July 17, 1934. J. S. FLUOR, JR 1,966,620

MUFFLER

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Fig. 1

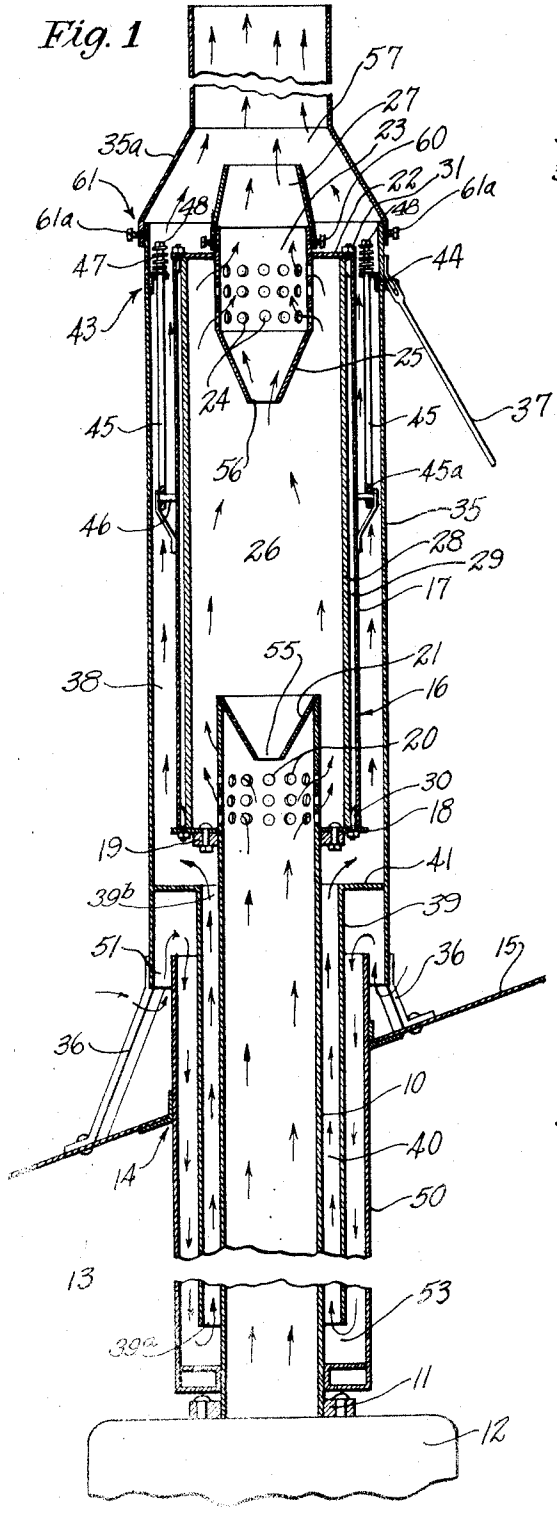
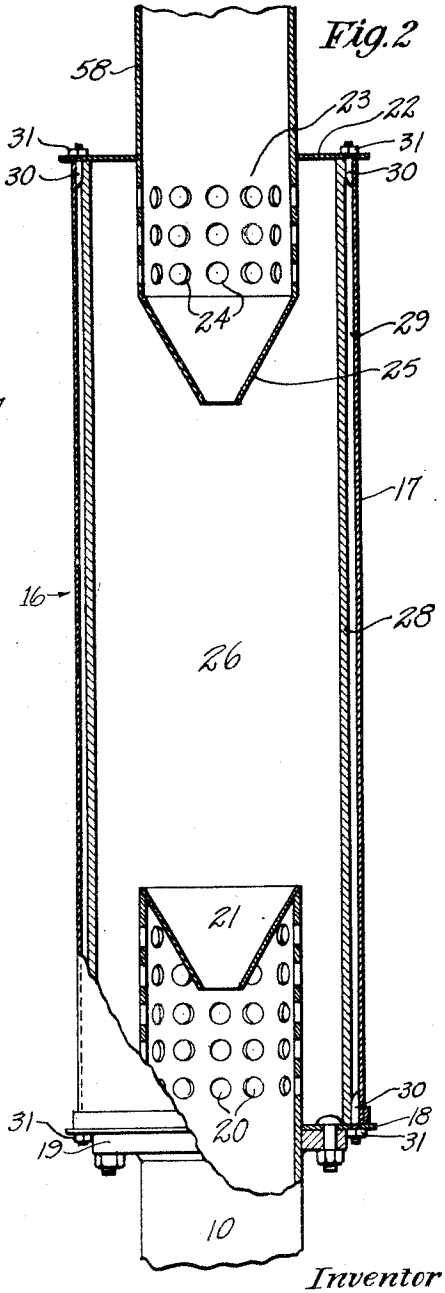


