Jan. 25, 1944. R. B. BOURNE 2,339,834

SPARK ARRESTER SILENCER

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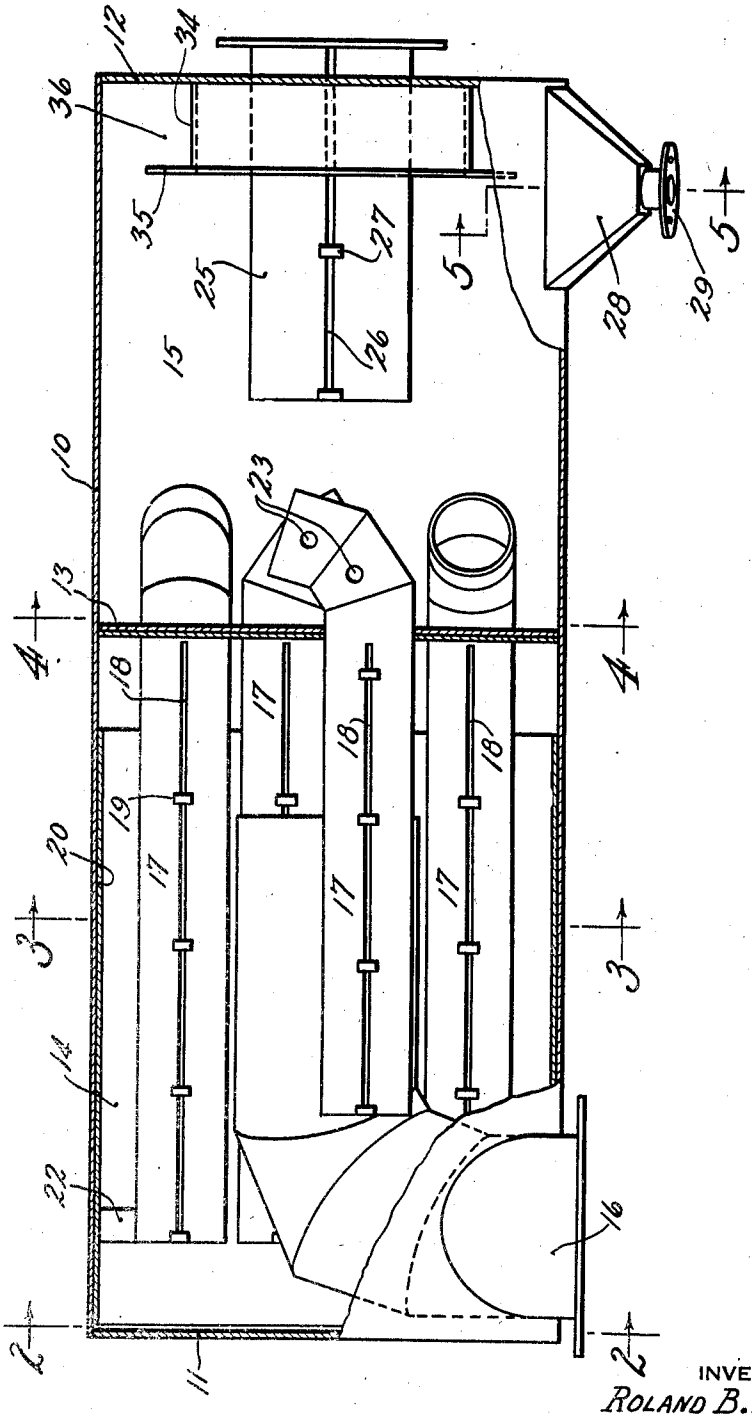


Fig. 1.

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Fig. 2.

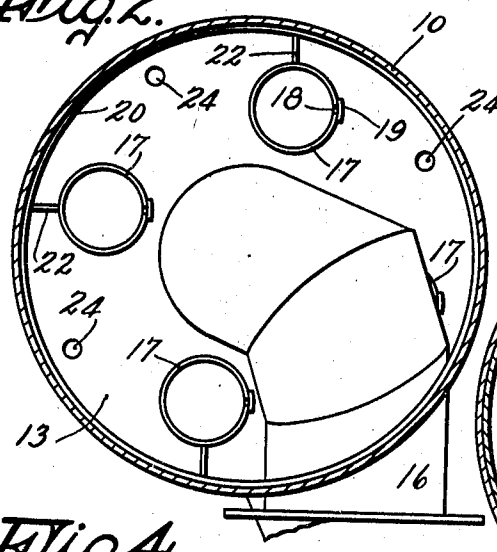


Fig. 3.

