Nov. 21, 1961 L. S. PAPP 3,009,539

SPARK ARRESTER

Filed May 7, 1960

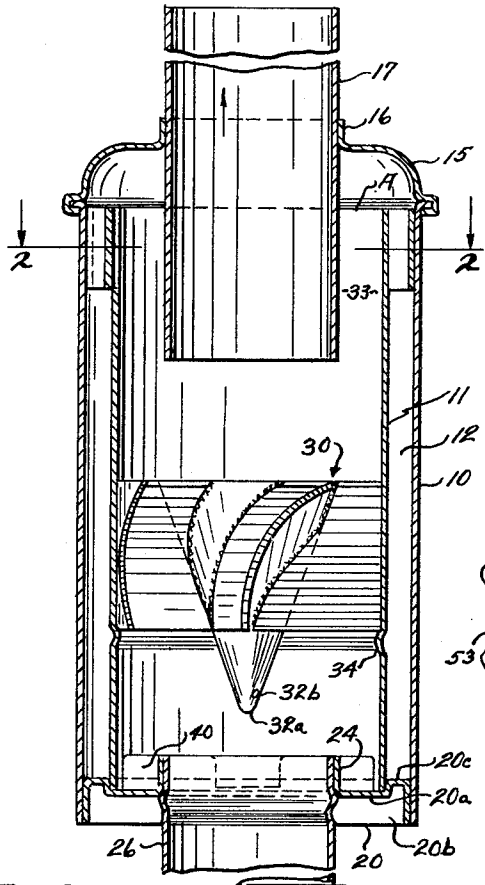


Fig. 1

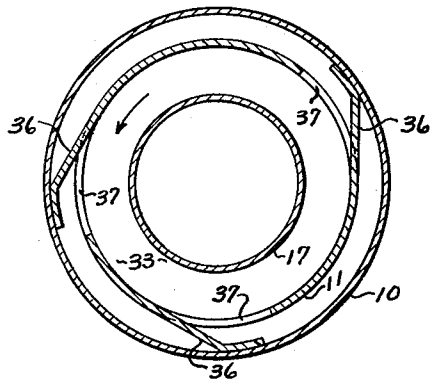


Fig. 2

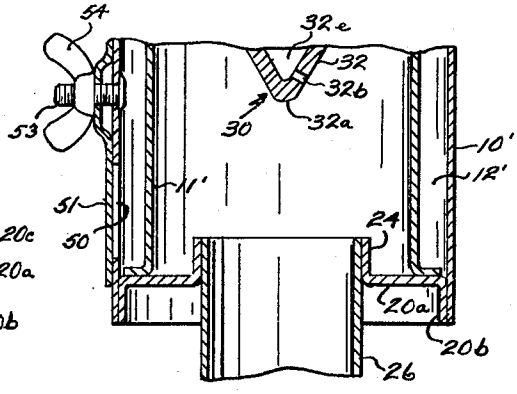


Fig. 4

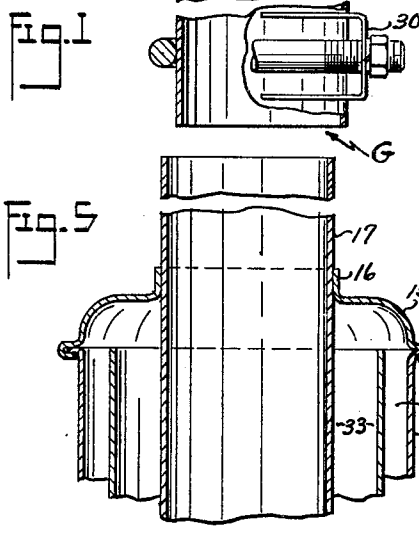


Fig. 5

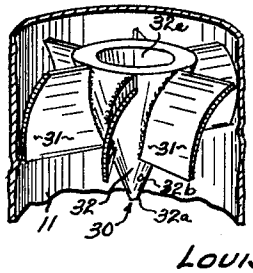


Fig. 3

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SPARK ARRESTER

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This invention relates to a spark arrester device especially designed for use with an internal combustion engine, or the like, wherein the gaseous exhaust from said engine is likely to include solid particles, a plurality of which may also be in an ignited condition, and it is desired to separate said particles from said exhaust and to extinguish those particles that are ignited while substantially reducing the physical dimension of all of said separated particles prior to the discharge of the same to atmosphere.

A primary object of the present invention is to provide a spark arrester device especially designed for use with an internal combustion engine, or the like, and which is operable to separate ignited and/or inert solid particles from the gaseous exhaust stream of said engine, said device functioning to separate said particles and to substantially reduce the size of the same while extinguishing those particles that are ignited, and to thereafter permit the re-entry of the reduced particles to said exhaust stream whereby the same may be discharged to atmosphere.

