

June 13, 1950

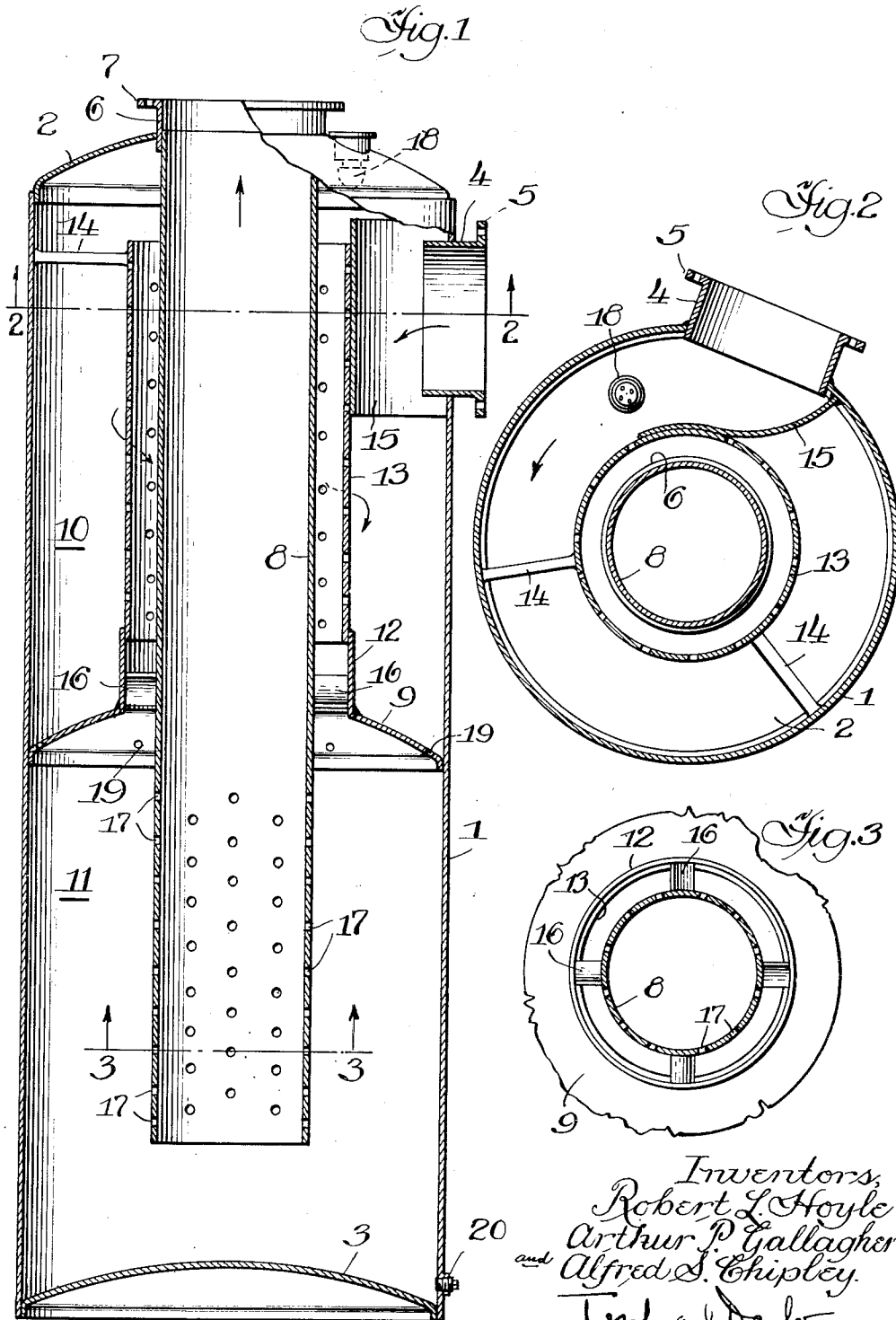
R. L. HOYLE ET AL

2,511,713

ENGINE EXHAUST SNUBBER AND SPARK ARRESTER

Filed Aug. 31, 1948

2 Sheets-Sheet 1



Inventors,
Robert L. Hoyle
Arthur P. Gallagher
and Alfred S. Chipley.
Trench and Darbo Attys.

