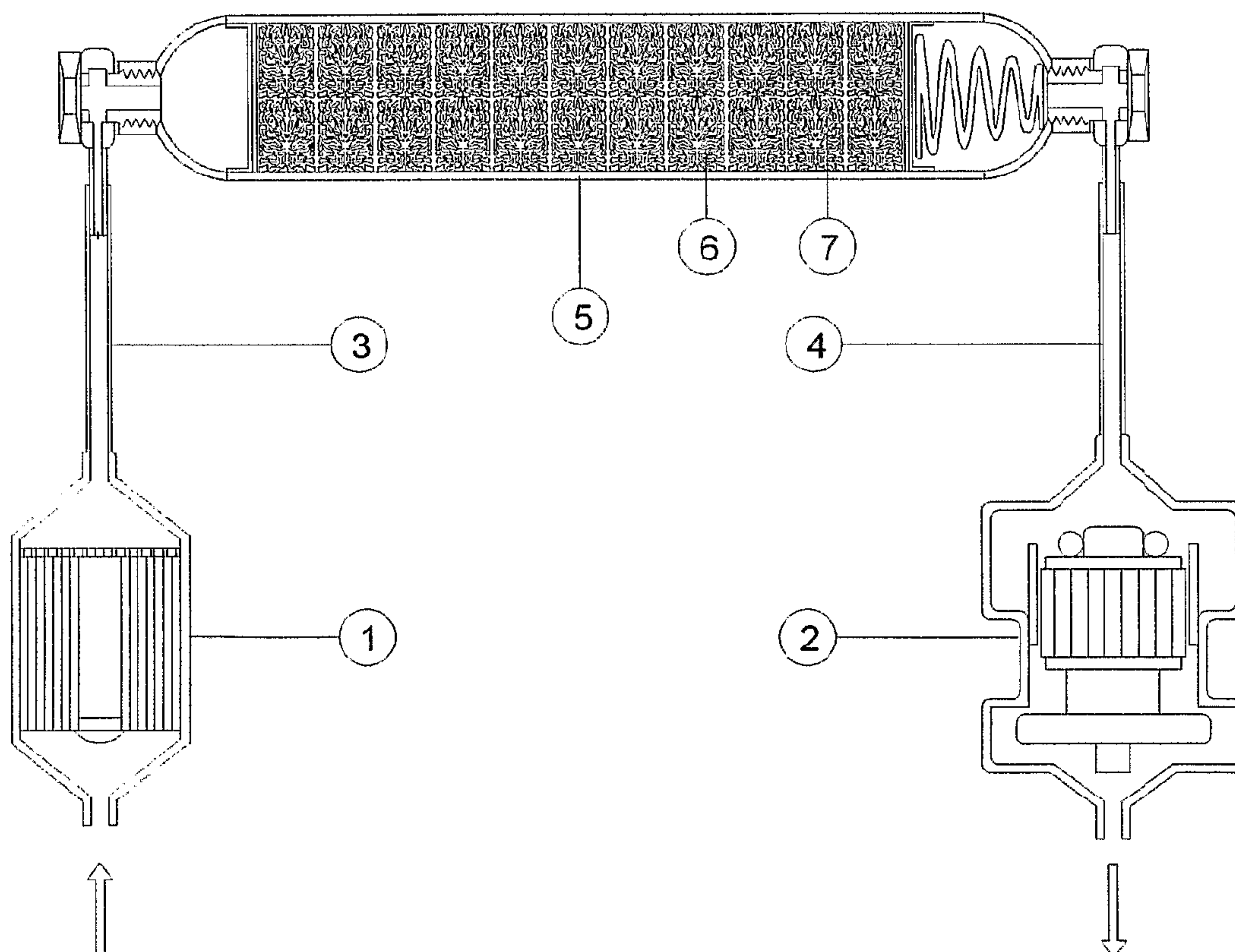




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(54) Titre : ACCELERATEURS DE COMBUSTION POUR MOTEURS ET BRULEURS
(54) Title: COMBUSTION ACCELERATOR FOR ENGINES AND BURNERS



(57) Abrégé/Abstract:

Described is an invention for the catalytic acceleration of combustion processes of fuels and heating oils, comprising dimensionally stable, tin-containing elements in a flow vessel for the production of tin organic compounds in the form of a flow vessel having an alloy structure or pads in a fuel filter container or another container, which due to the composition and ignition thereof during the appearance of light result in ignition or a flame having an extremely fast ignition distribution, therefore avoiding soot and lowering the nitrogen oxide concentrations.



