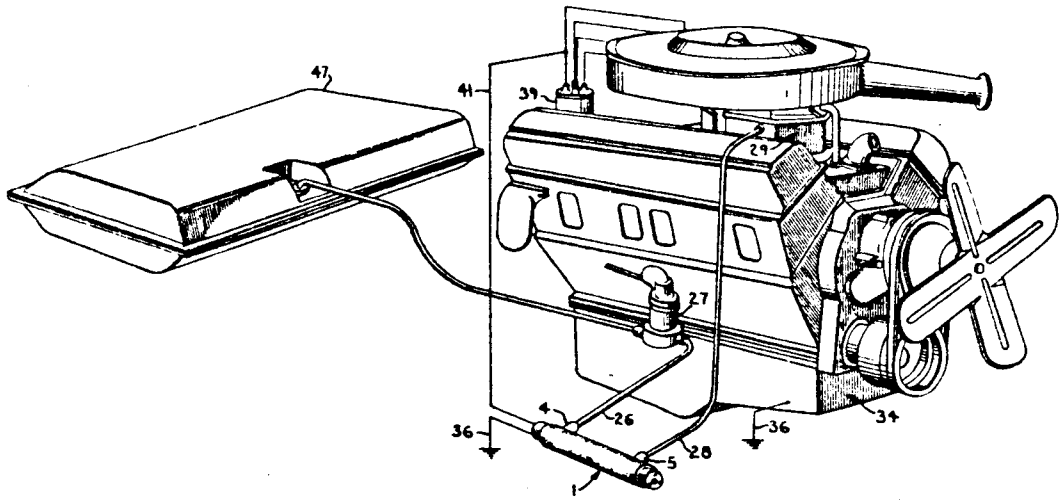
Primary Examiner—Ronald H. Lazarus

Attorney, Agent, or Firm—Litman, Day and McMahon

[57] **ABSTRACT**

A method and apparatus are provided for treating fluid hydrocarbon fuels. The method includes flowing the fuel through a treater region defined by the apparatus including a cylindrical outer electrode positioned coaxially about an insulated inner electrode. The annular treater region is preferably filled with small dielectric beads of a selected size and having spaces therebetween of a selected size. Also, in the preferred embodiment, the electrodes are connected across the high voltage ignition circuit of a motor, such a motor thereafter consuming the treated fuel, to thereby establish a high intensity electric field within the treater region.

17 Claims, 5 Drawing Figures



United States Patent [19]

Lohberg

[11] 4,119,063

[45] Oct. 10, 1978

[54] FEED SYSTEM FOR INTERNAL COMBUSTION ENGINES TO WHICH A FUEL-AIR MIXTURE AND WATER VAPOR ARE SUPPLIED

[76] Inventor: Werner Lohberg, 15, Elsener Strasse, 4790 Paderborn, Fed. Rep. of Germany

[21] Appl. No.: 764,597

[22] Filed: Feb. 1, 1977

[30] Foreign Application Priority Data

Mar. 2, 1976 [DE] Fed. Rep. of Germany 2604050

[51] Int. Cl.[2] F02D 19/00

[52] U.S. Cl. ..... 123/25 B; 123/25 L; 123/25 P

[58] Field of Search ..... 123/25 R, 25 B, 25 D, 123/25 P, 25 L

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3,996,902	12/1976	Ri et al.	123/25 L X