Fig. 2



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Fig. 3

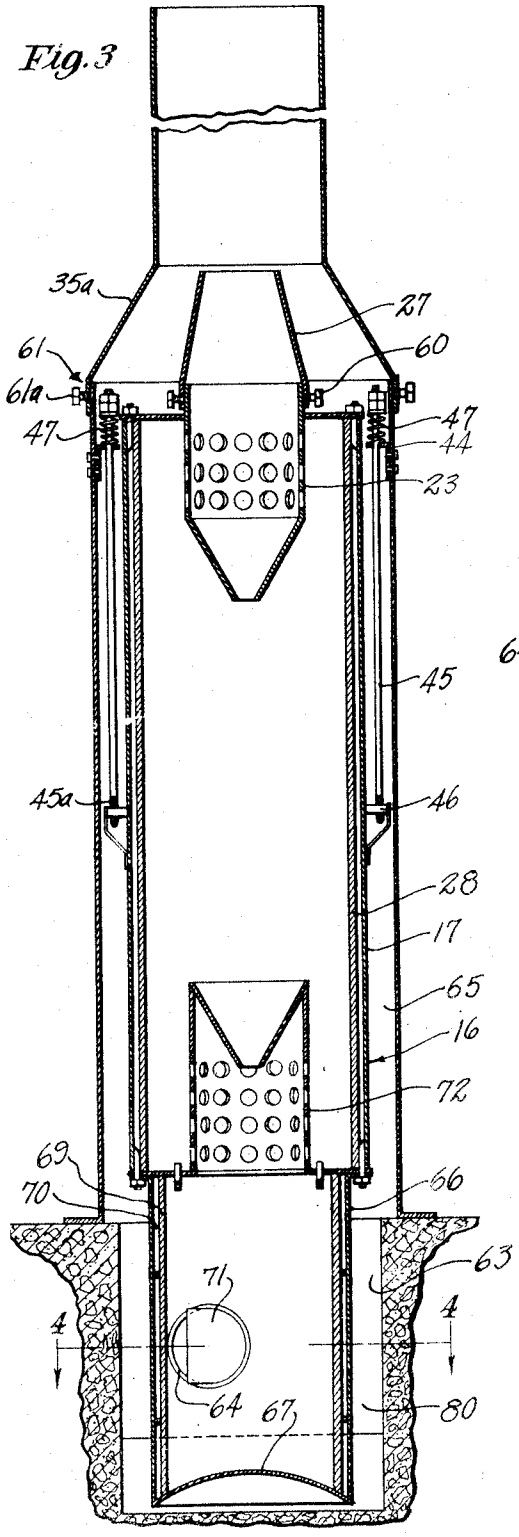
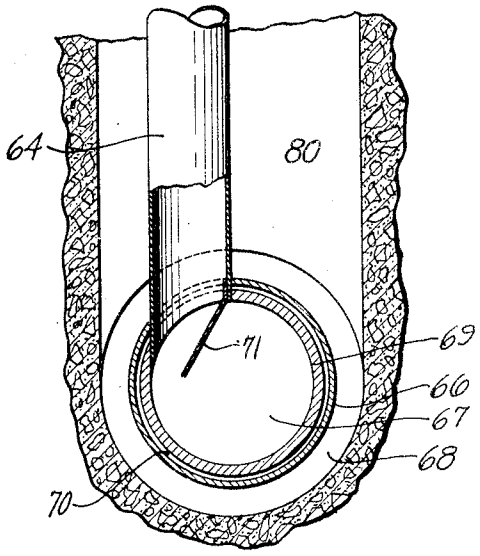


Fig. 4



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UNITED STATES PATENT OFFICE

1,966,620

MUFFLER

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Application November 26, 1932, Serial No. 644,443

11 Claims. (Cl. 60—31)

This invention has reference to mufflers for internal combustion engines, the present type of muffler being particularly, though by no means exclusively, adapted to use in connection with heavy stationary engines, for example of the compressor plant type. Mufflers of this general type also comprise the subject matter of a copending application, Ser. No. 595,732, filed Feb. 29, 1932, by my father, John S. Fluor, Sr., and myself, entitled "Muffler".