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ABSTRACT

Described is an invention for the catalytic acceleration of combustion processes of fuels and heating oils, comprising dimensionally stable, tin-containing elements in a flow vessel for the production of tin organic compounds in the form of a flow vessel having an alloy structure or pads in a fuel filter container or another container, which due to the composition and ignition thereof during the appearance of light result in ignition or a flame having an extremely fast ignition distribution, therefore avoiding soot and lowering the nitrogen oxide concentrations.

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PATENT APPLICATIONCOMBUSTION ACCELERATOR FOR ENGINES AND BURNERS

The patent application describes a flow reactor for the production of combustion accelerator substances in fuels of internal combustion engines. It is described as a method and as a device.

Object of the invention is the improvement of the combustion in internal combustion engines with the goal of pollutant reduction of the exhaust gas and consumption reduction. The fundamental idea assumes here that it is possible to improve the characteristics of the engines substantially if it will be possible to let the combustion run more uniform and faster.

In the patent application PA 198 29 175.2 and in the patent application DE 199 44 227 A1, ignition core devices from the metal alloys tin, copper, and silver are described. The disadvantage of these devices is the structure and the holder of the materials which do not ensure a required long service life and efficiency. This is due to the fact that the structures do not contain solution activators, such as platinum.

Also, the possibilities of the adaptation of the reactor to the service intervals are not considered which, in addition, complicates the utilization substantially. Devices for the protection of the structure are also inadequate in the present patent applications and can not be employed that way for the technical use. In addition, no solutions are shown which allow an installation in modern, compact engines which fill out the whole engine compartment.

Surprisingly, it was found that the metal alloys must contain either platinum or the mixed crystal lanthanum-

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cerium-cobaltite, and that the metal alloy has to be placed in a dimensionally stable meshwork within a reactor body which has to be held by means of a spring-supported filter basket on the outlet side and has to be adapted by means of the installation angle to the respective performance of the unit. Only in this manner is it ensured that the effect of the apparatus is maintained over a kilometrage of approximately 500,000 km.

Furthermore, it was surprisingly found that the same effect is achieved in a system with a substantially smaller construction and adapted to the service intervals of the engines and burners if the ICR material on the outlet side of the fuel filter is integrated in the form of pads, which are structured following the example of coffee machines, as sealing rings with a structure according to the invention. Thereby, in addition, the problem is solved when there is no space available for the installation of the device within the engine compartment since the pads are an integral part of the permanently present fuel filter and do not need any additional space.

The effects of the device according to the invention cause that the combustion does not run non-uniformly faster, thereby generating combustion peaks and hence nitrogen oxides which are too high, but that the combustion within the combustion chamber is fully distributed in an extremely fast running process.

Thereby it is possible to complete the combustion faster without further increasing the combustion peaks and hence the nitrogen oxides. This results from the fact that the tin organic compounds, which are generated by addition reaction during the contact of the combustible or fuel on the alloy surface, are light sensitive. Upon occurrence of an ignition at one location, they are ignited at all locations, thereby accelerating the combustion uniformly.

The goal of the development work, which led to success by a surprising finding or invention, is the minimization of the time to the full coverage of the entire combustion mixture within the flame. This object results from the current combustion engine processes in which the flame starts at few or at one point and the spreading of the flame takes a relatively long time.

By means of this slow initiation of the combustion in current engines and the subsequent high acceleration of the combustion process, the time for the combustion of the whole mixture is extended in such length that the flame only impinges on the piston at an angular position of the crankshaft. This can be heard in case of diesel engines by the pinging since the piston is pushed against the wall at when the flame impinges onto the piston. This is not prevented by the speed-dependent pre-injection or pre-ignition

It would be much better for engines if the flame at the start would immediately cover the whole combustion chamber and then combust simultaneously. Thereby it could be avoided that the flame, during its spreading, builds up a flame front which then impinges on the piston, thereby releasing a pressure impulse which can be heard in case of a diesel engine and is referred to as knocking of the diesel engine.

Since it is not possible in an internal combustion engine to mechanically install an unlimited number of ignition points, the development concerns the installation of a quasi-unlimited number of ignition points in a chemical manner. For this purpose, chemical additives of all conceivable organic compounds were tested with respect to this characteristic.

