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J. P. RUTH
EXHAUST GAS CONDITIONER

2,678,261

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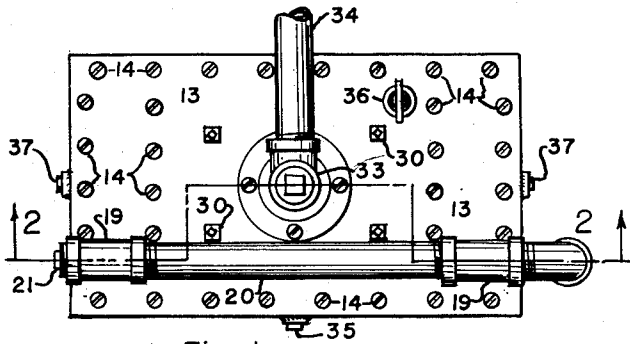


Fig. 1

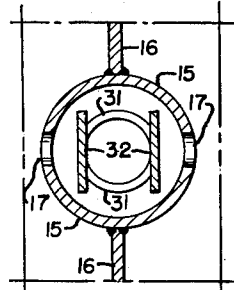


Fig. 4

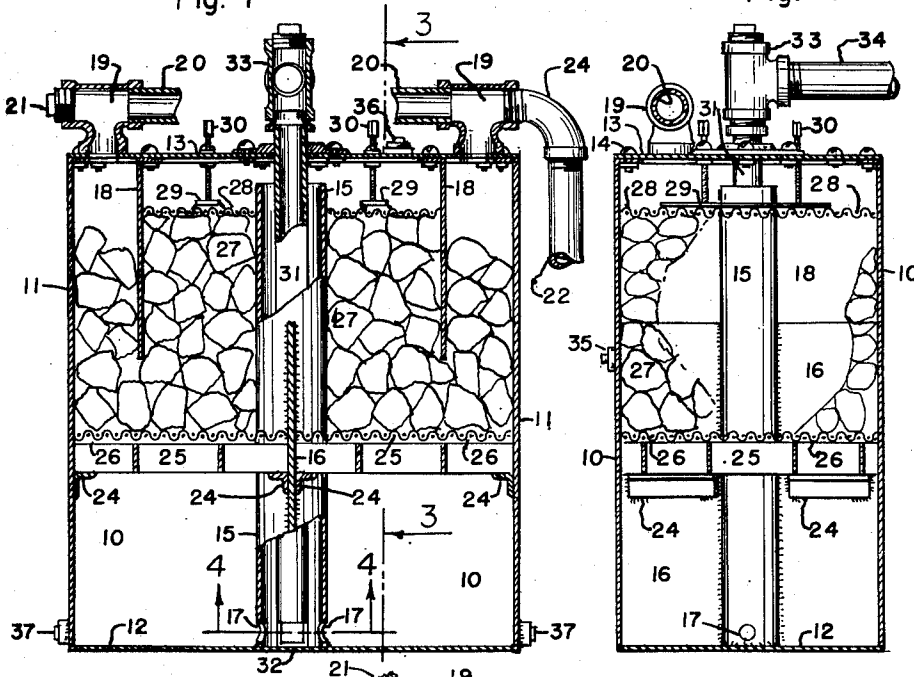


Fig. 2

Fig. 3

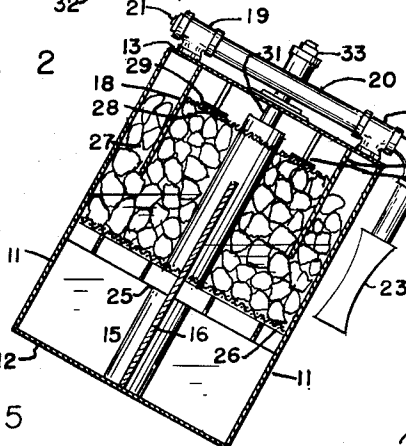


Fig. 5

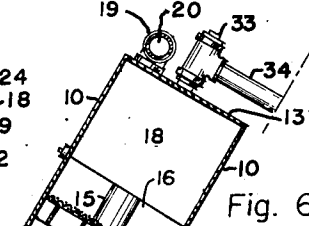


Fig. 6

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EXHAUST GAS CONDITIONER

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8 Claims. (Cl. 23—284)

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This invention relates to internal combustion engine accessory equipment known as exhaust gas conditioners and adapted to treat the exhaust gas output of an associated engine to alter and purify the same for safe discharge within confined spaces and has as an object to provide a novel and improved conditioner unit efficiently operable to apply and give effect to the principles disclosed in my copending applications for Letters Patent of the United States, Serial No. 138,801, filed January 16, 1950, now Patent No. 2,611,680, issued September 23, 1952, and Serial No. 257,761, filed November 23, 1951, in the many particular positions the unit may assume when associated with a movably-mounted engine.