One of the principal objects of the invention is directed to improvements in mufflers of the type embodying an apertured gas passing pipe within the muffler shell, and sound absorptive material between the pipe apertures and the muffler shell, and particularly with reference to the arrangement of the sound insulating material relative to the shell and interior apertured pipe. Sound absorptive material has heretofore been used in generally similar types of mufflers, but to the best of my knowledge, it has been customary to completely fill the space between the muffler shell and the interior apertured pipe with the material so that while some muffling effect is obtained, the heat insulating capacity of the sound absorptive material is so high as to cause the metal parts of the muffler to deteriorate as a result of overheating, in a comparatively short time. In accordance with the invention, I space insulating material from the inner exhaust pipe so that the gases are required to pass through a surrounding air chamber before striking the material, and in so doing obtain the advantageous results of being able not only to prevent overheating, but to increase the effectiveness of the muffler in its sound deadening capacity. I also preferably space the insulating material from the wall of the shell to gain the principal advantage of preventing an overheating of the latter.

A further object of the invention is to provide an improved means for placing the sound insulating material within the muffler shell. I preferably form the material as an integral tubular liner, and so arrange the liner that it may be removed from the shell when replacement becomes necessary. The use, in mufflers, of insulating material of this form, and the feature of being able to remove and replace the liner as a unit, are believed to be new in the art.

A further important aspect of the invention resides in the provision of an improved system for cooling the muffler and exhaust pipe by air circulation. In accordance with my preferred form of the invention, I mount the muffler at the outside of the engine room and jacket the exhaust pipe and muffler with a conduit which extends with the exhaust pipe through a wall of the room. Cool air is supplied from the atmosphere, or room exterior, to the conduit so as to cool the exhaust pipe and muffler throughout their complete extents, that is from the point of connection of the exhaust pipe with the engine, to the muffler outlet. This type of muffler is particularly adapted for roof installations connecting with an engine having an overhead exhaust.

The above as well as additional features and objects of the invention, will be understood to best advantage from the following detailed description of certain typical and illustrative forms. Throughout the description reference is had to the accompanying drawings, in which:

Fig. 1 is a sectional view illustrating a preferred embodiment of the invention in an air cooled muffler for roof installation;

Fig. 2 is an enlarged view of the muffler proper, without the air jacket;

Fig. 3 is a view similar to Fig. 1, but showing a variational form of installation in which the muffler is connected with a horizontally extending exhaust pipe; and

Fig. 4 is a transverse section on line 4—4 of Fig. 3.

In Fig. 1, the exhaust pipe 10 is shown to connect at 11 with the exhaust port or manifold of the engine 12 in room 13, the exhaust pipe passing through an enlarged opening at 14 in wall 15 of the room. This wall is here illustrated as the sloping roof of the engine room although it is to be understood that in the broad aspects of the invention, the term "wall" is to be regarded as inclusive of the sides as well as the roof of the room, and that should the desirability arise, the exhaust pipe and surrounding pipe assemblies may be led through a side wall of the room, instead of the roof. The illustrated form of installation, however, will generally be preferred in view of the fact that it is readily adaptable for connection with an engine having overhead exhaust.

The muffler proper, generally indicated at 16, comprises a shell 17 having an annular bottom closure 18 bolted to flange 19 welded to the exhaust pipe. The exhaust pipe projects upwardly within the lower portion of the muffler shell, as indicated, and is provided with a plurality of apertures 20. In the broad aspects of the invention, the muffler may be regarded as a continuation of the exhaust pipe. A baffle 21, preferably of frusto-conical shape, constricts to a large extent, the outlet of the exhaust pipe into the muffler. The upper end of the muffler shell

is closed by a plate 22 through which a pipe 23 extends, this pipe, as in the case of the exhaust pipe, being apertured at 24 within the shell, and having at its inner end a downwardly tapering portion 25. As illustrated, the inner ends of the apertured pipes are spaced apart so as to provide within the muffler shell, a chamber 26 allowing full expansion of the exhaust gases therein. Pipe 23 carries an extension 27 which preferably is tapered upwardly into the outlet throat of the stack, hereinafter described.