Surprisingly, only few chemical fuel compounds were found which are indeed light sensitive in a manner that they shorten the spreading of the flame by means of a light ignition to a time which can be almost as short as desired. Thereby, the ignition delay of the diesel engines would be reduced in a manner that, for the after-burning of the coke particles being generated, more time and higher temperatures are available.

For gasoline engines, by means of these chemical fuel compounds, an over-lubrication of the mixtures during the acceleration phase could be completely eliminated since the over-lubrication has the task only to generate additional ignition cores which prevent an "acceleration gap" at high acceleration.

Furthermore, it was investigated as to what extent these substances, even after the ignition distribution, are still effective in a catalytically stabilizing, pollutant-preventing and combustion-enhancing manner with respect to fully low-pollution combustion.

Thus, only such substances were searched which are ignition-distributing by generating ignition cores and act catalytically stabilizing as well during the combustion process.

Surprisingly, light sensitive metal organic compounds were found which have all these characteristics. However, their production is expensive and would burden the combustion improvement with a high cost factor. This relates to the production of such metal organic compounds as a liquid, and the dosing of these substances to the fuels during the combustion process.

Said dosing is necessary because the metal organic compounds can not be mixed with the fuel within the tank.

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In this case, these additives are transformed into effectless compounds by means of ion exchange due to the contamination in the diesel or gasoline filter such that this approach is not successful.

Therefore, additional concentration tests were also carried out to find out in which concentration these substances develop their full effectiveness in the process, and from which concentrations on these effects are not sufficient any more. Here it was found that the effectiveness of these substances decrease only when the concentrations fall below a value of less than 10 µg/liter.

Thereby, surprisingly, the possibility arose to generate such concentrations, which are above this concentration, during the flow of the fuels through a structure made of a metal alloy.

Finally, the production cost, durability, and operational cost were investigated to show the effect in a positive ratio to the cost. In doing so, it was found that the production cost and the effectiveness of the metal organic compounds arranged directly within the feed line to the injection pump are considerably below the cost of the central production in chemical plants.

Hence, the inventive result consists in that these substances are not produced in a chemical process of a plant, but that this reactor is designed as part of the combustion engine system. This decreases the cost to a small portion of the cost which would occur by means a central production. These reactors have been developed in such a manner that they maintain their consistent effect over 600,000 km of operation of the internal combustion engines.

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The invention is called ICR to characterize the inventive content, the ignition core, thus the ignition core reactor. The inventive method is described in more detail by means of Figure 1. Between the fuel filter 1 and the injection pump 2, an ICR reactor 5 is interconnected via the lines 3 and 4. The fuel from the fuel filter 1 gets into the ICR reactor 5 via the line 3, is enriched there with metal organic compounds by means of the surface reaction with the metal alloy, and gets into the injection pump 2 via the line 4.

Within the ICR reactor 5, the metal alloy is arranged in the form of a meshwork 6. The meshwork has the same gap distance 7 between all fibers. The meshwork is constructed in a manner that the structure, even after a material removal of 80 %, does not lose its structure or collapses.

The inventive device is shown in Figure 2. The fuel filter is designated as 11. There between are the inlet line 12 of the inventive device, called ICR, the outlet line 14 to the engine of the housing of the ICR 15, and the alloy structure 16. As 17, the distance of the elements of the alloy structure to one another is designated.

The structure is dimensioned with respect to the mass in such a manner that at a flow temperature of 40 - 50 °C with a total flow volume of 100,000 liter, the structure is still maintained. At a concentration of 1 mg Sn, thus 1000 µg Sn/liter, this corresponds to a weight decrease or material consumption, respectively, of 100 g/reactor. The service life of the reactor is at 100,000 liter and a flow through the reactor of 10 l/100 km 10,000 hours. At an average speed of 60 km, this corresponds to 600,000 km.

The further inventive development relates to the achievement of such a concentration of tin organic compounds in the fuel. Pure tin balls have a surface which

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It would be much better for engines if the flame at the start would immediately cover the whole combustion chamber and then combust simultaneously. Thereby it could be avoided that the flame, during its spreading, builds up a flame front which then impinges on the piston, thereby releasing a pressure impulse which can be heard in case of a diesel engine and is referred to as knocking of the diesel engine.

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is much too small and result in a surface compaction so that the effect is much too small and gets progressively smaller. Therefore, a solution had to be found which both prevents the compaction of packed beds and increases the reactivity of the reaction partner tin.