A further object of the invention is to provide a novel and improved exhaust gas conditioner unit operable in fixed relation with a movably-mounted internal combustion engine to maintain a water charge in effective conditioning correlation with gas flow through the unit irrespective of the particular attitudes thereby assumed as the engine shifts with its mounting.

A further object of the invention is to provide a novel and improved exhaust gas conditioner unit construction effective to substantially inhibit effluence of the unit water charge with the gas output from the unit in the various tilted attitudes of the latter incident to its operative association with a movably-mounted engine.

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

Figure 1 is a top plan view of a typical embodiment of the invention as constructed and arranged ready for practical use. Figure 2 is a vertical section longitudinally of the improved unit taken substantially on the indicated line 2—2 of Figure 1. Figure 3 is a vertical section transversely of the improved unit taken substantially on the indicated line 3—3 of Figure 2. Figure 4 is a fragmentary, detail section, on a relatively enlarged scale, taken substantially on the indicated line 4—4 of Figure 2. Figure 5 is a sectional view similar to Figure 2 and on a relatively reduced scale representing interior relationships obtaining in one tilted attitude of the improved unit. Figure 6 is a sectional view similar to Figure 3 on a relatively reduced scale and with portions broken away to conserve space representing interior relationships obtaining in a tilted attitude of the unit at right angles to that of Figure 5.

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In the construction of the improved conditioner unit, as shown, a rigid, rectangular, open-top housing or container is represented as comprised from spacedly-parallel side walls 10, spacedly-parallel end walls 11 perpendicular to and marginally engaged with said side walls, and a bottom member 12 marginally sealed to lower edges of said side and end walls, thus to constitute, from any appropriate material and in any expedient manner, a housing closed save for its open top and the exceptions hereinafter noted and preferably characterized by a depth approximating or exceeding its length and a width on the order of one-half of such length. The otherwise open top of the housing is normally closed by means of a plate 13 marginally engaging upper edges of the housing side and end walls in spaced parallelism with the bottom member 12 in a sealed, removable and replaceable attachment thereto, as by means of bolts or studs 14 engaged through said plate and with a flange inturned from and along the side and end wall upper margins.

Fixed at its lower end to a central area of the bottom member 12, a tubular conduit 15 upstands from and in axially-perpendicular relation with said bottom member interiorly of the housing and through most of the housing depth to terminate in an open upper end sufficiently below the plate 13 to define a flow space therebetween, and like, imperforate partition members 16 fixedly closed against the side walls 10, bottom member 12 and conduit 15 transversely of the housing and to span between opposite sides of the conduit and the housing side walls adjacent thereto in a height considerably less than that of the said conduit and approximating two-thirds the housing depth, thus to divide the central and lower portions of the housing into two like compartments from each of which access to the interior of the conduit 15 is had through apertures 17 opening oppositely through the base of the conduit on a diameter perpendicular to the plane of the partition members 16. Spacedly paralleling the housing end walls 11 and more nearly adjacent to said walls than to the conduit 15, like, imperforate baffles 18 edge-close against the housing side walls 10 and seal at their upper margins against the plate 13 to depend interiorly of the housing for disposition of their free lower margins in a plane spacedly paralleling the housing bottom member 12 and intersecting the partition members 16 adjacent and somewhat below the upper margins of the latter, thus to define end chambers in the upper portion of the housing, and similar

fittings 19 on and separately opening through the plate 13 in communication with the respective said housing end chambers are interconnected exteriorly of the housing by means of a line 20 to provide an outlet from the housing through and common to both the end chambers thereof; one end opening of the so-constituted outlet preferably being plugged, as at 21, and the other end opening of said outlet preferably delivering to and through a line 22 for discharge to atmosphere, expediently through a diffusing jet 23, or the like.

