June 23, 1942. H. VAN TONGEREN 2,287,652

SPARK ARRESTER

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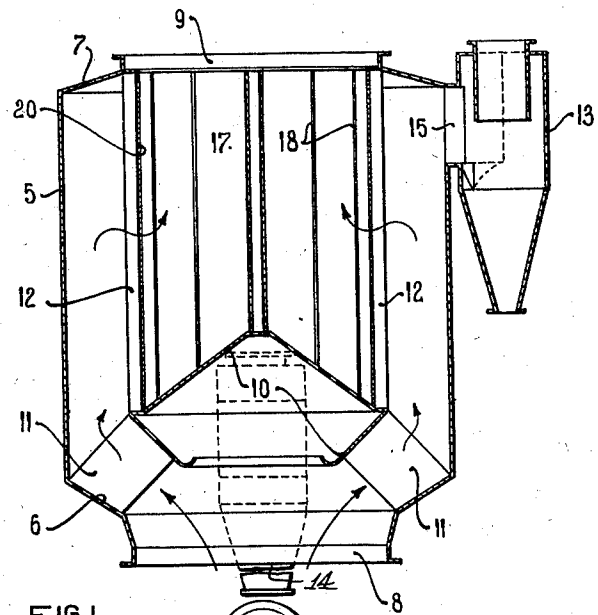


FIG. 1

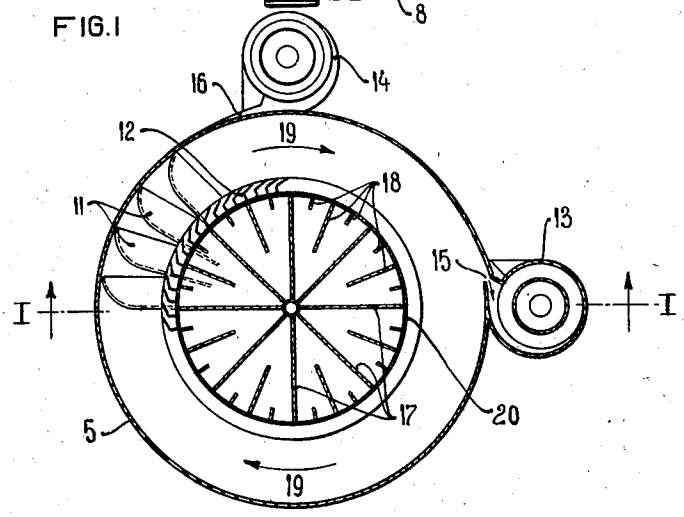


FIG. 2

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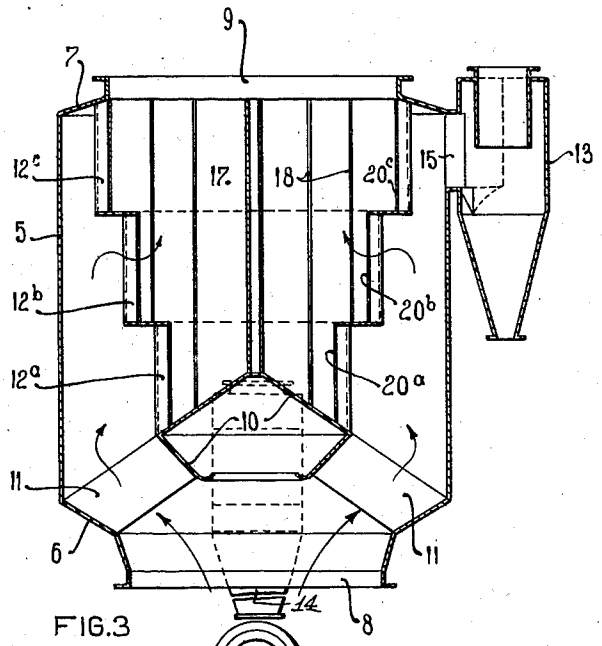