The substances lead, cadmium, and mercury for increasing the reactivity, which are mentioned in the American patents, are not permitted according to pollutant regulation. The reaction-enhancing properties hence had to be newly developed. This was inventively achieved in that the reaction-enhancing properties of new alloy elements, which are not harmful for the environment, were found.

Thus it was found that the smallest amounts of solution activators, to which platinum, palladium and its equivalent lanthanum-cerium-cobaltite belong together with the substances copper and silver, and which bring the tin in the alloy within the meshwork up to the reaction speed, generate metal organic compounds concentrations of 1 mg/liter fuel.

This takes place without additional heating during the pure flow. For this, according to the invention, the composition ranges of the alloy are in the following ranges: tin 90 - 97 %, copper 6 - 9 %, silver 0.1 - 1 %, platinum metals such as platinum and palladium 0.001 - 0.01%, and lanthanum-cerium-cobaltite 0.01 - 2 %.

According to the invention, the meshwork structure is generated in that the alloy is integrated in the form of pads, as they are used in coffee machines, on the outlet side of the gasoline or diesel filter. According to the invention, these pads are produced in a similar manner as the coffee machine pads, but with the difference that the cover meshes do not consist of cellulose but of a tinned wire mesh or plastic mesh, and the intermediate layer does

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not consist of coffee but of alloy chips, a long thin wire wound to a formed body, or of porous carriers with metal or ceramic structures dipped into the alloy according to the invention.

These pads can be attached in the form of a sealing ring within the filter on the outlet side. Here, the possibility exists to determine the number of pads and their content in such a manner that the amount of incorporated alloys for the consumption is adapted to the filter change time. Thereby, the amount is reduced in such a manner that during a filter change period, the amount of the incorporated alloy is used up to a large extent.

Figure 3 shows this embodiment as a method. The fuel filter is designated as 21 and the internal combustion engine as 22. The pad with its netting on both sides and the intermediate alloy structures is designated as 23. Figure 4 shows the inventive device. The fuel filter is designated as 31 and the internal combustion engine as 32. 33 designates the pad body which is arranged as a sealing ring, internally and externally, and as a netting with intermediate alloy elements which are shaped in the form of a long wire, open porous alloy foam, coated structures, or structure elements such as pins or rings.

Hence, the basic principle is met that the ICR is adapted to the service interval of the engine and no special additional installations in the engine are required which are difficult due to the space conditions of individual engines and are time consuming with respect to the installation.

Surprisingly, it was now found that the full effect of the reaction between this alloy content and the fuel flowing through is enabled by a special activation and filling process of the ICR reactor. This happens in the following

steps during the fabrication of the ICR reactor. The content of the pads or chips, which is produced from the alloy tin, copper, silver, platinum metal or its substitute lanthanum-cerium-cobaltite, is flushed in concentrated sodium hydroxide, reduced and pickled.

The active alloy then gets into an alcohol bath with propanol or butanol and subsequently into a bath of gasoline or diesel. After this, the active alloy is inserted into the reactor metal housing or processed as a pad. The reactor metal housing is welded by means of a special welding method with the zone of the meshwork being cooled and then filled with a mixture of gasoline or diesel.

From the alcohol bath, the opacifiers are added which contain organically dissolved alcoholic tin. After this, the ICR is closed in an air tight manner by means of a tight screw connection including a washer. In the case of the pads, the passivation takes place differently. The pads are passivated by means of a gasoline or diesel soluble wax layer so that the inactivation is prevented until the startup. Thereby, the problem of the combustion acceleration is solved for new engines, although, not for engines which are currently in operation.

Within the engine, in particular on the exhaust valve, the latter have contaminants which are burned off by catalytic substances. However, at concentrations of 1 mg/liter, this takes a relatively long time, depending on the contamination of the engine.

Therefore it is an object of the invention to shorten this cleaning process and, in the cleaned condition, to enable the engine after the installation of the device to achieve, as fast as possible, the possible combustion acceleration and hence the combustion improvement.

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The ICR reactors filled in this manner are stored at least 2 months before delivery, wherein an initiating liquid is generated which, after installation of the ICR reactor, cleans the cylinder content intensively at the start of the engines. For this purpose, an installation instruction is attached to the ICR reactors, which specifies that first the outlet is to be connected with the injection pump via a hose line, and, not until then, the inlet is connected with the filter.

