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SILENCER FOR INTERNAL-COMBUSTION
ENGINES

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This invention relates to silencers for internal combustion engines of the kind comprising expansion chambers and baffles whereby energy is absorbed from the exhaust gases before they are discharged to the atmosphere.

An exhaust silencer according to this invention comprises at least one primary expansion chamber packed with separate metallic balls, and at least one secondary expansion chamber packed with interstitial refractory material, the exhaust gases expanding into the interstices in the two packings on their way to the outlet end of the silencer.

Preferably the gases enter and leave each expansion chamber through baffle tubes or passages which cause the gases to enter and leave each chamber transversely to the longitudinal axes of the baffle tubes. The inlet end of the silencer may be furnished with a conical plug or tube flaring towards the adjacent expansion chamber and having its conical wall perforated so that the gases enter in directions transverse to the longitudinal axis of the cone. Similarly, the outlet end of the silencer may be provided with a conical plug or tube flaring towards the adjacent expansion chamber and having its conical wall perforated so that the gases escape to the atmosphere in directions transverse to the longitudinal axis of the cone.

The invention may be carried into practice in various ways, but one arrangement according to the invention, together with a modification thereof, is shown by way of example in the accompanying drawing, in which

Figure 1 shows one arrangement in side elevation,

Figure 2 is a longitudinal section, and

Figure 3 is a view similar to that of Figure 2 but of a modified arrangement.

In the construction shown in Figures 1 and 2 the silencer comprises an outer cylindrical metal casing A in opposite ends of which respectively are secured two spherical chambers B and C also of metal and packed with metal balls B¹, C¹, such for example as of the type normally employed in ball bearings. The annular chamber A¹ formed within the outer cylindrical casing A between the two spherical chambers B and C has a filling of interstitial refractory material, such for example as asbestos fibre.

Extending a short distance into the spherical chamber C at one end of the silencer is an inlet tube D which, when the silencer is in use, is coupled to the exhaust manifold of the engine, and disposed within this tube D adjacent to the spher-

ical chamber C (hereinafter referred to as the primary expansion chamber) is a conical tubular insert D¹ which flares towards the adjacent primary expansion chamber C and has its conical surface, which is presented to the exhaust gases, perforated so that the gases are caused to flow inwards in directions transverse to the longitudinal axis of the cone D¹, that is to say the longitudinal axis of the inlet tube D. The inner end of the inlet tube D lying within the primary expansion chamber C is closed by a transverse baffle wall D², but the cylindrical wall D³ of the inlet tube lying within this chamber C is perforated so that the incoming gases will enter the primary expansion chamber C in directions transverse to the longitudinal axis of the inlet tube D, these gases then expanding into the interstices formed between the metal balls C¹.

Extending through the inner wall of the primary expansion chamber C and into the annular chamber A¹ between the two spherical chambers B and C is a short length of tube E closed at both ends by transverse baffle walls E¹, perforations being however formed in the cylindrical end portions of the tube E, lying in the two adjacent expansion chambers C, A¹ respectively. The exhaust gases thus leave the primary expansion chamber C and enter the chamber A¹ filled with refractory material (hereinafter referred to as the secondary expansion chamber) in directions transverse to the axis of the tube E. In the secondary expansion chamber A¹ the gases again expand into the interstices formed within the refractory filling, and then flow through a similarly perforated and baffled tube F into a third expansion chamber formed by the second spherical chamber B at the outer end of the silencer casing A and similar to the primary expansion chamber C already described.

An outlet tube G, which finally leads the expanded gases to the atmosphere, extends a short distance into the third expansion chamber B, the construction of this tube G, including the conical insert G¹, being similar to those of the inlet tube D and insert D¹, so that the outgoing gases flow first from the third expansion chamber B through the perforations in the outlet tube G transversely to the longitudinal axis thereof, along this tube G and then again change direction by flowing outwards through the perforations in the conical part of the insert G¹ to the atmosphere. The several parts of the silencer are welded together, the welded joints being indicated at K.

Though the arrangement shown in Figures 1 and 2 comprises three expansion chambers sym-

metrically arranged, any desired number of expansion chambers may be used and arranged either symmetrically or asymmetrically. Further, if desired two expansion chambers only may be provided, for example as shown in Figure 3 in which the primary expansion chamber C, inlet tube D and intermediate tube E are as described with reference to Figure 2, but the exhaust gases, after expanding in the secondary expansion chamber A³ flow out to the atmosphere through an outlet tube H which, together with the plug H¹, is similar to the tube G and insert G¹ above described.