FOREIGN PATENT DOCUMENTS

142,977	1949	Australia	123/25 L

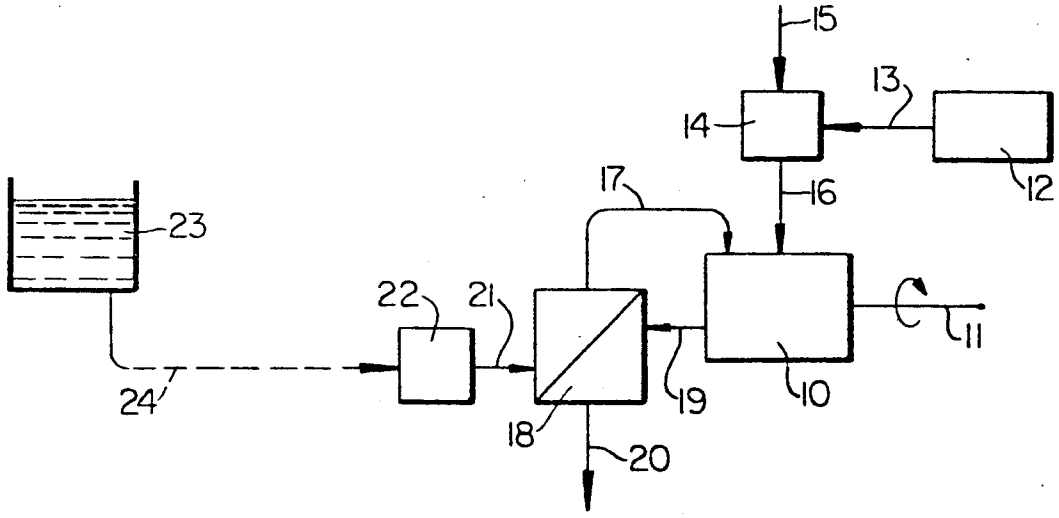
Primary Examiner—Ira S. Lazarus

Attorney, Agent, or Firm—Krass & Young

[57] ABSTRACT

Feed system for internal combustion engines to which is fed a fuel-air mixture and water vapor generated by a heat exchanger acted on by the exhaust gases, wherein there is a water chamber arranged before the heat exchanger in the water feed line, characterized in that the inlet and the outlet of the water chamber arranged directly before the heat exchanger are provided with valves which are to open automatically in an intrinsically known manner through the intake reduced pressure of the internal combustion engine and that the opening of the outlet valve is larger and/or longer in time than the opening of the inlet valve.

3 Claims, 2 Drawing Figures



123/557

United States Patent [19]

Adams

[11] 4,372,280

[45] Feb. 8, 1983

[54] FUEL VAPORIZER

[75] Inventor: Jerry W. Adams, Colony, Tex.

[73] Assignee: JEB Energy Industries, Inc., Dallas, Tex.

[21] Appl. No.: 255,267

[22] Filed: Apr. 17, 1981

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 67,879, Aug. 20, 1979, Pat. No. 4,274,383.

[51] Int. Cl.³ F02M 17/22

[52] U.S. Cl. 123/557; 123/522; 123/523; 261/DIG. 83

[58] Field of Search ..... 123/557, 522, 523; 261/144, 145, DIG. 6, 119, DIG. 50, DIG. 83

[56] References Cited

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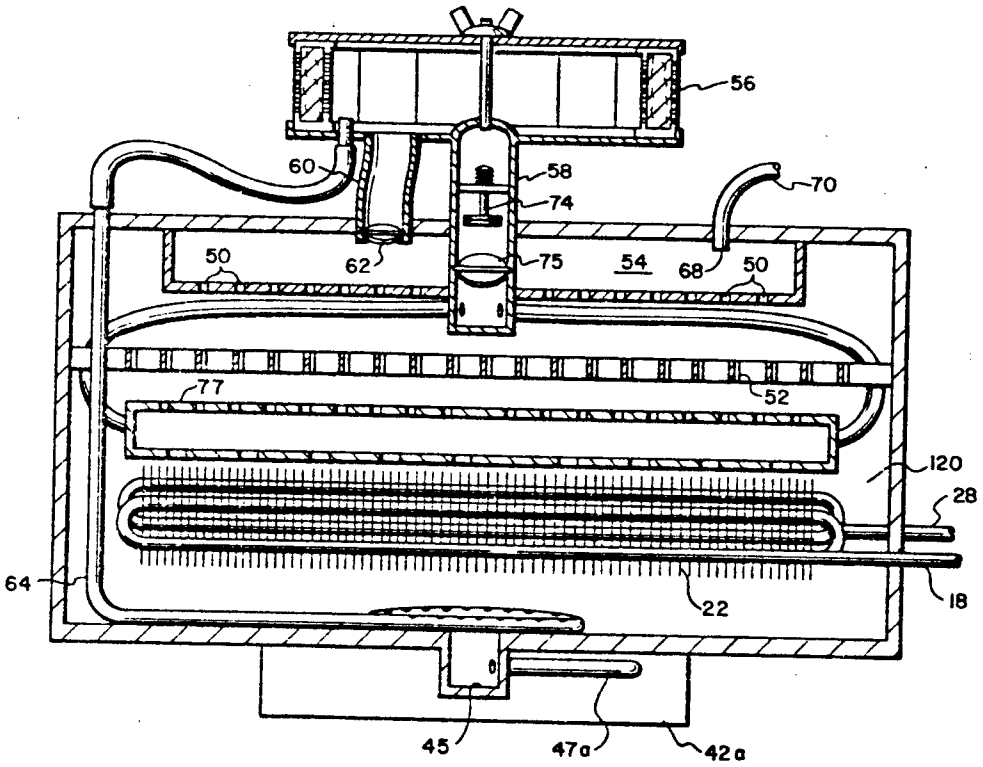
Primary Examiner—Ronald H. Lazarus

