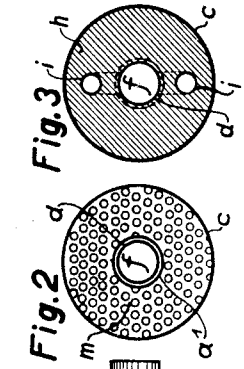
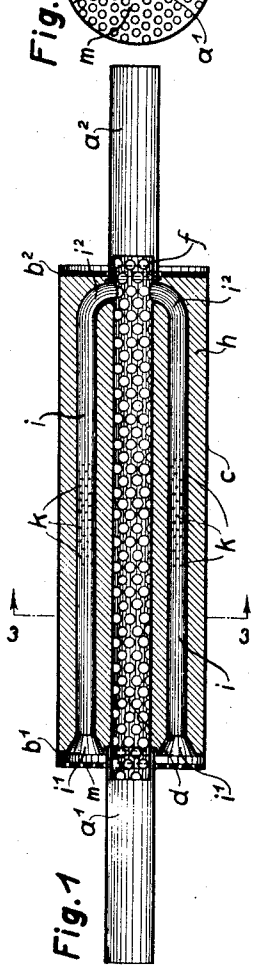
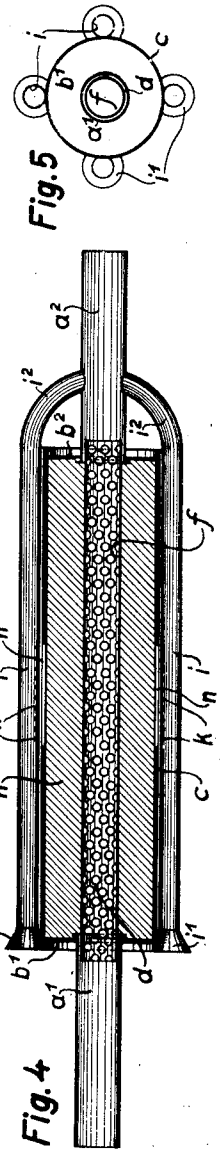
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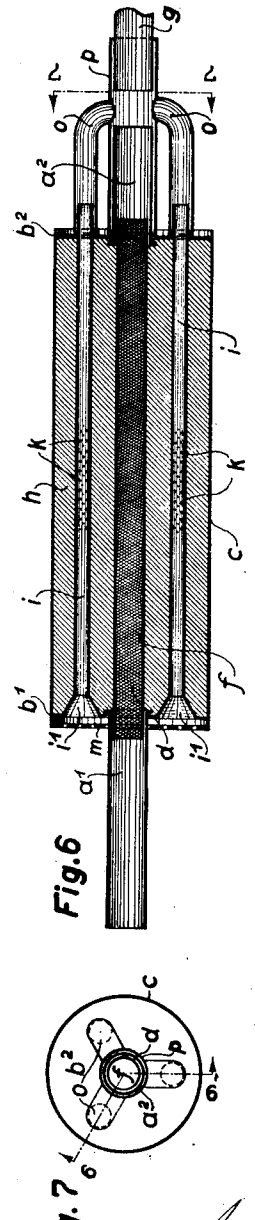
EXHAUST PIPE

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# UNITED STATES PATENT OFFICE

2,075,758

## EXHAUST PIPE

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11 Claims. (Cl. 181—46)

This invention relates to a sound deadening exhaust pipe for internal combustion engines of every type, which possesses an inner lining of heat resisting materials and a straight exhaust channel disclosing no variations to speak of over the entire length of the pipe.

In the known exhaust pipes of this class the inner lining is either not thick enough to insure silencing approximately to the same extent as the mufflers hitherto in use, or if a relatively thick inner lining has been chosen it is provided with an enamel coating on the layer facing the exhaust channel. An exhaust pipe thus constructed is quite durable and well resists the action of the hot exhaust gases, but the silencing effect thereof is unsatisfactory, as the enamel coating frustrates most of the silencing effect of the inner lining.