June 13, 1950

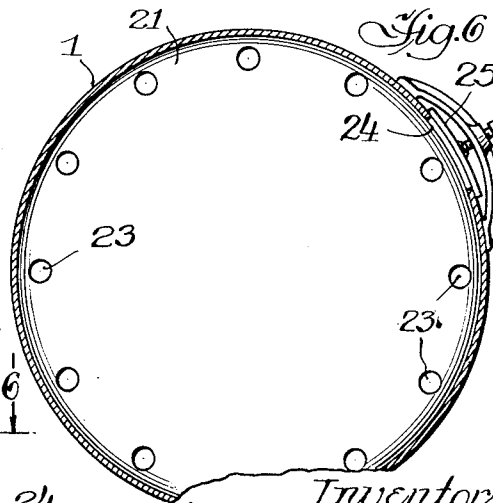
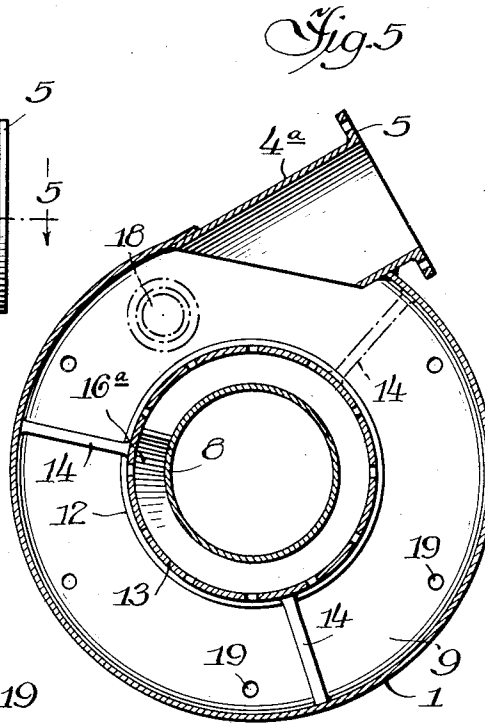
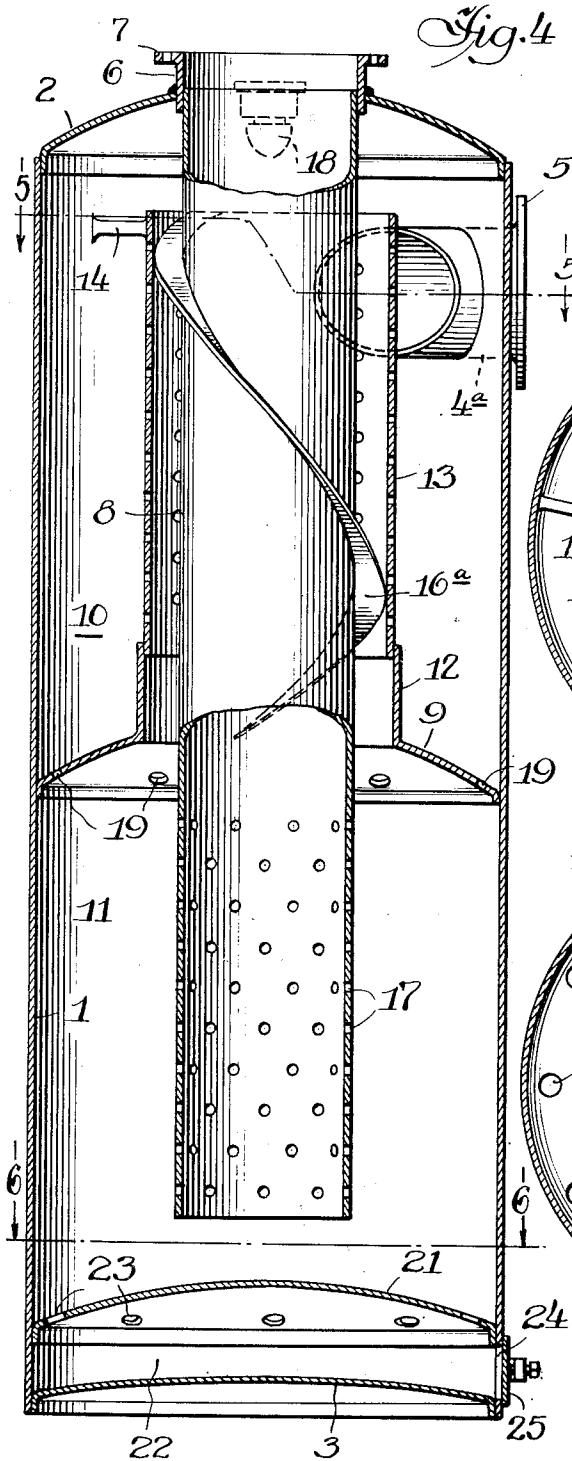
R. L. HOYLE ET AL