Attorney, Agent, or Firm—Hubbard, Thurman, Turner & Tucker

[57] ABSTRACT

Hot water is transmitted from an automobile's cooling system to a fuel vaporizer wherein it is utilized to heat gasoline to a vapor state. Air is drawn into the fuel vaporizer utilizing carburetor vacuum and is added to the vapor and drawn into the carburetor. Vaporized fuel and outside air are mixed in a separate dry vapor section within the vaporizer and the amount of air allowed to enter the fuel vaporizer is controlled utilizing a valve system. In this manner, the fuel-air vapor is more efficiently burned in the engine and improved gas mileage is achieved.

3 Claims, 6 Drawing Figures



United States Patent [19]

Miller

[11] 3,830,621

[45] Aug. 20, 1974

[54] PROCESS AND APPARATUS FOR EFFECTING EFFICIENT COMBUSTION

[75] Inventor: Doyle H. Miller, Corpus Christi, Tex.

[73] Assignee: Lectro-Static Magnetic Corporation, Corpus Christi, Tex.

[22] Filed: July 23, 1973

[21] Appl. No.: 381,431

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 222,095, Jan. 31, 1972, abandoned, which is a continuation-in-part of Ser. No. 13,136, Feb. 20, 1970, abandoned, which is a continuation-in-part of Ser. Nos. 758,565, Sept. 9, 1968, abandoned, and Ser. No. 731,369, May 21, 1968, abandoned.

[52] U.S. Cl. ..... 431/356, 55/3, 55/100, 110/72, 123/1, 123/32 R, 123/119 E, 204/309, 261/1, 261/74, 261/75, 335/209, 335/306, 431/253

[51] Int. Cl. ... F23d 21/00, F02b 75/10, B03c 1/14, F02b 75/12, B01f 3/20, F02m 27/04

[58] Field of Search ..... 123/119 E, 1, 32 R; 261/74, 75; 55/100, 3; 317/4; 204/309; 210/222, 223, 243; 335/209, 306; 110/72; 431/356, 253

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FOREIGN PATENTS OR APPLICATIONS

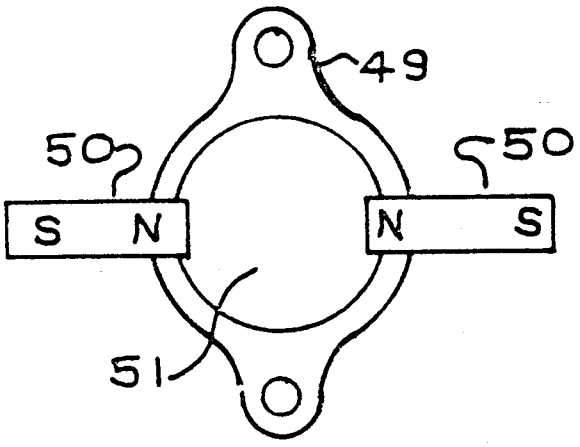
714,015	8/1954	Great Britain	123/119 E

Primary Examiner—Wendell E. Burns

[57] ABSTRACT

Means for effecting a more efficient combustion by causing the oxygen fed to the combustion zone to be in a south pole magnetic state.

16 Claims, 11 Drawing Figures



United States Patent [19]

Lancaster

[11] 4,270,601

[45] Jun. 2, 1981

[54] HEATER FOR PRE-HEATING FUEL WITH A HEATED LIQUID

[75] Inventor: Arthur Lancaster, Lafayette Hill, Pa.

[73] Assignee: The Budd Company, Troy, Mich.