The invention provides an exhaust pipe which with respect to silencing effect not only equals the known silencers provided with intermediate walls, worms, sieves, or similar means, but is superior thereto. This effect is due to a novel construction of the exhaust pipe, in which according to the invention the inner lining arranged on a sieve tube has the necessary thickness, i. e., represents a multiple of that of the surrounding metal shell, and is further in communication with air pipes extending in the longitudinal direction of the pipe and being open in the direction of motion, which air pipes opening in the rear into the exhaust channel or port. The good silencing effect attained by the relatively thick inner lining coming directly in contact with the exhaust gases is enhanced still more by the fact that the fresh air flowing in through the air pipes forms an eddy in the exhaust channel, which has the effect of a buffer upon the gases coming out of the exhaust pipe, so that the latter escape almost noiselessly from the last portion of the exhaust piping into the atmosphere. Furthermore, the air supplied by the air pipes simultaneously cools the exhaust pipe and the inner lining thereof, whereby heating of the device is materially reduced.

Without appreciable changes in cross section and without any distortions of the exhaust port better silencing is attained in the free pipe than with the known mufflers. Compared with the latter, the invention affords the advantage, owing to lack of throttling of the exhaust gases, that the engine output is not interfered with, which means a considerable saving in fuel. The unhindered escape of the exhaust gases further involves easier starting of the engine and better preservation thereof, as the exhaust valves are less stressed and do not become sooted to the same extent as now. The new silencing arrangement is finally distinguished by relatively low cost, easy installation and a pleasing smooth form.

The air pipes with their ends located rearwardly in the direction of motion may preferably be curved prior to their opening into the exhaust channel, so that the guiding of the air current positively causes eddying of the fresh air entering the exhaust port. To insure best possible cooling of the pipe lining by the fresh air it is advisable to provide the air pipes over their entire length or a portion thereof, and in the latter case preferably at a central point, with lateral passages. The air pipes may either be embedded in the inner lining or arranged on the outside of the metal shell surrounding the inner lining. In the latter instance, the metal shell may be cut out within range of the passages in the air pipes.

By way of example, several embodiments of the invention are illustrated in the accompanying drawing, in which Figure 1 is a longitudinal section of the exhaust pipe; Fig. 2, a front view of the left-hand side in Fig. 1; Fig. 3, a cross section on the line **3—3**, of Fig. 1; Fig. 4, a longitudinal section of an exhaust pipe of modified form; Fig. 5, a front view of the left-hand side of Fig. 4; Fig. 6 a longitudinal section on the line **6—6** of Fig. 7 of a third modification of an exhaust pipe; and Fig. 7, a cross section on the line **7—7** of Fig. 6.

Referring to the drawing, $a^1$ and $a^2$ are two pipe connections, the connection $a^1$ being connected with the exhaust pipe of the engine and the connection $a^2$ with the last portion of the exhaust piping opening into the atmosphere, if behind the silencing device such a pipe section is still available. The two pipe connections $a^1$ and $a^2$ are arranged on the end walls $b^1$, $b^2$ of a metal shell $c$ and jointly carry a sieve tube $d$ disposed inside the cylinder shell $c$ concentrically with the latter, the free inner space of the tube forming the exhaust channel or port $f$. The annular space between the sieve tube $d$ and the outer shell $c$, which as indicated has a considerable diameter compared with the thickness of the shell $c$, is filled with sound-deadening heatproof material, such as asbestos, steel wool, etc. It has been found that cotton slag alone or in connection with asbestos represents a cheap material particularly suited for this purpose. The inner lining $h$ of the exhaust pipe, owing to the pas-

sages in the sieve tube *d* which in the constructions according to Figs. 1 and 4 consists of a perforated pipe and in the example according to Fig. 6 of wire gauze, comes into direct contact with the exhaust gases and can fully exert its silencing effect, whereas the sieve tube *d* insures sufficient durability of the inner lining *h*.

The exhaust pipe described is, according to the invention, provided with additional air pipes *i* which supply cooling air to the lining *h* but which chiefly further the desired silencing effect by producing in the exhaust port *f* air eddies to act as buffers for the exhaust gases passing through the main channel. By means of these buffers the sound waves causing the heavy noise of the exhaust are damped and the gases expanded before they escape into the atmosphere. In this manner a surprisingly good silencing effect is attained without any throttling of the exhaust gases.

