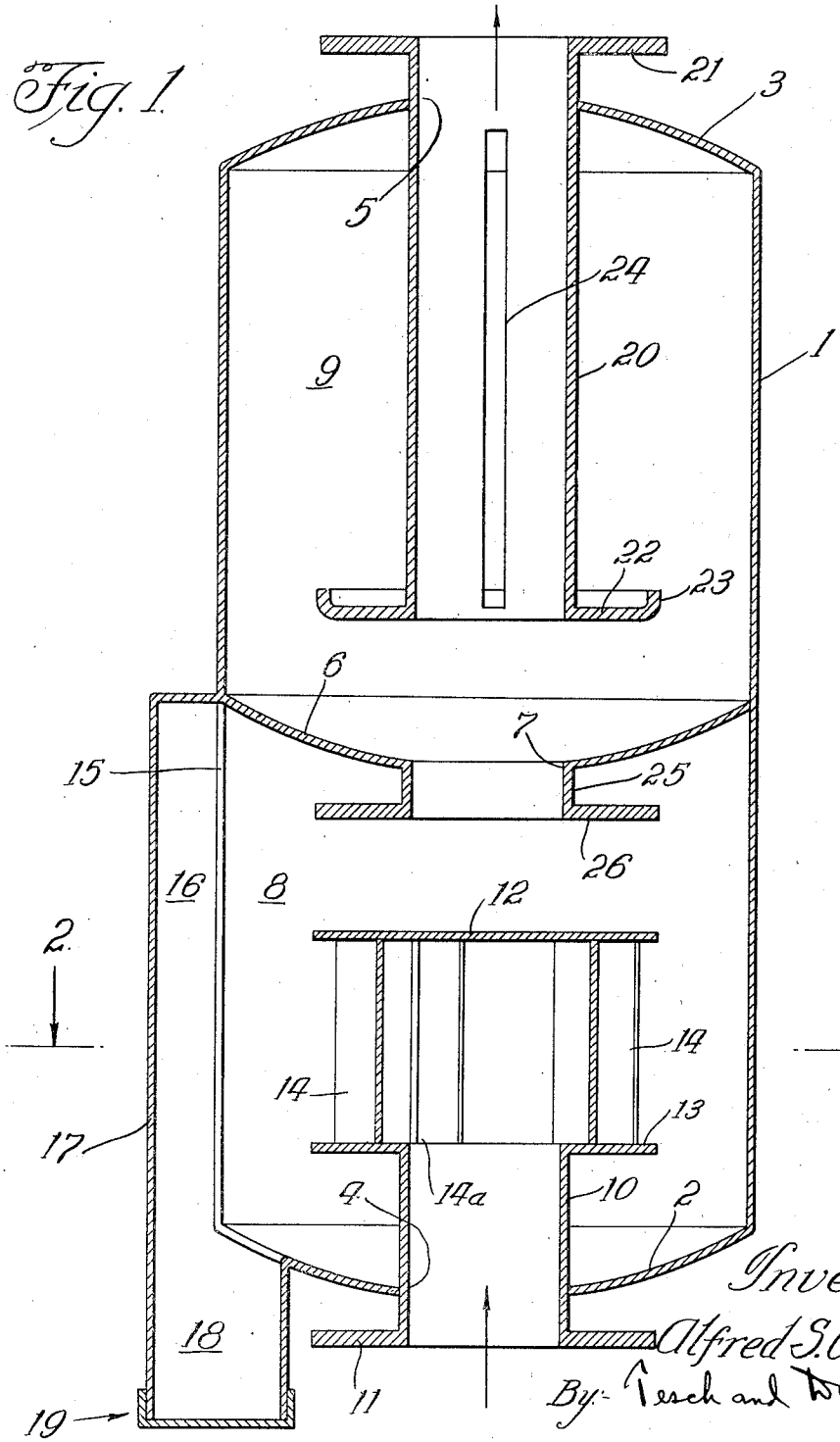
Sept. 7, 1943. A. S. CHIPLEY 2,329,101

APPARATUS FOR SILENCING PULSATING GAS STREAMS AND SEPARATING PARTICLES THEREFROM

Filed June 8, 1940 2 Sheets-Sheet 1

Fig. 1.