FIG.3

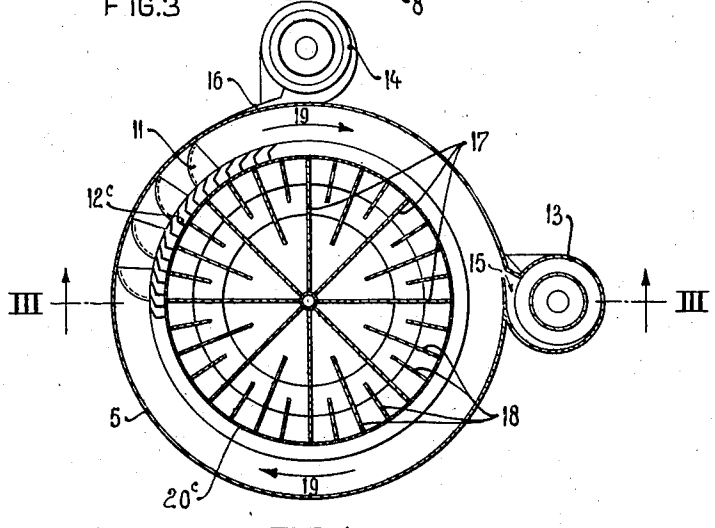


FIG.4

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UNITED STATES PATENT OFFICE

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SPARK ARRESTER

Hermannus van Tongeren, Heemstede, Netherlands

Application November 26, 1940, Serial No. 367,295
In Germany November 24, 1939

2 Claims. (Cl. 183—91)

This invention has for its object an improved spark arrester, which may be used for various purposes, and is particularly adapted to be mounted in the exhaust conduit or chimney of large marine Diesel engines. My novel spark arrester is of very simple and light construction, occupies little space and offers a very low resistance to the flow of the exhaust gases.

According to this invention, my novel spark arrester comprises, in addition to a substantially cylindrical and preferably vertically arranged casing having inlet and outlet openings of substantially equal sizes and accommodating in spaced relationship with its bottom wall a substantially bi-conical deflection member, a substantially circular series of baffle vanes extending in coaxial relation with the casing from said deflection member unto the top wall of the casing, and a second substantially circular series of spinning vanes extending from said deflection member unto the bottom wall of the casing, wherein the diameters of the casing and of the deflection member do not exceed twice and one and a half times, respectively, the diameter of the inlet and outlet openings, and wherein the circumferential wall of the casing is provided with at least one skimming opening communicating with a cyclone arranged outside the casing.

In order that my invention may be more clearly understood, I shall proceed to describe the same with reference to the accompanying drawings, which show, to some extent diagrammatically, two embodiments of my novel apparatus.

Figs. 1 and 2 are a sectional elevation and a cross-sectional view, respectively, of the first embodiment.

Figs. 3 and 4 show, in similar views, the second embodiment.

Referring to Figs. 1 and 2, the spark arrester comprises a cylindrical casing 5 having frusto-conical bottom and top walls 6 and 7, respectively, said walls being provided with coaxial and equally sized inlet and outlet openings 8 and 9, respectively.

Some distance from the bottom 6 there is arranged a hollow, bi-conical member 10, and mounted between this member and the bottom ring 6 is a circular series of spinning or whirl producing vanes 11. The circumference of member 10, which acts as a deflector, is connected with the top ring 7 through a circular set of more or less tangentially disposed baffle vanes 12, said set being concentric with casing 5.

Outside the casing there are provided two relatively small cyclones 13 and 14, the first of which is arranged near the top and the other near the bottom. Both cyclones communicate with the interior of casing 5 through relatively short skimming openings 15 and 16, respectively.

Mounted inside the vaned wall 12 and in concentric relation therewith is a perforated cylinder 20, which acts as a silencer. Provided within said cylinder are a number of long, radial baffle walls 17, and arranged intermediate said baffle walls are shorter baffles 18. Preferably said baffles are composed of sound absorbing material, for instance glass or steel wool, and in that case each baffle may comprise two spaced, perforated metal sheets, the interspace being filled up with said sound absorbing material.

The described spark arrester, which, for instance, may be mounted in the chimney of a motor vessel or of a locomotive, operates as follows.

The exhaust gases and any incandescent particles suspended therein enter at 8 and flow in a more or less axial direction through the passages between the spinning vanes 11 into the annular eddy space confined between the casing wall 5 and the circular set of baffle vanes 12. The spinning vanes 11 are so disposed as to impart additional rotary movement to said gases. This movement, indicated by the arrow 19, causes the sparks and other particles contained in the gases to be thrown outwardly and to be discharged, together with a small portion of the gases, through the skimming openings 15, 16 into the cyclones 13, 14. From the cyclones, the solid particles are delivered to a bunker (not shown), whereas the cleaned gases are conducted, for instance, into a chimney. Preferably, each cyclone 13, 14 is provided with an individual bunker.

The gases gyrating around the set of vanes 12 are obliged, in order to reach the outlet 9, to pass through the passages between said vanes. These passages extend, as appears from Figure 2, in a direction substantially opposite that of the flow of the gyrating gases, so that the latter, when entering said passages, are suddenly deflected through an angle of about 150°. The heavier particles contained in the gases are, owing to their inertia, prevented from following said change of direction, so that they impinge on the vanes 12 and thereby rebound into the rotating mass of gases. Since the baffle vanes 12 only serve the purpose of changing the direction of flow of the gases on their way from the annular eddy space to the outlet 9, they may be constituted as streamlined bars or tubes.

