

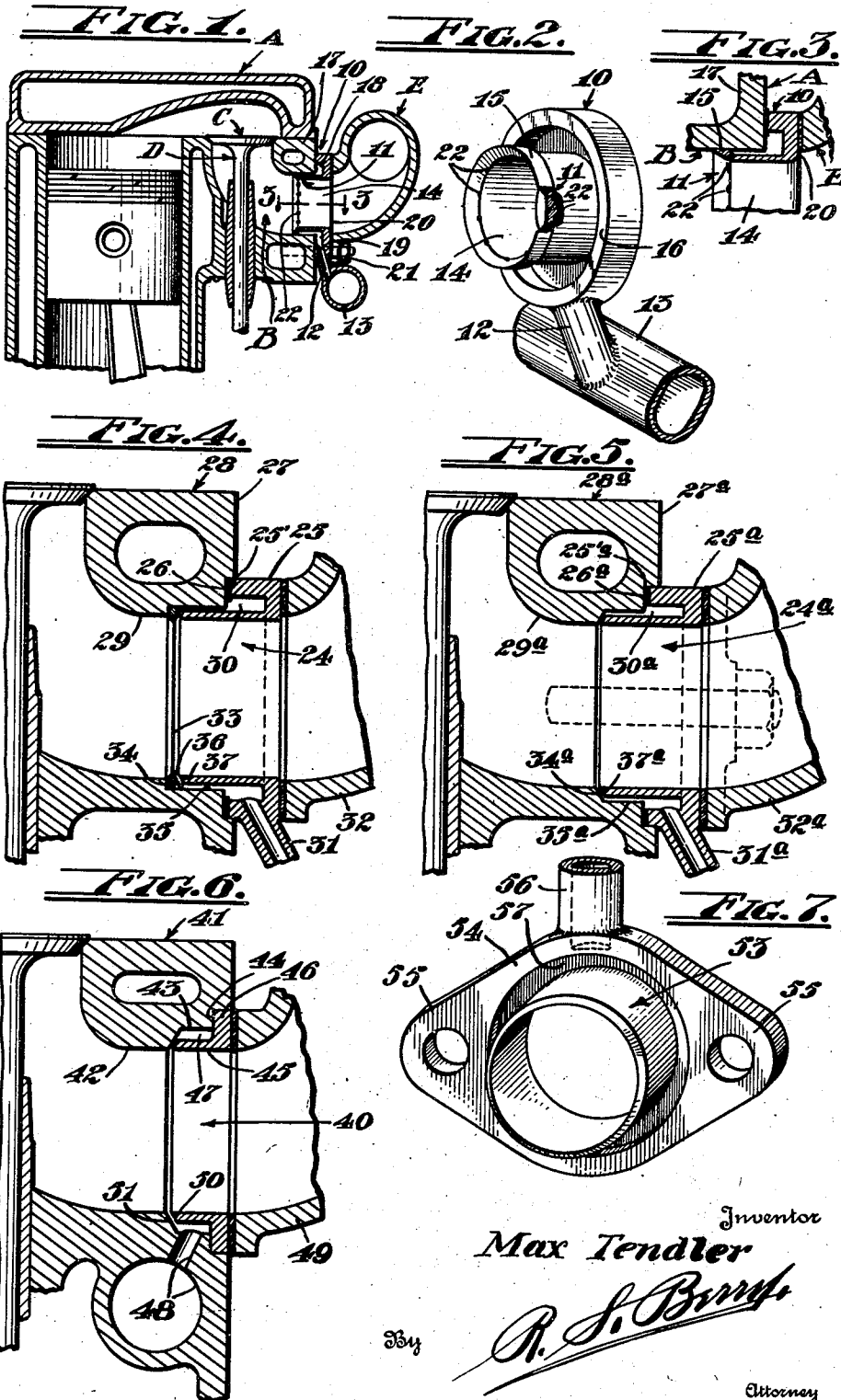
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INTERNAL COMBUSTION ENGINE

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INTERNAL COMBUSTION ENGINE

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4 Claims. (Cl. 60—30)

This invention relates to improvements in apparatus for eliminating noxious elements of exhaust gases in internal combustion engines.

In United States Letters Patent No. 2,217,241 issued October 8, 1940, there is disclosed a system and an apparatus for destroying noxious elements such as carbon monoxide, aldehyde and mercaptan, by continuously introducing air under pressure into the exhaust ports of an internal combustion engine, from nozzles or conduits which are sufficiently close to the valves or intake ends of the ports to insure that the portions of the exhaust gases into which oxygenizing air is discharged will be ignited by flames extending into said ports when the valves are open.

