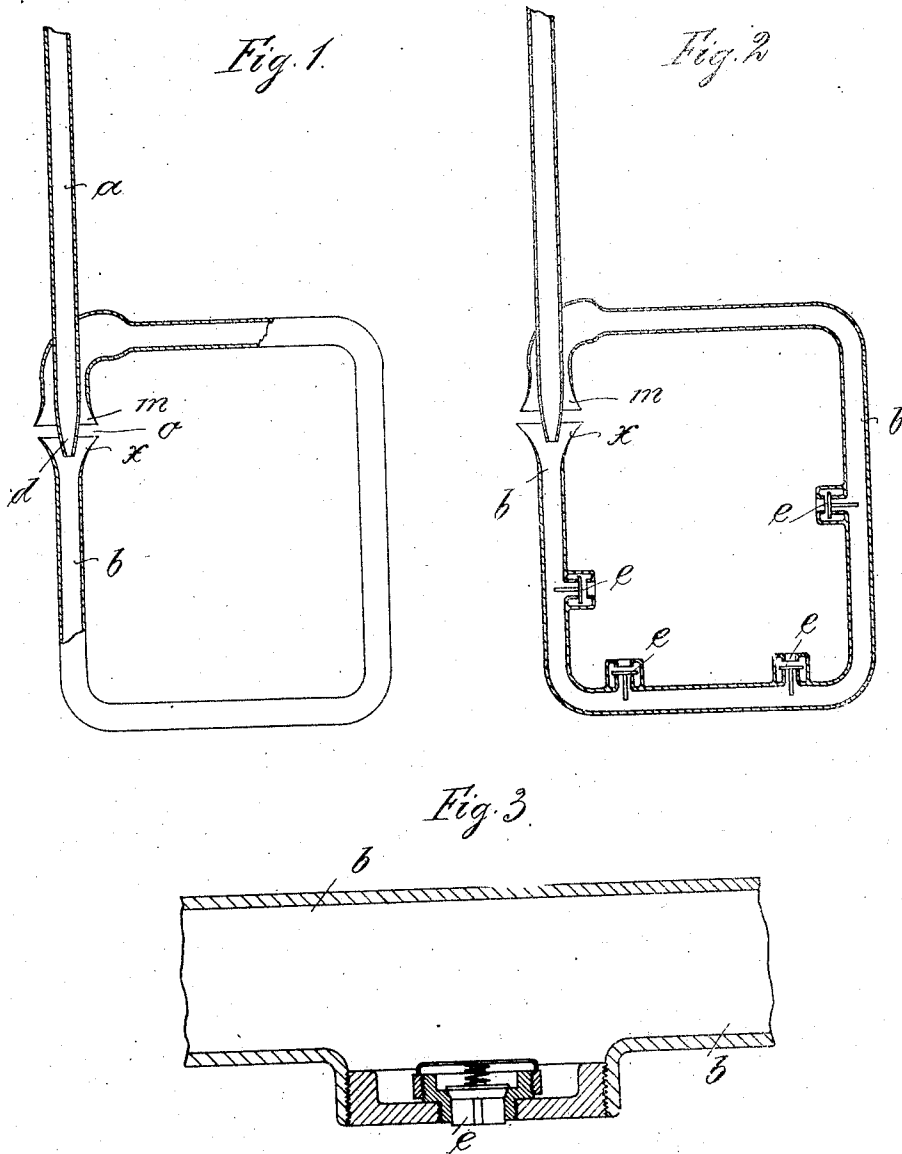


P. FEHDE.
EXHAUST SILENCER FOR EXPLOSION MOTORS.
APPLICATION FILED JULY 5, 1911.

1,044,157.

Patented Nov. 12, 1912.
2 SHEETS—SHEET 1.



Witnesses:
Corinne Myers.
Vera Paulsen.