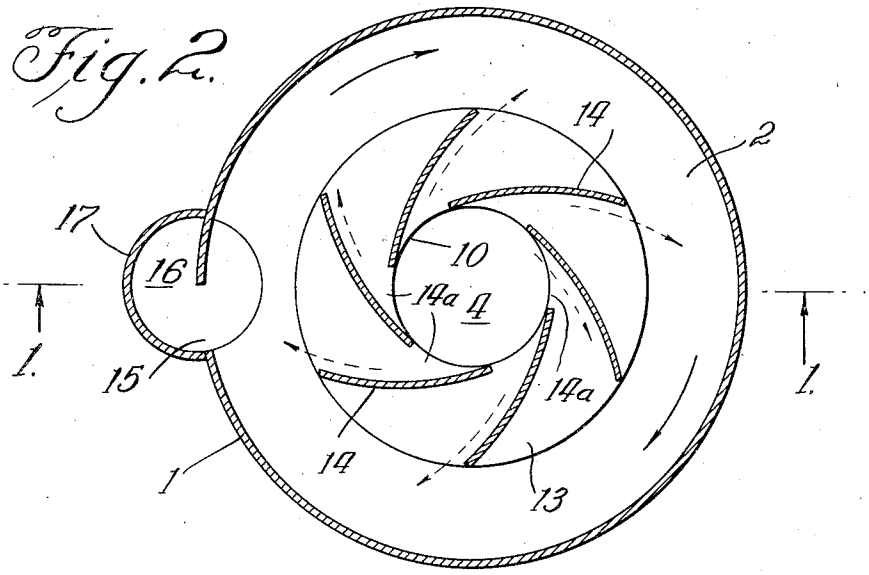
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Fig. 2.



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APPARATUS FOR SILENCING PULSATING GAS STREAMS AND SEPARATING PARTICLES THEREFROM

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Application June 8, 1940, Serial No. 339,472

4 Claims. (Cl. 183—91)

This invention relates to devices for removing particles carried by the exhaust gases of internal combustion engines and for silencing such exhaust gases.

The exhaust gases from all internal combustion engines carry particles of carbon and the like some of which are incandescent and leave the exhaust system as sparks. The sparks present a fire hazard and other particles are generally undesirable since they settle in the vicinity of the exhaust outlet and give an unsightly appearance thereto. The exhaust gases from the Diesel engines are particularly heavily loaded with the foreign particles including oil droplets as well as solid particles.

So-called spark arresters have been in use for a number of years as a safeguard against the setting of fires due to the operation of internal combustion engines. Some of these devices operate to remove the larger particles which are likely to remain incandescent a sufficient length of time after leaving the exhaust system to cause damage, the smaller particles being ignored, while other arresters have merely provided means for cooling these sparks prior to expulsion to the atmosphere. Some of these devices also functioned, to a greater or less extent, to silence the exhaust gases. In other cases a spark arrester was used in addition to the silencer.

An object of the present invention is to provide a combined exhaust gas cleaner and silencer which is very simple and inexpensive in construction yet efficient in accomplishing the dual function of the device. A further object is to provide such a combined unit which does not depend upon tuned resonating chambers or similar acoustical devices in accomplishing the silencing function and hence may be installed at any convenient point in the exhaust system. A further object is to provide a device of this character having exhaust gas cleaning efficiencies approaching 100 percent as required, for example, for Diesel engine installations in restricted neighborhoods and in marine installations, and at the same time operating at a minimum back pressure.

For convenience and clarity, and at the expense of strict accuracy, the term "spark arrester" will be used herein to designate a device for removing particles from the exhaust gases, although the device in fact removes very fine and cold particles, since spark arresting has been the primary function of such a device and is accepted as the generic designation in the art. For similar reasons the term "silencing" will be used as meaning the prevention of noise caused by the operation of the engine regardless of the actual mechanics of the operation. The invention herein described is believed to operate to prevent such noises by smoothing the pulsating flow before the gases reach the atmosphere thus preventing impact of the individual pulsations or "slugs" with the atmosphere with attendant percussions.

In the accompanying drawings:

Fig. 1 is a longitudinal, sectional view of a preferred form of the invention taken at the line 1—1 of Fig. 2 and

Fig. 2 is a transverse, sectional view of the device of Fig. 1 taken at the line 2—2.

The embodiment of the invention illustrated in Fig. 1 is housed within a cylindrical shell 1. The unit is intended to be used in the vertical position. The inlet-end or bottom member 2 and the outlet-end or top member 3 are somewhat dished for strength and to prevent vibration, the former being provided with an inlet opening 4 and the latter having an outlet opening 5. These openings are at the centers of the end members. A transverse partition 6, preferably dished as shown and having a central opening 7, divides the space within the shell 1 into two chambers which may be designated for convenience as swirling or cleaning chamber 8 and silencing chamber 9.

An inlet conduit 10 extends through the inlet opening 4, being provided with flange 11 for convenient connection to the exhaust pipe of the engine whose exhaust gases are to be cleaned and silenced. The end of conduit 10 within the shell is also provided with a flange or collar 13. A number of vanes 14 are securely welded between flange 13 and a disc or plate 12 having approximately the same diameter as flange 13. Any suitable number of vanes may be employed, six being illustrated in the drawing. They are equally spaced apart leaving slots 14a between adjacent vanes for the passage of gases. These vanes are substantially plane, being curved, as illustrated in Fig. 2, only slightly for strength and to prevent vibration of these members. They are tangentially arranged with respect to the conduit 10 whereby the gases with entrained particles passing through the slots 13 are directed substantially tangentially from the inlet conduit toward the lateral walls of the shell. The closure plate 12 is of sufficient diameter to completely cover the ends of vanes 14.

