Aug. 26, 1958 J. P. RUTH 2,849,295

EXHAUST GAS CONDITIONER

Filed Aug. 6, 1956

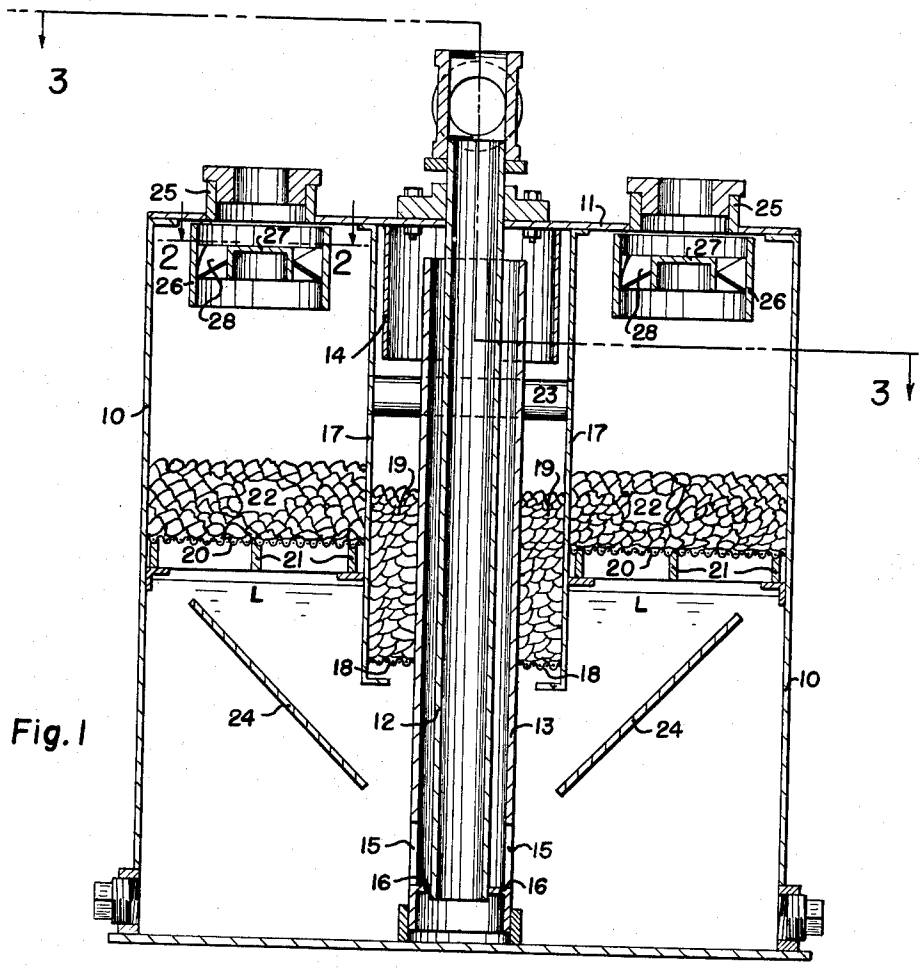


Fig. 1

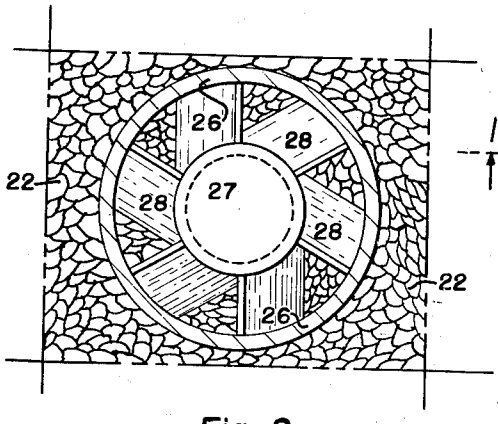


Fig. 2

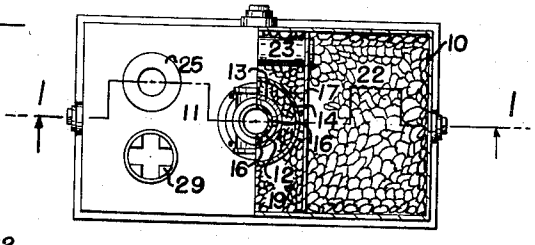


Fig. 3

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EXHAUST GAS CONDITIONER

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Application August 6, 1956, Serial No. 602,222