[21] Appl. No.: 110,329

[22] Filed: Jan. 7, 1980

[51] Int. Cl.[3] F28D 7/10; F02M 31/00

[52] U.S. Cl. 165/154; 123/557

[58] Field of Search ..... 123/122 E, 546, 557; 165/154, 156

[56] References Cited

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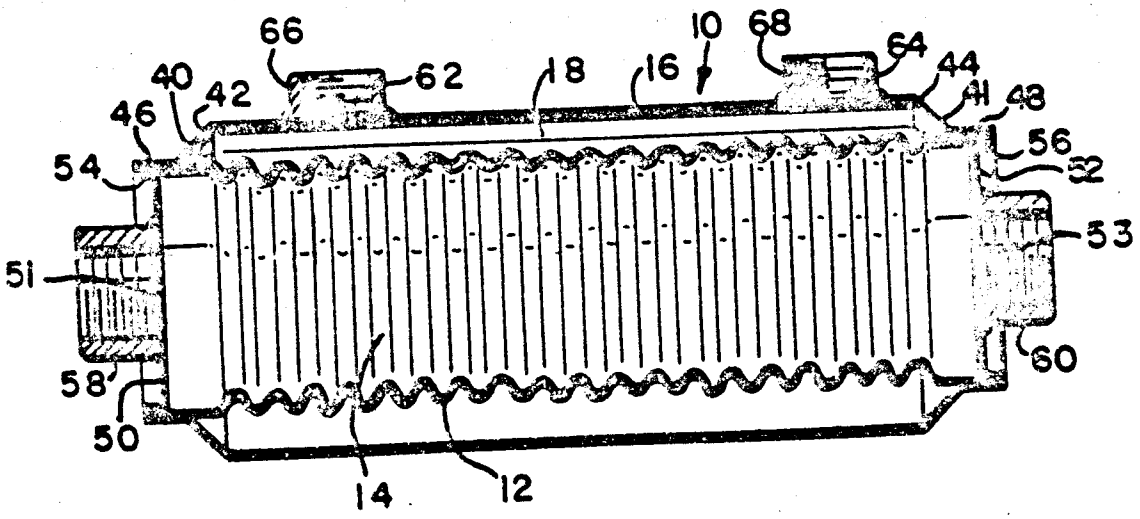
Primary Examiner—Sheldon J. Richter

Attorney, Agent, or Firm—A. L. Trueax, Jr.

[57] ABSTRACT

A pre-heater for fuel includes a corrugated tubing for passing hot water therethrough. An outer cylinder forms a jacket around said corrugated tubing to form a chamber to receive therethrough the fuel to be heated. The heat from the hot water is transmitted through the corrugated tubing to heat the fuel.