The present application has for its primary purpose the provision of an improved apparatus which will operate under the principles set forth in said patent but in a much more reliable and efficient manner, and be subject to installation without necessitating the drilling of openings in the exhaust manifold or changing the construction of the engine parts, by reason of the use of a new form and arrangement of means for introducing directly into the exhaust ports a gaseous oxygenizing fluid for promoting the combustion in said ports of the noxious elements of the exhaust gases.

Another purpose of my invention is to provide for treatment of the exhaust gases as aforesaid without restricting the normal flow thereof through the exhaust ports, or overheating or otherwise damaging the valves; while at the same time insuring that the introduction of the oxygenizing air takes place in such manner as to promote a more thorough combustion than heretofore, whereby destruction of a greater proportion if not substantially all of the noxious components is attained.

A further purpose is to provide for the introduction of jets of oxygenizing air into the exhaust ports so as to form substantially conical patterns which "fill" the ports and are projected towards the valves from tubular or annular nozzle members lining the discharge ends of the ports. These conical patterns have their apices centered in the ports but terminate short of contact with the valves to avoid overheating or other damage thereof. The tubular nozzle members afford substantially normal and unrestricted communication of the ports with the exhaust manifold and permit of the connection thereto of air supplying conduits or pipes without necessitating the extension or passage of the con-

duits or pipes through the manifold. Moreover, the tubular nozzles are adapted to be secured between the engine block and manifold, like washers or gaskets, and are mounted in and centered by the ports whereby the use of extraneous fastenings is unnecessary.

My improved apparatus may be said to advantageously provide for the discharge of the oxygenizing air from the surrounding "walls" of the exhaust ports between the ends thereof. The air may be discharged to form a curtain directed generally inwardly to meet and thereby thoroughly "mix" with the outflowing exhaust gases at points sufficiently close to the valves to insure that the flames from the openings controlled by said valves will ignite the mixture and thereby provide for a thorough combustion and destruction of the noxious components without damaging the valves.

With the foregoing objects in view, together with such other objects and advantages as may subsequently appear, the invention is carried into effect as illustrated by way of example in the accompanying drawing, in which:

Fig. 1 is a fragmentary vertical sectional view of a portion of an internal combustion engine as when equipped with apparatus embodying my invention;

Fig. 2 is a fragmentary enlarged perspective view of the tubular nozzle of my invention shown removed from the engine, and as connected with the air conduit, the nozzle being broken away and sectioned to show the nozzle orifices;

Fig. 3 is a fragmentary sectional view taken on the plane of line 3—3 of Fig. 1;

Fig. 4 is an enlarged fragmentary vertical sectional view of a modified form of my invention;

Fig. 5 is an enlarged fragmentary vertical sectional view of another modified form of the invention;

Fig. 6 is an enlarged fragmentary vertical sectional view of another modified form of the invention;

Fig. 7 is a fragmentary perspective view of another modified form of the invention.

With particular reference to the drawing wherein there is partly shown a conventional internal combustion engine A having a substantially L-shaped exhaust port B provided at its intake end with a valve C, the axial stem D of which extends downwardly through and is exposed in the port, it is seen that the apparatus embodying my invention primarily includes a tubular or annular member 10 serving as a nozzle for introducing oxygenizing air into said port and also as a coupling and exhaust gas passage-

way between the outlet end of the port and a conventional exhaust manifold E. In association with or embodied in this tubular nozzle member is discharge jet or orifice forming means 11 for discharging directly into and angularly across the exhaust port, but also in a direction generally toward the valve stem D, a jet pattern or jets of a gaseous oxygenizing fluid under pressure, such as air, and which is continuously supplied to the nozzle member from a branch pipe 12 leading from a supply manifold 13 connected with a source of supply of such gaseous fluid, not shown.

As shown in Figs. 1, 2, and 3 the tubular nozzle member 10 comprises a tubular open-ended body 14 adapted to have one end portion extend into the discharge end of the exhaust port so as to be circumferentially spaced from the surrounding wall of the port, except at the extremity of said end portion where an outstanding peripheral bead or flange 15 makes a close fit with said surrounding wall. Surrounding and formed integral with the outer end of the body 14 is an annular "cup-shaped" flange 16 which is adapted to contact the engine block 17 around the outlet end of the port as shown in Figs. 1 and 3 whereby with the flange 15 there is formed an annular air chamber 18 between said body and the surrounding wall of the port. In the body 14 is an opening 19 with which the air feed pipe 12 is connected and in the connection, it is important to note that it is unnecessary to form openings in or extend pipes through the exhaust manifold or change the construction of the engine parts in order to introduce air into the exhaust ports in accordance with this invention.