The necessity of the installation of the ICR reactor downstream of the fuel filter, or at its outlet, has the reason to prevent the reaction of the tin organic compounds with the tin deposits of the filter and to become effectless tin organic compounds. According to the invention, this is enabled by means of a special construction of the ICR reactor.

Within the reactor, downstream of the reaction netting in flow direction, a filter basket is located which, for the impacts within the vehicle, is designed with a spring which is specifically calculated for impact and which is arranged in flow direction.

In the case of the design as a pad, the latter is designed in such a manner that the vehicle impacts are absorbed inside the pad within its area and by the stability of the cover layers without a destruction taking place.

Surprisingly, it was now found that the installation position of the ICR reactor tube changes the concentration of the ignition cores and hence the doping concentration of the fuel. The steeper the installation position is, the higher is the concentration and hence the effectiveness. Thus, the same ICR reactor can be used for different engine sizes.

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The higher the engine power, the higher is the chosen inclination of the installation position. In doing so, the service life of the contained metal netting decreases accordingly, i.e., the ICR reactor has then to be replaced earlier. A strict perpendicular installation position has to be avoided here so that the impacts do not act too heavy on the metal netting.

The invention is explained in more detail by means of a specific exemplary embodiment.

A round metal block, consisting of 95 % tin, 4.5 % copper, 0.49 % silver and 0.01 % lanthanum-cerium-cobaltite, is formed in a special turning lathe into pyramid-shaped chips. For this, 10 pyramids with a diameter of 58 mm and a chip thickness of 10 mm, one pyramid with 38 mm and one with 18 mm inside, and rings with 58 mm and different inner diameters for the outer side were made.

The turning chip pyramids are placed for 10 minutes into a barrel with 5 % sodium hydroxide, wherein the lye is kept in motion by means of a stirring device. Subsequently, the chip pyramids are placed for an hour into a barrel with propanol. From this barrel, the respective formed parts in the form of the pyramids and rings are inserted into a tube with a 60 mm diameter.

The one end of the tube is welded and has a screen basket holder with a diameter of 59 mm and with an inspected metal spring with a diameter of 55 mm.

After insertion of the formed parts, the tube is welded while being cooled. The tube end with the spring is the outlet, the other end is the inlet. Both ends are provided with fuel screw connections. After completion of these process steps, the tube is closed on the inlet side with a tightly locking screw with washer, filled with a mixture of

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fuel and processed tin-containing butanol to 95 % of the content, and closed with a tightly locking screw with washer.

The product prepared in this manner is provided with adhesive labels which characterize the product, the installation, and the function, and is packed in a package including instructions, hoses, screw connections and holder.

A further exemplary embodiment describes the construction and the use of the ICR system in the form of pads. A fuel filter with the supply of the fuel through the cover in a tube to the bottom of the filter has a filter layer thereabove.

At the upper end of the fuel filter, the ICR insert in the form of a pad is clamped between the filter head with external thread and the filter body with internal thread. Here, the pad has an inner bore hole for the supply tube of the fuel filter.

In this manner, a plurality of pads can be clamped in the filter, wherein the filling here once projects upwards and once projects downwards, and the thicker layer of the pad is balanced out in the middle on the outside with respect to the filter ring. The size of the flow area of the pad provides that the pressure loss of the pad does not significantly obstruct the fuel flow. With the use of more than 2 pads, the sealing ring must be provided with the thickness of the pad, which requires an elongated thread of the filter head of the fuel filter.

In a specific exemplary embodiment, the construction as a pad is described. In a Golf Diesel with a diesel filter according to Figure 3, 2 pads with a plastic netting are inserted. The pads have a diameter of 100 mm and an inner diameter of 14 mm which is slipped over the supply tube

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with a diameter of 14 mm. The outer face is welded to a seal with a thickness of 5 mm and is covered with sealing compound. The alloy insert between the plastic nettings consists of a wire with a thickness of 0.1 mm and a length which results in a total mass of 10 g. This corresponds to approximately 20 m.