Another object of the present invention is the provision of a new and improved spark arrester device especially designed for use with an internal combustion engine or the like, and which is operable to separate ignited particles from the gaseous exhaust stream from said engine which, if permitted to exhaust directly to atmosphere might possibly create hazardous fire conditions; the device of the present invention functioning to separate said ignited or burning particles from said exhaust stream, then cyclically re-entering and separating said particles to and/from said stream within said device, during which time said particles are extinguished while being progressively reduced to minute dimensions and thereafter permitted to re-enter the exhaust stream in said device in said reduced condition and passed thereby to atmosphere.

Still another object of the present invention is to provide a new and improved spark arrester device, as is above described, and further characterized in having means to intercept the gaseous exhaust stream passing through said device and to spirally direct the same upwardly therethrough whereby the heavier solid particles in said stream are propelled outwardly of and removed from said stream, and thereafter re-circulated through said device in such manner so as to be reduced to minute dimensions, said reduced particles being thereafter re-entered into said exhaust stream, and carried thereby to atmosphere.

Still another object of the present invention is the provision of a new and improved spark arrester device, as above described, and further characterized in having means forming a depositing zone into which particles removed from the exhaust stream may be readily accumulated, said device, in addition, having means to permit periodic cleaning of said depository zone.

Other objects and advantages of the present invention will be realized by one skilled in the art to which it pertains, and upon reference to the following description of several preferred embodiments thereof, and which are illustrated in the drawings accompanying this specification and included as a part hereof, and wherein:

FIG. 1 is a vertical longitudinal sectional view of a spark arrester device embodying the concepts of the present invention;

FIG. 2 is a transverse sectional view taken approximately on the plane as indicated by the line 2—2 in FIG. 1;

FIG. 3 is a perspective view showing the means used in the device of the present invention for intercepting the inlet gaseous exhaust entering said device and which is effective to cause the separation of the heavier particles from said stream;

FIG. 4 is a fragmentary sectional view showing the inlet end of a second embodiment of spark arrester device of the present invention; and,

FIG. 5 is a fragmentary vertical sectional view showing the discharge end of a third embodiment of spark arrester device of the present invention.

Referring now to the drawings throughout which like elements are designated by the same reference character, the preferred embodiment of spark arrester device of the present invention, is illustrated in FIGS. 1 to 3 inclusive, and comprises a pair of cylindrical casing or shell members **10** and **11**, being disposed one within the other, the inner shell **11** being spaced radially inwardly from the outer shell **10** so as to define an annular chamber **12** extending longitudinally therebetween.

The upper end of the outer shell **10** rigidly mounts a cap member **15**, which is also seen to be centrally formed with an upwardly extending circular flange **16**. An outlet tube or conduit **17** is placed within said flange, and rigidly secured thereto as to communicate with said inner shell member in such manner that its lower end projects centrally downwardly into the inner shell **11** thus communicating with the same at a plane beyond or below the plane that is defined by the upper end of said inner shell, said latter plane being identified in FIG. 1 by the reference character A.

The bottom end of each of the outer and inner shell members is sealed by means of a cap member **20** having a base portion **20***a* and an upstanding rim **20***b* integrally formed with said base, said rim, as best seen in FIG. 1, being rigidly attached to the inner surface at the lowermost end of the outer shell **10** in a substantial sealing relation, the lower end of the inner shell **11** resting upon the upper surface of said base **20***a*, the latter having an annular shoulder **20***c* interspaced between said shell members and thus operable to maintain the aforementioned spaced relation therebetween.

The base **20***a* of said cap member, as seen in FIG. 1, is also centrally provided with an upwardly projecting circular flange **24**, into which is disposed an inlet tube or conduit **26**, the latter being preferably rigidly attached to said flange by welding, or the like, such that its upper end opens centrally into the inner shell member **11** at a plane upwardly of its lower end.

As is illustrated in FIG. 1, the instant embodiment of spark arrester device is preferably utilized in a vertical position such that the inlet conduit **26** is connected to said engine so as to support the aforesaid casing members **10** and **11** substantially vertically thereabove. However, as will also be hereinafter apparent, the instant device may likewise be utilized in a horizontal plane and function substantially in the manner intended herein.

To thus attach the instant assembly, the inlet tube or conduit **26** is intended to be securely fastened by any suitable fastening means, such as is indicated by the reference numeral **30** in FIG. 1, to the aforesaid exhaust apparatus of said engine so as to support the aforesaid casing or shell members **10** and **11** vertically thereabove, and thereby in position so as to directly receive the gaseous exhaust therefrom.