As shown in Figs. 1 and 3 the exhaust manifold E abuts the outer face of the flange 16 so that the intake port 20 of the manifold registers with the outer end of the body. Inasmuch as the member 10 is seated in the exhaust port and engages the engine block and exhaust manifold, it is seen that it is held in place by the latter, which has the conventional fastening elements 21 for securing it to the engine block. It is now seen that the exhaust gases will pass freely from the exhaust port into the exhaust manifold inasmuch as the member 10, offers little or no resistance to the flow of gases.

The jet or orifice forming means hereinbefore designated 11 to some extent is embodied in the construction for forming the annular air chamber but is primarily provided by means of circular series of minute orifices 22 formed in the body 14 at the juncture thereof with the peripheral flange 15, said orifices being inclined as shown in Figs. 2 and 3 so that the air jets will be directed angularly crosswise of the port and converge at the center of the port. These jets are discharged from points within and surrounding the port, somewhat toward the valve stem D but converge short of said stem and thereby form a conical pattern or curtain of air, occupying the full cross sectional area of the port, so that the hot and "flame containing" portion of the exhaust gases will be oxygenized sufficiently to insure that combustion of the noxious elements thereof will take place. As pointed out in my patent hereinbefore identified, it is necessary that the nozzle be close to the inner portions of the port in order that jets of air will oxygenize the exhaust gases at points where the flame extending into the port will ignite the resultant mixture.

In the present apparatus, the tubular nozzle 10 is extended directly into and surrounds the port and this insures that the air jets will oxygenize the exhaust gases in the "flame" zone of the port and that the resultant mixture will be ignited whereby to destroy by combustion within the port the noxious elements of the gases.

As in my patent, the present apparatus in continuously discharging air under pressure in the particular manner here provided, effectively scavenges the exhaust system when the exhaust valves are closed, and also keeps the exhaust ports charged with oxygenizing air so that effective destruction of the noxious components by combustion in the ports will take place immediately the exhaust valves are opened and continue as long as such components of the exhaust gases are present in the ports.

It should be noted that while I have shown but one of the tubular nozzle 10 and its associated elements, it is obvious that one of these nozzle units is used for each exhaust port of the engine and that such units may be readily incorporated with internal combustion engines of various types and other than here shown, as within the scope and purview of the invention shown, described and claimed in this application.

One feature of advantage afforded by the apparatus of my invention is that it is unnecessary to modify, alter or change the construction of the engine in order to attach the apparatus thereto, since it is apparent that it is only necessary to remove the exhaust manifold, fit the nozzles 10 in the exhaust ports, then replace the manifold and connect the air supply manifold 13 to a suitable source to install my apparatus on an engine.

Referring to Fig. 4, it is seen that a modified form of my invention may take the form of a tubular body or nozzle member 24 having an annular "cup" flange 25 at its outer end adapted to engage gaskets 25' set in an annular recess 26 in the outer face 27 of the engine 28. The body 24 extends into and is circumferentially spaced from the wall of the exhaust port 29 to form an annular air chamber 30. Air is supplied to this chamber from a source under pressure, not shown, through a pipe 31 connected with the body 24 between the manifold 32 and engine 28. A ring 33 is seated against a shoulder 34 formed by a counter-bore 35 in the wall of the exhaust port and has a beveled inner face 36 which is disposed in outwardly spaced relation to the beveled annular face 37 on the inner end of the body 24. These beveled faces define between them an annular orifice through which a conical jet of air is discharged from the air chamber 30 directly into the port. In order to vary the size of the annular orifice the gaskets 25' are used as shims whereby the body 24 may be adjusted longitudinally to vary the spacing of the beveled faces 36 and 37. This form of the invention operates in the same manner as the previously described form but differs therefrom in that it has an annular air discharge orifice formed between the ring 33 and the inner end of the body 24 and also in that it requires the formation of the gasket recess 26 and the counterbore 35.

As shown in Fig. 5 another modified form of the invention is the same as that shown in Fig. 4 except that the ring 33 is omitted. As the parts are alike in the forms shown in Figs. 4 and 5, the same reference characters are used but in Fig. 5 are distinguished by the character *a*. In omitting

the ring the shoulder 34a is beveled whereby the annular discharge orifice 37a is formed between the inner end of the body 24a and said shoulder. This modification operates in the same manner as the other forms of my invention as hereinbefore described.