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Descriptions to Figure 1

1. Fuel filter
 2. Injection pump
 3. Line to the ICR from the fuel filter
 4. Line from the ICR to the injection pump
 5. ICR reactor
 6. Meshwork made of metal alloy
- Gap distance between the structure of the metal alloy

Descriptions to Figure 2

11. Fuel filter body
 12. Injection pump of the internal combustion engine or burner
 13. Line from the filter to the ICR reactor body
 14. Line from the ICR reactor body to the injection pump of the engine or burner
 15. Reactor body with internal metal alloy netting
 16. Metal alloy netting
- Gap distance between the metal alloy netting

Descriptions to Figure 3

21. Filter for receiving the pad
22. Engine or burner
23. Pad on top of the filter body or a different housing, single-layered or multi-layered, for replacing at service (30,000 to 50,000 km)

Descriptions to Figure 4

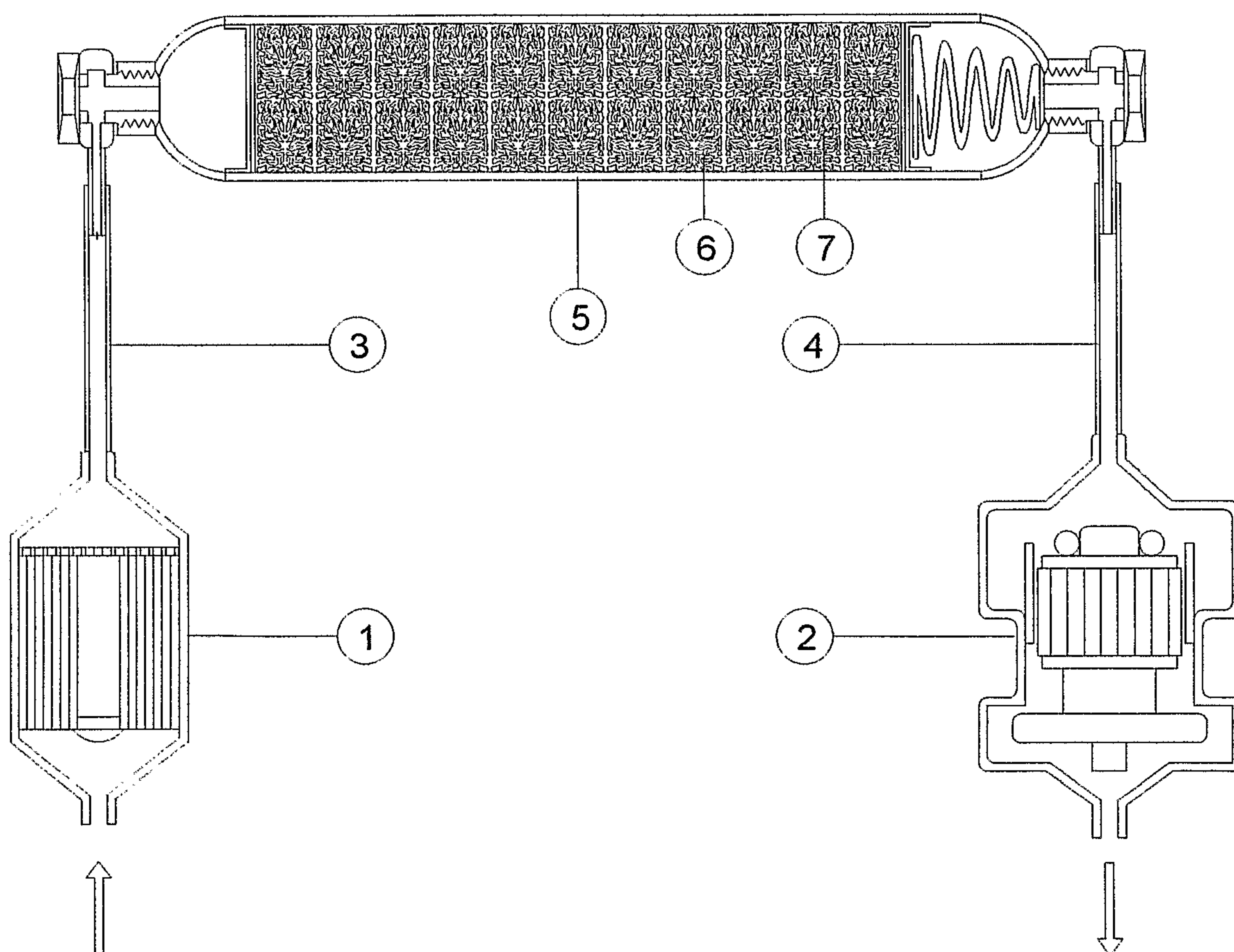
31. Filter body with screw thread for receiving the pad between the filter body and the head as a seal
32. Engine or burner
33. Pad body with intermediate ICR substance made of the inventive alloy