2,511,713

ENGINE EXHAUST SNUBBER AND SPARK ARRESTER

Filed Aug. 31, 1948

2 Sheets-Sheet 2



Inventors,
Robert L. Hoyle
Arthur P. Gallagher
and
Alfred S. Chipley
Lesch and Doris Attys.

UNITED STATES PATENT OFFICE

2,511,713

ENGINE EXHAUST SNUBBER AND SPARK
ARRESTER

Robert L. Hoyle, Libertyville, and Arthur P. Gallagher and Alfred S. Chipley, Mundelein, Ill.,
assignors to Burgess-Manning Company, Libertyville, Ill., a corporation of Illinois

Application August 31, 1948, Serial No. 47,118

14 Claims. (Cl. 183—21)

1

This invention relates to silencers or snubbers for the exhaust gases of internal combustion engines and particularly to such equipment for industrial engines.

The principal object of the invention is to provide a compact but efficient snubber having at least two silencing sections. Another object is to so design the unit that it will serve as a spark suppressor or arrester as well as a silencer. A further object is to incorporate means in such equipment to cool and wash the gases as they pass through the same.

In the accompanying drawings,

Fig. 1 is a vertical sectional view of a preferred form of the invention;

Fig. 2 is a cross-sectional view of the device of Fig. 1 taken at the line 2—2 thereof;

Fig. 3 is a detailed sectional view taken at the line 3—3 of Fig. 1;

Fig. 4 is a vertical sectional view of a combined snubber and spark arrester incorporating certain alternative forms of structural elements;

Fig. 5 is a cross-sectional view taken at the line 5—5 of Fig. 4, and

Fig. 6 is a cross-sectional view taken at the line 6—6 of Fig. 4.

The installation of a snubber for a large stationary industrial engine is frequently most conveniently done by providing a suitable foundation and standing the snubber, which is generally cylindrical in form, upon the foundation in vertical position. The engine exhaust pipe is then connected to an inlet fitting provided on the side of the snubber and the snubber tail pipe is connected to the top of the unit to carry the gases away to a point where they may be exhausted to the atmosphere. In many instances, the most convenient location of the inlet fitting is near the top of the snubber. Additionally, it is an almost universal rule of design that the snubber must be as small as possible to minimize cost and space requirements.

The snubber herein described is designed to meet these requirements.

The device illustrated in Figs. 1 to 3 comprises a housing consisting of a cylindrical side wall 1, top wall 2, and a bottom wall 3. An inlet fitting 4, having a flange 5 for connection of the engine exhaust pipe thereto, is welded in a suitable opening in side wall 1 near the top of the snubber. This fitting opens into the interior of the snubber. A similar outlet fitting 6 having a flange 7 for connection of the tail pipe thereto is welded in an opening centered in top wall 2. A conduit 8 extends downwardly from outlet fitting 6 con-

2

centrically with cylindrical side wall 1 and terminates short of bottom wall 3.

