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I. H. CARPENTER ETAL

3,216,181

EXHAUST SYSTEM

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Fig. 1.

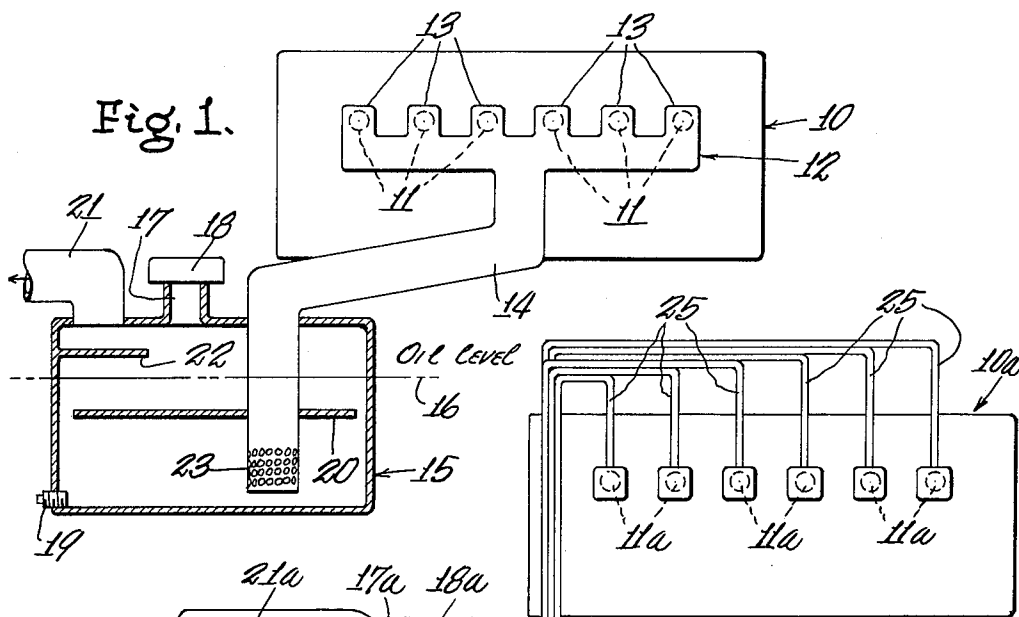


Fig. 2.

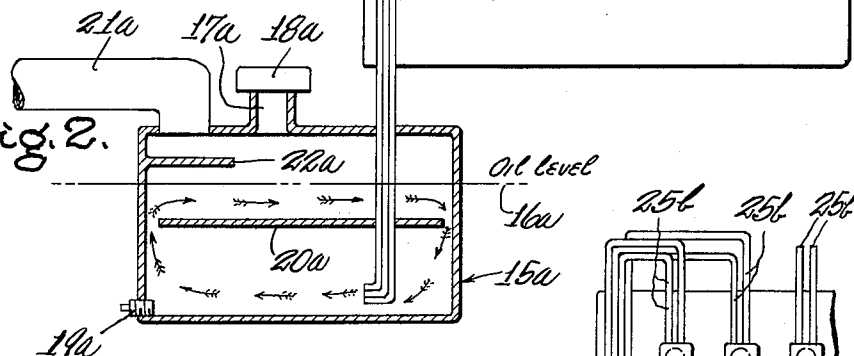


Fig. 3.