9 Claims. (Cl. 23—284)

As a development from and an improvement in certain respects over the exhaust gas conditioning apparatus disclosed in my Patents No. 2,508,297, dated May 16, 1950; No. 2,678,261, dated May 11, 1954; and my pending patent applications Serial No. 462,891, filed October 18, 1954, now Patent No. 2,785,963; Serial No. 396,049, filed December 3, 1953, now Patent No. 2,776,873 and to provide means for the efficient practice of the exhaust gas conditioning method described in my Patent No. 2,611,680, dated September 23, 1952, the instant invention relates to apparatus for the treatment of the exhaust gases from internal combustion engines, particularly those of diesel type, and has as an object to provide a novel and improved exhaust gas conditioner operable in reaction to the input pressure of exhaust gases routed therethrough to cool, cleanse, and modify the gases for release to atmosphere, even in confined areas, free from noxious and irritating properties inimical to humans.

A further object of the invention is to provide a novel and improved construction and unitary organization of elements constituting an exhaust gas conditioner characterized by high operative efficiency.

A further object of the invention is to provide a novel and improved exhaust gas conditioner unit operable to give practical effect to known principles with enhanced effectiveness.

A further object of the invention is to provide a novel and improved exhaust gas conditioner unit adapted to promote advantageously circulations in an associated water body as an incident of exhaust gas flow through the unit under the sole influence of the gas discharge pressures.

A further object of the invention is to provide a novel and improved exhaust gas conditioner unit operable to effectively entrap and recover moisture entrained with the treated gases as an incident of gas release to atmosphere.

A further object of the invention is to provide a novel and improved exhaust gas conditioner unit that is relatively inexpensive of production and operative installation in an extensive range of desired sizes and capacities, that is fully automatic in operation, that is promotive of but minimum inconsequential resistance to the flow of gases therethrough, that is conservative of the cooling and gas-ameliorating media employed therewith, that is adaptable to use in both fixed and mobile installations, and that is free from onerous servicing and maintenance requirements.

With the foregoing and other objects in view, my invention consists in the construction, arrangement, and operative combination of elements as hereinafter set forth, pointed out in my claims, and illustrated by the accompanying drawing, in which—

Figure 1 is a vertical section through a typical embodiment of the invention, taken substantially on the indicated line 1—1 of Figure 3.

Figure 2 is a fragmentary, detail section, on a relatively

enlarged scale, taken substantially on the indicated line 2—2 of Figure 1.

Figure 3 is a half-plan, half, sectional view, on a relatively reduced scale, of the organization according to Figure 1.

As is fully elaborated in my Patent No. 2,611,680, above noted, the exhaust gases from diesel and other types of internal combustion engines may be relieved of their noxious and irritant properties to a degree conditioning them for discharge to atmosphere in enclosed and confined areas free from menace to humans by circulation of the gases under the sole influence of their discharge pressures through water for the generation of a gas-water mixture and diffusing the wetted gases and gas-water mixtures through an intersticed bed or body of alkaline material, such as limerock, kept wetted and washed by the moisture entrained with the gas flow, and the instant invention is directed to the provision of an apparatus unit for such treatment and amelioration of exhaust gases with economy, practicality, and enhanced efficiency of result.