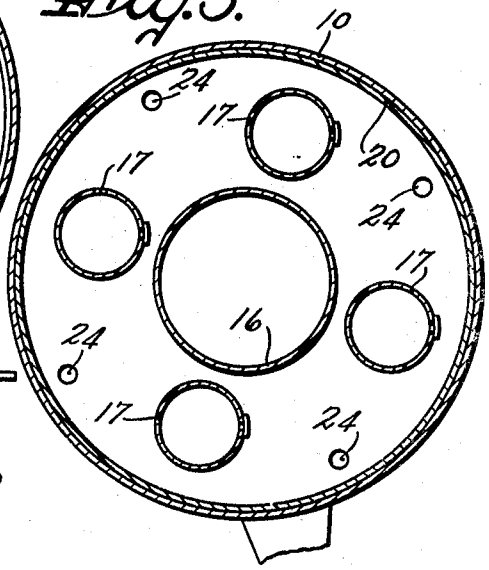


Fig. 4.

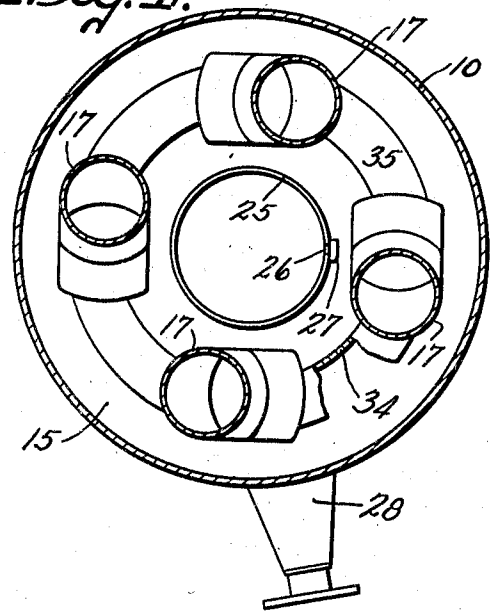
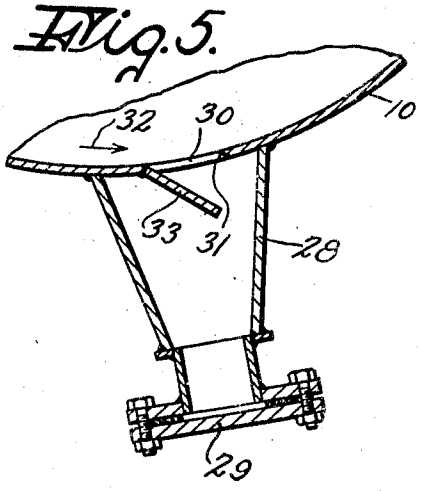


Fig. 5.



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Fig. 6.

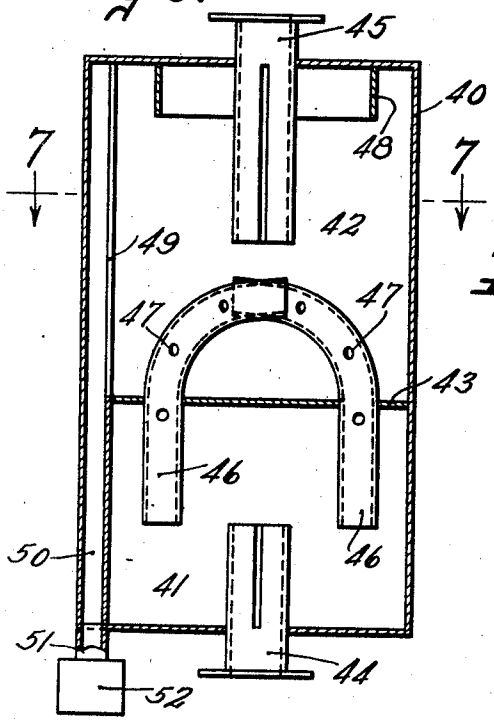


Fig. 8.