What I claim as my invention and desire to secure by Letters Patent is:

1. An exhaust silencer for internal combustion engines, comprising a primary expansion chamber packed with separate metallic balls and into which the exhaust gases flow from the engine, a secondary expansion chamber packed with interstitial refractory material and into which the exhaust gases flow from the primary expansion chamber, and an outlet through which the exhaust gases flow from the secondary expansion chamber after expanding into the interstices of the refractory packing therein.

2. An exhaust silencer as claimed in claim 1, having baffled conduits through which the exhaust gases enter and leave each expansion chamber the said baffled conduits causing the gases to enter and leave each chamber in directions transverse to the longitudinal axis of said conduits.

3. An exhaust silencer as claimed in claim 1, in which the inlet end of the silencer is furnished with a conical plug flaring towards the adjacent primary expansion chamber and having its conical wall perforated, the entering exhaust gases flowing through the perforations in directions transverse to the longitudinal axis of the plug.

4. An exhaust silencer as claimed in claim 1, in which the outlet end of the silencer is provided with a conical plug flaring towards the adjacent expansion chamber and having its conical wall perforated, the exhaust gases flowing out through the perforations in directions transverse to the longitudinal axis of the plug.

5. An exhaust silencer for internal combustion engines, comprising a primary expansion chamber packed with metallic balls, an exhaust gas inlet conduit through which the exhaust gases flow from the engine into the primary expansion chamber, a baffle at the inner end of the said inlet conduit within the primary expansion chamber, the baffle deflecting the incoming exhaust gases into the primary expansion chamber in directions transverse to the longitudinal axis of the inlet conduit, a secondary expansion chamber packed with interstitial refractory material, an intermediate conduit extending from the primary expansion chamber into the secondary expansion chamber, two baffles on the intermediate conduit within the two chambers respectively, said baffles constraining the exhaust gases to enter and leave the intermediate conduit in directions transverse to the longitudinal axis thereof, an outlet conduit leading from the secondary expansion chamber, a baffle at the inner end of the outlet conduit, said baffle constraining the exhaust gases leaving the secondary expansion chamber to enter the outlet conduit in directions transverse to the longitudinal axis thereof, and a hollow plug having a conical perforated wall arranged in the exhaust gas inlet conduit with the conical wall of said plug

flaring towards the adjacent primary expansion chamber, the exhaust gases from the engine flowing through the perforations in the plug in directions transverse to the longitudinal axis of the exhaust gas inlet conduit.

6. An exhaust silencer for internal combustion engines, comprising a primary expansion chamber packed with metallic balls, an exhaust gas inlet conduit through which the exhaust gases flow from the engine into the primary expansion chamber, a baffle at the inner end of said inlet conduit within the primary expansion chamber, the baffle deflecting the incoming exhaust gases into the primary expansion chamber in directions transverse to the longitudinal axis of the inlet conduit, a secondary expansion chamber packed with interstitial refractory material, an intermediate conduit extending from the primary expansion chamber into the secondary expansion chamber, two baffles on the intermediate conduit within the two chambers respectively, said baffles constraining the exhaust gases to enter and leave the intermediate conduit in directions transverse to the longitudinal axis thereof, a third expansion chamber packed with separate metallic balls, a second intermediate conduit extending from the secondary expansion chamber into the third expansion chamber, two baffles on the second intermediate conduit within the secondary and third expansion chambers respectively, said baffles constraining the exhaust gases to enter and leave the second intermediate conduit in directions transverse to the longitudinal axis thereof, an outlet conduit leading from the third expansion chamber, a baffle at the inner end of the outlet conduit, said baffle constraining the exhaust gases leaving the third expansion chamber to enter the outlet conduit in directions transverse to the longitudinal axis thereof, a hollow plug having a conical perforated wall arranged in the exhaust gas inlet conduit with the conical wall of said plug flaring towards the adjacent primary expansion chamber, the exhaust gases from the engine flowing through the perforations in the said plug in directions transverse to the longitudinal axis of the exhaust gas inlet conduit, and a second hollow plug having a conical perforated wall arranged in the exhaust gas outlet conduit with the conical wall of said second plug flaring towards the adjacent third expansion chamber, the exhaust gases from the engine flowing through the perforations in the second plug in directions transverse to the longitudinal axis of the exhaust gas outlet conduit.

7. An exhaust silencer as claimed in claim 5, in which a hollow plug having a conical perforated wall is arranged in the outlet conduit with the conical wall flaring towards the adjacent secondary expansion chamber, the exhaust gases flowing out through the perforations in the plug in directions transverse to the longitudinal axis of the outlet conduit.

8. A silencer as claimed in claim 5, in which the inlet, outlet and intermediate conduits are in the form of tubes having a plurality of transverse apertures or perforations adjacent to the associated baffles.

9. A silencer as claimed in claim 6, in which the inlet, outlet and intermediate conduits are in the form of tubes having a plurality of transverse apertures or perforations adjacent to the associated baffles.

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