In common with the disclosure of my Patent No. 2,678,261, above noted, and similarly utilizing the air lift pump feature of my pending application Serial No. 396,049, above identified, the improved apparatus of the present invention is characterized by a preferably-rectangular housing **10** adapted to confine a charge of water in its lower portion, a top closure **11** for said housing, a gas input line **12** sealed centrally through said closure **11** and depending vertically within the housing **10** to terminate in an open discharge end spaced above the housing floor, a conduit **13** upstanding from the housing floor coaxially with and spacedly about the line **12** to define an annular channel therebetween and terminating in an open end spacedly subjacent the closure **11**, a skirt **14** closing against and depending from the closure **11** concentrically with and spacedly and telescopically about the upper end of the conduit **13** with its open lower end well below the upper end of said conduit, apertures **15** intersecting the conduit **13** adjacent and just above the lower end of the line **12**, and fingers **16** intruding from the lower ends of the apertures **15** to abutting engagement against the line **12**. As explained in the patent and application last above noted, with a charge of water present in the lower portion of the housing **10** and a flow of exhaust gases incoming through the line **12**, the organization just described functions, through admission of water to the base of the conduit **13** through the apertures **15** and uprise of the gases through the annular channel between the line **12** and conduit **13** about the fingers **16** and past said apertures, to thoroughly and intimately admix the gases with water for the generation of gas-water mixtures and to deliver the resulting gases, mixtures, and entrained water from the upper end of the conduit **13** and interiorly of the skirt **14**, whence the flow is directed downwardly of the housing toward the water charge therein.

Distinguishing from the disclosures of my earlier patent and application, a pair of baffles **17** similarly close against and depend from the closure **11** at opposite sides of the skirt **14** and extend in spaced, parallel relation transversely of the housing **10** to close against the side walls thereof. The baffles **17** depend vertically within the housing **10** past the midheight thereof and through the level L denoting the surface of the water charge appropriate for operation of the unit and similarly terminate in free lower margins parallel to the housing floor between which a web **18**, of reticulate or foraminous material, is engaged to close entirely across the otherwise open lower end of the chamber defined by said baffles and the housing side wall areas intercepted therebetween, which web **18** supports an intersticed

charge 19 of alkaline material substantially insoluble in water and reactive to the characteristic acidity of the gas-water mixtures, such as broken limerock, in filling relation with the lower portion of said chamber about the conduit 13, whereby to impose in the path of the delivery from the skirt 14, and in intersecting relation with the water level L, a neutralizing medium through which said delivery must wash and diffuse in its return to the water charge of the housing and from which escape of gases and mixtures may be had only under and past the lower margins of the baffles 17.

The baffles 17 and the chamber therebetween divide the upper portion of the housing 10 into similar end compartments above the water level L, and a sheet 20 of reticulate or foraminous material carried by grids 21 obstructively traverses each of said end compartments parallel to and spacedly above the said level L, and hence well above the lower margins of said baffles, for support of an intersticed charge 22 of alkaline material, expediently the same as that forming the charge 19, entirely across and but partially filling each of said end compartments, through which charges 22 the vapors escaping past the lower margins of the baffles 17 must pass as they uprise interiorly of the end compartments of the housing. Since it is of advantage to maintain a balance of the pressures obtaining in the two separated end compartments of the housing, a hollow member 23 connects across the chamber between and opens through said baffles above the charge 19 as a passage wherethrough such pressure balance may be established.

Escape of vapors past the lower margins of the baffles 17 and subsequent uprise thereof through the water charge exteriorly adjacent each of said baffles is availed of to promote and to maintain advantageous circulations within the water charge, for which purpose an imperforate plate 24 is fixed transversely of the housing 10 to and between the housing side walls within the housing lower portion at each side of the conduit 13, and each of said plates is inclined upwardly and outwardly toward the adjacent housing end wall from a lower inner margin spacedly paralleling the housing floor in a spacing outwardly from the conduit 13 and well below the lower margin of the adjacent baffle 17 to an upper outer margin parallel to and spaced inwardly from the adjacent housing end wall sufficiently below the liquid level L to permit circulation of water thereover within the water charge. As is readily apparent, buoyant vapors escaping outwardly about the lower margins of the baffles 17 rise and spread outwardly through the upper portion of the water charge and coact with the adjacent plate to induce a current upwardly and outwardly along said plate and past the upper margin thereof, which current soon establishes a circulation in the water charge at each side of the conduit 13 which is manifest as an uprise of water about the lower inner margin of each plate 24 and a consequent upward and outward flow through the zone between each plate 24 and the adjacent lower margin of a baffle 17. The circulation thus established is advantageous in guiding and directing vapors for their transit through the sheets 20 and charges 22 carried thereby, for returning drip from said charges 22 to and for release of sediment within the relatively more quiescent portion of the water charge, and for assuring a constant supply of cooled water relatively free from contamination to the base of the conduit through the apertures 15 for repetitious admixture with the incoming gases.