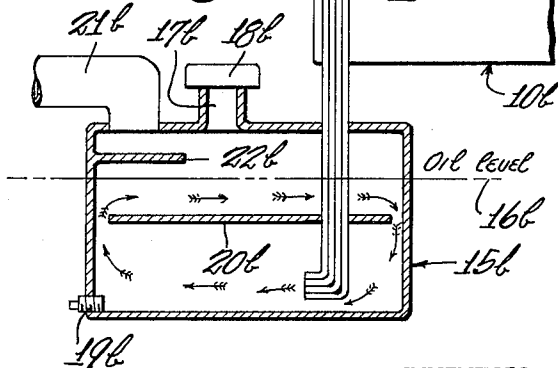
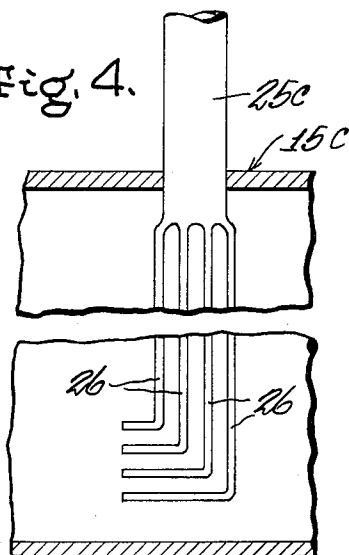


Fig. 4.



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1

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EXHAUST SYSTEM

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1 Claim. (Cl. 55-256)

The present invention relates to exhaust systems for internal combustion engines, more particularly to such systems which will remove from the exhaust gases irritants which are normally present, and the principal object of the invention is to provide new and improved systems of the character described.

Heretofore, attempts have been made to devise a system wherein exhaust gases from an internal combustion engine are passed through a liquid before discharging them into the atmosphere. Applicants have found, however, that two reasons such prior art attempts have not met with success is that the gas flow through the liquid was not sufficiently diffused and that the liquid was not sufficiently agitated.

The present invention is efficient, where prior art devices were not, since in the instant construction the exhaust gases are so diffused as they enter the liquid that they are thoroughly washed to remove smoke and other undesirable constituents normally present in the exhaust of internal combustion engines. Other advantages will become apparent from a study of the following description and from the appended drawing.

In the drawing accompanying this specification and forming a part of this application, there is shown, for purpose of illustration, embodiments which the invention may assume, and in this drawing:

FIGURE 1 is a generally diagrammatic view of one embodiment of the present invention,

FIGURE 2 is a view similar to FIGURE 1 but of another embodiment of the invention, and

FIGURES 3 and 4 are fragmentary views of still further embodiments.

With reference to FIGURE 1, there is illustrated an internal combustion engine 10 of any type suitable for use in a motor vehicle. For example, it may be assumed that engine 10 is a four-cycle gasoline engine having six cylinders, each of which has an outlet 11 through which the exhaust gases are discharged. Secured to the engine is a manifold 12 having branches 13 leading to each engine outlet 11 and leading from the manifold 12 is an exhaust pipe 14.

The construction thus far described is conventional, the exhaust gases from the outlets 11 being led into the manifold 12 by the branches 13 and then passing into the pipe 14 which, in the usual construction, is connected to a conventional muffler (not shown) that reduces their noise level before discharging them into the atmosphere.

In the embodiment seen in FIGURE 1, there is provided a vessel 15 into which the exhaust pipe 14 projects. Pipe 14 terminates adjacent the bottom of vessel 15 and its end is preferably closed by a suitable wall, not shown, for a purpose to appear. The juncture of the pipe 14 with the vessel 15 will of course, be suitably sealed to prevent leakage at this point. Vessel 15 is adapted to be filled with a suitable liquid later to be described to about the level indicated at 16. A filler opening 17 closed by a removable cap 18 permits introduction of the liquid and a suitable drain plug 19 permits drainage thereof.

Within the vessel 15 and below the liquid level 16 is a horizontally disposed baffle 20 through which the pipe 14 projects. Baffle 20 is either perforated adjacent the vessel walls or is spaced slightly therefrom as shown to provide for passage of exhaust gases from beneath the baffle to above the latter.

2

Communicating with the upper portion of vessel 15 above the liquid level 16 is a tailpipe 21 which may terminate at the rear of the vehicle in the usual manner to discharge the exhaust gases to the atmosphere. A second baffle 22 underlies the tailpipe opening within the vessel to insure that no liquid passes into the tailpipe.