3 Claims, 3 Drawing Figures



6p

Dec. 31, 1963 G. C. BERGER 3,115,872

VAPOR GENERATING APPARATUS

Filed Sept. 26, 1962

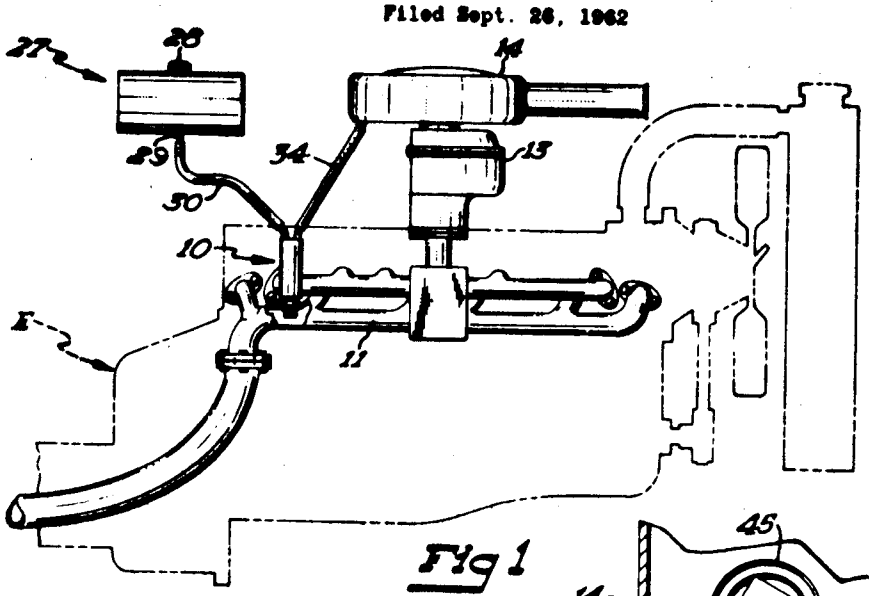


Fig 1

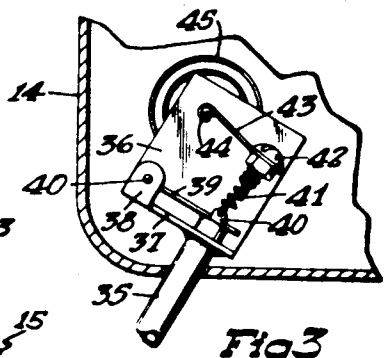


Fig 3

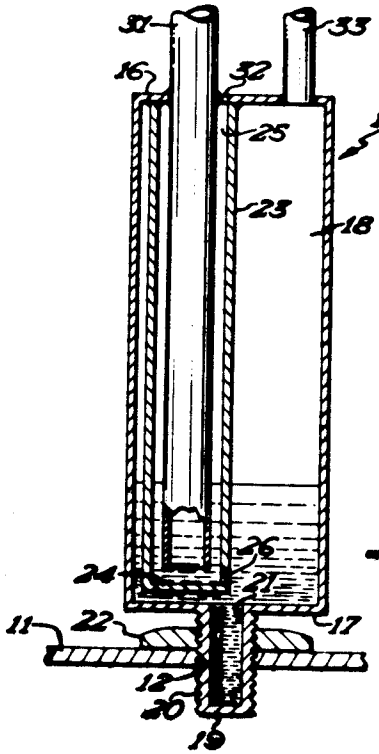


Fig 2

INVENTOR
GEORGE C. BERGER
BY
Williamson & Palmatier
ATTORNEYS

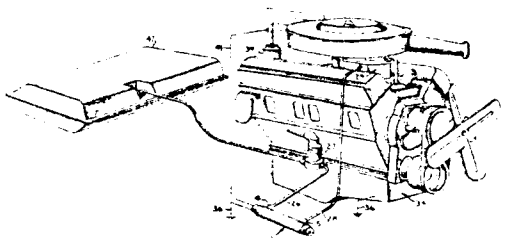
3115872

4,373,494

TREATMENT OF FLUID HYDROCARBON FUELS WITH ELECTRIC FIELDS

Roy C. McMahon, Kansas City, Mo., assignor to Electrostatic Equipment Company, Kansas City, Mo.

Filed Aug. 27, 1980, Ser. No. 181,689
Int. Cl.³ F02M 27/04
U.S. Cl. 123—538
17 Claims



1. In combination with an internal combustion engine and a fuel source, a treater for treating a liquid hydrocarbon fuel to be combusted in said engine; said treater being fuel flow positioned between said fuel source and said engine so as to improve the combustion efficiency of the fuel; said treater comprising the combination of:

(a) an elongated conductive inner electrode;

(b) an elongated conductive cylindrical outer electrode positioned substantially coaxially about said inner electrode to define an elongated annular treater region therebetween;

(c) a dielectric covering on at least one of said electrodes to insulate said one of said electrodes from said fuel during treatment;

(d) fluid connection means at opposite ends of said outer electrode and communicating with said treater region, one of said fluid connection means being for connection to said fuel source and the other of said fluid connection means for connection to said engine;

(e) a plurality of dielectric particles positioned within said treater region;

(f) means retaining said dielectric particles within said treater region;

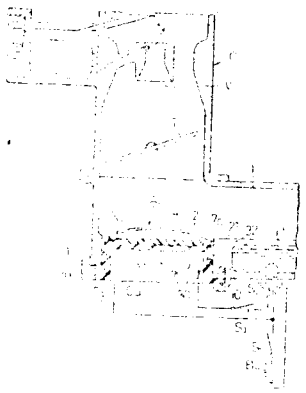
(g) high voltage supply means connected to said electrodes

4,325,344

FUEL EVAPORATOR

Toshihiko Igashira, Toyokawa; Naoki Umeda, Nagoya, and Seiko Abe, Kariya, all of Japan, assignors to Nippon Soken, Inc., Nishio, Japan

Filed May 30, 1980, Ser. No. 155,014
Claims priority, application Japan, Jun. 5, 1979, 54-70287; Jun. 8, 1979, 54-72477; Apr. 28, 1980, 55-56822
Int. Cl.³ F02M 31/00
U.S. Cl. 123—549
10 Claims