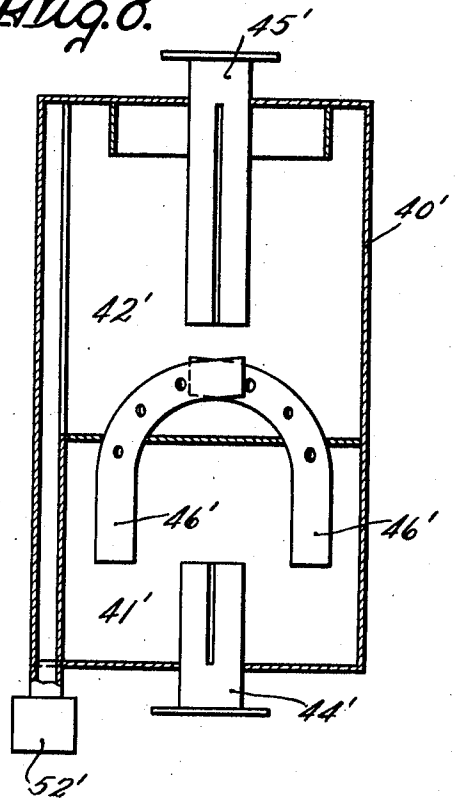
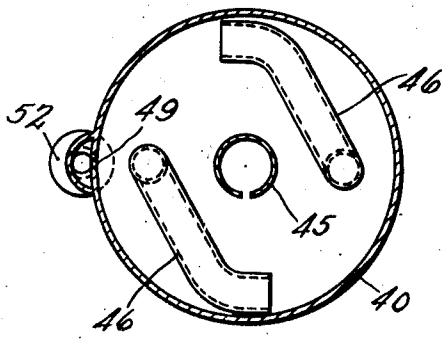


Fig. 7.



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Patented Jan. 25, 1944 2,339,834

UNITED STATES PATENT OFFICE

2,339,834

SPARK ARRESTER SILENCER

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Application June 6, 1942, Serial No. 446,072

7 Claims. (Cl. 181—36)

This invention relates to a combined spark arrester and silencer having improved attenuating and dirt-removing characteristics, and at the same time very low back-pressure. The structure is an improvement on that described in my prior Patent 2,265,343, December 9, 1941 in various particulars which will appear more fully below. Among these improvements are the general overall silencing action, the prevention of dirt particles and sparks getting into the exhaust stream by reason of rebounding from the end wall of the separating chamber, the provision of means for preserving the efficiency of the device while permitting the inlet connection to come through the side of the casing, and the avoidance of a suction effect on the dirt catching chamber which might result in drawing back into the gas stream dirt particles which had once been removed from it. Additional objects will appear from the following description and claims.

Referring to the drawings,

Fig. 1 is a view of a horizontal silencer embodying the invention, the casing being broken away to show the internal construction;

Fig. 2 is a section on line 2—2 of Fig. 1;

Fig. 3 is a section on line 3—3 of Fig. 1;

Fig. 4 is a section on line 4—4 of Fig. 1, partly broken away;

Fig. 5 is an enlarged section on line 5—5 of Fig. 1;

Fig. 6 is an elevation of a vertical type of silencer, the casing being broken away.

Fig. 7 is a section on line 7—7 of Fig. 6; and

Fig. 8 is a view similar to Fig. 6 showing a further modification.

Figs. 1 to 5 show a spark arresting silencer intended to be used with its axis horizontal. It will be described for completeness with the dimensions of its parts given for one particular use, but it will be understood that the invention is not limited to these proportions. It comprises a shell 10 having end headers 11 and 12, a laminated partition 13 located at a point which is preferably chosen so that the length of the longer chamber 14 is a non-integral of the length of the shorter chamber 15. Near one end there is an inlet conduit 16 passing from an eccentric point of entrance in a line of double curvature to the axis of the casing, along which it extends to its termination in an open end spaced from the partition 13 a distance preferably on the order of the diameter of the conduit. Extending through the partition to a distance from the end header preferably on the order of their diameters and overlapping conduit 16 are a plurality of conduits 17 which may be made by rolling a flat sheet into cylindrical form until a narrow slot 18 is formed between its edges, in which position they are held by straps 19 welded in place. The slots 18 may be replaced by a series of perforations if desired, although the construction described is simpler in manufacture. To avoid so-called "shell noise" the major part of the outer wall of the chamber 14, within which the conduits described are located, are preferably laminated as shown at 20. Brackets 22 hold the conduits in place.

The conduits 17 extend through the partition 13 and are turned as shown in Figs. 1 and 4 to direct the gases tangentially of the separator chamber 15. Holes 23 are preferably formed in the outer side of the bent part of each tube 17 and holes 24 are formed in the partition intermediate the tubes. The holes in the tubes serve to permit some of the gas to bleed out, thus increasing the silencing action, and also prevent shock excitation of the portion of the tube beyond the slot 18. The holes 24 in the partition assist in the silencing action, and also act to prevent accumulation of dirt at the end of the chamber 14 and to give to the dirt in the separating chamber an impetus which sends it along to the far end. An outlet conduit 25 extends into the separating chamber, and is preferably rolled as in the case of tubes 17 to leave a slot 26 bridged by straps 27 welded in place. The conduit 25 extends a substantial distance into the chamber, there being preferably no overlapping between it and the bent tubes 17.