It is an important feature of the present invention that the portion of pipe 14 beneath the baffle 20 is formed to provide a series of relatively small apertures 23 to permit the escape of exhaust gases, it being recalled that the terminal end of the pipe is plugged to thus compel the gases to escape through the apertures 23. It has been found that the best efficiency is obtained if the apertures are at least about one-eighth inch in diameter and are not much greater than three-eighths of an inch in diameter and preferably no greater than one-quarter inch in diameter. This provides the necessary diffusion of the exhaust gases so that they are thoroughly washed by the liquid as they are discharged thereinto. Obviously, the number of apertures will be such as to minimize back pressure in the pipe 14.

In connection with the size of apertures 23, it is to be understood that if they are too small, they may easily become clogged by carbon or the like. On the other hand, if they are too large, the gases will be discharged in such a large stream into the liquid that they will not be adequately washed and thus irritant removal therefrom will not be very effective. Also, while the apertures are herein referred to as being round, they may be otherwise configured so long as the area of each is within the limits above defined.

It has been found that ordinary engine oil functions well in the vessel 15 to remove irritants from the exhaust gases; however, it may be that other liquids will function as well or even better. In any event, assuming vessel 15 is to be filled with oil or other liquid to the level indicated at 16, it will be understood that with the engine 10 operating, exhaust gases will be discharged through the pipe apertures 23 where they will bubble up through the liquid in the vessel and about the periphery of baffle 20 to the vessel interior above the liquid level. From here, the gases will escape to the atmosphere through the tailpipe 21, the baffle 22 insuring against the loss of liquid through such tailpipe.

After a prolonged period of engine operation, the liquid in the vessel may become so contaminated that the efficiency of the device suffers. At such time, the liquid may be drained from the vessel by removing the drain plug 19 and the vessel then filled with fresh liquid through the filler opening 17 following replacement of the drain plug 19.

It has been found that the removal of irritants from exhaust gases will be enhanced if the gases are discharged intermittently, rather than continuously, into the liquid. This is believed to result because intermittent flow seems to effect greater diffusion of the exhaust gases through the liquid. For what is believed to be the same reason, circulation of the liquid also appears to enhance irritant removal. In order to effectuate the above-mentioned intermittent discharge and liquid circulation, the structure illustrated in FIGURE 2 has been devised. Since the structures of FIGURES 1 and 2 are similar, corresponding parts are identified by the same reference characters as before but with the suffix *a* added.

In this embodiment, the exhaust-collecting manifold 12 and the exhaust pipe 14 seen in FIGURE 1 are preferably omitted and a relatively small diameter line 25, each having an internal opening of a size corresponding to the previously described openings 23, leads from each engine exhaust port 11a to the interior of the vessel 15a. Such lines are preferably grouped together where they pass through the vessel and the juncture therebetween is

3

suitably sealed to prevent leakage. The grouped together lines 25 pass through the baffle 20a and have their open ends turned to face in the same direction, as illustrated, for a purpose to appear. It is to be understood that the lines are so arranged that the open ends of those connected to successively exhausting cylinders are not in side-by-side relation but are spaced from each other. Thus, diffusion of the gases throughout the liquid will be even further improved.

During operation of the engine 10a, exhaust gases will be discharged through a line 25 only when the cylinder to which such line is connected is passing through its exhaust cycle. During the remainder of such cylinder's cycle, no gases will flow therethrough. Accordingly, each line 25 will thus discharge exhaust gases intermittently into the liquid.

As previously pointed out, all of the open ends of the lines 25 are orientated in the same direction; accordingly, the discharge of gases through the lines will set up a current in the liquid, as indicated by the arrows, thus further improving diffusion of the gases therethrough. Although not shown, circulation of the liquid could further be enhanced by means of a fan or the like submerged in the liquid and driven by a suitable electric motor or other device. At the present time, however, it is believed that the orientation of the lines 25 as above described provides for adequate circulation of the liquid.