In a like spacing from and above the housing bottom member 12, angles 24 fixed to the housing end walls 11 and the partition members 16 engage under the opposite ends of and removably and replaceably support rigid, open grids 25 in a disposition substantially below the lower margins of the baffles 18 spacedly paralleling the housing bottom member 12 and bridging entirely across the housing lower portion compartments separated by said members 16, and a sheet 26 of reticulate or foraminous material is supported by and overlies each of the grids 25 to extend over and fill the space bridged by the latter. It is the function of the grids 25 and sheets 26 to position and support diffusing and gas-modifying material, such as broken lime rock 27, within and to substantially fill the central and upper zones of the housing interior in interrupting relation with the path of flow from the conduit 15 upper end, across the lower margins of the baffles 18 and through the housing end chambers to the fittings 19, the so-supported material, such as the lime rock 27, being charged within the housing when the plate 13 is removed to open the housing upper end and being supplied in an amount to rise well above the upper margins of the partition members 16 throughout the housing interior area, including the housing end chambers, and to a level approaching the upper end of the conduit 15. To firm the major body of the diffusing material in place and to hold it against displacement when and as the housing is rocked or tilted, a sheet 28 of reticulate or foraminous material is worked and sized to embrace the upper end of the conduit 15 and to fill the space thereabout between the housing side walls 10 and baffles 18 in covering relation with the lime rock 27, or other diffusing material, exposed in such area, and rigid strips 29 are attached to and transversely of the upper surface of the sheet 28 in position to register with and be end-engaged by clamp screws 30 threadedly intersecting the plate 13, thus, through manipulation of said screws 30, to hold the sheet 28 in generally-parallel, spaced relation with the plate 13 and in compacting relation with the portion of the diffusing material charge it overlies.

Input to the housing of the gas to be treated therein is had through a tube 31 carried by and centrally intersecting the plate 13 for accommodation within and registration coaxially with the conduit 15 when the said plate is in place to close the housing. The tube 31 has an exterior diameter sufficiently less than the interior diameter of the conduit 15 to leave an annular space therebetween when said tube is telescoped within the conduit, the said tube 31 is of a length adequate to extend from projection exteriorly of the plate 13 to disposition of its open, discharge end closely adjacent the housing bottom member 12, and the lower end of the tube 31 expediently carries spacedly-parallel, longitudinally-projecting

webs 32, conveniently the side legs of a yoke or stirrup, end-engageable with the housing bottom member 12 to determine the spacing of the tube discharge end thereabove and sized and disposed to spacedly register with and overlie the apertures 17 at the base of the conduit, thus to divert discharge from the tube 31 lower end away from said apertures. Exteriorly of the housing, the upper end of the tube 31 engages a fitting 33 wherethrough connection is had, as by means of a line 34, with the exhaust gas line or manifold of the engine to be served, thus providing for delivery of the exhaust gas output of the engine through the tube 31 and to the base of the conduit 15.

Additional to its charge of diffusing material, the housing is supplied with a charge or body of water normally standing therein when the conduit 15 is vertical to a level just below the plane of the baffle 18 lower margins and convenient of determination through removal of a threaded plug 35 normally closing a port at the desired level in one of the housing side walls 10, and a cap 36 removably and replaceably closing an opening through the plate 13 provides convenient means for the recharge, and resupply, of water to the housing. Facilitative of maintenance and cleaning operations, removable and replaceable plugs 37 normally close drain apertures opening from the separate housing lower portion compartments at the level of the bottom member 12.

In the practical use of the improved unit, the housing is installed in fixed relation with an engine and its mount to dispose the axis of the conduit 15 vertical when said engine is in its normal and preferred attitude of use, the interior of the housing above the sheets 26 is charged with lime rock as above explained, the plate 13 is secured in place to close the top of the housing and to position the tube 31 within the conduit 15, the screws 30 are tightened against the strips 29 to hold the sheet 28 in firming relation with the lime rock charge, the plugs 37 are applied to close the drain apertures, water is introduced through the opening closable by the cap 36 until the water level reaches the port adapted to receive the plug 35, whereafter said cap and plug are applied to close said opening and port, and the fitting 33 is coupled through the line 34 to receive the exhaust gas discharge from the engine, thus readying the unit for its intended use and operation. As the exhaust gas discharge from the engine traverses and escapes from the lower end of the tube 31 within and at the base of the conduit 15 it is deflected from the apertures 17 by the webs 32 and rises, by virtue of its inherent buoyancy, through the annular space between the tube and conduit to expand from the upper end of the conduit through the housing interior above the lime rock charge; such uprise of the gas within the conduit 15 entraining water which enters the base of the conduit through the apertures 17 and spraying the so-entrained water over and with wetting effect upon the lime rock charge area covered by the sheet 28. There being no outlet for the gas from the housing save through the housing end chambers established by the baffles 18 and thence through the fittings 19, the gas emerging from the upper end of the conduit 15 is constrained to penetrate and diffuse through the lime rock charge beneath the sheet 28 until it finds passage across the lower margins of the baffles 18 which enables it to rise through the lime rock charges of the housing end cham-

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bers to and through the fittings 19 and thence to exhaust through the outlet common to both said fittings provided by the lines 20 and 22; such transit of the gas through the unit and its charges functioning to cool, cleanse, purify, and condition the gas in the manner and for the purposes elaborated in my earlier patent applications, above noted.