1. A fuel evaporator for use in a fuel entry system of an internal combustion engine comprising:

a heating element which is made of ceramics and has a positive temperature coefficient of resistance, the resistance of said heating element suddenly increasing at a specific temperature;

a covering plate which is made of a material having high thermal conductivity and covers said heating element to be contacted with fuel droplets falling within an intake gas supplying passage of said fuel entry system of said engine; and

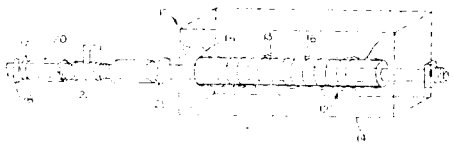
a connecting means for electrically connecting said heating

4,325,345

GASOLINE FUEL VAPORIZATION SYSTEM FOR INTERNAL COMBUSTION ENGINES

Robert S. Wilkinson, P. O. Box 61, Newfield, Me. 04095, and Alan S. Lowe, Kennebunk, Me., assignors to Robert S. Wilkinson, Newfield, Me.

Filed Sep. 4, 1979, Ser. No. 71,839
Int. Cl.³ F02M 31/00
U.S. Cl. 123—557
33 Claims



1. A new and improved gasoline fuel vaporization and delivery system for vaporization of gasoline from the fuel line of an internal combustion engine and for delivery of fuel in the vapor state to a conventional carburetor or into an airstream at the intake manifold of the internal combustion engine, said engine having an associated electrical power supply comprising:

an elongate vaporization chamber comprised of a tubular length of metal covered with a high temperature resistant, high thermal conductivity electrically insulating material, a heating coil of resistance wire wrapped in a helix around the electrically insulating material, and a coating of high temperature refractory material coated over the heating coil and chamber, said vaporization chamber formed with an inlet end for receiving liquid gasoline guel from the fuel line of the engine and an outlet end for delivering vaporized fuel,

said resistance wire heating coil comprised of a high temperature durable alloy having a resistance per unit length and overall length selected to generate heat at a temperature above the vaporization temperature of the gasoline fuel fractions or constituents but below the flash point temperature of such fuel constituents, when said coil is coupled to the electrical power supply voltage for the internal combustion engine, whereby the resistance wire heating coil at the applicaole voltage of the power supply is self limiting in temperature output attained in the vaporization chamber to a level at a safe margin below the flash point of gasoline fractions;

high temperature durable lead wires coupled to the ends of the heating coil, said high temperature lead wires having a lower electrical resistance than the heating coil resistance wire, the couplings between the ends of the heating coil and the high temperature lead wires also being of the type durable at high temperature;

a housing enclosing the vaporization chamber and also enclosing the couplings of high temperature durable lead wires to the ends of the heating coil;

the ends of the high temperature lead wires opposite the couplings located outside the vaporization chamber housing enclosure for coupling to power supply lead wire; and

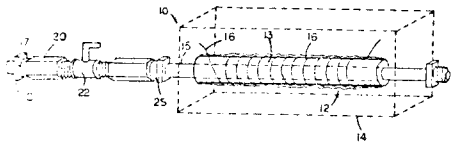
valve means to control the flow of gasoline fuel into the chamber including a restricted delivery orifice at the inlet end to fragment the liquid fuel as it enters the chamber and thereby facilitate vaporization, said restricted delivery orifice oriented to deliver fuel in a direction off axis from the elongate axis of the vaporization chamber thereby

4,325,345

GASOLINE FUEL VAPORIZATION SYSTEM FOR INTERNAL COMBUSTION ENGINES

Robert S. Wilkinson, P. O. Box 61, Newfield, Me. 04095, and Alan S. Lowe, Kennebunk, Me., assignors to Robert S. Wilkinson, Newfield, Me.