A transverse partition 9 is located approximately midway between the top and bottom of the snubber and divides the interior thereof into two sections 10 and 11. Partition 9 has a central opening in which a collar 12 having a diameter substantially greater than that of conduit 8 is welded. A perforated conduit 13 extends upwardly from collar 12 and terminates short of top wall 2. Suitable braces 14 may be employed to hold the upper end of conduit 13 firmly in position. The portion of conduit 8 which extends beyond partition 9 is perforated.

A deflection plate or baffle 15 extends from side wall 1 to conduit 13 at inlet fitting 4 for a short distance above and below the fitting. This deflection plate may be slightly curved, as shown, and is adapted to deflect the gas stream passing into the snubber through inlet fitting 4 and cause it to flow circumferentially within section 10. Four small flat or slightly curved deflection plates 16 are circumferentially spaced in the annular passageway between conduit 8 and collar 12. These elements are suitably fastened to conduit 8 and collar 12, as by welding, and serve to support the conduit. They are inclined, as shown in Figs. 1 and 3, the direction of inclination being correlated with the position of deflection plate 15 for the purposes more fully pointed out below.

The device thus described is a complete unit capable of efficiently smoothing the flow of exhaust gases to prevent noise. The device also operates as a spark suppressor.

The path of the gases flowing through the snubber is indicated by arrows. The severely pulsating exhaust gases enter through inlet fitting 4 and are immediately deflected to one side and the gases are thus caused to whirl within the annular space of section 10 between conduit 13 and side wall 1. These gases then flow into the annular passageway between the conduit 8 and conduit 13, partly through the perforations in the latter and partly through the open upper end of this conduit. This partially smoothed stream of gases continues spirally downwardly through the area of deflection plates 16 which are inclined in a direction and to an extent to permit the continued spiral flow and, if desired, to increase the circumferential component of flow. Due to the inertia of the gases, they continue to flow at high velocity in a spiral path within section 11 and pass into conduit 8 through perforations 17 which are distributed in the portion of

conduit 8 which extends into section 11 of the snubber, or a portion of the gases may enter the conduit through the open lower extremity thereof. The gas stream is then conducted upwardly through conduit 8 to the tail pipe and eventually to the atmosphere.

The centrifugal action of the gases in both sections 10 and 11 of the snubber produce two beneficial effects. The pressure of the gases is greatest immediately adjacent the wall 1 of the snubber and decreases progressively toward the center of the unit. This condition aids the natural tendency toward equalization of pressures within the expansion space of sections 10 and 11 with the result that the flow of the gases is greatly smoothed as they pass successively through the two sections of the snubber. This relatively smoothly flowing stream is not capable of causing noise as it is exhausted to the atmosphere.

The second advantageous effect of the centrifugal action of the gases results from the fact that any solid particles entrained in the exhaust gases pass to the outer fringes of flow at the surface of side wall 1. They repeatedly strike against this wall and such friable materials as carbon are broken up into fine particles. These small pieces of carbon are generally incandescent and would constitute a fire hazard if exhausted to the atmosphere. The breaking up of these pieces cools the material and renders the sparks harmless.

Under certain conditions, explosive mixtures of gases are present in the exhaust system, including the snubber itself and explosions result which are not only destructive of the entire exhaust equipment but which may also start a fire in the vicinity of the explosion. Explosions due to these causes may be avoided by reducing the temperature of the exhaust gases below the ignition point as soon as possible after they are expelled from the engine. This may be done effectively by introducing water into the gas stream in such a manner that the gases are almost instantaneously cooled. For this purpose, a spray head or atomizer 18 may be installed in top wall 2 of the snubber of Fig. 1. The nozzle for delivering the finely divided cooling water into the snubber is arranged to project the spray continuously into the exhaust gas stream as it emerges from inlet fitting 4 to enter section 10 of the unit. Sparks are quenched and the hot gases quickly convert the water to steam, losing the heat of vaporization in doing so, whereby the temperature of the gases is substantially reduced.