Where internal combustion engines are carried by movable mounts, such as tractors, road vehicles, and the like, the engine and its mount is often tilted in varying directions and to a quite considerable departure from its normal attitude, with corresponding tilting of the associated conditioner unit. In certain conditioner unit constructions, such tilting of the unit would result in undesirable evacuation of the unit water charge with the gas traversing the unit, hence an important feature of the present invention is the provision of the housing end chambers as established by the baffles 18 and as connected through the fittings 19 with a common outlet to atmosphere, all in association with the partition 16, since by virtue of the construction shown and described tilting of the unit in any direction and to a considerable divergence of the conduit 15 axis away from the vertical is accommodated without danger of water charge evacuation. As typified by Figure 5, tilting of the unit to oblique disposition of the unit end walls operates to raise the water level in the lower end chamber above the lower margin of the associated baffle 18, such rise of water level in the end compartment being minimized to an extent by the presence of the partition 16 in dividing relation with the water charge, but as the water level rises in the lower of the end compartments the level recedes from the other end compartment to open a path of diminished resistance through which the entire outflow of gas may pass to and for ultimate escape through the outlet lines. Similarly, as typified by Figure 6, tilting of the unit to oblique disposition of the unit side walls may function to submerge corresponding ends of the baffles 18 within the water charge, but at the same time the other ends of said baffles are lifted well above the water level to open a low resistance travel path along which the gas may move to the housing end compartments and thence to and through the outlet lines, all without such flooding of the gas escape path as might operate to "blow out" or evacuate the water charge of the housing.

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 liquid charge, a partition transversely bisecting said housing in a height less than that of the housing, a tubular conduit fixedly upstanding centrally of the housing with its upper end spaced below the housing top closure and communicating through its base with the housing on each side of said partition, baffles depending from the housing top closure below the level of the partition upper margin in spaced parallelism with and on the opposite sides of said partition to define end chambers in the housing upper portion, a com-

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mon discharge line serving said end chambers exteriorly of the housing, a perforate sheet transversely bridging said housing perpendicular to said partition and spacedly below the baffle lower margins adapted to support an intersticed charge of alkaline material about the conduit upper portion and within lower portions of said end chambers, and means for introducing exhaust gases interiorly and adjacent the base of said conduit.

2. An exhaust gas conditioner comprising a closed housing adapted to confine a liquid charge, a partition transversely bisecting said housing in a height less than that of the housing, a tubular conduit fixedly upstanding centrally of the housing with its upper end spaced below the housing top closure and communicating through its base with the housing on each side of said partition, baffles depending from the housing top closure below the level of the partition upper margin in spaced parallelism with and on the opposite sides of said partition to define end chambers in the housing upper portion, a common discharge line serving said end chambers exteriorly of the housing, grids bracket-supported on said partition and the housing end walls to transversely bridge the housing perpendicular to the partition and spacedly below the baffle lower margins, a perforate sheet overlying said grids adapted to support an intersticed charge of alkaline material about the conduit upper portion and to fill lower portions of said end chambers, and means for introducing exhaust gases interiorly and adjacent the base of said conduit.

3. An exhaust gas conditioner comprising a closed housing adapted to confine a liquid charge, a partition transversely bisecting said housing in a height less than that of the housing, a tubular conduit fixedly upstanding centrally of the housing with its upper end spaced below the housing top closure and communicating through its base with the housing on each side of said partition, baffles depending from the housing top closure below the level of the partition upper margin in spaced parallelism with and on the opposite sides of said partition to define end chambers in the housing upper portion, outlets from said end chambers through the housing top closure communicating with a common discharge line, grids bracket-supported on said partition and the housing end walls to transversely bridge the housing perpendicular to the partition and spacedly below the baffle lower margins, a perforate sheet overlying said grids adapted to support an intersticed charge of alkaline material about the conduit upper portion and to fill lower portions of said end chambers, and means for introducing exhaust gases interiorly and adjacent the base of said conduit.