As shown more clearly on the enlarged scale of Fig. 2, a tubular liner 28 is placed within the muffler shell, this liner being made of a suitable sound insulating material or composition capable of being formed into an integral tubular member. Sound absorptive liners made of asbestos and siliceous composition have proven satisfactory for this purpose. The liner is spaced at 29 from the shell and is held in spaced relation thereto by being inserted at the inside of bolts 30 which are welded to the inside of the shell 17. The end plates 18 and 22 of the muffler are held in place by nuts 31 threaded on the bolts 30. By removing end plate 22 from the shell, the liner 28 may be withdrawn from the latter. The provision of an integral tubular liner capable of being taken from the shell is of particular advantage in permitting the liner to be easily replaced when, for any reason, replacement may be found desirable.

As illustrated, the liner is spaced from the apertured portions of the pipes 10 and 23, and, as previously mentioned, the liner is also spaced from the wall of the shell. In addition to a more efficient sound deadening effect being gained by so arranging the liner relative to the apertured pipes and the shell, a further advantage is gained in that by maintaining the sound insulating material out of contact with the apertured pipes and shell, deterioration of the latter as a result of overheating, is effectively prevented. As I have previously stated, sound insulating material heretofore has been placed in a muffler shell in contact with an interior apertured pipe, but such arrangement has proven unsatisfactory for the reason that when maintained in engagement with the pipe, the sound insulating material acts also as a heat insulator to cause overheating and burning out of the interior gas passing pipe. The maintenance of an air space 29 between the liner and the shell has an advantage in addition to preventing overheating of the shell, in that the liner is rendered easily removable, without the possibility of its becoming lodged in the shell.

A stack 35, surrounding the muffler and the upper portion of the exhaust pipe, is supported on the roof 15 by suitable means, such as legs 36, the stack also preferably being braced by one or more guys 37. The stack is spaced about the muffler at 38 to provide an annular channel through which air may be circulated in the manner hereinafter described. The upper portion of the muffler shell is tapered to provide a constricted portion into which the exhaust gases from the muffler outlet 27 are discharged, the effect of discharging the exhaust gases into the stack throat being to create an up-draft of air through space 38 around the muffler. A pipe or conduit 39, annularly spaced about the exhaust pipe 10 as at 40, is attached to the wall of the stack by way of an interior ring 41, and extends down through the roof opening at 14 to a point near the connection 11 between the exhaust pipe and the engine 12.

In order that the outlet pipe 27 at the upper end of the muffler may be positioned relative to the throat 57 of the stack, to obtain the most effective up draft of air around the muffler as a result of the discharge of exhaust gases within the stack throat, I preferably make pipe 27 adjustable on the apertured pipe 23. Pipe 27 is here shown to be placed over the upper end of the apertured pipe so as to be vertically adjustable thereon, and to be held in adjusted position by set screws 60. To permit ready access to pipe 27 for adjusting it, the upper portion 35*a* of the stack is formed as a hood which is slipped, as at 61, over the upper end of the lower cylindrical section, the hood being held in place by set screws 61*a*.

The muffler and exhaust pipe are supported within the stack by way of a mounting generally indicated at 43, and in a manner such that the muffler is capable of relative vertical, and preferably also lateral, movement within the stack. Broadly speaking, any suitable means may be employed for so supporting the muffler within the stack, the herein illustrated mounting being regarded as typical only. The muffler and exhaust pipe are vertically supported on an annular angle iron 44 welded to the interior of the stack, there being a pair of hanger rods 45 extending down through openings in the angle iron and having at their lower ends, eyes 45*a* journalling trunnions 46 projecting from opposite sides of the muffler shell. The load on rods 45 is taken by springs 47 confined between angle iron 44 and nuts 48 on the upper ends of the rods. As the exhaust pipe 10 expands or contracts as a result of changing temperature conditions, vertical movement of the muffler within the stack is permitted by springs 47. Lateral movement of the muffler, as might be desirable in alining the exhaust pipe for connection with the engine, is permitted by the muffler trunnions 46 being journaled in the hanger rod eyes 45*a*.

Air from the atmosphere is supplied to the lower open end or inlet opening 39*a* of conduit 39, (which inlet opening is at the room-side of the exhaust pipe) by a pipe 50 spaced concentrically about the exhaust pipe and conduit, and open at its upper end to the atmosphere through space 51 between the pipe and the bottom of the stack. Pipe 50 being projected within the stack to the extent shown, no opportunity is given for rain or snow to gain access to the pipe and thus enter the air jacket. Pipe 50 preferably extends substantially to the point of connection of the exhaust pipe with the engine in order that the exhaust pipe may be jacketed and air cooled through its full length. The lower end of pipe 50 is closed about the exhaust pipe, a space being provided at 53 through which air passing down through the outer pipe may enter the conduit 39.