If the quantity of water introduced into the gas stream does not exceed the amount which is converted into steam by the heat of the gases, it is unnecessary to make provision for the removal of liquid water. However, in order to achieve the maximum possible cooling effect, it is generally desirable to introduce a small excess of water. It then becomes necessary to remove the water particles which become entrained in the rapidly flowing gas stream to prevent the spraying of dirty water from the tail pipe. This separation is accomplished in the snubber unit as a result of the centrifugal action which throws the heavier water particles to the side wall 1. This action may take place in both sections 10 and 11, the water separated in section 10 passing through drain holes 19 to section 11. All of the water thus separated from the gases flows to the bottom of the unit and suitable means for draining this water from the snubber may be provided where plug 20 is shown.

When an excess of water is introduced into the

device, a scrubbing action supplements the centrifugal action in the removal of solid and liquid particles. The water takes on a load of such particles as the spray passes through the gases and as the separated water flows down the side walls of the unit.

Certain alternative forms of structural elements of the snubber are illustrated in Figs. 4 to 6. In this device, parts similar to those of the snubber of Fig. 1 are similarly numbered.

In place of the deflection plate 15 of the device of Fig. 1, inlet fitting 4a is arranged to direct the incoming stream of exhaust gases tangentially into section 10. In place of the small inclined deflection plates 16 of Fig. 1, a spiral vane 16a is arranged within the annulus between conduits 8 and 13 to provide a spiral passageway for the gases passing from section 10 to section 11. An additional partition 21 is arranged as a false bottom in spaced relation to bottom wall 3 to form a trap or reservoir 22. A plurality of spaced openings 23 afford limited connection between the volume of section 11 and trap 22. A suitable handhole 24, having a cover 25, is provided for access to trap 22.

As in the case of the device of Figs. 1 to 3, the apparatus of Fig. 4 may be operated either with or without water. In either event, solid or liquid particles carried into the snubber by the exhaust gases will pass into trap 22 through openings 23 and may be removed from the trap as the accumulations require. Other forms of trap may be employed. If desired, a separate trap may be provided for section 10 to remove a portion of the particles while the gases are passing through that section. Operation of the device of Fig. 4 is otherwise similar to that of Fig. 1.

The modified forms of elements shown in the device of Fig. 4 may be employed in the device of Fig. 1. However, the combination illustrated in Fig. 1 is considered to be the preferred embodiment of the invention.

Invention is claimed as follows:

1. A snubber for pulsating gases comprising a housing having a cylindrical side wall and first and second end walls, said side wall having an inlet opening therein near the first end wall and said first end wall having a centrally located outlet opening therein, a transverse partition intermediate said end walls dividing the volume of said housing into two sections, said partition having a centrally located opening therein, an open-ended perforated conduit connecting with said opening in said partition and extending toward said first end wall but stopping short thereof, a second open-ended conduit having a smaller diameter than said first-mentioned conduit extending from said outlet opening through said first-mentioned conduit toward said second end wall but stopping short thereof, the portion of said second conduit between said partition and said second end wall being perforated, and means for causing the gases to whirl within the housing after passing through said inlet opening.

2. A snubber in accordance with claim 1 in which the means for causing the gases to whirl comprises a baffle extending from the side wall adjacent the inlet opening to the first-mentioned conduit so arranged in the path of the gas stream that the gases are deflected in a sidewise direction.

3. A snubber in accordance with claim 2 and including a plurality of similarly oriented circumferentially spaced inclined deflection plates

radially arranged within the annular passageway between the first-mentioned conduit and the second conduit near the partition.

4. A snubber in accordance with claim 1 in which the means for causing the gases to whirl comprises an inlet conduit arranged tangentially with respect to the side walls of the housing and opening into the housing at the inlet opening.

5. A snubber in accordance with claim 4 and including a plurality of similarly oriented circumferentially spaced inclined deflection plates radially arranged within the annular passageway between the first-mentioned conduit and the second conduit near the partition.

6. A snubber in accordance with claim 1 and including a spiral vane arranged between the first-mentioned conduit and the second conduit.