In the construction according to Figs. 1 to 3 two air tubes *i* are provided which are embedded in the inner lining *h*. They extend parallel to the sieve tube *d* and with their orifices lying in front in the direction of driving are secured to the adjacent correspondingly recessed front wall $b^1$ of the metal casing *c*, $b^1$, $b^2$, for instance by welding. To insure good interception of the fresh air the inlet openings $i^1$ are funnel-shaped. With their curved rearward ends $i^2$ the air pipes *i* open into the main channel *f*, the curved ends $i^2$ being either connected with the sieve tube *d* as shown or with the connection $a^2$ which is then correspondingly extended inwardly. On a central portion the pipes *i* over their entire circumference with lateral passages or holes *k* through which a part of the inflowing fresh air is directly supplied to the inner lining *h*, so that at the specially heated portions of the exhaust pipe improved cooling is effected. In front of the funnel-shaped inlet openings $i^1$ of the air pipes *i* a sieve *m* is arranged for preventing coarser particles of dirt from entering the pipes *i*. The annular sieve *m* is secured between the front end of the metal cylinder *c*, slightly projecting from the front wall thereof, and the connection $a^1$.

Compared with the construction described, the exhaust pipe shown in Figs. 4 and 5 differs in so far as four air pipes *i* are provided on the outer surface of the cylinder *c*. The curved rearward ends $i^2$ of the pipes *i* are connected outside the cylinder *c* to an exposed portion of the connection $a^2$. The pipes *i* possess on a central portion thereof a plurality of passages *k* arranged in a row and the metal casing *c* has a slotlike recess *n* within range of the passages *k* to convey fresh air directly to the insulating layer *h*. A sieve in front of the extended inlet openings $i^1$ is dispensed with.

The exhaust pipe according to Figs. 6 and 7 is provided with three air pipes *i* staggered 120° relative to one another. These pipes, however, do not pass directly into the main channel *f* as in the first example, but are rectilinearly guided through the rear end wall $b^2$ and project a distance therefrom. On these freely projecting pipe ends elbows *o* are provided and arranged on a joint middle pipe *p* which serves as coupling member for the outlet connection $a^3$ of the exhaust pipe and the exhaust gas piping *g* connected therewith. The connecting pipe *p* equipped with the bends *o* permits easy and simple installation of the exhaust pipe according to the invention in the exhaust main.

With respect to its other parts, the exhaust pipe shown in Figs. 6 and 7 substantially corresponds to the previously described first construction.

The invention is of course not restricted to the examples shown which may be varied in many ways without departing from the scope of the invention. For instance, the number of air pipes may be chosen at will and the rectilinear arrangement thereof is not absolutely necessary.

I claim:—

1. Sound deadening exhaust pipe for internal combustion engines, comprising an inner lining of heatproof substances, a metal cylinder surrounding the inner lining, a straight exhaust channel having no appreciable variations over the entire length of the pipe, a sieve tube for carrying the inner lining, said inner lining representing a multiple of the thickness of the surrounding metal cylinder, and air pipes extending in the longitudinal direction of the pipe and open in front in driving direction, said air pipes communicating with the inner lining and opening in the rear into the exhaust channel.

2. An exhaust pipe according to claim 1, wherein the air pipes are embedded in the inner lining and connected with their inlet openings to the correspondingly recessed end wall of the metal cylinder.

3. An exhaust pipe according to claim 1, wherein the air pipes are arranged on the outside of the metal casing surrounding the inner lining.

4. An exhaust pipe according to claim 1, wherein the air pipes on their contact surfaces with the inner lining are provided with lateral air passages over their entire length.

5. An exhaust pipe according to claim 1, wherein the air pipes are provided on their contact surfaces with the inner lining only in the middle portion with lateral air passages.

6. An exhaust pipe according to claim 1, wherein the air pipes on their contact surfaces with the inner lining are provided with lateral air passages and the metal casing surrounding the inner lining is recessed within range of said passages.

7. An exhaust pipe according to claim 1, wherein the air pipes with their ends rearwardly disposed in the direction of motion are curved and with their outlet openings are directly connected with the exhaust channel.

8. An exhaust pipe according to claim 1, wherein the rectilinear rearward ends of the air pipes project beyond the rear end wall of the metal casing and open into bends extending into a middle pipe for connecting the rearward connection of the exhaust pipe with the exhaust main.

9. An exhaust pipe according to claim 1, wherein the inlet openings of the air pipes are expanded in funnel-like fashion.

10. An exhaust pipe according to claim 1, wherein a sieve is arranged in front of the inlet openings of the air pipes.

11. An exhaust pipe according to claim 1, wherein the inner lining consists wholly or partly of cotton slag.

ALFRED FREUND.