As is previously mentioned, the instant spark arrester device is primarily intended to remove the solid particles from the gaseous exhaust and to extinguish those particles that are in an ignited condition while substantially

reducing all of the separated particles in their physical dimension, and to thereafter provide for the re-entry of the reduced-extinguished-particles into the exhaust stream whereby the same may thence be harmlessly discharged to atmosphere.

To accomplish the separation of said particles from the aforesaid exhaust, a vane assembly as is identified in its entirety by the reference numeral **30**, is disposed within the inner casing member **11** near the point of entry of the exhaust gases. As best seen in FIGS. 2 and 3, said assembly includes a plurality of vane or blade members **31** suitably attached to and arranged in spiral fashion around an inverted conical-shaped hub **32**. The instant vane assembly preferably utilizes a group of six of said vane elements, however said number is merely one of choice and is not to be considered as a structural limitation in any sense.

The vane elements **31** are each seen to be of maximum transverse or radial dimension adjacent the apex part **32***a* of the conical hub **32**, thence progressively diminishing in said dimension longitudinally therealong and to be a minimum dimension at the base portion of said hub.

In addition, said vane members are preferably equally spaced around said conical hub, with the wrap thereof being counterclockwise, as viewed in FIG. 3, although the vanes may turn in the opposite direction.

As is best seen in FIG. 1, the vane assembly **30** is located within the aforesaid inner casing **11**, intermediate the ends thereof, being suitably centrally disposed therein in such manner that the apex part **32***a* of said hub is axially located and points toward and lies closely adjacent the upper or inner end of the inlet conduit **26**. The vane assembly is preferably of such dimension that the outer edge of each of the vane elements **31** lies in close juxtaposition to the inner wall of the casing **11** and in position to be suitably attached thereto to thus retain said assembly in its operative position. If desired, the inner casing **11** may also be provided with an inwardly projecting shoulder **34** extending circumferentially therearound and so positioned as to form a supporting means for the lower end of each of the aforesaid vane elements.

With the construction of the spark arrester device thus far described, it will now be realized, that with the same connected to the exhaust apparatus of an internal combustion engine in the manner as previously mentioned whereby a gaseous exhaust stream, as is figuratively identified by the arrow G in FIG. 1, enters directely into the inlet conduit **26** and transgresses upwardly therethrough and into the inner casing member **11**, said exhaust stream will impinge upon the vane elements **31** of said assembly and will thus be directed to flow in a spiral counterclockwise direction, as viewed from above in FIG. 3, upwardly through said inner casing **11** and toward the outlet conduit **17** in communication with said casing thereabove. Inasmuch as the gaseous exhaust is exiting from the engine at a considerable velocity, as will be well understood, it creates substantial turbulence within said inner casing, and as a result any heavy particles carried upwardly therein by said exhaust stream, will be propelled under considerable force outwardly and upwardly against the aforesaid wall of said inner casing. A small aperture **32***b* is formed in the hub **32** of said vane assembly **30**, communicating with the hub cavity **32***e* and thus preventing a vacuum from being created therein which would tend to draw the aforesaid solid particles therein. Said aperture is likewise operable to permit any condensate that may fall into said hub cavity to be drained therefrom and returned to said inlet stream flow.

As said particles are thus separated they intermittently strike and/or grate against said casing wall literally crawling and/or tumbling upwardly therealong and hence are abraded and further diminished in size thereby.

Said particles continue to move upwardly along the wall of said inner casing, and enter into an annular throat portion **33** defined between the wall of the latter and the lower end of the outlet conduit **17**.

As best seen in FIGS. 1 and 2, a plurality of vanes **26** are preferably provided to aid the escape of its solid particles radially outwardly. These vanes are struck from the upper end of the wall of the inner casing **11**, defining openings or passageways **37** which communicate with said throat portion **33** and the upper end of the aforementioned annular chamber **12**. Said vanes are also seen to project across the upper end of said annular chamber **12**, extending thereacross in a counterclockwise direction as seen in FIG. 2, and having the outermost ends thereof secured to the inner wall of the outer casing member **10** to thereby maintain the inner casing in its operative position centrally within the same.

As said solid particles carried by the gaseous exhaust stream enter into the aforementioned throat portion **33**, they are propelled out through the openings **37**, and into the upper end of the chamber **12**, since there they are removed from the suction of tube **17**.

Said particles, upon entering said chamber, fall downwardly therethrough in the direction opposite to the aforesaid gaseous exhaust and accumulate upon the upper surface of the annular shoulder **20***c* defining the closed end of said annular chamber **12**.

In this manner, the solid particles are separated prior to the egress of said stream through the outlet conduit **17** and are thus prevented from escaping directly to atmosphere.

As previously mentioned, the instant spark arrester of FIGS. 1 to 3 is intended to permit the cyclical separation and re-entry of the particles back into the gaseous exhaust stream whereby the same may be successively influenced by the spiralling of said stream through the inner casing member **11** and thus further reduced in physical dimension before being exhausted to atmosphere.