7. A snubber in accordance with claim 6 in which the means for causing the gases to whirl comprises an inlet conduit arranged tangentially with respect to the side walls of the housing and opening into the housing at the inlet opening.

8. A snubber in accordance with claim 1 and including a second transverse partition spaced between the end of the second conduit and the second end wall to form a dust trap enclosure, said second partition having spaced peripheral openings therein.

9. A combined snubber and spark arrester comprising a housing having a cylindrical side wall and first and second end walls, said side wall having an inlet opening therein near the first end wall and said first end wall having a centrally located outlet opening therein, a transverse partition intermediate said end walls dividing the volume of said housing into two sections, said partition having a centrally located opening therein, an open-ended perforated conduit connecting with said opening in said partition and extending toward said first end wall but stopping short thereof, a second open-ended conduit having a smaller diameter than said first-mentioned conduit extending from said outlet opening through said first-mentioned conduit toward said second end wall but stopping short thereof, the portion of said second conduit between said partition and said second end wall being perforated, and means for injecting a spray of water into the gases as they enter the housing.

10. A combined snubber and spark arrester in accordance with claim 9 wherein said means for injecting a spray of water into the gases comprises a spray head mounted in the first end wall and adapted to be connected to a continuous supply of water under pressure.

11. A combined snubber and spark arrester comprising a housing having a cylindrical side wall and first and second end walls, said side wall having an inlet opening therein near the first end wall and said first end wall having a centrally located outlet opening therein, a transverse partition intermediate said end walls dividing the volume of said housing into two sections, said partition having a centrally located opening therein, an open-ended perforated conduit connecting with said opening in said partition and extending toward said first end wall but stopping short thereof, a second open-ended conduit having a smaller diameter than said first-mentioned conduit extending from said outlet opening through said first-mentioned conduit toward said second

end wall but stopping short thereof, the portion of said second conduit between said partition and said second end wall being perforated, a baffle extending from the side wall adjacent the inlet opening to the first-mentioned conduit so arranged in the path of the gas stream that the gases are deflected in a sidewise direction, a plurality of similarly oriented circumferentially spaced inclined deflection plates radially arranged within the annular passageway between the first-mentioned conduit and the second conduit near the partition, and a spray head mounted in the first end wall and adapted to be connected to a continuous supply of water under pressure and inject a spray of water into the gases as they enter the housing.

12. A combined snubber and spark arrester in accordance with claim 11 and including a second transverse partition spaced between the end of the second conduit and the second end wall to form a dust trap enclosure, said second partition having spaced peripheral openings therein.

13. A combined snubber and spark arrester comprising a housing having a cylindrical side wall and first and second end walls, said side wall having an inlet opening therein near the first end wall and said first end wall having a centrally located outlet opening therein, a transverse partition intermediate said end walls dividing the volume of said housing into two sections, said partition having a centrally located opening therein, an open-ended perforated conduit connecting with said opening in said partition and extending toward said first end wall but stopping short thereof, a second open-ended conduit having a smaller diameter than said first-mentioned conduit extending from said outlet opening through said first-mentioned conduit toward said second end wall but stopping short thereof, the portion of said second conduit between said partition and said second end wall being perforated, an inlet conduit arranged tangentially with respect to the side walls of the housing and opening into the housing at the inlet opening, a spiral vane arranged between the first-mentioned conduit and the second conduit, and a spray head mounted in the first end wall and adapted to be connected to a continuous supply of water under pressure and inject a spray of water into the gases as they enter the housing.

14. A combined snubber and spark arrester in accordance with claim 13 and including a second transverse partition spaced between the end of the second conduit and the second end wall to form a dust trap enclosure, said second partition having spaced peripheral openings therein.

ROBERT L. HOYLE,
ARTHUR P. GALLAGHER,
ALFRED S. CHIPLEY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
397,048	Bretney	Jan. 29, 1889
710,605	Osbourne et al.	Oct. 7, 1902
1,573,135	Bourne et al.	Feb. 16, 1926
1,754,126	Stievenart	Apr. 8, 1930
2,392,872	Wolfe	Jan. 15, 1946