As previously pointed out, it is important to limit the size of the openings through which the exhaust gases are discharged into the liquid in order to secure maximum washing of the gases. While this may be done by limiting the internal size of the lines 25, a problem may arise when a line, so limited in size, is thus too small to carry the volume of exhaust gases discharged by the cylinder to which it is connected. Under such circumstances, one expedient is to utilize multiple lines 25 leading from each engine exhaust port to the vessel.

As fragmentarily shown in FIGURE 3 wherein corresponding parts are identified by the same reference characters as before but with the suffix *b* added, a pair of lines 25b, each having the optimum internal size previously mentioned, extend from each exhaust port 11b and terminate within the vessel 15b. Here again, all of the lines 25b are preferably grouped together and all have their discharge ends orientated in the same direction. In addition to arranging the discharge ends of the lines 25b so that such ends of the pair of lines leading from any one cylinder will be spaced from the discharge ends of the lines leading from the next successively exhausting cylinder, the discharge ends of the lines 25b of each pair of lines will also be spaced apart from each other. Obviously, three or even more lines 25b could, if desired, lead from each cylinder exhaust port to the vessel.

As fragmentarily shown in enlarged scale in FIGURE 4, still another expedient may be employed where the volume of exhaust gases discharged from each engine cylinder is quite large. In this figure wherein corresponding parts are identified by the same reference characters hereinbefore used but with the suffix *c* added, a single line 25c is connected to each engine exhaust port and leads to the vessel 15c. Each line may be of a size sufficient to carry the exhaust volume of its cylinder, such size being materially larger than the desired, maximum efficiency, discharge opening.

In order to reduce the size of the opening through which the exhaust gases will be discharged but without unduly impeding the escape of exhaust gases from the engine, each line 25c will be divided into a number of branch lines 26 each of which has the desired, optimum internal size and which, in aggregate, are adequate to carry the gas flow in the line 25c without creating excessive back pressure therein. As herein shown, each line

4

25c is divided into four branch lines 26; however, a greater or smaller number may be employed. In common with the previously disclosed lines 25, 25b, branch lines 26 all have their discharge ends orientated in the same direction for reasons hereinbefore described. Additionally, all of the branch lines 26 of a given line 15c will have their discharge ends spaced from each other for reasons previously mentioned and the branch lines 26 of each line 25c will be spaced from the branch lines communicating with the exhaust port of the next successively exhausting cylinder.

In view of the foregoing, it will be apparent to those skilled in the art that we have accomplished at least the principal object of our invention and it will also be apparent to those skilled in the art that the embodiments herein described may be variously changed and modified, without departing from the spirit of the invention, and that the invention is capable of uses and has advantages not herein specifically described; hence it will be appreciated that the herein disclosed embodiments are illustrative only, and that our invention is not limited thereto.

We claim:

An exhaust system for a multicylinder internal combustion engine having an exhaust outlet provided in each cylinder, comprising a vessel containing a liquid and having a bottom wall, a top wall and a pair of horizontally opposed, space-apart side walls, a separate exhaust conduit extending from each engine outlet into said vessel and terminating within said vessel in an exhaust discharge opening disposed below the level of the contained liquid and substantially adjacent said bottom wall and all of said discharge openings facing the same one of said vessel side walls and causing a horizontal discharge of exhaust gases and thus a unidirectional horizontal flow of liquid within said vessel between said pair of vessel side walls, a baffle extending horizontally substantially throughout said vessel and disposed beneath the level of the contained liquid and above said conduit discharge openings and providing passages substantially adjacent said pair of horizontally opposed vessel side walls, said baffle imperforate throughout its horizontal extent except for said passages and providing for vertical flow of liquid within said vessel only adjacent respective vessel side walls aforesaid and said baffle separating horizontal liquid flow within said vessel between said side walls in one direction from horizontal liquid flow between said side walls in the opposite direction, and an outlet in said vessel above the level of the contained liquid and providing for escape of exhaust gases from the interior of said vessel.

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