For this purpose, the bottom end of the wall of the inner casing member **11** is formed with a plurality of circumferentially spaced openings, as are identified by the reference numeral **40**, and which connect the bottom end of the aforesaid annular chamber **12** to the interior of the inner casing member **11** preferably directly opposite the flange **24**, formed on the base **20***a* of the bottom cap member **20**. For most efficient operation of the instant device, the top edge of the flange **24** is preferably coplanar with or slightly above the uppermost edge of the openings **40**.

With this particular construction, it will be realized that with the gaseous exhaust stream passing rapidly into and through the inner casing member **11** it will tend to create a suction in the area of said openings **40**, and as a result the particles previously deposited in the bottom of the annular chamber **12** are pulled through said openings and into said inner casing and thus re-entered into the gaseous stream passing therethrough.

In this manner therefore, it will now be seen that the solid particles in said exhaust are initially separated from the latter as it passes through the inner casing member **11** and thereafter are cyclically re-entered and separated into and from said stream whereby the same are reduced in their physical dimension until the weight thereof has been substantially diminished to a degree whereby they are no longer thrown outwardly by the device **30** but are carried through said outlet conduit **17** to atmosphere with said exhaust stream.

With reference now directed to the modified embodiment shown in FIG. 4, the separated particles may be caught in chamber **12** and lodged at the bottom thereof without the recirculation step just described. In this form the openings **40** are omitted. For cleaning out the collected particles the outer casing, as identified in its present form by the reference numeral **10'**, is preferably provided with a port **50** which communicates with the annular chamber **12'** adjacent its closed end. While the spark arrester device is being used, said port **50** is pref-

erably sealed from atmosphere by means of a door **51** which is seen to be swingably attached by a threaded fastener **53** over the exterior surface of the wall of said outer casting. Suitable locking means such as wing nut **54** may be threaded over said fastener and moved into engagement with said door to lock the same in its sealing position.

With this construction therefore, when an undesirable quantity of solid material accumulate within the annular chamber **12'**, said door may be readily moved to expose the underlying port **50** whereby said material may be easily removed therefrom.

In FIG. 5, is shown another embodiment of spark arrester device, wherein the vanes **36** and resulting openings **37** formed in the upper end of the inner casing member in the previous assembly, are omitted.

With this modified construction, the solid particles, as separated from the exhaust stream, are required to travel upwardly and over the upper edge of the inner casing member before entering the annular chamber **12** between the latter and the outer casing **10**.

Having thus described several preferred embodiments of spark arrester device of the present invention, it will be realized that the same are susceptible to various modifications, combinations and arrangements of parts without departing from the inventive concepts thereof as are defined in the following claims.

What is claimed is:

1. A spark arrester device comprising a pair of shell members disposed one within the other and defining an annular chamber therebetween, an inlet conduit communicating with said inner chamber for directing a gaseous stream having particulate material suspended therein in a first direction into said inner shell of said pair, at one end thereof, vane means in said inner shell disposed downstream from said inlet conduit and effective to alter the flow of said stream and propel said material outwardly thereof, means connecting said inner shell member with said chamber so as to permit said separated material to enter into said chamber, an outlet conduit communicating with said inner shell downstream from said vane means and positioned so as to receive said altered flow of said gaseous stream, the inner of said shell members extending downstream beyond said outlet conduit, and port means connecting said chamber and inner shell member upstream from said vane means for returning said separated material from said chamber into said inner shell member and gaseous stream whereby the same may be discharged through said outlet conduit to atmosphere.

2. In a spark arrester device as is defined in claim 1 and wherein the port means for returning said separated material into said inner shell member is in communication with the latter upstream from the communicating end of said inlet conduit.

3. A spark arrester device comprising a pair of shell members disposed one within the other and defining an annular chamber therebetween, an inlet conduit communicating with one end of said inner shell for directing a gaseous stream having particulate material suspended therein in a first direction into said inner shell, a plurality of blade members extending transversely across said inner shell being effective to alter said stream and to cause the same to advance through said inner shell in a spiral fashion in said first direction so as to propel said material outwardly of said stream, means connecting said inner shell member with said chamber so as to permit said separated material to enter into said chamber, an outlet conduit communicating with the opposite end of said inner shell downstream from said blade members and positioned so as to receive and discharge said altered flow of said gaseous stream, the inner of said shell members extending downstream beyond said outlet conduit, and port means in said inner shell member connecting said chamber and inner shell member upstream from the communicating end of said inlet conduit for returning said separated material from said chamber into said inner shell member and gaseous stream whereby the same may be discharged through said outlet conduit to atmosphere.

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