The treated gases uprising through the charges 22 collect in the end compartments of the housing above said charges and are thence vented to atmosphere, or through lines to other processing or disposition, through nipples 25, of any suitable form and construction, carried by and opening through the closure 11 adjacent each end of the housing. The vapors released from the housing through the nipples 25 entrain considerable water which it is desirable to recover and return to the housing water charge, to which end a sleeve 26, of a diameter greater than that of the nipple, is fixedly suspended from the closure 11 concentric with each nipple 25 and in a slight spacing away from said closure, and an inverted cup 27 of a diameter to blank the passage through the associated nipple is fixed centrally of each sleeve 26 by means of angularly spaced, spiral vanes 28 closing radially between the periphery of said cup and the inner wall of the sleeve. Thus, the vapors moving to outflow through each nipple 25 are constrained to pass through the associated sleeve 26 where they are deflected about the cup 27 with some consequent entrapment of entrained moisture and are further deflected and swirled by and between the vanes 28 for the generation of cyclonic effect which acts to expel entrained moisture through the space between the closure 11 and the upper end of the sleeve 26; such entrapped and expelled moisture returning as drip to the underlying charge 22 with wetting and washing effect thereon.

Ports appropriately provided through the closure 11 and normally capped, as at 29, serve in an obvious manner to facilitate replenishment of the charges 19 and 22, when and as desired, and replenishment of the water charge at need may be had through one of said ports, or otherwise, as may be deemed to be expedient.

The operation and advantages of the improvement shown and described are adequately manifest from the foregoing. The vapors and mixtures delivered from the skirt 14 to the chamber between the baffles 17 under the original discharge pressure of the exhaust gases collect in said chamber until a pressure is developed sufficient to depress any water standing in said chamber to the level of the baffle lower margins, whereafter said vapors and mixtures escape from the chamber after traversing the constantly washed and wetted charge 19, traverse an upper portion of the water charges 22 to the housing end compartments whence release to atmosphere is had with substantial dewatering of the purified vapors through the sleeve organizations underlying the outflow nipples.

Since changes, variations, and modifications in the form construction, and arrangement of the elements shown and described may be had without departing from the spirit of my invention, I wish to be understood as being limited solely by the scope of the appended claims, rather than by any details of the illustrative showing and foregoing description.

I claim as my invention:

1. An exhaust gas conditioner comprising a closed housing adapted to confine a charge of water substantially filling its lower half portion, spaced, parallel baffles closing transversely between sides of said housing and depending from closed relation with the housing top to free margins below the mid-height of the housing and hence within the housing water charge, whereby to define a closed chamber centrally and transversely of the housing upper portion between like housing end compartments, means including a conduit opening to the upper portion of said chamber from communication at its lower end with a lower portion of the housing in spacedly-surrounding relation with a coaxial gas input line disposed to deliver within and spacedly adjacent the conduit lower end reactive to the input of exhaust gases through said line under discharge pressure for the generation and circulation of gas-water mixtures to delivery within the upper portion of said chamber whence the vapors may escape only about the submerged lower margins of said baffles, a vent to atmosphere from an upper portion of each of said end compartments, and a plate spanning transversely between and perpendicular to the sides of the housing lower portion beneath each of said end compartments at an upward and outward lateral inclination from a disposition of its inner margin parallel to and spacedly subjacent the lower margin of the adjacent baffle to an outer margin inwardly adjacent the

housing end wall and below the housing midheight, whereby to induce a circulation of the water charge at each side of the housing lower portion about the plate submerged therein in reaction to outflow from said chamber about the lower margin of the corresponding baffle.