In operation, gases discharged upwardly through the exhaust pipe are partially deflected by the conical baffle 21 out through the pipe apertures 20, a comparatively small proportion of gases, however, continuing straight through the baffle opening 55. In being directed out through the apertures 20, the gases strike the sound insulating liner 28, resulting in a deadening of the explosion sounds. A further deadening effect is produced by the baffling action of member 21. The gases, after passing the apertures 20, are released into the comparatively larger volume muffler chamber 26, with resultant retardation in

the rate of flow of the gases and consequent muffling of the explosion sounds. Sound or explosive pulsations are transmitted to liner 28 and because of the physical character of the liner, are largely absorbed.

From chamber 26, the gases flow upwardly into pipe 23 through the opening at 56 and the pipe apertures 24, the constriction offered the gas stream in being required to pass through these openings resulting in additional silencing of the explosion sounds. After leaving the pipe 27, the gases are injected through the upper throat of the stack at 57 at such velocity as to cause air to be drawn up through the annular passage 38 between the nozzle and the stack. At the outlet of pipe 27, there is a commingling of the exhaust gases and muffler cooling air which, by virtue of the turbulence set up and cooling of the exhaust gases by admixture with the air, produces final muffling effect.

The up-draft of air in space 38 caused by the high velocity discharge of exhaust gases at 57, causes cool air from the atmosphere to be drawn through space 51 into pipe 50, and to flow down through the latter into the lower end of conduit 39. The cool air then flows upwardly around the exhaust pipe, out through conduit outlet 39*b* and then upwardly along the muffler to effect a substantial cooling of the exhaust gases. Cooling of the exhaust gases results in a substantial decrease in volume, and decrease in volume brings about muffling effect of the explosion sounds, in addition to the sound deadening effects produced in the muffler, as previously described.

The muffler illustrated in Fig. 2 is similar to that previously described with reference to Fig. 1, except that it is especially adapted for installation without the air cooling jacket. Here the muffler shell 17 is merely exposed to the surrounding atmosphere, and the exhaust gases, instead of being discharged into a surrounding stack, pass through a stack pipe 58 forming a continuation of the upper aperture pipe 23.

The construction shown in Fig. 3 also is generally similar to that of Fig. 1, as regards the muffler and stack construction and arrangement. The attachment of the exhaust pipe with the lower end of the muffler is somewhat modified, from that shown in Fig. 1, in view of the installation being specially designed for connection with a horizontal run of exhaust pipe leading from the engine room. A similar installation is illustrated in my copending application referred to hereinabove.

In Fig. 3, the stack rests on a concrete trench 63 within which the exhaust pipe 64, see Fig. 4, extends horizontally. The trench may be enclosed so as to provide a duct 80 surrounding the exhaust pipe, through which air may be drawn into the space 65 between the stack and muffler, and finally discharged at the top with the exhaust gases. Attached to the bottom of the muffler is a shell 66 having a bottom closure 67, the shell being spaced at 68 from the end wall of the trench. This bottom shell contains a tubular liner 69, similar to the previously described liner 28 of sound insulating material, the liner being spaced at 70 from the interior of the shell. Exhaust pipe 64 leads substantially tangentially into the shell 66, as shown in Fig. 4, a baffle 71 being placed at the exhaust pipe outlet to cause the gases to flow in a circularly rising path within the shell. The gases then rise through apertured pipe 72 leading through the bottom closure of the muffler and thence pass up through the muffler into the stack in the manner previously described with reference to Fig. 1.

As temperature changes in the exhaust pipe 64 results in its longitudinal expansion or contraction, lateral movement of the muffler and bottom shell assembly is permitted by the muffler being able to swing on the trunnions 46. This feature is also shown in my early application and is broadly claimed therein.

I claim:

1. The combination comprising, an exhaust pipe extending through the wall of a room and connected with an engine therein, a conduit surrounding a portion of the exhaust pipe within said room, said conduit having an inlet opening at the room side of said wall and an outlet opening at the opposite side of said wall, means for creating a flow of air through said conduit, from inlet to outlet, and means for supplying air to the inlet of the conduit from the exterior of the room.