Filed Sep. 4, 1979, Ser. No. 71,839
Int. Cl.³ F02M 31/00
U.S. Cl. 123—557
33 Claims



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an elongate vaporization chamber comprised of a tubular length of metal covered with a high temperature resistant, high thermal conductivity electrically insulating material, a heating coil of resistance wire wrapped in a helix around the electrically insulating material, and a coating of high temperature refractory material coated over the heating coil and chamber, said vaporization chamber formed with an inlet end for receiving liquid gasoline guel from the fuel line of the engine and an outlet end for delivering vaporized fuel;

said resistance wire heating coil comprised of a high temperature durable alloy having a resistance per unit length and overall length selected to generate heat at a temperature above the vaporization temperature of the gasoline fuel fractions or constituents but below the flash point temperature of such fuel constituents, when said coil is coupled to the electrical power supply voltage for the internal combustion engine, whereby the resistance wire heating coil at the applicable voltage of the power supply is self limiting in temperature output attained in the vaporization chamber to a level at a safe margin below the flash point of gasoline fractions;

high temperature durable lead wires coupled to the ends of the heating coil, said high temperature lead wires having a lower electrical resistance than the heating coil resistance wire, the couplings between the ends of the heating coil and the high temperature lead wires also being of the type durable at high temperature;

a housing enclosing the vaporization chamber and also enclosing the couplings of high temperature durable lead wires to the ends of the heating coil;

the ends of the high temperature lead wires opposite the couplings located outside the vaporization chamber housing enclosure for coupling to power supply lead wire; and

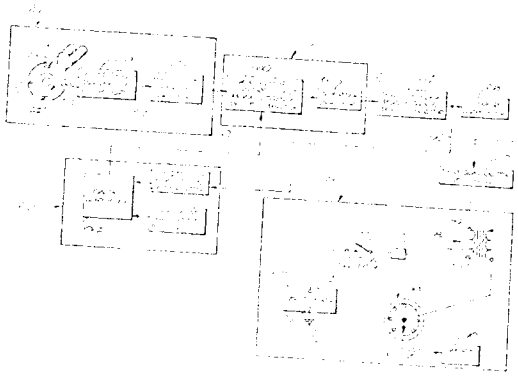
valve means to control the flow of gasoline fuel into the chamber including a restricted delivery orifice at the inlet end to fragment the liquid fuel as it enters the chamber and thereby facilitate vaporization, said restricted delivery orifice oriented to deliver fuel in a direction off axis from the elongate axis of the vaporization chamber thereby

3,923,029

ELECTRONIC IGNITION SYSTEM

Benito Polo, 9446 Borson St., Downey, Calif. 90241

Continuation-in-part of Ser. No. 361,652, May 18, 1973, which is a continuation of Ser. No. 167,900, Aug. 2, 1971. This application Apr. 17, 1974, Ser. No. 461,773
Int. Cl.² F02P 5/04
U.S. Cl. 123—148 E
8 Claims



1. An electronic ignition system for internal combustion engines comprising:

A. electromagnetic means for generating a plurality of pulses,

1. said means generating one pulse for each spark plug which will fire during each revolution of a crankshaft in said engine, and

2. the repetition rate of said pulses being directly proportional to engine speed;

B. control means having first and second input terminals and an output terminal for providing a control signal having a duration variable with engine speed thereby to advance the firing of the spark plugs in said engine, said control signal upon termination thereof initiating the firing of a spark plug;

C. an electronic function generator means for automatically generating an electronic signal of predetermined but constant wave form having a characteristic matching the desired spark advance profile of said engine, said electronic signal commencing responsive to termination of said control signal;

D. means connecting said pulses from said electromagnetic means to said first terminal of said control means, said control signal being initiated by each of said pulses;

E. capacitive feedback means connected between said output terminal and said second input terminal for terminating said control signal a predetermined fixed time after initiation thereof in the absence of an electronic signal; and

F. means connecting said electronic signal to said second terminal for automatically advancing termination of said control signal as engine speed increases.

4,325,344

FUEL EVAPORATOR

Toshihiko Igashira, Toyokawa; Naoki Umeda, Nagoya, and Seiko Abe, Kariya, all of Japan, assignors to Nippon Soken, Inc., Nishio, Japan

Filed May 30, 1980, Ser. No. 155,014
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Int. Cl.³ F02M 31/00
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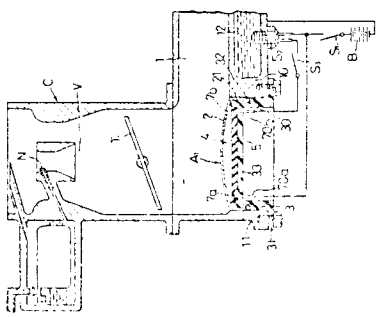
10 Claims



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a covering plate which is made of a material having high thermal conductivity and covers said heating element to be contacted with fuel droplets falling within an intake gas supplying passage of said fuel entry system of said engine; and

a connecting means for electrically connecting said heating