2. An exhaust gas conditioner comprising a closed housing adapted to confine a charge of water substantially filling its lower half portion, spaced, parallel baffles closing transversely between sides of said housing and depending from closed relation with the housing top to free margins below the mid-height of the housing and hence within the housing water charge, whereby to define a closed chamber centrally and transversely of the housing upper portion between like housing end compartments, means including a conduit opening to the upper portion of said chamber from communication at its lower end with a lower portion of the housing in spacedly-surrounding relation with a coaxial gas input line disposed to deliver within and spacedly adjacent the conduit lower end reactive to the input of exhaust gases through said line under discharge pressure for the generation and circulation of gas-water mixtures to delivery within the upper portion of said chamber whence the vapors may escape only about the submerged lower margins of said baffles, a vent to atmosphere from an upper portion of each of said end compartments, a hollow member bridging said chamber through said baffles for free pressure-balancing flow between said end compartments, and a plate spanning transversely between and perpendicular to the sides of the housing lower portion beneath each of said end compartments at an upward and outward lateral inclination from a disposition of its inner margin parallel to and spacedly subjacent the lower margin of the adjacent baffle to an outer margin inwardly adjacent the housing end wall and below the housing midheight, whereby to induce a circulation of the water charge at each side of the housing lower portion about the plate submerged therein in reaction to outflow from said chamber about the lower margin of the corresponding baffle.

3. An exhaust gas conditioner comprising a closed housing adapted to confine a charge of water substantially filling its lower half portion, spaced, parallel baffles closing transversely between sides of said housing and depending from closed relation with the housing top to free margins below the mid-height of the housing and hence within the housing water charge, whereby to define a closed chamber centrally and transversely of the housing upper portion between like housing end compartments, means including a conduit opening to the upper portion of said chamber from communication at its lower end with a lower portion of the housing in spacedly-surrounding relation with a coaxial gas input line disposed to deliver within and spacedly adjacent the conduit lower end reactive to the input of exhaust gases through said line under discharge pressure for the generation and circulation of gas-water mixtures to delivery within the upper portion of said chamber whence the vapors may escape only about the submerged lower margins of said baffles, an intersticed charge of diffusing material obstructively filling the lower portion of said chamber in the path of circulation therethrough, a vent to atmosphere from an upper portion of each of said end compartments, a hollow member bridging said chamber through said baffles for free pressure-balancing flow between said end compartments, and a plate spanning transversely between and perpendicular to the sides of the housing lower portion beneath each of said end compartments at an upward and outward lateral inclination from a disposition of its inner margin parallel to and spacedly subjacent the lower margin of the adjacent baffle to an outer margin inwardly adjacent the housing end wall and below the housing midheight, whereby to induce a circulation of the water charge at each side of the housing lower portion about the plate submerged therein in reaction to outflow from said chamber about the lower margin of the corresponding baffle.

4. An exhaust gas conditioner comprising a closed housing adapted to confine a charge of water substantially filling its lower half portion, spaced, parallel baffles closing transversely between sides of said housing and depending from closed relation with the housing top to free margins below the mid-height of the housing and hence within the housing water charge, whereby to define a closed chamber centrally and transversely of the housing upper portion between like housing end compartments, means including a conduit opening to the upper portion of said chamber from communication at its lower end with a lower portion of the housing in spacedly-surrounding relation with a coaxial gas input line disposed to deliver within and spacedly adjacent the conduit lower end reactive to the input of exhaust gases through said line under discharge pressure for the generation and circulation of gas-water mixtures to delivery within the upper portion of said chamber whence the vapors may escape only about the submerged lower margins of said baffles, an intersticed charge of diffusing material obstructively filling the lower portion of each said end compartment above the housing mid-height in the path of vapor uprise therein, a vent to atmosphere from an upper portion of each of said end compartments, a hollow member bridging said chamber through said baffles for free pressure-balancing flow between said end compartments, and a plate spanning transversely between and perpendicular to the sides of the housing lower portion beneath each of said end compartments at an upward and outward lateral inclination from a disposition of its inner margin parallel to and spacedly subjacent the lower margin of the adjacent baffle to an outer margin inwardly adjacent the housing end wall and below the housing midheight, whereby to induce a circulation of the water charge at each side of the housing lower portion about the plate submerged therein in reaction to outflow from said chamber about the lower margin of the corresponding baffle.