A lengthwise slot 15 is provided in a lateral wall of cleaning chamber 8 for the passage of particles from the operating space within the chamber into a zone of quiescence 16 within

housing 17. The bottom portion of the latter forms a storage chamber 18 intended to receive the foreign particles from the zone of quiescence 16. Any suitable means 19 may be provided for access to this chamber for removal of accumulated material.

An outlet conduit 20 extends through outlet opening 5 from flanged end 21 outside of shell 1 into silencing chamber 9 to a point short of partition 6. A flange 22 having a lipped periphery 23 is preferably provided at the end of the outlet conduit within chamber 9. One or more slots 24 are provided in the outlet conduit or this member may be otherwise perforated to a limited extent, as by means of round holes or short slots.

A short tubular segment 25 extends toward the inlet end of the device from partition 6 at opening 7, this segment also being flanged at 26. This tubular member is not essential in the construction of the unit but is advantageously used to increase its efficiency from both the cleaning and silencing standpoints.

The relative dimensions of this device are not critical but should preferably be approximately as shown in the drawing. The total area of slots 14a should be approximately 1½ to 4 times the cross-sectional area of inlet conduit 10 and the total area of slot or slots 24 or other equivalent apertures, if used, may be equal to from 30% to 100% of the cross-sectional area of the outlet conduit 20.

In the operation of the device illustrated in Figs. 1 and 2, gases entering the unit at the bottom (as indicated by the arrow) pass into the cleaning chamber 8 through slots or passages 14a. The vanes 14 direct the gases together with the foreign particles carried by them toward the lateral walls of the shell 1 in a tangential direction with respect to inlet conduit 10 as indicated by the broken line arrows in Fig. 2. The gases turn and swirl about the axis of the shell, as indicated by the solid line arrows in Fig. 2, but the particles, having greater specific mass and therefore inertia than the gases, tend to continue in the tangential direction toward the shell walls. The result is an immediate separation of the large bulk of the particles from the gases, the particles passing through slot 15 and dropping down into the storage space 18 from which they may be removed periodically. Any fine particles which are more readily carried by the swirling gases are separated by centrifugal action. The particles collect in a layer adjacent the inside surface of the shell walls and are eventually separated from the gases by the edge of the shell at slot 15 facing the gases. As shown in Fig. 2, slot 15 extends only approximately half way between the sides of housing 17, which construction more efficiently operates to remove the foreign particles in the manner described.

The violently swirling gases move upwardly through cleaning chamber 8 and pass into silencing chamber 9 through opening 7. Upon emerging into chamber 9, the gases immediately tend to flow radially as they spin so that only a portion of the gases pass directly into outlet conduit 20. The larger portion of the gases, especially the gases flowing at peak speeds due to the inertia of the exhaust gas slugs initially entering the device, pass into a snubbing space surrounding outlet conduit 20. In this space the velocity energy of the gases is partly spent and partly transformed into static pressure which, in turn, is dissipated as the gases pass into the outlet conduit 20 through slots 24 in controlled volumes. The relatively smoothly flowing stream of cleaned gases flows to the atmosphere either directly from outlet conduit 20 or through a tail pipe (not shown) connected to this conduit.

I claim:

1. A device for silencing a pulsating gas stream comprising an elongated shell of circular transverse section having an inlet end and an outlet end, a transverse partition having a central opening therein forming a cleaning chamber at the inlet end and a silencing chamber at the outlet end of said shell, deflecting means within said cleaning chamber and adjacent said inlet end of said shell adapted to cause all gases entering said shell to swirl about the axis thereof, and an outlet conduit extending from said outlet end of said shell into said silencing chamber and toward said central opening in said partition but terminating short thereof, said conduit having its walls apertured and being open at its end within said shell for direct communication with said opening in said partition.

2. A device in accordance with claim 1 and including a flanged tubular segment extending from said partition at said opening therein toward said inlet end of said shell.

3. A device for silencing a pulsating gas stream comprising an elongated shell having side walls of curved transverse section and an inlet end and an outlet end, a transverse partition having an opening therein forming a cleaning chamber at the inlet end and a silencing chamber at the outlet end of said shell, deflecting means within said cleaning chamber adjacent said inlet end of said shell adapted to cause all gases entering said shell to swirl about the axis thereof, means at the lateral walls of said shell for trapping gas-borne particles, and an outlet conduit extending from said outlet end of said shell into said silencing chamber and toward said partition but terminating short thereof, said conduit having its walls apertured and having its end within said shell open and in direct communication with said opening in said partition.

4. A device in accordance with claim 3 in which the apertures in the walls of the outlet conduit occupy an area equal to approximately 30% to 100% of the cross sectional area of the outlet conduit.

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