In Fig. 6 I have shown another form of my invention in which certain parts are built-in. This form is particularly adapted for use in factory installations. As here provided a tubular nozzle member 40 is countersunk in the engine block 41, the exhaust port 42 being provided with counter bores 43 and 44 respectively receiving the body 45 of the tubular member 40 and an annular flange 46 on the outer end of said body. The body 45 is spaced circumferentially of the surrounding wall of the port 42 to form an annular air chamber 47 supplied with air from passages 48 formed in the engine block and connected with a source of supply under pressure, not shown.

The exhaust manifold 49 is connected with the engine block in the conventional manner and holds the tubular member 40 in place in the same manner as in the other forms of my invention hereinbefore described. The inner end of the body 45 is beveled as at 50 and is opposed to a beveled shoulder 51 at the inner end of the counterbore 43 whereby to provide an annular discharge orifice as in the form of the invention shown in Figs. 4 and 5. This form of my invention operates in the same manner as those shown in Figs. 4 and 5.

Yet another modification as shown in Fig. 7 comprises a tubular body 53 similar to the one in Fig. 5. In this form the "cup" flange 54 surrounding the outer end of the body is provided with laterally extending apertured ears 55 to provide for bolting the unit to the engine block in any suitable manner which it is not deemed necessary to illustrate. The air supply pipe 56 leads into the air "chamber" 57, at the top of the flange 54. This form of my invention may be more desirable than the others for certain types of engines but operates and is installed in the same manner, as is obvious.

While I have shown and described specific embodiments of my invention I do not limit myself to the exact details of construction set forth, and the invention embraces such changes, modifications and equivalents of the parts and their formation and arrangement as come within the purview of the appended claims.

I claim:

1. An apparatus for eliminating noxious components of exhaust gases in internal combustion engines, including an open ended tubular member adapted to extend into the discharge end of an exhaust port of such an engine and to establish an unrestricted exhaust gas pasageway from the port to the exhaust manifold, said member being adapted to be spaced from the wall of the port to form an air chamber extending into the discharge end of said port, means for supplying air to said chamber, and means in association with said member for defining an outlet within said discharge end for discharging air inwardly from said discharge end, said outlet being arranged to lie sufficiently close to the portion of the port into which flames extend from the engine cyl-

inder to insure that the portions of the exhaust gases into which the air is discharged will be ignited by said flames.

2. In combination with an internal combustion engine, including a cylinder, an exhaust port, a valve at the inner end of said port and an exhaust manifold at the outer end of said port; a tubular member open at its ends and having one end disposed within said port and its other in communication with said manifold for affording normal egress of gases from the port to the manifold, means associated with said member for defining an air chamber which extends into and surrounds the outer end of said port, means for supplying air to said chamber, and means associated with said member for defining an outlet within said outer end for discharging air into said port in a direction toward said valve for supporting combustion within said port, the air from said chamber.

3. In combination with an internal combustion engine having cylinders and exhaust ports therein and an exhaust manifold, of members disposed between the exhaust ports and the manifold and having passages therein affording normal communication between the said ports and said manifold, means providing air chambers in association with said members, means for introducing air under pressure into said chambers, and air discharge means for discharging air from points in said chambers located within said ports for promoting combustion therein of noxious elements of exhaust gases, the means providing said air chambers including portions of said air chambers including portions of said members extended into and spaced circumferentially from portions of the walls surrounding said ports, and other portions on said members abutting said cylinders at points surrounding said ports and closing the outer ends of the spaces between the aforesaid circumferentially spaced portions.

4. In combination with an internal combustion engine having cylinders and exhaust ports therein and an exhaust manifold, of members disposed between the exhaust ports and the manifold and having passages therein affording normal communication between the said ports and said manifold, means providing air chambers in association with said members, means for introducing air under pressure into said chambers, and air discharge means for discharging air from said chambers into said ports for promoting combustion therein of noxious elements of exhaust gases, said air discharge means providing for introduction of the air from the walls surrounding the passages in said members, and angularly into and in a direction towards the inner ends of said ports, said means providing said air chambers including portions of said members extending into and circumferentially spaced from portions of the walls of said port, and annular portions on said members having cylinder-engaging faces extending at right angles to the longitudinal axes of said members and engaging said cylinders at points surrounding said ports for closing the outer ends of the spaces defined between said opposed portions.

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