5. An exhaust gas conditioner comprising a closed housing adapted to confine a charge of water substantially filling its lower half portion, spaced, parallel baffles closing transversely between sides of said housing and depending from closed relation with the housing top to free margins below the mid-height of the housing and hence within the housing water charge, whereby to define a closed chamber centrally and transversely of the housing upper portion between like housing end compartments, means including a conduit opening to the upper portion of said chamber from communication at its lower end with a lower portion of the housing in spacedly-surrounding relation with a coaxial gas input line disposed to deliver within and spacedly adjacent the conduit lower end reactive to the input of exhaust gases through said line under discharge pressure for the generation and circulation of gas-water mixtures to delivery within the upper portion of said chamber whence the vapors may escape only about the submerged lower margins of said baffles, an intersticed charge of diffusing material obstructively filling the lower portion of said chamber in the path of circulation therethrough, a vent to atmosphere from an upper portion of each of said end compartments, an intersticed charge of diffusing material obstructively filling the lower portion of each said end compartment above the housing mid-height in the path of vapor uprise therein, a hollow member bridging said chamber through said baffles for free pressure-balancing flow between said end compartments, and a plate spanning transversely between and perpendicular to the sides of the housing lower portion beneath each of said end compartments at an upward and outward lateral inclination from a disposition of its inner margin parallel to and spacedly subjacent the lower margin of the adjacent baffle

to an outer margin inwardly adjacent the housing end wall and below the housing midheight, whereby to induce a circulation of the water charge at each side of the housing lower portion about the plate submerged therein in reaction to outflow from said chamber about the lower margin of the corresponding baffle.

6. An exhaust gas conditioner comprising a closed housing adapted to confine a charge of water substantially filling its lower half portion, spaced, parallel baffles closing transversely between sides of said housing and depending from closed relation with the housing top to free margins below the mid-height of the housing and hence within the housing water charge, whereby to define a closed chamber centrally and transversely of the housing upper portion between like housing end compartments, means including a conduit opening to the upper portion of said chamber from communication at its lower end with a lower portion of the housing in spacedly-surrounding relation with a coaxial gas input line disposed to deliver within and spacedly adjacent the conduit lower end reactive to the input of exhaust gases through said line under discharge pressure for the generation and circulation of gas-water mixtures to delivery within the upper portion of said chamber whence the vapors may escape only about the submerged lower margins of said baffles, a vent to atmosphere from an upper portion of each of said end compartments, a sleeve concentrically underlying each said vent in a slight spacing below the housing top, an inverted cup centrally of each said sleeve masking the associated vent, and spiral vanes closing between said cup and sleeve for the centrifuging of vapors in transit to and through the vent, a hollow member bridging said chamber through said baffles for free pressure-balancing flow between said end compartments, and a plate spanning transversely between and perpendicular to the sides of the housing lower portion beneath each of said end compartments at an upward and outward lateral inclination from a disposition of its inner margin parallel to and spacedly subjacent the lower margin of the adjacent baffle to an outer margin inwardly adjacent the housing end wall and below the housing midheight, whereby to induce a circulation of the water charge at each side of the housing lower portion about the plate submerged therein in reaction to outflow from said chamber about the lower margin of the corresponding baffle.

7. An exhaust gas conditioner comprising a closed housing adapted to confine a charge of water substantially filling its lower half portion, spaced, parallel baffles closing transversely between sides of said housing and depending from closed relation with the housing top to free margins below the mid-height of the housing and hence within the housing water charge, whereby to define a closed chamber centrally and transversely of the housing upper portion between like housing end compartments, means including a conduit opening to the upper portion of said chamber from communication at its lower end with a lower portion of the housing in spacedly-surrounding relation with a coaxial gas input line disposed to deliver within and spacedly adjacent the conduit lower end reactive to the input of exhaust gases through said line under discharge pressure for the generation and circulation of gas-water mixtures to delivery within the upper portion of said chamber whence the vapors may escape only about the submerged lower margins of said baffles, an interstiсed charge of diffusing material obstructively filling the lower portion of said chamber in the path of circulation therethrough, a vent to atmosphere from an upper portion of each of said end compartments, a sleeve concentrically underlying each said vent in a slight spacing below the housing top, an inverted cup centrally of each said sleeve masking the associated vent, and spiral vanes closing between said cup and sleeve for the centrifuging of vapors in transit to and through the vent, a hollow member bridging said chamber through said baffles for free pressure-balancing flow between said end compartments, and a plate spanning transversely between and perpendicular to the sides of the housing lower portion beneath each of said end compartments at an upward and outward lateral inclination from a disposition of its inner margin parallel to and spacedly subjacent the lower margin of the adjacent baffle to an outer margin inwardly adjacent the housing end wall and below the housing midheight, whereby to induce a circulation of the water charge at each side of the housing lower portion about the plate submerged therein in reaction to outflow from said chamber about the lower margin of the corresponding baffle.