One type of silencer will now be described dimensionally, but as stated above this is intended only as a particularized description of one commercial form and not in any way as limiting the invention beyond the scope of the appended claims. In this specific silencer the shell 10 is 41⅝" diameter and 114" long, the partition 13 being placed 65⅜" from the inlet end. The inlet conduit 16 is of 16" diameter. The slots in the intermediate conduits are ½" wide, and the conduits themselves 8" diameter. The outlet conduit 25 is of 14" diameter with a ⅞" slot and extends 27¾" into the chamber. The holes 23 are two in number in each pipe and of 1⅝" diameter, while the holes 24 are four in number and are of 1½" diameter.

A dust collecting casing 28 of pyramidal form is attached to the casing 10 adjacent its outlet end and has a removable cap 29 to permit cleaning out accumulated dirt. The connection between this casing and the separating chamber

28 is of importance in preventing dirt once in the casing from being sucked out into the gas stream. An aperture 30 extends longitudinally along the chamber and is provided with one sharpened edge 31 facing in a direction to deflect into the box the dirt whirled around the periphery of the separating chamber in the direction of the arrow 32. From the other edge of the aperture a vane 33 extends into the box at an angle sufficient to permit the dirt to enter the box freely but to provide a trap in back of the vane which will prevent the inspirating action of gas passing the aperture from drawing the dirt out again. The vane keeps the gas within the box sufficiently quiescent so that there is not the tendency to whirl that customarily occurs in devices of this kind.

In order to prevent dirt particles which may rebound from the end wall of the separating chamber from being drawn out the exhaust pipe a cylindrical baffle 34 is attached as by welding to the end header and is of a size sufficient to leave substantial spaces both between it and the exhaust pipe and between it and the outer shell, and supports an annular plate 35 which projects outwardly part way to the shell. Since the whirling dirt particles are kept by their motion close to the shell, any of them that do not pass into the dirt box will get in the chamber 36 formed beyond plate 35 and outside baffle 34. If they lose their whirling motion in this chamber they will drop down to the box, which is located adjacent the bottom of the silencer, but will be unable to get out the exhaust conduit.

Figs. 6, 7, and 8 show modifications which use certain features of the above construction in a vertical spark arresting silencer.

The embodiment of the invention shown in Figs. 6 and 7 comprises the generally cylindrical casing 40, the interior of which is divided into an inlet chamber 41 and an outlet spark arresting chamber 42 by the transverse header 43. A slotted inlet conduit 44 extends co-axially into the inlet chamber 41 and a slotted outlet conduit 45 extends into the interior of the chamber 42. Passing through the transverse header 43 are two conduits 46 having relatively small perforations 47 in their walls to prevent resonance therein and to assist in breaking up gas pulses as described in United States Patents 2,264,195 and 2,265,343.

It will be noted that the portions of the conduits 46 which extend into the lower chamber 41 are straight and are off-set laterally with regard to the inlet conduit 44. Immediately upon passing through the header 43 the conduits take a quasi-helical form whereby gases passing through them into the chamber 42 are given a whirling motion. The curvature of the conduits 46 is such that the whirling motion imparted to the gases in the chamber 42 is more circular than helical—in other words there is no great tendency to direct the whirling gas upwards toward the outlet end of the silencer. By so doing, I have found that the back pressure is reduced a very substantial amount. Tests show that the whirling, dirt-bearing gases do diffuse over the entire interior cylindrical wall of the chamber 42, but that most of the dirt remains in a region near the open ends of the conduits 46. A cylindrical, co-axially disposed baffle 48 is positioned on the outlet header to prevent any small migration of dirt particles to the neighborhood of the outlet conduit 40. A slot 49 in the wall of the shell 40 in the chamber 42 permits entrained dirt to pass out of the chamber into the dirt collecting conduit 50 where it drops by gravity into the externally disposed pipe 51 and thence into the dirt box 52, from which it can be removed from time to time.

I do not limit myself to the use of two whirl-producing conduits 46, but may use three or four such conduits depending upon the design required as in the horizontal form previously described. The action remains the same. In any case the total area of the conduits passing through the transverse header is of the order of the area of the inlet conduit.

The performance of this device is such that it may conveniently be used as a silencer only, the added cost of the bent intermediate conduits being more than offset by the reduction in back-pressure.