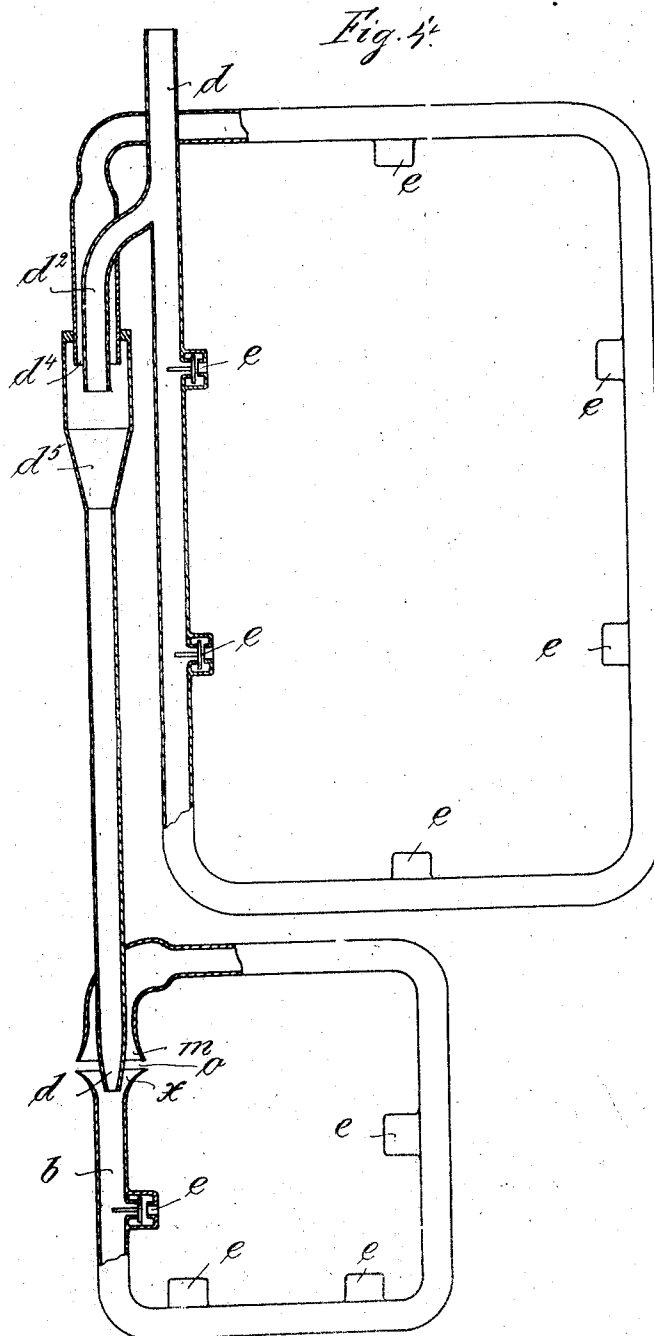
Inventor:
Paul Fehde
by L. K. Bohme
Attorney.

BEST AVAILABLE COPY

P. FEHDE.
EXHAUST SILENCER FOR EXPLOSION MOTORS.
APPLICATION FILED JULY 5, 1911.

1,044,157.

Patented Nov. 12, 1912.
2 SHEETS—SHEET 2.



Witnesses:
Corinne Myers.
Vera Paulsen.

Inventor:
Paul Fehde
by L. R. Bohm,
Attorney

UNITED STATES PATENT OFFICE.

PAUL FEHDE, OF BERLIN, GERMANY.

EXHAUST-SILENCER FOR EXPLOSION-MOTORS.

1,044,157.

Specification of Letters Patent:

Patented Nov. 12, 1912.

Application filed July 5, 1911. Serial No. 636,860.

To all whom it may concern:

Be it known that I, PAUL FEHDE, a subject of the King of Prussia, and a resident of 70^e Schönhauser Allee, Berlin, German Empire, physician, have invented an Improved Exhaust-Silencer for Explosion-Motors.

This invention relates to an improved exhaust silencer for explosion motors and also comprises means whereby the unburned exhaust gases may be consumed before passing into the atmosphere.