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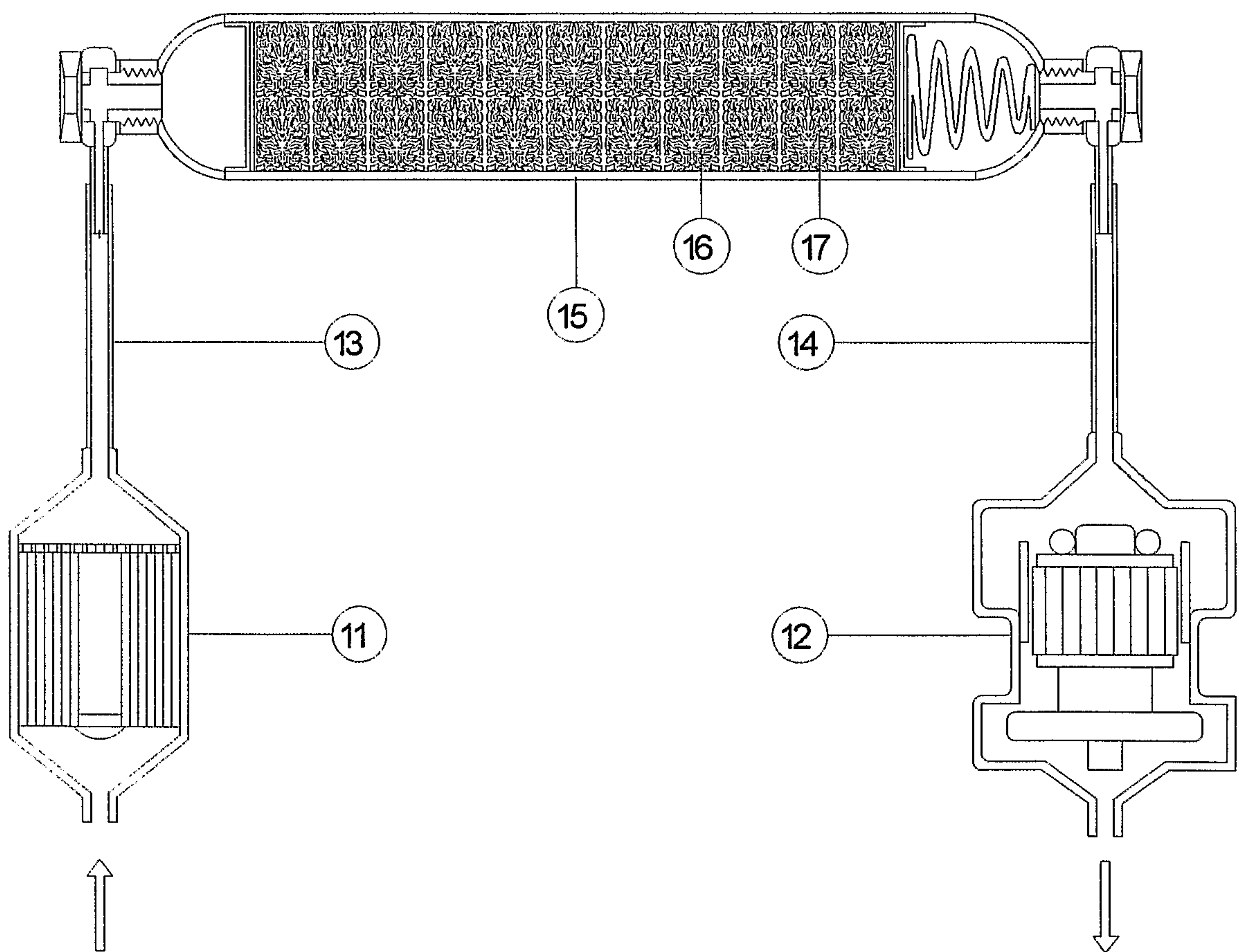
PATENT CLAIMS

1. A method for combustion acceleration in internal combustion engines, turbines, and burners by means of a chemical reaction with a fuel or combustible in a structure comprising a tin-containing alloy, the method comprising:
 - transforming the tin-containing alloy into dimensionally stable structures;
 - activating the tin-containing alloy in the dimensionally stable structures in one or more reduced solutions; and
 - filling a flow vessel containing the dimensionally stable structures with the fuel or fuel oil.
2. The method according to claim 1, wherein the tin-containing alloy contains the metals tin, copper, silver, and the activators platinum metals or lanthanum-cerium-cobaltite.
3. The method according to claim 1, further comprising:
 - forming one or more of the dimensionally stable structures into one or more of a pad and a sealing ring;
 - inserting one or more of the pad and the sealing ring in one or more layers of the flow vessel, the flow vessel comprising a fuel filter head; and
 - periodically replacing one or more of the pad and the sealing ring.
4. A device for carrying out the method of any of claims 1 to 3, wherein a receiving container for the dimensionally stable structure comprises a filter basket with a shock absorber spring arranged behind it.