The intermediate header 43 is in this case so positioned that the inlet chamber is smaller than the outlet chamber. This gives the greatest possible length to the outlet conduit 45, which, being slotted, is thus more able to render any tail pipe used with the silencer untuned. In installations having a very short tail pipe, the outlet pipe 45 serves in this capacity. The intermediate conduits 46 are positioned in the header in such a way that a free path for whirling gases exists between them and the wall of the chamber. The space between the conduits and the wall will of course vary with different sized silencers; but, as an example, if the diameter of the casing is ten inches, this space should be not less than one-half inch and preferably about three-quarters inch. The conduits 46 should be so bent and disposed that the gas emerging therefrom is as nearly tangentially directed as possible, with an upward component of not more than about 20 degrees. The improvement in silencing over that of the devices described in Patent 2,265,343 is due to the inwardly projecting outlet conduit 45 and the intermediate conduits 46 projecting into the chamber 41.

Without violating the substance of the invention, it is possible to start the curvature of the conduits 46 within the inlet chamber 41, as shown in Fig. 8 in which the parts have been marked with primed numerals. The total length of the conduits is preferably the same and the proportion in each chamber substantially the same. This construction is useful where the length of the outlet conduit must be as great as possible. By starting the curvature in the lower chamber, the total bending is accomplished with less vertical height in the upper chamber. In all cases, the lower end of the outlet conduit 45 should be at least half a pipe diameter above the plane of the upper ends of the conduits 46.

What I claim is:

1. A spark arresting silencer comprising a generally cylindrical casing having end headers and divided by a transverse partition into a plurality of chambers, an open-ended inlet conduit having a portion with a substantial extent along the axis of one chamber, a plurality of open-ended intermediate tubes located between said axial portion of the inlet channel and the casing, said tubes extending through the partition into the second chamber and being bent into a substantially tangential direction, a longitudinally slotted exhaust conduit extending substantially axially within the second chamber and terminating with an open end at a point spaced axially beyond the bent ends of the intermediate tubes, and a dirt collecting box extending along the

peripheral wall of the second chamber and having a longitudinal slot opening thereto.

2. A spark arresting silencer as in claim 1 in which the dirt collecting box is closed except for said slot, and in which said slot connecting the dirt collecting box with the chamber is of less circumferential extent than the box and is provided with a vane extending at an angle into the box in the direction of whirling of the dirt particles within the second chamber, and has a sharpened edge on the side opposite the vane.

3. A spark arresting silencer as in claim 1 having a cylindrical baffle wall between the outlet conduit and the cylindrical wall of the casing and an annular baffle extending outwardly from the inner end of the cylindrical baffle.

4. A spark arresting silencer as in claim 1 in which the slot connecting the dirt collecting box with the chamber is of less circumferential extent than the box and is provided with a vane extending at an angle into the box in the direction of whirling of the dirt particles.

5. A spark arresting silencer as in claim 1 having a cylindrical baffle wall between the outlet conduit and the cylindrical wall of the casing.

6. A spark arresting silencer comprising a generally cylindrical casing having end headers and divided by a transverse partition into a plurality of chambers, an open-ended inlet conduit having a portion with a substantial extent along the axis of one chamber, a plurality of open-ended intermediate tubes located between said axial portion of the inlet channel and the casing, said tubes extending through the partition into the second chamber and being bent into a substantially tangential direction, and being longitudinally slotted within the first chamber and provided with spaced holes along their bent portions in the second chamber, a longitudinally slotted exhaust conduit extending substantially axially within the second chamber and terminating with an open end at a point spaced axially beyond the bent ends of the intermediate tubes, and a dirt collecting box extending along the peripheral wall of the second chamber and having a longitudinal slot opening thereinto.

7. A spark arresting silencer comprising a generally cylindrical casing with a horizontal axis and having end headers and divided by a transverse partition into a plurality of chambers, an open-ended inlet conduit entering one of the chambers through its cylindrical wall and having a portion with a substantial extent along the axis thereof, a plurality of open-ended intermediate tubes located between the axial portion of the inlet conduit and the casing, said tubes extending through the partition into the second chamber and being bent into a substantially tangential direction and being longitudinally slotted within the first chamber and provided with spaced holes along their bent portions in the second chamber, a longitudinally slotted exhaust conduit extending substantially axially within the second chamber and terminating in an open end at a point spaced axially beyond the bent ends of the intermediate tubes, a cylindrical baffle wall extending from one header between the outlet conduit and the cylindrical wall of the casing, an annular baffle extending outwardly from the inner end of the cylindrical baffle part way to the casing wall, and a dirt collecting chamber located adjacent the bottom of the casing in overlapping relation to the annular baffle and having a longitudinal slot opening into the second chamber, said slot being of less circumferential extent than the box and provided with a vane extending at an angle into the box in the direction of whirling of the dirt particles and a sharpened edge on the side opposite the vane.

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