The noise ensuing from exhaust is caused by air filling the more or less evacuated space resulting from the rapid and free exit of the gases from the exhaust pipe, an evacuated space being formed after each exhaust in the exhaust pipe or at the outlet of the latter owing to the high velocity at which the exhaust gases issue. Owing to the rapid expansion and cooling of the exhaust gases in the atmosphere water is condensed therefrom and the gases issue in the form of a bluish white vapor having a very unpleasant odor.

According to this invention the exhaust gases after their exit from the exhaust pipe are constrained to make a circuitous path and to return and flow past the outlet of the exhaust pipe, the gases being capable of rapidly expanding and cooling without the intervention of baffle plates or like obstructions and the oil vapor and steam being thereby condensed while the return of the gases or the admission of air into the vacuum formed at the outlet of the exhaust pipe is prevented owing to the velocity at which the gases returning thereto flow past the outlet end of the exhaust pipe. The gases finally issue in a perfectly cold state unvaporized and free from odor. The gases issuing from the exhaust pipe are caused to return and flow past the outlet end of the exhaust pipes by the pressure of the next succeeding exhaust.

In order to effect a complete combustion of the exhaust gases I provide means whereby the latter after returning to the outlet end of the exhaust pipe are caused to ignite before passing into the atmosphere.

In order that the invention may be more clearly understood reference is made to the accompanying drawings which show by way of example various methods of carrying out my invention.

Figure 1 is a sectional elevation showing

one construction of my improved apparatus. Fig. 2 is a similar view to Fig. 1 showing a slightly modified form of the same. Fig. 3 is a detail view of the valves diagrammatically illustrated in Fig. 2. Fig. 4 is a sectional elevation of a still further modified form of apparatus.

Referring to Fig. 1 of the drawings *a* is the exhaust pipe which is inserted to a certain depth somewhat as shown into the open end *x* of a circuitous conduit *b* which is of larger diameter than the nozzle *d* of the exhaust pipe *a*. The outlet end *m* of the circuitous conduit *b* opens just above the inlet end *x*, a break *o* being formed between the inlet and outlet ends *x* and *m* respectively.

On the first exhaust of gases from the pipe *a* the air-cushion in the pipe *b* is set in rapid motion or driven out before the exhaust gases so that the air and gases issue from the pipe *b* at *m* at such a velocity that they cannot return into the vacuum formed at or within the nozzle *d* after the first exhaust and the noise caused by exhaust is thereby obviated. Part of the air and gases issuing at *m* pass into the outer atmosphere at *o*, the remainder of the gases returning into the tube *b* past the nozzle *d*.

As the gases issuing from the exhaust pipe *a* attain a velocity of about 800 meters per second, a current is created in the return conduit *b* of about 200 meters per second according to the relative diameters of the return conduit *b* and exhaust nozzle *d* and owing to the high velocity therefore at which the gases issue from the conduit *b* at *m* there is no possibility of the same returning into the exhaust pipe *a*.

It is preferable to form the open ends of the conduit *b* of funnel shape as shown. It will be seen that there are three currents at the nozzle *d*, viz. the inner exhaust gases issuing from the nozzle *d*, the air and gases issuing from the outlet end and surrounding the exhaust gases from the nozzle *d* and the gases escaping at *o* and as the flow of the gases is not limited in any way, the possibility of the formation of heat by contact with obstructions is obviated.

The gases can of course be allowed to escape at any point in the length of the return conduit *b* through slots, openings or the like, and instead of the inlet and outlet ends *x* and *m* of the return conduit *b* entirely surrounding the nozzle *b* they may only

partly surround the same or open in proximity thereto.

A slight modification of the invention is shown in Fig. 2 in which means are provided for enabling the exhaust gases to be burned before passing into the atmosphere. For this purpose return valves *e* are provided in the return pipe *b*, the return valve being adapted to open inwardly against the action of a spring, as shown in detail in Fig. 3. Air may thus be admitted to the exhaust gases in the conduit *b* intimately mixing with the same and passing by the nozzle *d* where the mixture of air and exhaust gases is ignited by the hot exhaust gases issuing from the nozzle *d*. Any other suitable form of air admission may be provided for admitting air into the return-conduit *b*.