2. The combination comprising, an exhaust pipe extending through the wall of a room and connected with an engine therein, a conduit surrounding a portion of the exhaust pipe within said room, means for ceating a flow of air through said conduit, and a pipe communicating with and supplying air to said conduit from the exterior of the room, said pipe extending through said wall.

3. The combination comprising, an exhaust pipe extending through the wall of a room and connected with an engine therein, a conduit surrounding said exhaust pipe and extending through said wall, and means for creating a flow of air from the exterior of the room through said conduit in the direction of exhaust-gas-flow through the exhaust pipe and along a portion of the exhaust pipe within the room.

4. The combination comprising, an exhaust pipe extending through the wall of a room and connected with an engine therein, a conduit surrounding said exhaust pipe and extending through said wall, and means for creating a flow of air by the discharge of gases through said exhaust pipe, from the exterior of the room through said conduit in the direction of exhaust-gas-flow through the exhaust pipe and along a portion of the exhaust pipe within the room.

5. The combination comprising, an exhaust pipe extending through the wall of a room and connected with an engine therein, a conduit surrounding said exhaust pipe and extending through said wall, a pipe surrounding said conduit and extending through said wall, one end of the pipe opening to the atmosphere and the other end connecting with said conduit at a point within the room, and means whereby a flow of air from the atmosphere is created by the discharge of gases through said exhaust pipe, through said conduit surrounding pipe into the conduit, and then through the conduit along the exhaust pipe.

6. The combination comprising, an exhaust pipe extending upwardly through the roof of a room and connected to an engine therein, a conduit surrounding said exhaust pipe and extending through the roof, said exhaust pipe discharging into said conduit, a pipe surrounding said conduit and passing through the roof, the upper end of the pipe opening to the atmosphere and the lower end being in air communication with said conduit below the roof, air from the atmosphere being drawn downwardly through said pipe into the conduit, and then passed upwardly around

the exhaust pipe to be discharged with exhaust gases, to the atmosphere.

7. The combination comprising, an exhaust pipe extending upwardly through the roof of a room and connected to an engine therein, a conduit surrounding said exhaust pipe and extending through the roof, said exhaust pipe discharging into said conduit, a pipe surrounding said conduit and passing through the roof, the upper end of the pipe opening to the atmosphere and the lower end being in air communication with said conduit below the roof and at substantially the point of connection of the exhaust pipe with the engine, air from the atmosphere being drawn downwardly through said pipe into the conduit, and then passed upwardly around the exhaust pipe to be discharged with exhaust gases, to the atmosphere.

8. The combination comprising, an exhaust pipe extending upwardly through the roof of a room and connected to an engine therein, a vertically extending stack and a muffler within said stack and connected to the exhaust pipe, and a conduit surrounding said exhaust pipe and extending through the roof to connect with said stack, there being a continuous space for passing air between said conduit and exhaust pipe and between the stack and muffler.

9. The combination comprising, an exhaust pipe extending upwardly through the roof of a room and connected to an engine therein, a vertically extending stack and a muffler within said stack and connected to the exhaust pipe, a conduit surrounding said exhaust pipe and extending through the roof to connect with said stack, there being a continuous space for passing air between said conduit and exhaust pipe and between the stack and muffler, and means for supplying air from the exterior of said room to said conduit at its lower end.

10. The combination comprising, an exhaust pipe extending upwardly through the roof of a room and connected to an engine therein, a vertically extending stack and muffler within said stack and connected to the exhaust pipe, a conduit surrounding said exhaust pipe and extending through the roof to connect with said stack, there being a continuous space for passing air between said conduit and exhaust pipe and between the stack and muffler, and a pipe surrounding said conduit and extending through the roof, said pipe being open to the atmosphere at its upper end and being in air communication at its lower end with said conduit.

11. The combination comprising, an exhaust pipe extending upwardly through the roof of a room and connected to an engine therein, a vertically extending stack and muffler within said stack and connected to the exhaust pipe, a conduit surrounding said exhaust pipe and extending through the roof to connect with said stack, the lower end of said conduit extending to substantially the point of connection of said exhaust pipe with the engine, there being a continuous space for passing air between said conduit and exhaust pipe and between the stack and muffler, and a pipe surrounding said conduit and extending through the roof, said pipe being open to the atmosphere at its upper end and being in air communication at its lower end with said conduit.

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