8. An exhaust gas conditioner comprising a closed housing adapted to confine a charge of water substantially filling its lower half portion, spaced, parallel baffles closing transversely between sides of said housing and depending from closed relation with the housing top to free margins below the mid-height of the housing and hence within the housing water charge, whereby to define a closed chamber centrally and transversely of the housing upper portion between like housing end compartments, means including a conduit opening to the upper portion of said chamber from communication at its lower end with a lower portion of the housing in spacedly-surrounding relation with a coaxial gas input line disposed to deliver within and spacedly adjacent the conduit lower end reactive to the input of exhaust gases through said line under discharge pressure for the generation and circulation of gas-water mixtures to delivery within the upper portion of said chamber whence the vapors may escape only about the submerged lower margins of said baffles, an interstiсed charge of diffusing material obstructively filling the lower portion of each said end compartment above the housing mid-height in the path of vapor uprise therein, a vent to atmosphere from an upper portion of each of said end compartments, a sleeve concentrically underlying each said vent in a slight spacing below the housing top, an inverted cup centrally of each said sleeve masking the associated vent, and spiral vanes closing between said cup and sleeve for the centrifuging of vapors in transit to and through the vent, a hollow member bridging said chamber through said baffles for free pressure-balancing flow between said end compartments, and a plate spanning transversely between and perpendicular to the sides of the housing lower portion beneath each of said end compartments at an upward and outward lateral inclination from a disposition of its inner margin parallel to and spacedly subjacent the lower margin of the adjacent baffle to an outer margin inwardly adjacent the housing end wall and below the housing midheight, whereby to induce a circulation of the water charge at each side of the housing lower portion about the plate submerged therein in reaction to outflow from said chamber about the lower margin of the corresponding baffle.

9. An exhaust gas conditioner comprising a closed housing adapted to confine a charge of water substantially filling its lower half portion, spaced, parallel baffles closing transversely between sides of said housing and depending from closed relation with the housing top to free margins below the mid-height of the housing and hence within the housing water charge, whereby to define a closed chamber centrally and transversely of the housing upper portion between like housing end compartments, means including a conduit opening to the upper portion of said chamber from communication at its lower end with a lower portion of the housing in spacedly-surrounding relation with a coaxial gas input line disposed to deliver within and spacedly adjacent the conduit lower end reactive to the input of exhaust gases through said line under discharge pressure for the generation and circulation of gas-water mixtures to delivery within the upper portion of said chamber whence the vapors may escape

only about the submerged lower margins of said baffles, an intersticed charge of diffusing material obstructively filling the lower portion of said chamber in the path of circulation therethrough, a vent to atmosphere from an upper portion of each of said end compartments, a sleeve concentrically underlying each said vent in a slight spacing below the housing top, an inverted cup centrally of each said sleeve masking the associated vent, and spiral vanes closing between said cup and sleeve for the centrifuging of vapors in transit to and through the vent, an intersticed charge of diffusing material obstructively filling the lower portion of each said end compartment above the housing mid-height in the path of vapor uprise therein, a hollow member bridging said chamber through said baffles for free pressure-balancing flow between said end compartments, and a plate spanning transversely between and perpendicular to the sides of the housing lower portion

beneath each of said end compartments at an upward and outward lateral inclination from a disposition of its inner margin parallel to and spacedly subjacent the lower margin of the adjacent baffle to an outer margin inwardly adjacent the housing end wall and below the housing mid-height, whereby to induce a circulation of the water charge at each side of the housing lower portion about the plate submerged therein in reaction to outflow from said chamber about the lower margin of the corresponding baffle.

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