The baffle walls 17, 18 cause the gases to reach the outlet 9 in a steady, axial flow and thus

reduce the resistance of the spark arrester. Moreover, they act as sound absorbers, particularly as far as the higher frequencies are concerned. The lower frequencies are already partly damped in the hollow member **10**. This member, which is accommodated within the vaned wall **12** and consequently does not occupy any extra space, is of great importance since the gases usually enter the spark arrester in a pulsating flow.

The deflector member **10** may also be lined with sound absorbing material. By suitably dimensioning the bottom opening and also the angle of the upper cone of said member, the resonance in the exhaust conduit can be controlled.

The outer diameter of member **10** determines the minimum diameter of casing **5**. Thus, a compact construction of the spark arrester necessitates a small deflector **10**. Preferably, the maximum diameter of said member should not exceed the diameter of the inlet and outlet openings **8** and **9**, and at any rate not by more than 50%. Moreover, vertical acceleration of the gases entering the eddy space should possibly be prevented, inter alia for the reason that the resistance of the apparatus increases with the square of the gas velocity. From a simple calculation, taking into account the rotary movement imparted to the gases by the spinning vanes **11**, it appears that the inner diameter of the casing needs not exceed twice the diameter of the exhaust conduit. Therefore, as compared with known constructions, the present spark arrester can be very compact. This is essential, since spark arresters of the type under consideration have ordinarily to be accommodated in a relatively small space and should have as little weight as possible.

Figs. 3 and 4 show an embodiment, wherein the diameter of member **10** is considerably smaller than those of the inlet and outlet openings and wherein, consequently, the spinning vanes **11** are substantially larger than in the first embodiment. This accounts for a stronger gyrational movement in the eddy space, assuming the resistance to remain the same, but necessitates a somewhat different arrangement of the baffle vanes **12**. In the example shown, there are three concentric series of baffle vanes, designated by **12***a*, **12***b* and **12***c*, and having diameters increasing from the bottom towards the top. Inside these sets of vanes there are arranged perforated cylinders **20***a*, **20***b* and **20***c*, respectively.

This construction is not really more complicated than that shown in Figs. 1 and 2, for in the latter special provision is to be made, for instance by means of welded strengthening rings, in order to prevent vibration of the uninterrupted and consequently long vanes.

Owing to the fact that in apparatus as illustrated in Figs. 3 and 4 the static pressure in the eddy space rapidly decreases from the outside towards the axis, the greater part of the gases is liable to escape through the passages between the vanes of the series having the greater diameter. As a consequence, the amount of gas escaping between the vanes of series **12***c* would be much in excess of that corresponding with the surface of said series, whereas only a relatively very small amount of gas, or no gas at all would escape through the passages between the vanes **12***a*, and in some cases there might even be set up a flow in the reverse direction, i. e. from the central space outwards. In order to prevent this, I suggest that the width of the gaps between the baffle vanes of the various series should decrease from the bottom towards the top, in such a manner that all sets of vanes discharge equal amounts of gas per unit of time. This can also be accomplished by suitably perforating the cylinders **20***a*, **20***b* and **20***c*.

What I claim is:

1. In a spark arrester for the exhaust flues of Diesel engines, a cylindrical casing having frusto-conical top and bottom walls provided with coaxial inlet and outlet openings of equal diameter, a cyclone outside of the casing and having its inlet connected with the side of the casing, an annular series of whirl producing vanes carried by the said frusto-conical bottom wall of the casing, a substantially bi-conical deflector member supported on said vanes coaxially of the casing inwardly of said inlet opening, and gas outlet means communicating with said outlet opening of the casing, said means comprising a substantially circular vaned outer wall extending from the peripheral portion of the bi-conical member to said outlet opening, a perforated wall within the vaned wall and permitting the passage of gas from the vaned wall to said outlet opening, and a series of radially and vertically disposed baffle walls within the perforated wall and extending from the top of the bi-conical member to the mouth of the outlet opening.

2. In a spark arrester for the exhaust flues of Diesel engines, a cylindrical casing having frusto-conical top and bottom walls provided with co-axial inlet and outlet openings of equal diameter, a cyclone outside of the casing and having its inlet connected with the side of the casing, an annular series of whirl producing vanes carried by the said frusto-conical bottom wall of the casing, a substantially bi-conical deflector member supported on said vane coaxially of the casing inwardly of said inlet opening, said deflector member being of less diameter than the inlet and outlet openings, and gas outlet means communicating with said outlet opening of the casing, said means comprising a vaned outer wall including a series of vertically stepped concentric sections, the diameter of the lowermost section corresponding to the diameter of the bi-conical deflector, and the diameters of the superposed sections progressively increasing so that the uppermost section is of the same diameter as the outlet opening of the casing, a perforated inner wall for each section, and a plurality of radially and vertically disposed baffle vanes within each of the said perforated inner walls.

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