A still further modified form of apparatus is illustrated in Fig. 4. In this case the exhaust pipe *d'* forks into a short pipe *d²* and into a return conduit *d³* which may be provided with air-inlet valves *e*. The return pipe *d³* open into a chamber *d⁵* surrounding the short tube *d²*, the chamber *d⁵* opening into a pipe *a* provided with an exhaust nozzle *d* opening into a return pipe *b* of similar construction to that shown in Fig. 2. In this arrangement part of the exhaust gases from the pipe *d'* pass by way of the pipe *d²* into the chamber *d⁵* while the remainder of the gases pass along the conduit *d³* mixing with air admitted thereto by way of the valves *e* and issuing from the return pipe *d³* at *d⁴* surrounding the short tube *d²*, where the mixture of air and gases is ignited in the chamber *d⁵* by the hot exhaust gases issuing from the pipe *d²* and the consumed exhaust gases and air then pass by way of the pipe *a* to the nozzle *d*, where means are provided for silencing the exhaust in the same manner as shown in Fig. 2.

I claim:—

1. In combination with the exhaust pipe of an explosion motor, a circuitous pipe of substantially uniform cross-section and open only at its ends, said pipe ends being arranged in alinement with and in proximity to each other but forming a gap between them, and the outlet end of said exhaust pipe opening into the inlet end of said circuitous pipe while the outlet end of said circuitous pipe opens somewhat in the rear of the outlet end of said exhaust pipe.

2. In combination with the exhaust pipe of an explosion motor, a circuitous pipe of substantially uniform cross-section and open only at its ends, said pipe ends being flared outwardly and arranged in alinement with and in proximity to each other but forming

a gap between them, and the outlet end of said exhaust pipe opening into the inlet end of said circuitous pipe while the outlet end of said circuitous pipe opens somewhat in the rear of the outlet end of said exhaust pipe.

3. In combination with the exhaust pipe of an explosion motor, a circuitous pipe of substantially uniform cross-section and open only at its ends, said pipe ends being arranged in alinement with and in proximity to each other but forming a gap between them, and the outlet end of said exhaust pipe opening into the inlet end of said circuitous pipe while the outlet end of said circuitous pipe opens somewhat in the rear of the outlet end of said exhaust pipe and inwardly-opening check valves in the wall of said circuitous pipe for enabling the admission of air thereto.

4. An exhaust silencer for explosion motors and means for consuming the exhaust gases comprising, in combination, a circuitous pipe forming a continuation of the exhaust pipe, means for admitting air to said circuitous pipe, a branch pipe from said exhaust pipe, the outlet end of said circuitous pipe surrounding said branch pipe, a chamber into which said circuitous pipe and branch pipe open, a secondary exhaust pipe connected to said chamber, and a second circuitous pipe into whose inlet end said secondary exhaust pipe opens, the outlet end of said second circuitous pipe surrounding the outlet end of said secondary exhaust pipe in proximity to the outer end of the latter.

5. An exhaust silencer for explosion motors and means for consuming the exhaust gases comprising, in combination, a circuitous pipe forming a continuation of the exhaust pipe, means for admitting air to said circuitous pipe, a branch pipe from said exhaust pipe, the outlet end of said circuitous pipe surrounding said branch pipe, a chamber into which said circuitous pipe and branch pipe open, a secondary exhaust pipe connected to said chamber, and a second circuitous pipe into whose inlet end said secondary exhaust pipe opens, the outlet end of said second circuitous pipe surrounding the outlet end of said secondary exhaust pipe in proximity to the outer end of the latter, the inlet and outlet ends of said second circuitous pipe being in axial alinement and funnel-shaped.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

PAUL FEHDE.

Witnesses:

HENRY HASPER,
WOLDEMAR HAUPT.