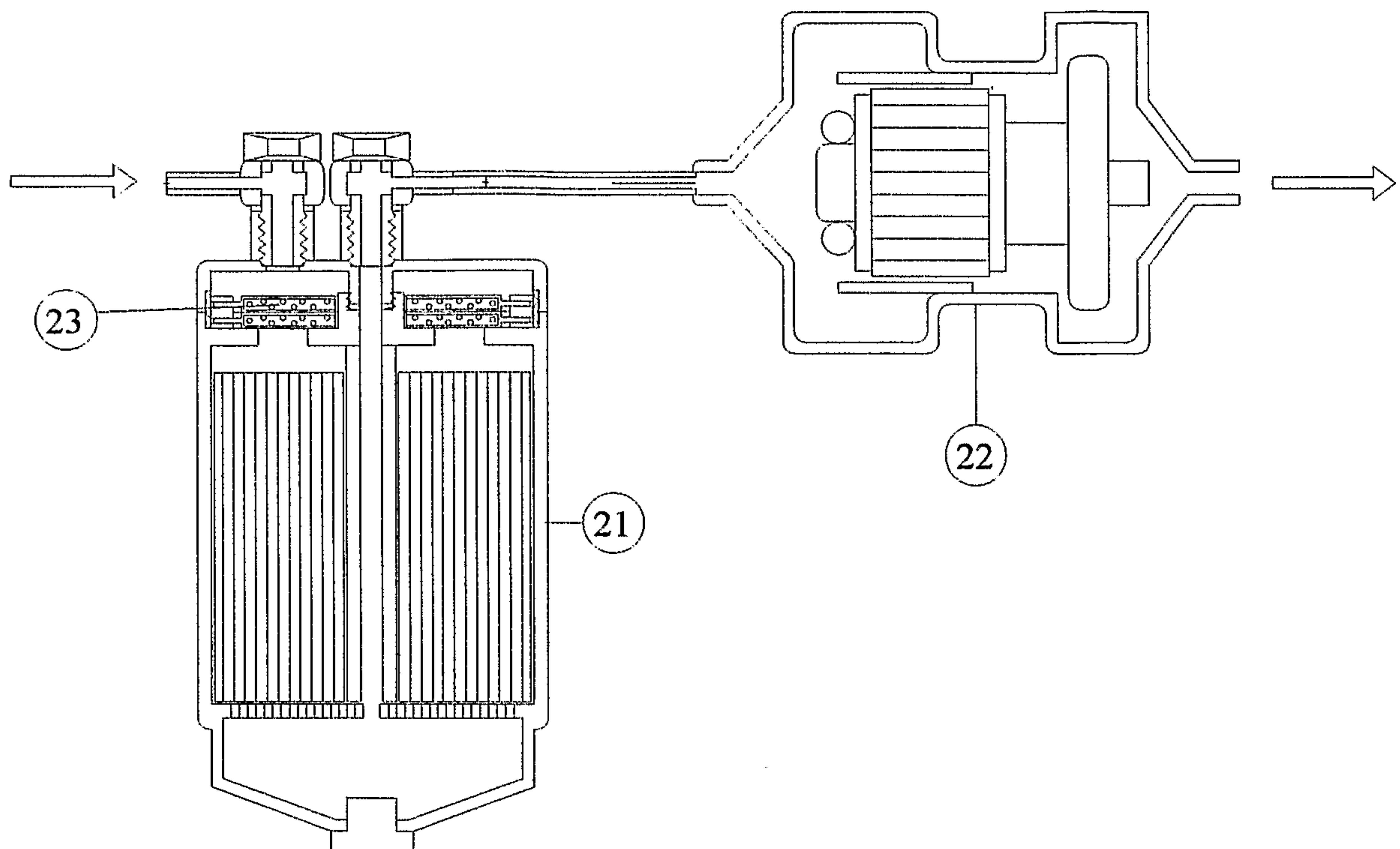
Figur 1



Figur 2



Figur 3



Figur 4