4. An exhaust gas conditioner comprising a closed housing adapted to confine a liquid charge, a partition transversely bisecting said housing in a height less than that of the housing, a tubular conduit fixedly upstanding centrally of the housing with its upper end spaced below the housing top closure and communicating through its base with the housing on each side of said partition, baffles depending from the housing top closure below the level of the partition upper margin in spaced parallelism with and on the opposite sides of said partition to define end chambers in the housing upper portion, outlets from said end chambers through the housing top closure communicating with a common discharge line, grids bracket-supported on said partition

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and the housing end walls to transversely bridge the housing perpendicular to the partition and spacedly below the baffle lower margins, a perforate sheet overlying said grids adapted to support an intersticed charge of alkaline material about the conduit upper portion and to fill lower portions of said end chambers, and a gas input tube coaxially within and spaced from the walls of said conduit sealed through the housing top closure with its delivery and adjacent the conduit base.

5. An exhaust gas conditioner comprising a closed housing adapted to confine a liquid charge, a plugged port in and above the altitudinal center of one of the housing walls employable to establish the level of a maximum housing liquid charge, a tubular conduit fixed centrally of and rising perpendicularly from the housing floor to terminate in an open upper end spaced from and below the housing top closure, like partition members aligned transversely of the housing in edge-closing relation with the housing floor, side walls, and opposite sides of said conduit to intersect the plane paralleling the housing floor through said plugged port in a height less than that of said conduit, whereby to divide the liquid-chargeable housing portion into two like compartments, flow apertures opening through the base of said conduit to each of said compartments, baffles spacedly paralleling and on opposite sides of said partition members depending in edge-closing relation with the housing top closure and side walls slightly below the plane paralleling the housing floor through said plugged port, whereby to define like end chambers in the housing upper portion, outlets from said end chambers through the housing top closure communicating with a common discharge line, a perforate sheet transversely bridging the housing in spaced parallelism with the housing floor below the lower margins of said baffles adapted to support an intersticed charge of alkaline material about said conduit and within lower portions of said end chambers, and a gas input tube coaxially within and spaced from the walls of said conduit sealed through the housing top closure with its delivery end adjacent the housing floor.

6. In an exhaust gas conditioner, a closed housing adapted to be partially charged with liquid, a perforate sheet transversely bridging said housing in spaced parallelism with the housing floor adapted to support an intersticed charge of alkaline material in the housing upper portion, means for introducing exhaust gas to the lower portion of the housing, means associated with said gas-introducing means and extending upwardly through said perforate sheet for circulation of the liquid charge through the housing portion above said sheet as an incident of gas input to the housing, a partition transversely bisecting the housing lower portion and extending above the perforate sheet, baffles depending from the housing top closure in spaced parallelism with and on the opposite sides of said parti-

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tion with their lower margins defining a plane upwardly spaced from and paralleling said perforate sheet below the partition upper margin to define end chambers in the housing upper portion, and outlets from said end chambers through the housing top closure communicating with a common discharge line.

7. In an exhaust gas conditioner having a closed housing adapted to be partially charged with liquid, a perforate sheet transversely bridging said housing in spaced parallelism with the housing floor adapted to support an intersticed charge of alkaline material in the housing upper portion, means for introducing exhaust gas to the lower portion of the housing, and means associated with said gas-introducing means and extending upwardly through said perforate sheet for circulation of the liquid charge through the housing portion above said sheet as an incident of gas input to the housing, means adapting the conditioner for use with mobile engine installations, said latter means comprising a partition transversely bisecting the housing lower portion and extending above the perforate sheet, baffles depending from the housing top closure in spaced parallelism with and on the opposite sides of said partition with their lower margins defining a plane upwardly spaced from and paralleling said perforate sheet below the partition upper margin to define end chambers in the housing upper portion, and outlets from said end chambers through the housing top closure communicating with a common discharge line.

8. In an exhaust gas conditioner having a closed housing adapted to be partially charged with liquid, a perforate sheet transversely bridging said housing in spaced parallelism with the housing floor adapted to support an intersticed charge of alkaline material in the housing upper portion, means for introducing exhaust gas to the lower portion of the housing, and means associated with said gas-introducing means and extending upwardly through said perforate sheet for circulation of the liquid charge through the housing portion above said sheet as an incident of gas input to the housing, means adapting the conditioner for use with mobile engine installations, said latter means comprising a partition transversely bisecting the housing lower portion and extending above the perforate sheet, baffles depending from the housing top closure in spaced parallelism with and on the opposite sides of said partition with their lower margins defining a plane upwardly spaced from and paralleling said perforate sheet below the partition upper margin to define end chambers in the housing upper portion, outlets from said end chambers communicating with a common discharge line, and a second perforate sheet bridging said housing between said baffles in upwardly-spaced substantial parallelism with said first sheet and adjustable altitudinally of the housing to firm and immobilize a charge between said two sheets.

No references cited.